Psychological Review
1999, Vol. 106, No. 1, 89–118

0033-295X/99/$3.00

The Comprehension and Validation of Social Information

Robert S. Wyer, Jr.
University of Illinois

Gabriel A. Radvansky
University of Notre Dame

The information one acquires in daily life concerns specific people and events about which one has prior knowledge. A theory of social cognition is proposed to account for the comprehension and verification of such information. The theory views comprehension as a process of constructing situation models of new information on the basis of previously formed models about its referents. The theory specifies the conditions in which statements about familiar people and events (e.g., "Jane Fonda does aerobics") are spontaneously recognized as true or false in the process of comprehending them. It further specifies the conditions in which these spontaneous validity judgments of a statement will influence perceptions of its implications when the statement is made in a social context. The comprehension of both single statements and multiple pieces of information in combination is considered.

The way in which new information is interpreted can have considerable influence on how well it is remembered (Bransford, Barclay, & Franks, 1972; Bransford & Johnson, 1972; Hamilton, Katz, & Leirer, 1980). Moreover, when a piece of information (e.g., "John gave someone an answer during an exam") can be understood in terms of more than one concept (e.g., dishonest or helpful), the particular concept that is applied not only influences judgments and behavior toward its referents, but the magnitude of this influence increases over time (Carlston, 1980; Higgins, Rholes, & Jones, 1977; Srull & Wyer, 1980, 1983).

Numerous theories of social cognition attempt to account for these effects and when they will occur (Bargh, 1997; Higgins, Bargh, & Lombardi, 1985; Martin, 1986; E. R. Smith, 1990; Wyer & Srull, 1986, 1989). Wyer and Srull's theory (1986, 1989) goes on to specify how the comprehension of information at early stages affects processing at later, goal-directed stages. These latter stages include the organization of different pieces of information into a single representation of their referent, the computation of a subjective judgment, and the transformation of this judgment into a response. The theory explicates the memory storage and retrieval processes that occur at each stage of cognitive activity.

The Wyer and Srull model is the most well-articulated theory of social cognition to date, and it generates unique predictions for a number of phenomena that have been identified in social cognition research (e.g., Srull & Wyer, 1980, 1983, 1989; Wyer & Bodenhausen, 1985; Wyer & Budesheim, 1987; Wyer & Unverzagt, 1985). It nevertheless shares weaknesses with other, more circumscribed theories (e.g., M. B. Brewer, 1988; Carlston, 1994; E. R. Smith, 1990; Wyer & Carlston, 1979). Perhaps the most important weakness is its failure to detail the operations that govern the comprehension of social information when it is first encountered, before more goal-directed cognitive activity is performed. The theory merely states that information is spontaneously encoded in terms of low-level semantic concepts without providing any indication of how this is done. Moreover, several assumptions of the model constrain its ability to account for important aspects of social comprehension that come into play when people receive information concerning specific persons and events about which they have prior knowledge (e.g., Bill Clinton or the O. J. Simpson trial).

We propose a theoretical formulation of social comprehension that remedies these deficiencies. Our conceptualization, which has its roots in theory and research on situation models, specifies the cognitive mechanisms that underlie people's comprehension of information about persons and events about which they have prior knowledge. In doing so, it postulates conditions in which people recognize information as true or false in the course of comprehending it and addresses the post comprehension cognitive activity that is likely to result from validity judgments when the information is presented in a social context.

Limitations of Existing Theories of Social Information Processing

The desirability of developing a formulation of the sort we propose in this article can be conveyed through a few examples of the deficiencies in existing theoretical understanding of social comprehension. They concern the interplay of comprehension and validation of information, the cognitive consequences of assessing the validity of information when it is conveyed in a social context, and the influence of both verbal and nonverbal information on the comprehension of social information.

Robert S. Wyer, Jr., Department of Psychology, University of Illinois; Gabriel A. Radvansky, Department of Psychology, University of Notre Dame.

Preparation of this article was supported in part by Grant MH52616 and a B/START grant from the National Institute of Mental Health. Thanks are extended to the University of Illinois Social Cognition Group for insightful comments and suggestions concerning the theoretical formulation proposed and to Rashmi Adaval and Kerry Marsh for exceptionally penetrating comments on an earlier version of the article.

Correspondence concerning this article should be addressed to Robert S. Wyer, Jr., Department of Psychology, University of Illinois, 603 East Daniel Street, Champaign, Illinois 61820. Electronic mail may be sent to rwyer@s.psych.uiuc.edu.

Comprehension and Verification

Validation of Social Information

To reiterate, Wyer and Srull (1989) assumed that information is initially interpreted in terms of general semantic concepts. Referent-specific knowledge is not used until a later, goal-directed stage of processing. This implies that the validity of information about known persons and events is not assessed unless people have a specific objective to which the information is relevant. This implication is intuitively suspect. For example, the assertion "Bill Clinton is president of the United States" is almost immediately recognized as true while comprehending it, whereas "Bill Clinton is prime minister of England" is almost as quickly recognized as false. These validity assessments seem to occur in the absence of any conscious processing objective other than comprehension. With few exceptions (e.g., Gilbert, 1991), the cognitive processes that underlie these assessments have not been articulated in any theory of social cognition.

Information is likely to be processed quite differently when it is comprehended with reference to prior knowledge about its referents than when it is interpreted in terms of semantic concepts alone. Person memory research provides evidence of this. For example, suppose people receive information that a fictitious person is kind and intelligent, followed by descriptions that the person has behaved both consistently with these traits (e.g., reads bedtime stories to the neighbor's children) and inconsistently with them (e.g., confused by situation comedies on television). The validity of this behavioral information cannot be determined on the basis of prior knowledge about the person being described. In this case, recipients appear to think about the person's behavior with reference to a concept they have formed from the initial trait description, devoting particular attention to behaviors that are inconsistent with this concept. As a result, they have greater recall of the inconsistent behaviors later (Srull & Wyer, 1989; Wyer & Srull, 1989).

However, these processes do not occur when information has implications for social policies about which recipients are familiar and have previously formed opinions (e.g., picketing an abortion clinic or organizing a sit-in at a nuclear power plant). In this case, people think about the person's behaviors with reference to their prior knowledge and have better recall of behaviors reflecting opinions they consider to be invalid (e.g., opinions with which they disagree; Wänke & Wyer, 1996; Wyer, Budesheim, Lambert, & Swan, 1994; Wyer, Lambert, Budesheim, & Gruenfeld, 1992). In short, people who receive information for which their existing knowledge has implications do not think only about its semantic meaning. They construe its implications with reference to their prior knowledge, devoting relatively more attention to implications they consider incorrect.

Consequences of Validity Assessment

Recognizing information as true or false is likely to stimulate additional cognitive activity. Grice (1975) and others (Green, 1989; Higgins, 1981; Sperber & Wilson, 1986) noted that when obviously true statements are made in a social context, they violate expectations that communications should be informative. Correspondingly, obviously false statements may appear to violate expectations for communications to convey information that the speaker believes to be true. Recipients of these counternormative statements may reinterpret them in ways that are not implied by their literal meaning. For instance, a liberal Democrat's remark that "What this country needs is another Ronald Reagan" is likely to be interpreted as sarcastic.

Several theories of social communication and judgment assume that when people recognize a message as either obviously true or false during comprehension, they reassess its literal implications. This assumption is central to theories of humor elicitation (Wyer & Collins, 1992), emotional communication (Scott, Fuhrman, & Wyer, 1991), and communication and persuasion (Wyer & Gruenfeld, 1995; Wyer, Swan, & Gruenfeld, 1995). In the latter regard, Gruenfeld and Wyer (1992) found that when people read statements from newspapers that they already believed were true, they changed their beliefs in a direction opposite to that implied by the assertions (e.g., an assertion that Lyndon Johnson was not responsible for the assassination of John Kennedy increased people's beliefs that he was). However, not all statements are recognized as true or false during comprehension. The cognitive mechanisms that underlie validation have not been articulated in any general theory of information processing.

Nonverbal Coding of Social Events

Much of the information people acquire in daily life is obtained through direct experience. This information is conveyed both nonverbally and verbally. Moreover, it often consists of thematically related sequences of events that occur over a period of time. The mental representation of social knowledge should reflect these different types of information. However, how these different types of information interact in social cognition has not been explicated (but see Baggett, 1979, for a comparison of verbal and nonverbal encodings).

In this regard, the information in mental representations is not always reflected in the modality in which the information is conveyed. For example, verbal information can often elicit nonverbal (e.g., spatial) images of the situations it describes (Bransford et al., 1972; Garnham, 1981; Radvansky, Gerard, Zacks, & Hasher, 1990). Although this possibility is well recognized in research on text comprehension (Zwaan & Radvansky, 1998), its implications have not been incorporated into most social cognition theories. The Wyer and Srull (1989) theory, for example, allows for the construction of mental representations in a variety of sense modalities, and Carlston (1994) has theorized that visual and linguistic processing systems can interact during impression formation. Nevertheless, the nature of this interaction is left ambiguous. Neither Wyer and Srull's theory nor Carlston's is very explicit about how new information from different modalities is encoded. The mental representations that people form of their daily life experiences can be organized along multiple dimensions. Several theories in both cognitive psychology (A. Anderson, Garrod, & Sanford, 1983; Graesser, Singer, & Trabasso, 1994; Schank & Abelson, 1977, 1995; Zwaan, Magliano, & Graesser, 1995) and social cognition (Abelson, 1976; Newtson, 1976; Pennington & Hastie, 1986; Wyer & Bodenhausen, 1985) provide some insight into the construction and use of these representations. Nevertheless, the factors that influence how people partition their own and others' experiences into different units and the way they index

these units into memory are not well articulated in theories of social information processing.

The Present Theory

The theory of social comprehension we propose addresses the deficiencies of the Wyer and Srull (1986) model and theories of social cognition more generally. It has three aims:

1. To specify the context and structure of the mental representations formed during comprehension about known persons and events (e.g., Bill Clinton or the Chicago Bulls' victory over the Utah Jazz in the NBA championship). This applies to information that is conveyed in any modality and that concerns both single events and sequences of events.
2. To specify the conditions in which information about familiar people and events is recognized spontaneously as true or false during comprehension. To this end, the theory distinguishes between these conditions and those in which the validity of information is not assessed until more goal-directed processing requires it.
3. To specify the conditions in which the spontaneous recognition of information as true or false stimulates additional cognitive activity. In doing so, the theory takes account of the way in which social contextual factors can influence the implications that are drawn from the information.

The theory borrows several constructs (with some modifications) from other theories of comprehension and retrieval. We integrate and extend the implications of these ideas in several ways. For example, we use the construct of situation models (Johnson-Laird, 1983, 1989; Kintsch, 1988, 1998; van Dijk & Kintsch, 1983) in conceptualizing the comprehension of events. Although several theories assume that these models play an important role in comprehension (e.g., Gernsbacher, Goldsmith, & Robertson, 1992; Graesser et al., 1994; Johnson-Laird, 1983; Kintsch, 1998; Zwaan, Langston, & Graesser, 1995), they usually do not explicate how previously formed situation models are used to establish the validity of new information.

Verification processes have been the focus of research on semantic decision making (e.g., E. E. Smith, Shoben, & Rips, 1974). However, this work has not articulated how information about specific persons and events is verified. Nor has it considered the conditions in which the validity of information is evaluated during comprehension. Finally, theories of the role of conversational norms in information processing (Grice, 1975; Higgins, 1981; Wyer & Gruenfeld, 1995) consider the effects of situational factors on the interpretation of information conveyed in a social context. However, as noted earlier, these formulations do not explicate the processes that lead people to spontaneously recognize information as counternormative. The theory we propose brings these perspectives together in a way that allows their interrelations to be seen.

We first place our theory within the context of the more general formulation of social cognition proposed by Wyer and Srull (1989) and point out the modifications of the earlier model that are required. We then consider (a) the mental representations that are formed of social knowledge, (b) how these representations are used to comprehend new information, and (c) the spontaneous recognition of information as true or false in the course of comprehending it. The representation of both single units of information and several thematically related pieces is considered. Finally, we turn to how judgments of a statement's validity can influence perceptions of its implications when the statement is made in a social context.

Architecture of the Information-Processing System

Several changes in the Wyer and Srull (1989) theory were made. The earlier theory is multifaceted, and its implications are too extensive and diverse to be discussed here (for details, see Wyer & Srull, 1986, 1989). We first review briefly the major aspects of the original theory and then indicate the nature of the changes.

The Wyer and Srull (1989) Theory

The theory proposed by Wyer and Srull (1989) is depicted in Figure 1. As can be seen, cognitive operations are localized in several specialized processing units. The *Comprehender* is an initial encoding device that interprets input information in terms of general semantic concepts. This is done automatically and independently of more specific goal-directed processing.

The other processing units (e.g., Encoder/Organizer, Inference Maker, and Response Selector) become involved only during goal-directed activity (for a detailed discussion of these units, see Wyer & Srull, 1989). Each unit has a library of routines that it uses to perform its functions. These routines pertain to the encoding and organization of information, inference making, or response generation (behavior, judgment, or decision). This processing, unlike the automatic processing by the Comprehender, is monitored by an *Executor* that directs the flow of information between processing and memory storage units based on instructions in a preexisting goal schema.

Of the four memory stores postulated in the original model, only two are of importance here.[1] The *Work Space* contains the information that is currently involved in goal-directed processing: input information transmitted to it by the Comprehender, previously acquired knowledge, and the outputs of processing. The *Permanent Storage Unit,* which is analogous to long-term memory, contains mental representations that are formed in the course of processing monitored by the Executor.

Information enters the processing system through the Sensory Store (Footnote 1) and is transmitted to the Comprehender, where it is interpreted in terms of concepts and knowledge drawn from Permanent Storage. These initial comprehension processes are performed automatically and independently of any specific processing objectives that exist. The output of the Comprehender is then sent to the Work Space, where it is reviewed by the Executor. If the output refers to a processing goal, or if a goal has already been activated, the Executor retrieves a relevant procedure (goal schema) from Permanent Storage and uses it to direct the flow of information among the Work Space, Permanent Storage, and special-purpose processing units. The output of this goal-directed processing is ultimately deposited in permanent storage, where it becomes available for future goal-directed activity.

[1] Two other memory units are postulated. One, the *Sensory Store,* is a temporary repository of sensory input. The other, the *Goal Specification Box,* is a temporary store of goal schemas, or cognitive procedures, that are used by the Executor to direct information processing in the pursuit of specific objectives. These units are not central to the issues of concern here and so are not discussed.

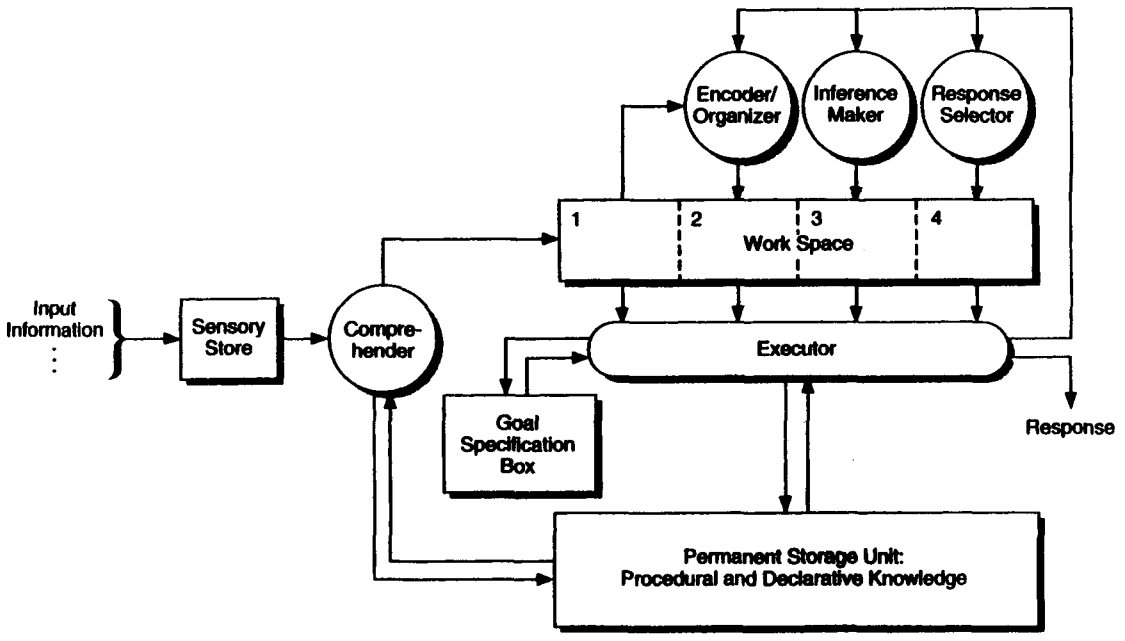

Figure 1. Metaphorical representation of the information-processing system proposed by Wyer and Srull (1989).

Modifications Required by the Proposed Conceptualization

The overall architecture of the system (Figure 1) is preserved in the present theory. In addition, most activities of the specialized processing units (for details, see Wyer & Srull, 1989) are unaffected. However, several modifications are required in other components. These modifications surround (a) the organization of information in Permanent Storage, (b) the duties of the Comprehender and the resources available to it, and (c) retrieval processes.

Structure of Permanent Memory

The Wyer and Srull model assumed that knowledge is organized in permanent storage in a collection of content-addressable storage bins. In contrast, the present theory drops the idea of bins. Each memory trace is assumed to be stored independently and is itself content addressable. As such, the current formulation is consistent with multiple-trace global matching theories of long-term memory (e.g., Hintzman, 1986; Logan, 1988).

Resources Available to the Comprehender

The new theory can largely be viewed as an elaboration of the duties of the Comprehender. In the original model, the Comprehender had access to semantic knowledge alone. However, in the new theory, the Comprehender has access to all types of declarative knowledge. Thus, it can draw on knowledge of particular persons and past experiences in interpreting new information. Moreover, this can occur early in processing and before any goal-directed processing monitored by the Executor.

Retrieval Processes

Both the previous theory and the present one assume that mental representations are retrieved from Permanent Storage by activation of a configuration of probe cues, or features that circumscribe the type of information being sought. In the earlier theory, however, these probe cues first led to the identification of a semantic or referent bin, after which a top-down search of its contents is performed. In the new theory, the accessibility of a representation is a function of only the frequency and recency with which it has been used in the past and the degree to which its contents match a memory cue.

These changes allow the new theory to account for a number of phenomena surrounding the processing of information about familiar persons and events that were predicted either incorrectly or not at all by the previous theory. At the same time, they preserve the ability to address previously explained phenomena (see Wyer & Srull, 1989). In the following sections, the central assumptions of the theory and the processes it implies are discussed, and empirical support for its implications is provided.

Social Memory

The proposed theory is about the comprehension of social information. This information can pertain to oneself, to people and events about which one already has substantial knowledge, and to novel situations that one observes, reads about, or hears about. Knowledge about the nonsocial world (e.g., principles of physics or mathematics) is generally not considered. In the following sections, we first describe several different types of social knowledge and the formats in which this knowledge can be encoded. We

then discuss the different types of mental representations that are formed in the course of comprehending social situations.

Types of Knowledge

We are primarily concerned with the acquisition of declarative knowledge. This knowledge can be either categorical or referent specific. Whereas categorical knowledge concerns broad classes of referents (e.g., Mexicans, lawyers, or hate crimes), referent-specific knowledge refers to particular persons, objects, or situations. Person-specific or object-specific knowledge might include pansituational attributes of the referent. In contrast, situation-specific knowledge refers to a specific event or state of affairs that has occurred. (Radvansky & Zacks, 1997). These types of knowledge are obviously interrelated. For example, a given piece of information, such as "John slapped Mary at dinner," constitutes both referent-specific knowledge about John and Mary and situation-specific knowledge about the event.

Procedural knowledge also comes into play in social cognition. This knowledge can be conceptualized as a set of cognitive procedures or productions (e.g., J. R. Anderson, 1983; E. R. Smith, 1990, 1994) or goal schemas (Wyer & Srull, 1989). The application of some procedures (e.g., goal schemas) is under conscious control, whereas others (e.g., those contained in the libraries of processing units; see Wyer & Srull, 1989) are performed automatically (Bargh, 1994, 1997). Several complex cognitive responses to social information, considered later, can be conceptualized in terms of the application of procedural knowledge to the comprehension of information in different contexts.

Types of Mental Representations

We distinguish between two types of knowledge structures: situation models and generalized representations. Certain similarities and differences between our conceptualization of these knowledge structures and those developed elsewhere are worth noting.

Situation Models

Situation models represent one's understanding of specific events or states of affairs. Situation model theory has been used in a number of domains, including language comprehension (Zwaan, 1996), memory retrieval (Radvansky & Zacks, 1991), spatial knowledge (Taylor & Tversky, 1992), and logical reasoning (Schaeken, Johnson-Laird, & d'Ydewalle, 1996). Much of the work on situation models has focused on their construction during language comprehension (cf. Johnson-Laird, 1983; Kintsch, 1988, 1998; van Dijk & Kintsch, 1983; Zwaan & Radvansky, 1998), by observing actions or events (e.g., as in a movie; Magliano, Dijkstra, & Zwaan, 1996), or by imagining experiences that have not yet occurred (cf. Glenberg, 1997; Glenberg, Kruley, & Langston, 1994; Graesser et al., 1994). They can also be formed as a result of one's personal involvement in the situations being represented. These latter models might correspond to autobiographical memories (Conway, 1996).

The situation model that is formed during text comprehension is often distinguished from a representation of the surface features of the text itself and the abstract propositions that are derived from it (e.g., Kintsch, 1988, 1998; Schmalhofer & Glavanov, 1986). Although the lower levels of knowledge representations are important, we do not concern ourselves with them here. Instead, we focus on the relation of situation models to more general knowledge structures such as categories (e.g., stereotypes), scripts, and schemas.

Generalized Representations

Situation models are formed during comprehension. However, generalized representations of knowledge may be constructed as well. For example, knowledge about attributes of persons or objects that generalize over many situations (e.g., their names) may be incorporated into a generalized representation of the referent, along with other features the referent is known to possess. Generalized representations are often constructed in the course of pursuing more specific processing objectives (e.g., forming an impression or making a behavioral decision). These representations are often created in a manner similar to ad hoc categories (Barsalou, 1983). Their construction can sometimes be stimulated by an apparent incongruity between new and prior information about a referent (Srull & Wyer, 1989). These inconsistencies often stimulate thinking about features in relation to one another, producing a configuration of associated attributes that might otherwise be stored in memory independently.

Generalized representations are often formed by integrating new information into previous knowledge structures. New features can be added to an existing representation either during comprehension or later, in response to demands to make a judgment or decision (for a theory of the conditions in which inferences are made, see Graesser et al., 1994). Alternatively, several existing representations might be combined to form a new one as a result of goal-directed activity that requires thinking about them in relation to one another. For example, if a set of arguments is used to derive a conclusion, a single representation might then be formed of the arguments and the conclusion in combination (Loken & Wyer, 1983; Wyer & Gordon, 1984). Representations of abstract knowledge about a general class of people (i.e., stereotypes) might be formed in an analogous manner. The most common examples of ad hoc representations in social cognition research are theoretically constructed in the course of forming an impression from descriptions of a person's traits and behaviors (Srull & Wyer, 1989; Wyer & Srull, 1989). These representations are typically formed only in the service of specific processing objectives (e.g., impression formation) and require additional mental activity.

Representations can be "updated" by adding or deleting features in response to new experiences or by combining them with other representations. Like Wyer and Srull (1989), we assume that the new knowledge structures do not replace the originals in memory. Thus, the old and new representations can be retrieved and used independently of one another. This latter assumption, which is compatible with multiple-trace models of memory (e.g., Hintzman, 1986; Logan, 1988), is discussed more formally in the context of retrieval processes.

Nature of Situation Models

We assume that situation models are often constructed spontaneously in the course of comprehending the information conveyed

in social situations (for more general discussions, see Johnson-Laird, 1983, 1989; Kintsch, 1998; Radvansky & Zacks, 1997; Radvansky & Zwaan, 1998; van Dijk & Kintsch, 1983; Zwaan & Radvansky, 1998). Once constructed, these models provide the primary basis for comprehending new information and judging the people and events to which this information refers. Situation models are assumed to model the structure of situations as they might exist in the world. However, they are often incomplete and capture only the most relevant information for understanding the situation.

Content and Structure

The theory of situation models conveyed in this article is based in part on a theory outlined by Zwaan and Radvansky (1998; Radvansky & Zwaan, 1998). This theory integrates elements of the event indexing model developed by Zwaan and colleagues (Zwaan, Langston, & Graesser, 1995; Zwaan, Magliano, & Graesser, 1995; Zwaan & Radvansky, 1998) with other ideas about situation-specific knowledge (e.g., Barwise & Perry, 1983; Radvansky & Zacks, 1997).

The event indexing model (Zwaan, Langston, & Graesser, 1995; Zwaan, Magliano, & Graesser, 1995; Zwaan & Radvansky, 1998) assumes that people keep track of at least five dimensions during comprehension. Those dimensions outlined by the model are (a) space, (b) time, (c) entities, (d) causality, and (e) intentionality. *Space* and *time* refer to the spatial–temporal context in which events occur. *Entities* refers to those entities that serve as agents or are otherwise functionally or causally necessary for understanding the structure of a situation. *Causality* refers to the cause and effect relations between events, and *intentionality* refers to the goals, needs, and desires of the agents in a situation. Consistent with this, our theory assumes that these sorts of dimensions are also important to the comprehension of social situations.

However, not all situations are alike. Barwise and Perry (1983), for example, distinguished between states of affairs and course of events. A state of affairs is a situation in which there is a single spatial–temporal framework. These types of situations are more static. In contrast, a course of events is a collection of states of affairs that is unified by a common entity in some thematic fashion. In a similar vein, our theory distinguishes two types of situation models. *Event models* are representations of specific spatial–temporal frameworks and roughly correspond to states of affairs. As such, an event model contains information about the spatial–temporal framework, the entities in the situation, and the structural relations among those entities. *Episode models* represent the linking relations between events and roughly correspond to courses of events. As such, an episode model would contain information about temporal, causal, and intentional relations and the entities affected by those relations. The construction of such representations might be guided by scripts (Abelson, 1976, 1981; Schank & Abelson, 1977) or story skeletons (Schank, 1990). In this scheme, entities serve as the basis for coordinating information in the event and episode components of a situation model and can be viewed as being most central to the structure of a situation model.

Some important aspects of this view should be noted. The first is the distinction between structural relations and linking relations. Structural (e.g., spatial) relations are primarily characteristic of event models. (Kinship or ownership relations can sometimes be represented in these models as well. Thus, for example, a model of Bob kissing Mary may be different if Mary is Bob's wife than if she is someone else's.) Linking relations, which are largely confined to episode models, are primarily temporal, causal, and intentional and connect several events to form a coherent episode. To this extent, an episode model is composed of several interrelated event models.

Second, information that appears similar on the surface can be treated very differently in the context of a situation model. For example, temporal information comes into play in constructing both a temporal framework and temporal relations. A temporal framework may identify a particular time period in which an event occurred (e.g., "April 29" or "when the microwave beeped"). In contrast, temporal relational information conveys the order in which events occurred (e.g., that Event *A* occurred before Event *B*). Similarly, spatial information is involved in the construction of both a spatial framework (e.g., the location of an event) and spatial relations (e.g., the layout of the entities in a given situation). It is worth noting that although temporal framework information is infrequently provided and is poorly remembered, temporal relations are conveyed very often and are remembered well (Friedman, 1993). In contrast, spatial framework information has been found to be an effective way of organizing information (as in the method of loci), whereas spatial relations are often not remembered well unless they are needed to understand the functional or causal relations among the entities in a situation (e.g., Zwaan & van Oostendorp, 1993).

The distinction between event models and episode models is important. People are limited capacity processors, and consequently they may focus more on one level than the other during comprehension. When reading a narrative, for example, people may often focus on the episode level, processing temporal, causal, and intentional relations, as well as the entities in which these relations are grounded. In doing so, they may ignore more fine-grained changes in spatial location. This was shown by Zwaan, Radvansky, Hilliard, and Curiel (in press). In their study, participants read a passage in which there were changes along all five of the situational dimensions and reading times were recorded. Reading times were always affected by changes along the temporal, entity, causal, and intentional dimensions. However, changes along the spatial dimension influenced reading time only when participants had memorized a map of the context before being exposed to the passages. Thus, only in these latter conditions was the monitoring of spatial information sufficiently undemanding that it could be handled by participants' limited-capacity comprehension system.

The structure and content of situation models involve three basic types of information: a spatial–temporal framework, a collection of entities, and a set of relations among those entities (Radvansky & Zacks, 1997). The *spatial–temporal framework* provides the context in which the events and episodes are to occur. This information is what helps make situation models representations of circumstances in a real or fictional world. The spatial–temporal framework can either be explicitly states or be left implicit. For example, "Mary bought a car" and "Mary is dying her hair red" might be represented in event models because they refer to events that occurred at a particular (albeit unstated) time and place. In contrast, "Mary owns a car" and "Mary has red hair" are unlikely

to be represented in an event model because the conditions they depict are not so constrained. In these cases, the information would be encoded as part of a generalized representation of Mary that might contain other attributes she possesses as well.

The *entities* are the people and objects that affect and are affected by the events that surround them. This aspect of situations is of particular concern in social cognition, in which understanding and evaluation of people and events are greatly influenced by situational context. The entities in a spatial–temporal framework are represented by tokens. Attributes of these entities (e.g., physical properties, psychological and emotional states, or a name) may be associated with these tokens. However, these features are not necessarily represented in the situation model itself but, rather, may be stored in a generalized representation of the entity.

Finally, *relation information* provides the glue that gives structure to one's understanding of a situation. A situation model conveys the relations among the entities in the situation it depicts as well as the relations of entities across events. The format in which relational information is represented can sometimes be conceptualized metaphorically as a mental image. Such an image can be formed from different perspectives. For example, the image of "John went into the house" may be formed from the perspective of someone outside the house, whereas the image of "John came into the house" may be formed from the perspective of someone inside. The effects of perspective on prose comprehension are well established (e.g., Black, Turner, & Bower, 1979; de Vega, 1995), and their implications for situation model construction are considered more fully later.

Two additional assumptions are included in our theory. First, the social events to which situation models pertain often include oneself as a participant or observer. To this extent, these models are likely to contain information about one's own cognitive or affective responses to the events being portrayed as well as characteristics of the events themselves. This does not deny the influence of models that lack a representation of the self. Instead, we are simply suggesting that situation models can have this characteristic, and these models are the focus of this article.

Second, propositional or meta-linguistic information (e.g., a person's name), over and above that used to create a situation model, can be associated with it. The additional propositional information may be conceptualized metaphorically as a "caption" that refers to the event (the "picture"). Note, however, that this is usually not necessary for comprehension. Therefore, it is unlikely to be added spontaneously to the model. This is particularly true if the information to be comprehended is conveyed nonverbally. When propositional information is added after the events have been experienced, it is often influenced by semantic concepts and knowledge that happen to be easily accessible in memory (Bargh, 1994; Higgins & King, 1981; Wyer & Srull, 1989). Thus, situational factors that exist after an event has occurred can affect how the information is ultimately represented in memory and the implications that are later drawn from it (Higgins & Rholes, 1978; Loftus & Palmer, 1974).

To the extent that an episode model consists of a series of connected events, it is somewhat analogous to a comic strip (see also Abelson, 1976; Wyer & Carlston, 1979). However, the comic strip metaphor should be distinguished from that of "a movie." Experiences are not represented in memory by continuous streams of events. Rather, sequences of events are represented by a series of discrete frames, each of which is typical of the event it depicts (Ebbesen, 1980; Newtson, 1976; Wyer & Carlston, 1994; Wyer & Srull, 1989).[2] This means that when a situation model is constructed from an observed experience, some information is necessarily lost that cannot later be recaptured.

Note that a verbally described sequence of events and an observation of these events are often represented similarly in memory. For example, the verbally conveyed information that John got up from his chair, walked to the refrigerator, and got a beer and the observation of John engaging in these activities may both be represented in an episode model whose segments represent the activities described. The segments formed from the verbally described sequence are likely to contain propositional features (captions) describing the events, whereas the event models formed from the observed sequence might not. Nevertheless, the comprehension and use of situation-specific knowledge in comprehension and judgment are governed by similar processes, regardless of the modality in which the information was originally received.

Headers

Situation models may be assigned headers, or titles. These headers often constitute generalizations of the events to which they refer and describe what the model is about.[3] Thus, the propositional equivalent "the fight with my wife about how to arrange the furniture" might be the header of a model that conveys the events that occurred during the argument.[4] A model's header serves to index the model in memory. Therefore, features of the header (as well as features of the model itself) can cue its retrieval (see also Schank & Abelson, 1995). For example, "Skinheads harass ethnic minorities" could index a situation model of specific events that one has seen or read about.

A given generalization may index several different models. However, other generalizations might not refer to any model at all.[5] In this regard, many beliefs and opinions can be conceptual-

[2] Our conception differs from that of Newtson (1976), who assumed that the frames extracted from an event sequence are at break points, or transitions between one event and another. In contrast, we assume that a single frame is extracted that exemplifies a typical point in the stream of events it represents and thus could occur anywhere within it. Thus, for example, "John walked to the refrigerator" is represented by a particular frame of John in the course of performing the action and not by two frames, one at the beginning of the action and another at the end (see also Ebbesen, 1980; Wyer & Srull, 1989).

[3] Our assumption that a header is typically coded propositionally may be too restrictive. Representations at a more abstract level than that in which segments of the model itself are coded could also function as headers. However, it is reasonable to suppose that these abstract headers, however coded, are easily expressed as propositions. To this extent, our working assumption that a header is propositionally coded is reasonable. That is, a header is functionally equivalent to a propositionally coded generalization, if not identical to it.

[4] This conceptualization of a header should be distinguished from the construct of a "bin header" in Wyer and Srull's (1986, 1989) theory. In the earlier theory, a bin header was assumed to index an entire body of knowledge. In contrast, the header of a situation model denotes only the specific situation that the model depicts.

[5] Schank and Abelson (1995) argued that all propositional representations are abstractions of more specific, "storylike" representations analo-

ized as headers that differ in terms of the number of situation models they identify. To this extent, the strength of one's belief in a statement (e.g., "Capitalism is detrimental to world peace" or "Honesty is the best policy") might be a positive function of the number of models for which the statement serves as a header. This is another way of saying that the strength of a belief or opinion increases with the number of exemplars that can be easily retrieved and used to instantiate it.

Just as a given header can index several situation models, a given situation model can have more than one header. Suppose the aforementioned argument about furniture occurred during dinner at Yen Ching's. An alternative header of the situation model of this event might refer to "dinner at Yen Ching's " rather than to the argument. The assignment of a header to a situation model is assumed to be a conscious process that occurs as a result of goal-directed activity (e.g., communicating about the event). Therefore, some models might not be assigned headers at all. In these cases, stimulus features that refer to the abstract encoding of the event as a whole would not cue its retrieval.

Summary

To summarize, situation models mentally represent knowledge about specific events and episodes that is formed during comprehension. The information about the events represented can be either conveyed verbally or acquired through direct participation or observation. Situation models contain knowledge about the place and time in which events take place, the entities involved in the events, and the relations among these entities. Two implications of this conceptualization are stated in the form of postulates.

> *Postulate 1:* A situation model is formed from new information if and only if the information refers to an event or episode.

> *Postulate 2:* Once a situation model has been formed, subsequent information will be integrated into it if and only if it is perceived to concern the same situation.

Empirical Evidence

The role of situational models in language comprehension has been studied extensively. We describe a few representative studies that bear on the assumption that situation models are formed during comprehension and the conditions in which this construction occurs (Postulates 1 and 2).

Effects of Situation Models on Comprehension

The assumption that situation models are formed while one is comprehending new information is supported by evidence that the identification of described events has a considerable impact on the ease of comprehending them. In a test of recognition memory, for example, Garnham (1981; see also Radvansky et al., 1990) found that people were more likely to confuse "The hostess bought a mink coat from the furrier" with "The hostess bought a mink coat at the furrier's" than to confuse "The hostess received a telegram from the furrier" with "The hostess received a telegram at the furrier's." This occurred because the first two sentences describe the same situation, whereas the second two describe quite different situations.

A study by Glenberg, Meyer, and Lindem (1987) has similar implications. They had people read passages in which an object (e.g., a sweatshirt) was either associated with the protagonist (e.g., "John put on his sweatshirt before going jogging") or separated from the protagonist (e.g., "John took off his sweatshirt before going jogging"). Subsequent recognition responses to the target object ("sweatshirt") were faster in the first condition than in the second, even though the actual time between the mention of the object in the text and presentation of the recognition item was the same in both cases. People in the first condition apparently associated the sweatshirt with the token for John, and this persisted throughout the episode model they formed. This was not true in the second condition.

Similar implications can be drawn from research on perspective shifts. Black et al. (1979), for example, found that sentences such as "As Mary was reading a book in her room, John went in to talk with her" took longer to comprehend than sentences such as "As Mary was reading a book in her room, John came in to talk with her." This is because the first sentence leads to the construction of a representation from the perspective of someone inside the room. Whereas the description of John's coming into the room can also be represented in a model that is formed from this perspective, the representation of John's going into the room requires a perspective shift. Results of other studies (e.g., de Vega, 1995) have similar implications.

When Are Situation Models Formed?

The aforementioned research provides evidence that fits our theory of situation models. However, Postulate 1 asserts that the integration of information into a situation model does not occur if the information is not identifiable as an event or episode. A study by Radvansky, Wyer, Curiel, and Lutz (1997) provided support for both this postulate and Postulate 2. Participants first learned a series of sentences about people (e.g., "the lawyer") and objects (e.g., "the bicycle"). In some sets of sentences, each person was associated with one, two, or three objects. In other sets, each object was associated with one, two, or three persons. In one condition, the relations denoted an abstract state of ownership ("The lawyer owns the bicycle"), whereas, in other cases, the relations described a concrete act ("The lawyer is buying the bicycle"). Finally, the objects associated with a given person either could all be purchased in the same location (e.g., a drugstore) or were unlikely to be found in the same location (e.g., toothpaste, compact disks, and a diamond ring). After memorization of the sentences, a recognition test was given, and the time required to respond to each statement was recorded.

If participants construct a different situation model of each statement, the model they form of one statement about a given person or object should interfere with their retrieval of models formed of other statements about the same referent. In other words, "fan effects" (an increase in response time with the number of associates to a concept; see J. R. Anderson, 1974) should be observed. However, if all of the information about a referent is incorporated into a single situation model, then there should be little or no interference, and no fan effect should be observed.

---

gous to situation models. Although we do not make this assumption, we agree that a large amount of general knowledge is "story" based.

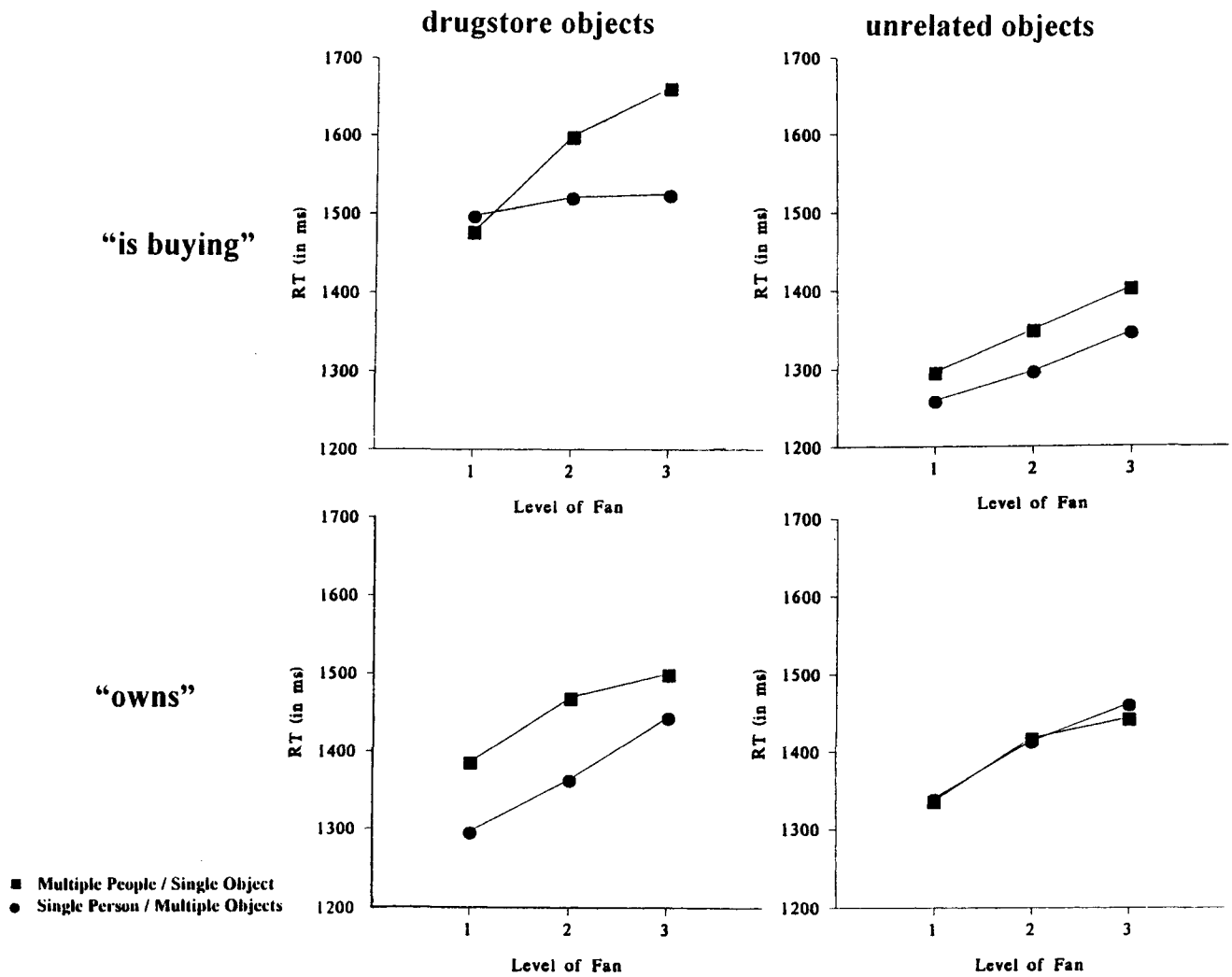

Figure 2. Mean time to verify stimulus as a function of the number of persons associated with a given object and the number of objects associated with a given person. The two top panels show responses to items pertaining to buying objects that could be found either in a single location (a drugstore) or in different locations. The two bottom panels show responses to items pertaining to owning these objects (based on data reported by Radvansky, Wyer, Curiel, & Lutz, 1997). RT = response time.

The results summarized in Figure 2 are very clear and are consistent with Postulates 1 and 2. When the verb phrase referred to a specific event ("is buying") and the objects could all be bought in the same time and place (a drugstore), people could integrate the information into a common situation model. In this case, there was not retrieval interference, and no fan effect was observed. However, when (a) the verb phrase did not clearly refer to a specific time and place ("owns"), (b) the objects could not be bought in the same place at the same time, or (c) the statements referred to different people buying or owning the same object, the information was not integrated into a common situation model, and retrieval interference was evident.

These results further support our idea that situation models are formed during comprehension. Note that this does not imply that they are always created automatically or without effort. Situation models are theoretically constructed by the Comprehender (Figure 1), whose function is to create an understanding before specific goal-directed activity. There may be conditions in which people receive information without the goal of comprehending it and, therefore, do not create a situation model. Proofreading provides a good example (Singer & Halldorson, 1996). However, in the social situations to which the present theory applies, it is reasonable to assume that people wish to attain a reasonable level of understanding of the information they receive and that they form situation models in doing so.[6]

[6] Zwaan (1994) found that people were more likely to create a situation model when a text was described as an account from a newspaper than when it was described as a literary text (in which the emphasis is more on the language used).

Other Considerations

Postulate 1, that situation models are not formed when information cannot easily be interpreted as referring to a single situation, is important in conceptualizing the comprehension and use of information about events that cannot easily be imagined. For example, a situation model of "Two million people were killed in World War II" is difficult if not impossible to construct accurately, because it does not refer to a specific event. Rather, a non-situation-specific, generalized representation is likely to be constructed. In contrast, a situation model of "A 16-year-old boy was killed in World War II" is easy to form. These considerations are noteworthy in the context of evidence that judgments and decisions are more likely to be influenced by concrete (imageable and situation-specific) information than by abstract knowledge (Nisbett & Ross, 1980). This suggests that if people were asked their attitudes toward war, their judgments would be influenced more strongly by the second type of knowledge representation than by the first. More generally, social judgments and decisions may be based more often on situation models than on other, abstract representations of knowledge.

Functional Independence of Model Components

Our theory assumes that situation models contain information about the spatial–temporal context of events, about the entities involved, and about the various relations among these entities. In addition, the segments of the models may have "captions" that describe the entities, events, and episodes. These considerations lead to a third postulate.

> *Postulate 3:* The components of a situation model can enter into processing independently, and therefore they can influence processing in different ways.

Postulate 3 implies that one component of a previously formed situation model can be retrieved and used to construct new representations without carrying the other components with it. In person memory research (Wyer & Carlston, 1994), for example, the information presented about a target person typically includes a series of unrelated behaviors. To the extent that the spatial–temporal context is implicit and no linking relations are provided, separate situation models might be formed of each behavior. However, only the header components of the models are likely to be integrated into a generalized representation of the target person of the sort hypothesized by Wyer and Srull (1989; see also Srull & Wyer, 1989).

In a related vein, the headers of several different situation models can often be combined during goal-directed activity to form a more abstract event representation in which only the headers are included. For example, a man might construct a generalized representation of his professional life composed of the ideas "graduates from the University of Colorado," "took a job at Iowa," "got fired," and so forth. These descriptions might each be the header of a previously formed model. However, the abstract representation is primarily coded propositionally (see Footnote 3). Thus, although each segment of this latter representation might index a situation model, it is presumably constructed and stored independently of other components. These considerations imply that the rules that govern the manipulation of concepts and propositions can be applied to entity components of a situation model independently.

The separability of the different components of a situation model is evident in research based on the event indexing model (Zwaan, Langston, & Graesser, 1995; Zwaan & Radvansky, 1998). Indirect evidence that the different components of a situation model can be brought to bear on judgments and can influence these judgments in different ways was reported by Strack, Schwarz, and Gschneidinger (1985). Strack et al. had people to explain why a past event from their life had occurred, an activity that presumably required generalized representations. These people reported experiencing little affect or emotion as a result of generalizing the explanation and later used the explained event as a standard of comparison in judging their present life satisfaction. That is, they reported being less satisfied when the recalled event was favorable than when it was unfavorable. In contrast, other people imagined how the event had occurred, an activity that encouraged them to use a situation model. These people did experience affect and then used their affective reactions as a basis for inferring their general life satisfaction (for a summary, see Clore, Schwarz, & Conway, 1994). Both groups of participants presumably retrieved a situation model of the life event they described. However, they used different aspects of the model, depending on the task they were asked to perform. Specifically, people who described why the event occurred considered aspects with implications for the causes of the event and the motives of the protagonists. In contrast, people who described how the event occurred focused on nonverbal features that had more affect-eliciting details.

Interrelatedness of Situational Models and Generalized Representations

The components of situation models can serve as the ingredients for other types of representations. For example, the information that Mary Jones has blue eyes and blond hair might be represented by a mental image, whereas information that she is a lawyer and owns a car might be represented propositionally. These representations might further become components of generalized representations of Mary consisting of a central concept and a number of associated attributes.

The impact of referent-specific representations on the comprehension of new information is an integral part of our theory. It nevertheless seems incontrovertible that by far the greatest proportion of people's social knowledge concerns specific situations that they directly observe, see in movies or on television, read about, or hear others describe. This information is represented in situation models. The creation of a situation model obviously requires specific references to the people, objects, and actions it represents. Thus, even situation models that do not specify a referent by name (e.g., "The lawyer bought a car") contain tokens that refer to specific exemplars of the referenced categories. These requirements do not necessarily refer to any known individual but might be formed by combining features from past experiences. These considerations suggest a fourth postulate.

> *Postulate 4:* The referent of a situation model is more likely to be a specific exemplar of a category or concept than to be the concept or category itself.

Support for this possibility, which is consistent with other conceptualizations of situation models (e.g., Kintsch, 1998), was re-

ported by Whitney (1986; see also Whitney & Callas, 1984). In one study, for example, people performed a Stroop color-naming task after reading a pair of sentences (e.g., "The reporter went to the vehicle to look for papers. She hoped they were in it as she had left them"). The words for the Stroop task were either typical (e.g., "car") or atypical (e.g., "helicopter") members of the category mentioned in the priming sentences ("vehicle"). Priming facilitated responses to the typical words but interfered with responses to the atypical ones. This is consistent with the idea that, in forming a situation model of the priming sentence, people instantiated "vehicle" as a specific exemplar of that category. Thus, they experienced less interference on the Stroop task when the item was a likely candidate for that category than when it was not.

Memory Storage and Retrieval Processes

A theory of how previously formed knowledge representations are used to comprehend new social information requires assumptions about how they are retrieved from memory. Numerous retrieval theories have been proposed in both cognitive psychology (J. R. Anderson, 1983; Collins & Loftus, 1975; Hintzman, 1986; Raaijmakers & Shiffrin, 1981; Ratcliff, 1978) and social cognition (Higgins et al., 1985; Wyer & Carlston, 1979; Wyer & Srull, 1989). Although a complete theoretical explication of retrieval processes is beyond the scope of this article, the essential features, which we borrow from theories developed by Ratcliff (1978; see also Neisser, 1967) and Hintzman (1986), are summarized.

Storage

We assume that each mental representation that is formed (be it a situation model or a generalized representation) constitutes a separate unit of knowledge that is stored separately from other units. Some support for this assumption was obtained by Klein and Loftus (1993). In a study of the accessibility of self-knowledge in memory, they found that the time people needed to decide whether or not they had a particular trait was unaffected by their recall of a trait-related behavior before making this decision. Moreover, the time people required to recall a behavior did not depend on whether or not they had previously made a behavior-related trait judgment. Although their judgments typically pertained to themselves rather than other persons, these results suggest that trait-based and event-based representations of a referent are often stored and retrieved separately regardless of their conceptual relatedness. Note that this assumption does not imply any inherent organization of knowledge in memory. Not all knowledge units are equally likely to be retrieved, however, for reasons indicated subsequently.

Retrieval

The mechanisms we postulate to govern knowledge retrieval make use of a "tuning fork" metaphor similar to that proposed by Ratcliff (1978); for a similar theory in language comprehension, see Albrecht & Myers, 1995; Albrecht & O'Brien, 1993; Kintsch, 1998; Klin, 1995; Myers, O'Brien, Albrecht, & Mason, 1994). Many implications of Ratcliff's conceptualization are similar to those of a spreading activation, associative network model (J. R. Anderson, 1983; Collins & Loftus, 1975; Wyer & Carlston, 1979). However, no assumptions concerning organization in memory are needed. Briefly, Ratcliff assumed that when a configuration of stimulus features is activated (i.e., consciously thought about), it "vibrates," and this causes it to resonate with memory traces that contain some or all of these features. The degree to which a memory trace resonates with the stimulus configuration depends on the similarity of its features to those of the stimulus. If the resonance of a memory trace exceeds a threshold value, it is also activated. Once a trace is activated, it remains so until it is no longer involved in processing.

A similar mechanism is assumed to operate in the conditions of concern here. Like Wyer and Srull (1989), we assume that retrieval is governed by a configuration of features, or *probe cues,* that are either extracted from incoming information by the comprehender or compiled by the executor in the service of specific processing objectives. These probe cues include any or all components of a situation model. Thus, they can convey relations among the entities they describe as well as the entities themselves.

Five more assumptions are made about information retrieval. Because these assumptions are consistent with other theories, we treat them as a set of general retrieval principles.

Principle 1: The activation of a set of probe cues for use in retrieving information causes all units of knowledge that contain these cues to resonate.

Principle 2: The resonance of a knowledge unit increases with (a) the similarity of its features to those of the probe and (b) the length of time the probe cues have been activated.

Principle 3: A unit of knowledge, k, is activated by a set of probe cues when its resonance exceeds a given threshold value, T_k. (a) If several knowledge units resonate with the probe cues and one unit reaches activation threshold before any other, only this unit is activated. (b) If two or more knowledge units reach threshold simultaneously, a composite of their features is activated. The weight of each feature in such a composite is a positive function of the proportion of times it occurs in the set of knowledge units that are retrieved. (Thus, a feature that is common to all units would have a weight of 1.)

Principle 4: If a knowledge unit in memory has resonated with a set of probe cues, this resonance does not immediately dissipate but, rather, decreases over time.

Principle 5: The activation threshold of a knowledge unit in memory is an inverse function of the number of times it has been activated in the past.[7]

The first two principles are suggested by Ratcliff's formulation noted earlier. Principle 3a is consistent with assumptions of the independent-trace model proposed by Logan (1988). Principle 3b, on the other hand, borrows from the conceptualization proposed by Hintzman (1986) to account for the abstraction of general concepts from exemplars. In effect, it implies that when a set of probe cues is common to several representations and these representations are equally accessible in memory, a conglomeration of the features that compose the exemplars is created. In this aggregate, features that are contained in many representations are weighted heavily, whereas the features that are idiosyncratic to a single representation are filtered out.

Thus, a baseball fan who hears that "Nolan Ryan pitched a

[7] For a similar interpretation of the effects of activation frequency on accessibility, see Higgins et al. (1985).

no-hitter" may have previously formed a situation model of each of the six no-hitters that Ryan pitched. All of these models should be activated more quickly than situation models that contain only a subset of cues in the probe set (e.g., models that refer to people other than Ryan). If one of these Ryan models reaches activation threshold before any other, the statement would elicit a representation of the particular game. However, if all six models reach threshold equally fast, a composite representation would be created from the activated components. In this composite, components that are common to all six models would have the greatest weight, whereas components unique to a particular model would be weighted very little.

Because Nolan Ryan is the referent of all of the models that are activated in our example, features that uniquely characterize him (as opposed to other baseball players) are weighted heavily. However, if the target statement refers to a general category (i.e., "A baseball player pitched a no-hitter"), a situation model that refers to this particular set of circumstances is unlikely to exist (Postulate 4). Consequently, each sentence component may resonate with a different set of representations. The subject, for example, may resonate with representations of baseball players, whereas the predicate is likely to resonate with a large number of models of individuals who have pitched a no-hitter, only a few of which refer to Ryan. If these latter models are equally accessible, only a small number of common features may be heavily weighted in the composite that is activated (e.g., only those that characterize no-hitters in general and are common to a large number of pitchers who are known to have pitched a no-hit game).

General Implications

Although the implications of the retrieval principles become apparent later in our discussion of comprehension, a few examples of their applicability to other phenomena are worth noting. Several of these phenomena cannot be explained by the Wyer and Srull (1989) theory.

Set Size Effects

Because a set of stimulus features activates all of the representations in memory that contain these features, the identification of one particular model can be difficult. Therefore, when a person's goal is to retrieve a particular experience, interference is likely to occur. The magnitude of this interference increases with the number of other activated representations. One implication of this is consistent with the well-known effects of set size (J. R. Anderson, 1974) and list length (Ebbinghaus, 1913/1964) on recall. That is, the greater the number of items that are associated with a concept or category, the less effective the concept is in cuing the retrieval of any particular item (for alternative conceptualizations of this effect, see Collins & Loftus, 1975; Rundus, 1971; Srull & Brand, 1983; Wyer & Srull, 1989). Note that our earlier interpretation of the fan effect is based on this assumption.

A distinction should, of course, be made between the ease of identifying a particular model from a set of several situation models and the ease of accessing components that are common to several models. For example, the greater the number of models that are identified by a header (e.g., "watching a New York Yankees baseball game"), the more quickly one should be able to identify features that they share in common and thus are "prototypic." At the same time, it should also be more difficult to retrieve any particular ballgame. Although this implication of the theory is not unique (cf. Reder & Anderson, 1980; Reder & Ross, 1983), its consistency with these alternative theories is worth noting.

Frequency Versus Recency Effects on Accessibility

A second implication of our retrieval assumptions is that the recency with which knowledge has been activated has only a transitory effect on its accessibility. That is, its resonance ultimately decreases to baseline. In contrast, the effect of frequently activating a knowledge unit, which affects its activation threshold, is more enduring. This means that although the effects of recency have an initially greater influence on concept accessibility than frequency, the relative influence of these factors reverses after a period of time has elapsed. Support for this was obtained by Higgins et al. (1985). The Wyer and Srull (1989) theory can account for this reversal only with the help of several ad hoc assumptions. More generally, these considerations suggest that if knowledge has been activated very frequently, it becomes "chronically" accessible (Bargh, Bond, Lombardi, & Tota, 1986) and thus becomes generally likely to be used to process new information (see Klinger, 1975). The Wyer and Srull theory has difficulty accounting for this possibility as well.

Indirect Effects of Knowledge Activation

To reiterate, a unit of knowledge continues to resonate for a period of time after it has been deactivated (Principle 4). As long as this residual resonance has not dissipated, the unit should reach activation threshold more quickly as a result of resonance from new sources. This "priming" effect, which is also an implication of spreading activation models (Collins & Loftus, 1975; Wyer & Carlston, 1979), is well established (Bargh, 1994, 1997; Wyer & Srull, 1989).

Only the first knowledge unit that reaches activation threshold is activated by the probe cues that govern a memory search (Principle 3). Nevertheless, other nonactivated knowledge units have also resonated with these cues, and the resonance of these units takes time to dissipate as well. This means that the probe cues used to retrieve a given knowledge unit can affect the later retrieval of not only this unit but also others that were not fully activated at the time.

For example, suppose a person is asked whether Jane Fonda does aerobics. This question is likely to activate a previously formed situation model of her performing this activity. However, a model of scenes from *Cat Ballou,* a movie in which she appeared with Lee Marvin, may also resonate with the probe cue "Jane Fonda," and so this model will temporarily become more easily accessible despite its objective irrelevance to the processing goal at hand. This means that answering the question "Does Jane Fonda do aerobics?" might facilitate later responses to the question "Was Lee Marvin in *Cat Ballou*?" This prediction would not be made by the Wyer and Srull (1989) theory without the introduction of several ad hoc assumptions. Evidence bearing on this prediction is provided shortly.

Effects of Thought Suppression

Macrae, Bodenhausen, Milne, and Jetten (1994) showed that instructing people to suppress the use of a social stereotype (e.g., "skinhead") increased the accessibility and use of stereotype-related attributes (e.g., "aggressive") in a later, ostensibly unrelated word-fragment-completion task. One interpretation of this is that the suppression of the stereotype-based representation (Wegner, 1994) led the attributes in this representation to resonate at a level below activation threshold. Consequently, these attributes were more likely to be activated later by stimulus cues to which they were applicable.

The theory we propose has broader implications. To extend our earlier example, suppose that instead of asking whether Jane Fonda does aerobics, people are told to suppress thoughts about Jane Fonda engaged in this activity. The attempts to suppress these thoughts and the representations to which they refer should not only lead the situation model of Jane Fonda doing aerobics to resonate but lead other models of her to resonate as well. Thus, these suppression attempts should facilitate later responses to not only a question about Jane Fonda's own activities but also a question about Lee Marvin's performance in *Cat Ballou,* despite the ostensible irrelevance of the latter question to the thoughts that had been suppressed.

In summary, our retrieval principles help to conceptualize a variety of factors that affect the accessibility of social information in memory and its influence in making judgments (Bargh, 1994; Higgins & King, 1981; Wyer & Srull, 1989). Moreover, they generate additional predictions that the Wyer and Srull (1989) theory cannot. However, their implications for comprehension processes are of particular relevance to the issues of primary concern in this article. We now turn to these implications.

Initial Comprehension Processes

The comprehension of social information can occur in two stages. During initial encoding, information is interpreted by the Comprehender in terms of preexisting knowledge about persons, objects, or events. If the information cannot be easily understood, or if its literal meaning violates expectations, additional operations are performed to construe its implications. These latter operations, which are governed by the Executor, are discussed later.

We conceptualize the initial comprehension of new information as a process of either (a) identifying a previously formed situation model that is described by this information or (b) constructing a new model. To this end, the Comprehender is metaphorically thought of as having two components. One, the *Parser,* transforms verbal information into propositions. The other, the *Model Constructor,* either identifies preexisting situation models or constructs new models from knowledge contained in Permanent Storage. In so doing, it has the capacity to (a) identify and retrieve knowledge from Permanent Storage, (b) evaluate the compatibility of new information with previously formed situation models, (c) substitute features of the new information for those of preexisting models to form a new one, and (d) combine individual segments extracted from previously formed models to form a new, episode model that depicts a unique sequence of events.

In this section, we describe the manner in which statements about people and events are understood. In doing so, we specify the conditions in which these statements are recognized as true or false during comprehension. Empirical support for several implications of the theory is provided. We then discuss the construction of situation models from several different pieces of information.

Comprehension of Single Statements

The comprehension of a verbal statement is assumed to proceed as follows. First, the statement is parsed into a proposition consisting of a subject and a predicate. The subject can refer to a specific exemplar (e.g., "Jane Fonda" or "*Gone with the Wind*") or to one or more members of a general category (e.g., "an actress," "a book," "some sorority members"). The predicate can refer to either a specific or general action (e.g., "does aerobics") or a relation between the statement's subject and an attribute (e.g., "has brown hair"). We restrict our present consideration to predicates that describe actions. However, much of our discussion applies equally well to statements that describe subject–attribute associations.

The remaining activities, which are performed by the Model Constructor, are described in terms of postulates.

> *Postulate 5:* The subject and predicate of a target statement are independently used as probe cues of memory, resonating with all of the mental representations that contain them. As noted in our retrieval assumptions, the representations whose resonance level reaches threshold fastest are the most likely to be retrieved. The speed of reaching threshold, in turn, depends on (a) the number of features of the representations that are also contained in the probe set and (b) the degree to which the representations are already "vibrating" as a result of prior cognitive activity. These considerations lead to three further postulates.

> *Postulate 6:* If a memory search activates a previous situation model (or other knowledge unit) that is consistent with the target statement, the statement is identified as redundant with prior knowledge, and a new model is not constructed.

> *Postulate 7:* If no previously formed model refers to both the subject and predicate of a target statement, the features that have been activated by the statement's subject are compared with a weighted composite of the features extracted from the set of previously formed models activated by its predicate. This comparison yields a global estimate of similarity, S. A new situation model is formed if either (a) S is greater than a threshold value, T_C, or, if not, (b) the target's subject contains the subset of features that are common to all models of the predicate.

This construction is performed by combining the composite of features that were activated by the subject and the composite of features activated by the predicate. In each case, however, only those features that are weighted heavily in the composite are included.

> *Postulate 8:* A statement is comprehended spontaneously if it is redundant with prior knowledge or a new model is constructed of it. If neither is the case, comprehension of the statement requires (Executor-controlled) goal-directed processing.

These postulates require some unpacking. To understand their implications, suppose a person hears that "Jane Fonda did aerobics." In this case, a previously formed model of Ms. Fonda doing aerobics is likely to exist, and this model should be activated more

quickly by the subject and predicate of the target statement than would models about other persons or other events. Thus, the statement should take little time to comprehend.

However, now suppose someone is told that "Jane Fonda rode a motorcycle" and has never heard about this before. In this case, Postulate 7 applies. Specifically, "Jane Fonda" may activate an array of features contained in previously formed representations of Jane Fonda, the weights of which depend on the number of times they occur in these representations. For simplicity, assume that the array is $a_1b_5c_5d_5e_1$, where a–e denote features and subscripts indicate their relative frequency of occurrence. The predicate "rode a motorcycle" should independently activate an array of features that are contained in previously formed models of people riding motorcycles. Assume that this array is $a_6b_7c_4e_5f_5w_2x_5y_7z_1$, where a–f are features of the persons represented in these models and w–z are features of the events (riding a motorcycle). The array of person features activated by the predicate and the array of features activated by the subject are then compared, and a global estimate of similarity (S) is computed. Assuming that this similarity is above threshold (T_C), a new model is formed, and the statement is comprehended. The new model includes only features that are weighted heavily in the array activated by the subject (b, c, and d) and the array activated by the predicate (x and y). Thus, the representation of Jane Fonda in this model (bcd) is likely to be less detailed than the representation of her in a model of doing aerobics, and the representation of riding a motorcycle (xy) is likely to be less detailed than it is in many of the previously formed models of motorcycle riding.

The extent to which comprehension requires additional processing depends in part on the range of one's prior knowledge about the events described and the people who are typically in them. In our example, the comprehension of "Jane Fonda rode a motorcycle" depends on the similarity of features associated with "Jane Fonda" to those features of the persons represented in previously formed situation models of motorcycle riders. Thus, S is more likely to exceed comprehension threshold if one's prior knowledge of motorcyclists is representative of the general population than if it is limited to members of the Hells Angels, whose features are less similar to Ms. Fonda's. In the latter case, comprehension might require a second stage of processing to determine whether Jane Fonda's attributes include those that are common to all previously formed models of motorcycle riders (e.g., "humans"). In this case, comprehension would still occur, but it would take longer than if the first stage of comprehension had been sufficient.

On the other hand, suppose the target statement had been "The hippopotamus rides a motorcycle." The subject of this statement is unlikely to have all of the features that are common to referents of previously formed models of motorcycle riders, and so comprehension is unlikely to occur immediately. Rather, the statement would be identified as anomalous and would be transmitted to the work space along with an indication that additional processing is necessary. This latter processing would presumably require a more complex model-construction process.[8]

Postulates 5–8 generate some obvious predictions. For example, they imply that the ease of comprehension is a positive function of the similarity of the statement's implications to those of prior knowledge about its referents. Many other theories undoubtedly have similar implications (e.g., Gernsbacher, 1990; Kintsch, 1988, 1998).

Another prediction derives from the assumption that only features that are weighted heavily in the configuration activated by the target statement are included in the formed representation. As the number of representations pertaining to a referent increases, the number of referent-specific features that are common to these representations and, therefore, the number that are weighted heavily in a new representation of the referent are likely to decrease. This means that the situation model of new information will normally decrease in detail as the amount of previously acquired information about this referent increases. A corollary to this hypothesis is that the mental representation is an initial encounter with an exemplar (e.g., one's first big league baseball game) that is often more detailed than the representations of later ones. Consequently, memory for these early experiences is often more vivid. A less obvious prediction of the theory concerns the comprehension of information about persons who are described in terms of their category membership (e.g., an actress or a steelworker). The time necessary to comprehend these statements depends on the extent to which the statements describe a category with which the referent of an existing model is strongly associated. Consider the statement "An actress does aerobics." No existing model of doing aerobics may have "actress" as its referent (Postulate 4). Nevertheless, the subject of the target statement ("actress") is likely to activate a generalized representation of actresses with which "Jane Fonda" is associated. Moreover, previously formed models of doing aerobics are very likely to have "Jane Fonda" as their subject as a result of the frequency with which people are exposed to her engaged in this activity. Consequently, the combined resonance emanating from the generalized representation and "did aerobics" may lead the situation model of "Jane Fonda did aerobics" to be activated more quickly than models that refer to other people. In fact, "An actress did aerobics" should take little more time to comprehend than a statement that refers explicitly to Ms. Fonda.

Moreover, "An actress did aerobics" should take less time to comprehend than a statement that refers to categories whose members are not specified in a previously formed model of doing aerobics. Thus, for example, it should take less time to comprehend "An actress did aerobics" than to comprehend "An athlete did aerobics," even though aerobics (an athletic activity) is semantically more similar to "athlete" than to "actress." The Wyer and Srull (1989) theory could not generate this prediction. Nor can any theories of prose comprehension and discourse that we know of.

The most important features of Postulates 5–8 concern their implications for the relation between comprehension and the recognition of information as either true or false. We now turn to these implications.

Verification Processes

In our theory, the recognition that a statement is true or false is often a by-product of comprehension. This is most obvious when

[8] A statement does not need to be anomalous or bizarre for this conscious, goal-directed stage of comprehension to occur. For example, a similar situation would arise in response to the statement "Jane Fonda rides a motorcycle" if one's previously formed models of motorcycle riding pertained only to men.

there is already a situation model in memory. In this case, the model is activated during comprehension (Postulate 6), and awareness of its existence is often sufficient to recognize the statement.

This idea assumes, of course, that situation models characterize episodes or events that have actually occurred. This is not always the case. Situation models can pertain to fictitious persons and events (e.g., "Santa Claus comes down the chimney on Christmas Eve") that one knows to be untrue. Such representations are likely to contain "tags" denoting their falsity. In the absence of these tags, statements that instantiate an existing model might be incorrectly evaluated as true by virtue of the model's prior existence in memory. A postulate formalizes this possibility.

Postulate 9: A statement is spontaneously recognized as true if (a) it is redundant with the content of a previously formed situation model and (b) no tag has been attached to the model that denotes it as false.

Empirical Evidence

Indirect support for this postulate comes from several sources. In a study by Hasher, Goldstein, and Toppin (1977; see also Kelley & Lindsay, 1993), people first completed a general knowledge questionnaire containing statements about unfamiliar events and situations. In a later session, they completed a second questionnaire in which some of the earlier statements were repeated. According to our theory, the comprehension of the statements in Session 1 should lead situation models of them to be constructed. Consequently, these models should later be retrieved and used to comprehend the same statements in Session 2. Therefore, the preexistence of these models should increase inferences of the statements' validity. Consistent with this, repeated statements were judged more likely to be true in the second session than they had been initially.

Two quite different studies demonstrated that explaining a hypothetical event increased subsequent predictions of its actual occurrence (Ross, Lepper, Strack, & Steinmetz, 1977; Sherman, Skov, Hervitz, & Stock, 1981). Generating an explanation for an event presumably required the construction of a situation model of it, and this model was later retrieved and used as a basis for judging the likelihood that the event would actually occur.

Verification of New Information

Spontaneous judgments of a statement's validity can also occur when a previously formed model of the statement does not exist. According to Postulate 7, comprehension often involves a two-stage comparison process somewhat analogous to that proposed by E. E. Smith et al. (1974). In Smith's theory, people decide whether an object belongs to a category (e.g., whether a robin is a bird) by first computing a global estimate of the similarity of the object to typical category members, affirming membership if this estimate is above some upper threshold value but rejecting it if the estimate is below some minimum value. If the estimate falls between these extremes, a second stage of processing is required in which only the defining features of the category are considered. Thus, people quickly confirm that "A robin is a bird" is true and that "A refrigerator is a bird" is false, but they take more time to decide whether "an ostrich is a bird" or "a bat is a bird."

A similar process may occur spontaneously during comprehension. Postulate 7 implies that when a previously formed model does not exist, people compute a global estimate of the similarity (S) between the target subject and the referents of previously formed situation models of the predicate. To determine whether S exceeds the comprehension threshold, T_C, they are likely to become aware of its relation to the values that are necessary to confirm or disconfirm its validity. To this extent, the recognition of a statement's truth is a by-product of the same processes used in comprehension. The next postulate formalizes this assumption.

Postulate 10: A statement about an event is recognized as true if the similarity of its subject to those of previous models of the event (S) exceeds an upper threshold, T_T. It will be identified as false if S is below a lower threshold, T_F. These inferences are then transferred to the Work Space along with a situation model of the statement. If S falls between T_T and T_F, the statement's validity is not spontaneously evaluated.

Thus, as an example, "Hitler donated money to a synagogue" is likely to be immediately judged as false. This is because very few features of Hitler are likely to characterize the subjects of previously formed models of donating money to a synagogue (i.e., $S < T_F$). In contrast, "An Israeli donated money to a synagogue" would be quickly judged as plausible, because the categorical representation of "Israeli" is likely to share many features with the subjects of these models ($S > T_T$). Finally, "Madonna donated money to a synagogue" would not be immediately evaluated as either true or false, because Madonna's known features are neither highly similar nor highly dissimilar to those of the relevant models' subjects ($T_F < S < T_T$). That is, the latter statement would be comprehended, but its validity would be assessed only if more specific, goal-directed processing required it.

In our initial tests of the theory, we assumed, for simplicity, that the threshold of similarity for recognizing a statement as true and the threshold for comprehending it are the same (i.e., $T_T = T_C$). This is consistent with Gilbert's (1991) idea that the tentative acceptance of a statement as true is necessary for comprehension. Although our data are consistent with this, possible limitations on its generality should be kept in mind.

Empirical Evidence

Consider the following five types of statements:

Type 1. exemplar-referent statements known to be true (e.g., "Jane Fonda does aerobics")

Type 2. exemplar-referent statements known to be false (e.g., "Jane Fonda plays pro hockey")

Type 3. exemplar-referent statements of unknown validity (e.g., "Jane Fonda rides a motorcycle")

Type 4. category-referent statements that involve at least one known exemplar and therefore, are known to be true (e.g., "An actress does aerobics") and

Type 5. category-referent statements that are likely to be true but for which there is no known exemplar (e.g., "A steelworker does aerobics").

The comprehension of statements and judgments of their validity can be broken into several stages, as implied by Postulates 5–10. These stages are summarized in Table 1. Exemplar-referent statements that are redundant with a previously formed representation (Type 1) and category-referent statements for which a known exemplar exists (Type 4) are both comprehended and

judged as true at the time the representation is identified in memory. In contrast, comprehension of exemplar-referent statements that are either false (Type 2) or of unclear validity (Type 3) requires a global comparison of the features of the target's subject with features that characterize the referents of activated situation models. In addition, a more detailed assessment is made of whether the subject has features that define these referents (i.e., features that all referents have in common). During the first comparison, clearly false statements are immediately recognized as such ($S < T_F$). However, statements of unclear validity are not spontaneously evaluated as either true or false ($T_F < S < T_T$). The validity of these latter statements is computed only when goal-directed processing requires it.

Some ambiguity arises when processing a category-referent statement that has no clear exemplar (Type 5). The comprehension of such a statement (like Types 2 and 3) requires a comparison of the features associated with its subject with features of the activated situation models. It is unclear a priori whether only the subject's characteristic features need to be considered or whether its defining features must also be compared. Thus, assuming that $T_T = T_C$, it is also unclear whether the validity of these statements is evaluated spontaneously (i.e., whether $S > T_T$) or only if task demands require it. The predictions in Table 1 assume that comprehension is based on the defining features of the models' referents and, therefore, that the statements' validity is not inferred spontaneously. Our data are consistent with this assumption.

The various stages of processing outlined in Table 1 obviously do not take the same time to perform. However, if the time to generate an output (comprehension or verification) is an increasing function of the number of stages of processing that are involved (summarized in the last row of Table 1), several predictions can be generated, including the following.

1. Target statements that either (a) refer to exemplars and are known to be true (Type 1) or (b) refer to categories with which known exemplars are strongly associated (Type 4) should take less time to comprehend than other types of statements.

2. With one exception, the time to judge the validity of target statements should not differ from the time taken to comprehend them. The exception occurs in the case of exemplar-referent statements of unclear validity (Type 3), which should take longer to verify than to comprehend.

Most theories might account for the differences in comprehension time described in the first hypothesis. However, none generate predictions pertaining to the second. Two studies were conducted in collaboration with Gary Wong to evaluate these predictions. In Experiment 1, people judged statements representing Types 1, 2, 3, and 5 as described in Table 1. In Experiment 2, they judged Types 1 and 4. In the latter study, the effect of priming one target statement on responses to other related statements was also investigated. These two studies, which involved very similar procedures, are described next.

Method

Eighty-four students participated in Experiment 1 to fulfill a course requirement. A comparable group of 72 students participated in Experiment 2. People in both experiments were introduced to the studies with one of two sets of instructions. People given *comprehension* instructions were told that a series of statements about people and events would be presented on a computer screen and that they were to read

Table 1
Stages of Processing Involved in the Comprehension and Validation of Five Types of Target Statements Considered in Experiments 1 and 2

	Exemplar-referent statements			Category-referent statements	
Processing stage	Type 1 (true)	Type 2 (false)	Type 3 (uncertain validity)	Type 4 (exemplar known)	Type 5 (exemplar unknown)
Parse statement into subject and predicate					
Comprehension	X	X	X	X	X
Validity judgment	X	X	X	X	X
Retrieve previously formed mental model					
Comprehension	X	X	X	X	X
Validity judgment	X	X	X	X	X
Compute global similarity of state to T_c, T_t, and T_f					
Comprehension		X	X		X
Validity judgment		X	X		X
Compare target statement's subject with defining features of models' referents					
Comprehension		X	X		X
Validity judgment		X	X		X
Compute validity on the basis of goal-directed processing					
Comprehension					
Validity judgment			X		
Total number of processing stages involved					
Comprehension	2	4	4	2	4
Validity judgment	2	4	5	2	4

Note. Stages of processing that are postulated to occur are denoted by "X."

each statement as it was presented and indicate whether the statement was comprehensible. As a means of conveying what we meant by comprehensibility, people were given examples of statements that were either meaningful (e.g., "Mozart wrote operas") or anomalous (e.g., "A show played poker"). People given *validity-judgment* instructions were asked to read each statement and to judge whether it was true or false. Again, examples were provided, including an anomalous statement that people were told to regard as false.

Stimuli were presented in a manner described subsequently and preceded by a "Ready?" signal. Judgments were reported by pressing one of two buttons, denoted "yes" and "no," on the keyboard. In each case, the time between stimulus onset and response was recorded and used as an index of either comprehension or verification time.

Stimulus materials: Experiment 1. The materials presented in this study composed three stimulus replications. Each replication consisted of three sets of six statements. The three sets of statements, examples of which are provided in Table 2, differed as follows.

In true versus false statement sets, four exemplar-referent statements in each set were made by combining each of two predicates with each of two exemplars. This was done so that one statement pertaining to each exemplar was commonly known to be true and the other was known to be false. In addition, two category-referent statements were made by pairing each predicate with a category (e.g., steelworker) that was not typically associated with it but was nonetheless likely to contain at least one exemplar who fit the description specified in the predicate.

In true versus unknown-validity statement sets, each of two exemplars in each set was combined with each of two predicates so that one statement pertaining to each exemplar was commonly believed to be true but the other was of unknown validity. In addition, two category-referent statements were made by pairing a category with each predicate, as in true versus false statement sets.

In false versus unknown-validity statement sets, four statements constructed from each set were such that one statement pertaining to each exemplar was false and the other was of unknown validity. The remaining two (category-referent) statements were constructed in the manner described earlier.

In addition, 13 filler statements were constructed that were true, false, or anomalous. Six of these statements were presented at the beginning of the series, and the others were interspersed among the 54 target statements. The target statements were presented in eight different orders. Pooled over these orderings, (a) each type of exemplar-referent statement (true, false, or unknown validity) and each category-referent statement appeared the same proportion of times in each serial position, and (b) statements with either the same predicate or the same subject were separated by at least 4 other items. Note that, pooled over all three types of stimulus sets, a partial confound exists between statement type and the specific subjects and predicates involved in the statements (Table 2). Within each set, however, each predicate occurred with equal frequency in each type of statement.

Stimulus materials: Experiment 2. Target stimuli in Experiment 2 were either true exemplar-referent statements (Type 1) or statements that referred to a category with which an exemplar was strongly associated (Type 4). Sixteen statements of each type were constructed from eight different sets of subjects and predicates. Each set consisted of (a) a well-known public figure, (b) a category that the public figure exemplified, and (c) two behaviors or attributes with which the individual was commonly associated. One set, for example, consisted of the exemplar "Jimi Hendrix," the category "rock star," and the predicates "played the guitar" and "took a drug overdose"; a second consisted of the exemplar "Abraham Lincoln," the category "U.S. president," and the predicates "came from Illinois" and "was assassinated." Four statements were made from each set by combining each subject and predicate. Thus, each predicate was paired, with equal frequency, with both an exemplar and a category to which the exemplar belonged.

Two types of category-referent items were presented. In *single-referent* conditions, statements referred to a single member of the category (e.g., "A rock star . . . "), whereas, in *multiple-referent* conditions, they referred to several members (e.g., "Some rock stars . . . "). This manipulation was between subjects, whereas the exemplar-referent statements ("Jimi Hendrix . . . ") were shared by all conditions. In addition to the 32 target statements, 18 filler items were constructed. Of these, 2 were true, 8 were false (e.g., "Fidel Castro ran in the Olympics"), and 8 were anomalous (e.g., "A blanket swept the water faucet"). Two fillers of each type were placed at the beginning of the stimulus series as practice, and the others were interspersed among the target statements.

The 32 target statements were presented in each of 16 different orders. In each ordering, 4 exemplar-referent statements and 4 category-referent statements (one from each of the eight subject–predicate sets) were presented before any other statement constructed from items in the same set. Also, one exemplar-referent target statement from each set (e.g., "Jimi Hendrix took a drug overdose") was immediately preceded by a prime that was (a) identical to it, (b) referred to the same subject but a different predicate ("Jimi Hendrix played the guitar"), (c) referred to the category to which the exemplar belonged and the same predicate as the target ("A rock star took a drug overdose"), or (d) referred this category but a different predicate ("A rock star played the guitar"). Likewise, one category-referent statement from each set was preceded by a prime of each type. Pooled over

Table 2
Examples of Stimulus Materials Used in Experiment 1

	Type of statement			
Statement set	True (Type 1)	False (Type 2)	Uncertain validity (Type 3)	Category referent (Type 5)
True vs. false	Mozart wrote a symphony	Billy Joel wrote a symphony		A German wrote a symphony
	Billy Joel plays rock music	Mozart played rock music		A German played rock music
True vs. uncertain validity	Jane Fonda does aerobics		Nancy Reagan does aerobics	A sorority member did aerobics
	Nancy Reagan reads horoscopes		Jane Fonda reads horoscopes	A sorority member read horoscopes
False vs. uncertain validity		Abraham Lincoln kissed Robert Redford	Madonna kissed Robert Redford	A lawyer kissed Robert Redford
		Madonna shaved her beard	Abraham Lincoln shaved his beard	A lawyer shaved his beard

Table 3
Comprehension and Validity-Judgment Times for Target Statements Presented in Experiments 1 and 2 (in s)

Experiment and statement type	Type of judgment: Comprehension	Type of judgment: Validity	Difference
Experiment 1			
Exemplar-referent statement			
True (Type 1)	1.35 (.97)	1.55 (.97)	0.20
False (Type 2)	1.64 (.82)	1.86 (.16)	0.22
Uncertain validity (Type 3)	1.55 (.92)	2.07 (.49)	0.52
Category-referent statement, unknown exemplar (Type 5)	1.68 (.96)	1.88 (.90)	0.20
Experiment 2			
True exemplar-referent statement (Type 1)	1.84 (.96)	1.99 (.89)	0.15
Category-referent statement, known exemplar (Type 4)			
Single referent	2.00 (.91)	2.06 (.91)	0.06
Multiple referents	2.34 (.96)	2.41 (.94)	0.07

Note. Proportion of affirmative judgments is given in parentheses.

the 16 orderings, each of the 32 stimulus statements was used as a target and a prime equally often, and the mean serial position of each type of prime–target pair was approximately the same.

Results

Comprehension time. People should take less time to comprehend both true exemplar-referent statements (Type 1) and category-referent statements to which these exemplars were relevant (Type 4) than to comprehend the other three types of statements. Data relevant to these predictions are shown in Table 3. (The data for Experiment 2 concern only the eight target statements that people judged before they were exposed to any other statements in the same set.) The likelihood of judging each type of statement as comprehensible was high and about the same for all conditions. Although objectively false statements in Experiment 1 were judged as somewhat less comprehensible than the others, this difference was not significant ($p > .10$).

The pattern of comprehension times confirmed our expectations. In Experiment 1, true exemplar-referent statements (Type 1) took less time to comprehend than exemplar-referent statements that were either false (Type 2) or of unknown validity (Type 3). They also took less time to comprehend than category-referent statements for which people were unlikely to know a particular exemplar (Type 5). The overall effect of statement type on comprehension time was significant, $F(3, 123) = 18.96, p < .01$.[9] Moreover, less time was necessary to comprehend true exemplar-referent statements ($M = 1.35$ s) than to comprehend any of the other three types of statements ($M = 1.62$ s), $F(1, 42) = 16.25, p < .01$; the latter three did not differ.[10]

In Experiment 2, category-referent statements pertained to categories with which known exemplars were strongly associated (Type 4). The time to comprehend these statements should be similar to the time to comprehend statements that refer specifically to those exemplars (Type 1). This prediction was confirmed when category-referent statements referred to a single member. Statements that referred to several category members took longer to comprehend.[11] Perhaps the comprehension of statements that refer to multiple members of a category stimulates a consideration of several previously formed situation models rather than only one, and an integration of the implications of these models adds to comprehension time.

Validity judgment time. The proposed theory implies that the recognition of validity is often a by-product of comprehension and requires little additional time. The primary exception occurs when no previously formed situation model exists and the features of the statement's subject are only moderately similar to referents of previously formed models of the predicate ($T_F < S < T_T$). Then, validity is computed only if the task requires it. As shown in Table 1, this condition was expected to arise only in the case of exemplar-referent statements of unclear validity (Type 3) and category-referent statements for which specific exemplars were not known (Type 5).

Results (see Table 3) were clearly consistent with these predictions. In Experiment 2, previously formed models were used to comprehend both exemplar-referent and category-referent state-

[9] As shown in Table 2 and noted earlier, different sets of materials were used to construct each of the three stimulus sets, and each set differed in terms of the particular statements to which it pertained. Therefore, an item analysis (Clark, 1973) was not meaningful. As a result, conclusions concerning the generalizability of results over a random sample of stimulus item sets must be treated with some caution.

[10] Separate analyses of each of the three types of stimulus sets (see Table 2), in which the content of the different types of statements is controlled, confirm the conclusions of the overall analysis. Analyses of true versus false statement sets and true versus uncertain-validity statement sets both yielded significant main effects of item type on comprehension time, $Fs(2, 82) > 3.32$, $p < .05$, which were due to the shorter time required to comprehend true (Type 1) statements than other types. Analyses of false versus uncertain-validity sets yielded no significant effect of item type on comprehension time, $F < 1$.

[11] An overall analysis of response times to all three conditions confounds between-subjects and within-subject variation. However, separate analyses involving only people who judged both types of statements being compared revealed that although statements referring to several members of a category did not differ significantly from the time to comprehend statements about a single member (2.33 vs. 2.00), $F(1, 34) = 2.09, p > .10$, they did take significantly longer to comprehend than did exemplar-referent statements (2.33 vs. 1.93), $F(1, 17) = 18.88, p < .01$.

ments. There was no difference between the time to comprehend these statements and the time to verify them ($F < 1$).

As expected, people in Experiment 1 took longer to judge the validity of Type 3 (uncertain validity) statements than to comprehend them. In all other cases, however, the difference between the comprehension and validation times was small and independent of statement type. These conclusions were confirmed by a significant interaction of instructional condition and statement type, $F(3, 246) = 10.29, p < .01$ (see Footnote 8). When Type 3 statements were removed from the analysis, the difference between comprehension and verification times was significant but small, $F(1, 82) = 8.31, p < .01$; the interaction with item type was not significant, $F < 1$.[12]

The comprehension and verification of category-referent statements having no known exemplar (Type 5) involve somewhat different processes (see Table 1). Therefore, the fact that the difference in time to comprehend and verify these statements was similar to the difference obtained for other types of statements could be fortuitous. Nevertheless, the results support our contention that the processes that underlie comprehension and judgments of validity are often performed simultaneously and do not differ appreciably in the time and cognitive effort expended.

Priming Effects

The subject and predicate of a target statement resonate with all of the memory representations that contain them, and this resonance takes time to dissipate (see Retrieval Principles 1 and 4). Consequently, exposure to the target makes these representations temporarily more accessible. Thus, for example, activating the predicate of a target statement should increase the accessibility of one or more existing representations of the event it describes. Therefore, it should increase the ease of identifying and using these representations to comprehend other statements that also have this predicate.

The effect of activating a target statement's subject, however, depends on whether it refers to an exemplar or to unspecified members of a general category. First, suppose the reference is to an exemplar. All mental representations that contain it should resonate. Many of these representations are likely to be situation models of events that are unrelated to the described event. Nevertheless, these latter models should become more available for comprehending statements that refer to these unmentioned events. For example, comprehending "Jane Fonda acts in movies" may activate models of her doing aerobics. Thus, it should facilitate the comprehension of later statements that concern "doing aerobics," even though this action was not previously mentioned. Moreover, this should be true regardless of whether the later statements refer to Ms. Fonda or to someone else.

In contrast, the effect of category-referent statements should not be as widespread. This is because category labels are less likely to be contained in previously formed situation models (Postulate 4) and may consequently only resonate with generalized representations. This means that category-referent statements should resonate with situation models that refer to the same events. Unlike exemplar-referent statements, however, they should not resonate appreciably with models that concern other, unrelated events.

In summary, thinking about an exemplar-referent statement should decrease the time necessary to comprehend statements about either the same event or other events in which the same exemplar is known to have been involved. This difference should be similar regardless of whether the target statements refer to this same exemplar, to a category to which the exemplar belongs, or to a different person or category. Thinking about a category-referent statement should also decrease the time required to comprehend target statements about the same event regardless of whether they refer to this category or to an exemplar of it. In this case, however, the decrease should be less evident if the event described in the target statement is different from the earlier one than if it is the same.

These hypotheses were confirmed in Experiment 2. In some conditions, each target statement was primed by a statement that referred to either a category or an exemplar and whose predicate was either the same as or different from the target statement. Priming effects are indicated by differences between response time to a target statement under each of the four priming conditions and response time to this same statement when it was presented before any other statement from the same set. These differences, pooled over the two types of category-referent statements (single vs. multiple), are shown in Table 4 for both comprehension and verification judgments.[13]

The overall priming effect was significantly different from zero ($M = -0.35$), $F(1, 68) = 44.95, p < .01$, and did not reliably differ under comprehension and validity-judgment conditions (-0.41 s vs. -0.29 s; $p > .10$). As predicted, however, this effect was contingent on both the predicate of the prime statement and its referent. This contingency is best conveyed in the bottom section of Table 4. Specifically, when the prime referred to an exemplar, response time did not differ when the predicate was either the same as the target's ($M = -0.36$ s) or different ($M = -0.30$ s). When the prime referred to a category to which the exemplar belonged, however, the effect was greater when the predicate was the same as the target's ($M = -0.59$ s) than when it differed ($M = -0.28$ s), $F(1, 68) = 7.29, p < .01$. The interaction implied by this pattern of results was significant, $F(1, 68), = 6.22, p < .02$, and was evident in each of the four sets of data shown in Table 4. (The interaction was not contingent on either instructions or the type of target statement being judged, $F < 1$.[14])

The finding that a prime statement's subject had effects on

[12] Separate analyses of each type of item set confirmed these conclusions. That is, analyses of true versus uncertain-validity statement sets and false versus uncertain-validity statement sets yielded an interaction of item type and instructions, in each case, $F(2, 164) > 6.76, p < .02$. In the analysis of true versus false statement sets, however, this interaction was not significant, $F(2, 164) = 1.13, p > .10$.

[13] Analyses in which the type of category-referent statement was included as a variable yielded only one uninterpretable higher order interaction, the nature of which does not compromise any of the conclusions drawn.

[14] Note that the effects of priming on validity judgments were particularly low when the priming statement and test statement had neither the subject nor the predicate in common. Although this is unsurprising, comparable differences in comprehension time were not evident. Although this difference in the pattern of comprehension and verification response times is not predicated by the model, it was not significant ($p > .10$).

Table 4
Effects of Priming Statements on Time to Comprehend and Judge the Validity of Target Statements: Experiment 2

	Comprehension		Validity judgments	
Statement type	Target and prime with same predicate	Target and prime with different predicates	Target and prime with same predicates	Target and prime with different predicates
Exemplar referent				
Exemplar-referent prime	−0.39	−0.34	−0.36	−0.36
Category-referent prime	−0.45	−0.30	−0.48	−0.17
Category referent				
Exemplar-referent prime	−0.51	−0.40	−0.30	−0.12
Category-referent prime	−0.63	−0.32	−0.80	−0.30
Overall				
Exemplar-referent prime	−0.40	−0.36	−0.33	−0.24
Category-referent prime	−0.54	−0.31	−0.64	−0.24

Note. Cell means refer to difference (in seconds) between the time to judge target statements after a priming statement and the time to judge these statements in the absence of a prime (see Table 3).

response times similar to those of category-referent and exemplar-referent target items eliminates a trivial interpretation of the results. Considered in isolation, the effects could indicate that judgments were facilitated by either a similar referent or predicate but that these two factors in combination do not have an influence over and above the effect of each in isolation. If this were the case, however, predicate similarity should have had less of an effect on response times to category-referent statements when the prime also referred to the category than when it did not. In fact, the opposite was true.

Conclusions

Summary of results. Experiments 1 and 2 support the hypothesis that information about known persons and events is often verified during comprehension. In addition, the data confirm other, more specific predictions of our theory.

1. The time both to comprehend and to verify obviously true statements about known persons is less than the time to comprehend and to verify obviously false statements about them.

2. When a specific category exemplar is known to have performed a given behavior, a statement that an unspecified category member has performed the behavior is comprehended just as quickly as a statement about the specific exemplar. When a category exemplar who has performed the behavior is not known, however, a statement that refers to the category takes longer to comprehend than a statement that refers to an exemplar.

3. Exposure of a statement that a known person has performed a certain behavior (e.g., "Jimi Hendrix played the guitar") facilitates both the comprehension of a later statement about this person (e.g., "Jimi Hendrix took a drug overdose") and verification of the statement's validity. Moreover, this is true regardless of whether the two statements refer to the same behavior or to different ones and regardless of whether the second statement refers to the person by name or refers only to a category to which the person belongs (e.g., rock star). When the first statement refers to a category to which the individual belongs, this is not the case. That is, exposure to this type of information has a smaller influence on later comprehension when the statements refer to different behaviors than when they refer to the same behavior.

Several other implications of the theory remain to be tested. For example, when an exemplar resonates with all situation models that contain it, a statement about the exemplar should facilitate the comprehension of statements to which these models are relevant even when the statements refer to a totally unrelated person or category. Suppose people have previously formed models of both "Jane Fonda plays in movies" and "Jane Fonda does aerobics." Comprehension of "Jane Fonda plays in movies" should also lead the model of Jane Fonda doing aerobics to resonate. This, in turn, should increase the speed of later identifying and using this model to comprehend statements about doing aerobics, regardless of whether the statements concern Jane Fonda, another actress, or Queen Elizabeth.

Other theories. No other model of social cognition can account for the results of Experiments 1 and 2 without additional assumptions. The Wyer and Srull (1989) theory, for example, assumes that information is comprehended via general semantic concepts before it is thought about in relation to referent-specific knowledge. The finding that category-referent statements, which are easily encoded in terms of semantic concepts, take longer to comprehend than exemplar-referent statements is directly opposite to the predictions of this theory. Moreover, the Wyer and Srull theory assumes that the validation of information about known persons and events does not occur immediately but is performed at a later stage of processing. Consequently, it cannot account for the fact that the exemplar-referent statements are verified almost as quickly as they are comprehended.

The only current theory of social cognition that explicitly considers the relation between comprehension and verification is that of Gilbert (1991). His theory assumes that although the initial acceptance of a statement as true is a precondition for comprehension, the identification of a statement as false requires additional processing. Both Gilbert's theory and the present one predict that false statements are comprehended and verified slower than true statements and that the time to verify true statements may often not differ appreciably from the time to comprehend them. Unlike Gilbert's theory, however, the present theory predicts that the time it takes to verify false statements may also not differ appreciably from the time needed to comprehend them. The data supporting

this prediction might seem to contradict Gilbert's theory. Note, however, that statements are recognized as false only if they meet the conditions specified in Postulate 10. If the features activated by false statements are not sufficiently dissimilar to those of existing situation models (i.e., if $S > T_F$), they may fall into the category we have designated as Type 3 (see Table 1). That is, an additional, postcomprehension stage of processing may be required to establish their invalidity, as Gilbert would predict and as our response time data indicate (Table 3).

Although our theory assumes retrieval processes similar to those postulated by others (Hintzman, 1986; Ratcliff, 1978; E. E. Smith et al., 1974), none of these earlier theories predict our results. For example, Smith et al.'s model applies only to conditions in which people are asked to verify a relation between two preexisting concepts. Consequently, it does not account for comprehension or for the spontaneous verification of new statements.

Model Construction From Several Pieces of Information

The information one typically receives about social situations often describes features that have some spatial, temporal, or functional interrelatedness. In such cases, situation models are likely to be constructed to reflect the set of information as a whole. The comprehension processes of Postulates 5–8 are presumably applicable under these conditions as well. However, some additional considerations arise. Postulate 6 (that new situation models are not constructed if a previously formed model already exists) implicitly assumes that the construction of situation models is guided by a cognitive economy. This principle provides the basis for two additional postulates that concern the construction of situation models from more than one piece of information.

Cognitive Economy in Model Construction

A different situation model is unlikely to be constructed for each new piece of information. The information in several different statements can often be captured in a single model. Postulate 2 implies that once a situational model is formed, subsequent information is likely to be integrated into that model as long as it is situationally consistent. This possibility leads to the following cognitive economy principle.

> *Postulate 11:* No more situation models are constructed from a given amount of information than are necessary to comprehend it.

To see this postulate's applicability, suppose a person is told that John is watching television and constructs a situation model of this information. Later, the person learns that Mary is also watching television. According to Postulate 11, the information about Mary should be added to the existing information. For example, the spatial relation between John and the television might need to be altered to include Mary. A separate situation model would be constructed, however, only if an extensive revision were required.

The implications of Postulate 11 can be evaluated on the basis of fan effects of the sort described earlier. If a separate situation model is formed for each item presented, the amount of retrieval interference that occurs and the time required to retrieve any given information item should increase with the number of items presented. However, if related information can be integrated into a single model, then the interference should be reduced.

Support for Postulate 11 was obtained by Radvansky, Spieler, and Zacks (1993). People in one experiment learned sets of facts describing the location of objects. In multiple-object–single-location sets, the statements described one, two, or three objects in a single location (e.g., "The pay phone is in the hotel," "The potted palm is in the hotel," and "The wastebasket is in the hotel"). In single-object–multiple-location sets, a given object was described as being in one, two, or three locations (e.g., "The ceiling fan is in the barber shop," "The ceiling fan is in the museum," and "The ceiling fan is in the city hall"). After memorization, people were given a recognition test, and response time was recorded.

It is easy to imagine several objects being in the same location. Thus, according to Postulate 11, statements in multiple-object–single-location sets should be represented in a single model. However, the same object cannot be in different locations at the same time. Therefore, each statement in single-object–multiple-location sets should be represented in a different situation model. Consistent with this, recognition response time increased with the number of statements presented in the second condition but not the first.

It is not always easy to form a single situation model from different pieces of information, even if they pertain to the same location. In a study by Radvansky et al. (1993), people learned sets of sentences about the locations of persons rather than objects. However, the locations were all small ones that typically contain only a single person, such as a phone booth, a tanning bed, or the bathroom on a Greyhound bus. It is difficult to imagine several people being in any of these locations at the same time. Therefore, separate models of each individual should be constructed. Results confirmed this prediction; recognition times increased with the number of persons described in the same location.

Construction of Episode Models

Event models of daily life experiences are more the exception than the rule. Such experiences typically consist of a sequence of related events. Consequently, situation models of these experiences are likely to be composed of several segments or episodes.

The criteria for determining whether different pieces of information are integrated have been articulated by Zwaan, Langston, and Graesser (1995) and by Radvansky and Zwaan (1998). For example, causality and intentionality are central to a person's understanding of how segments of an episode are related to one another (Black & Bower, 1980; Fletcher & Bloom, 1988; Myers & Duffy, 1990; Myers, Shinjo, & Duffy, 1987; Trabasso & van den Broek, 1985). These dimensions are actively monitored during comprehension (Lutz & Radvansky, 1997; Suh & Trabasso, 1993). The instrumentality of events in attaining a superordinate goal is equally important (Bransford & Johnson, 1972; Bransford & Stein, 1984; W. F. Brewer & Dupree, 1983). However, the causal relatedness or goal relevance of events is often not explicit in descriptions. Two events may be quickly included in the same situation model if segments in them coexist in a previously formed model or generalized representation. However, when this is not the case, inferences of causality may not be rapid but may require higher order, goal-directed processing (Wyer & Srull, 1989).

The role of thematic relatedness in the construction of episode models was demonstrated by Wyer and his colleagues (Wyer & Bodenhausen, 1985; Wyer, Shoben, Fuhrman, & Bodenhausen, 1985). People in Wyer and Bodenhausen's (1985) study read about

several different events at a cocktail party. Although the events were thematically related, those in one sequence had no obvious relation to those in the others except for their occurrence at the party. Two target episodes, each composed of several events, were conveyed to some people in chronological order (e.g., "John reached for an hors d'oeuvre. Someone bumped his arm. He spilled his Bloody Mary over Carol's white dress. Carol called him an idiot and stalked off to the bathroom") and to other people in the reverse order ("Carol called John an idiot and stalked off to the bathroom. John had spilled a Bloody Mary on her white dress. Someone had bumped his arm . . . "). Moreover, the events composing each episode were either presented together in the passage or separated by unrelated event descriptions.

The events composing each target episode were recalled together and in chronological order regardless of how they were presented. This suggests that people constructed an episode model of each sequence and then used this model as a basis for recall. This is consistent with Postulate 11. That is, single models were formed of thematically related events. However, people did not lump unrelated episodes into a single situation model even though they were learned about in the same general situation (i.e., the cocktail party). Rather, they constructed separate models of these episodes, and the more recently formed model was the first one they later retrieved.

Cognition Economy in Comprehension

Most of the events we have considered thus far are relatively novel. That is, people were unlikely to have previously formed situation models stored in memory. In contrast, some events are experienced repeatedly with only minor variations. Representations of such episodes (e.g., scripts; see Graesser, 1981; Schank & Abelson, 1977) can be explicated in terms of the theory proposed here.

In discussing the comprehension of single statements, we noted that when the components of a verbal statement activate a number of previously formed situation models, the new representation that is formed contains only those features that are weighted heavily in the composite set of attributes that is extracted from them. That is, the more experiences of a given type (e.g., eating at a restaurant) one has, the fewer parts of previously formed situation models are likely to be common to all such experiences. Therefore, fewer parts are likely to be included in a new model that is constructed of this type of experience. Thus, once these representations are stored in memory, they come to function as prototypes whose retrieval can be cued by statements that refer to that type of experience.

The assumption that representations of situation prototypes exist in memory (cf. Schank & Abelson, 1977, 1995) has further implications when considered in the context of the cognitive economy principle. The next postulate formalizes these implications.

> *Postulate 12.* Once a prototype representation has been formed for a given type of situation, events specified in the prototype are typically not represented in the situation model of a new experience to which the prototype is applied. Segments pertaining to these events are retained only if their inclusion is necessary to reconstruct the situation.

Thus, suppose someone who has previously formed a representation of what goes on at restaurants learns that a friend, John, went to dinner at the Boar's Head, ordered a steak and a glass of wine, paid $20.40 for the meal, and left. The events described all instantiate ones that occur in most restaurants (entering, ordering, eating, etc.) and so are redundant with the prototype. Therefore, these events are unlikely to be retained in the model that is formed. In fact, only a header would need to be constructed (e.g., "John's dinner at the Boar's Head"), along with a set of translation rules that specify the values of specific variables composing the prototype (e.g., "restaurant" = "Boar's Head" or "meal" = "steak"; see also Graesser et al., 1979).

However, most social experiences are a mix of both familiar and unfamiliar events. For example, many events that occur in the course of dinner at a restaurant (e.g., spilling a drink, waving to a friend at another table, or discussing abortion) cannot be predicted a priori. Thus, a new situation model must be constructed to comprehend and remember them. What would the mental representation of such a situation look like?

Postulate 12 provides a partial answer. The events that duplicate those of a prototypic representation are typically not retained in the resulting situation model. However, they will, in fact, be retained if they are needed to localize the novel events. For example, suppose that while ordering his meal at the Boar's Head, John spilled his cocktail on his lap. This event cannot be predicted from a prototypic restaurant visit. Thus, a segment that describes this event must be retained. In addition, a segment of the prototype that concerns ordering the meal must also be retained to reconstruct the point at which the mishap occurred.

Empirical Evidence

Implications of this idea were tested by Trafimow and Wyer (1993). In one study, people read about a person's behavior in four situations. The described situations were ones that were likely to have occurred frequently in a reader's past (e.g., cashing a check, changing a tire, or making tea). However, the descriptions varied in two respects. First, a statement identifying the kind of situation (e.g., "John decided to make some tea") was conveyed either before or after the description of the events. Second, either two or six prototypic events (e.g., "determined how much to make" and "got some bags") were described. In all cases, descriptions of four additional, unrelated events (e.g., "answered the phone" and "paced around the room") were inserted that were unlikely to be contained in a prototype of the described situation.

Note that although the prototypic events were relevant to the situation to which they pertained, the descriptions of them were ambiguous and thus, if considered in isolation, would probably activate situation models of other event sequences as well. Therefore, without specification of the topic (making tea), people were unlikely to identify the type of situation to which the events pertained until the end of the sequence. People read the entire set of four episodes and then, after a short delay, recalled as much of the information as they could.

When the type of situation is not identified until the end, people should treat all of the events as unrelated and should form a separate model of each. Consequently, their difficulty in recalling the events should increase with the number presented (i.e., the number of models constructed) for reasons noted earlier. When the type of situation is identified at the outset, however, the description should activate a prototypic representation. Consequently, people

should interpret and organize the relevant events with reference to this prototype, and their difficulty in recalling the events should not depend on the number presented. Results confirmed this hypothesis. When the situation type was not identified at the beginning of the scenario, a lower proportion of prototype-relevant events were recalled if six events had been described (.10) than if only two had been described (.53). In contrast, when the situation had been identified at the outset, the proportion of events recalled was virtually identical in the two cases (.23 vs. .24).

According to Postulate 12, prototypic events should be included in the new representation that is formed only if they are necessary to reconstruct the positions of the atypical events. A general implication of this is that the retrieval of prototype events should be cued by unrelated events that have immediately preceded or followed them in the sequence rather than by other prototypic events. Note that this prediction is the opposite of what would be expected if the prototypic sequence itself were used as a basis for recall. This prediction was supported when the topic was mentioned at the outset. That is, the likelihood of recalling a prototypic event was greater immediately after the recall of a prototype-unrelated event (.40) than after the recall of another prototypic one (.21). This was true regardless of the number of prototypic events presented. However, when the topic of the sequence was mentioned at the end, a corresponding difference in recall was not apparent (.29 vs. .26).

Further Implications

Trafimow and Wyer's (1993) findings are consistent with our theory. At the same time, they challenge other theories. Graesser and Nakamura (1982), for example, assumed that when people receive information that is redundant with a previously formed script, they append script-unrelated events as tags rather than integrating them into the script itself. Thus, their theory has difficulty predicting the facilitating effects of prototype-unrelated events on the retrieval of prototypic ones.

Some caution should be taken in generalizing Trafimow and Wyer's (1993) results to situations outside the laboratory. For example, the events were mundane and were described in little detail. It nevertheless seems reasonable to suppose that similar processes operate in numerous social situations that people encounter. Although many situations are idiosyncratic, situations of a general type nevertheless occur repeatedly in the individual's life, and thus their representation in memory may attain the status of a prototype. For example, an individual may construct a generalized representation of his wife's reactions to his getting drunk at parties and may apply this representation to new experiences in the same way that he applies a prototypic representation of eating at a restaurant.

Goal-Directed Comprehension Processes: The Effects of Spontaneous Validity Judgments

When a statement has been spontaneously identified as true or false during comprehension, an estimate of its validity is transmitted to the work space along with the situation model that has been formed (Postulate 10). Then higher order comprehension processes may be activated to understand why the information was conveyed, and this activity, in turn, may influence the impact of the information on responses to it.

Grice (1975; see also Green, 1989; Higgins, 1981; Sperber & Wilson, 1986) noted that the communications transmitted in a social context are governed by normative principles that are applied by both the communicator (in deciding what information to transmit) and the recipient (in comprehending this information). Communications are expected to be informative, that is, to convey knowledge that the recipient does not already have. Also, they are expected to convey truth as the communicator sees it.[15] The recipient of a communication therefore assumes these characteristics and interprets the message accordingly.

These considerations are relevant when literal interpretations appear to violate one of these principles. For example, a statement might be obviously true and, therefore, be completely uninformative. Alternatively, it might be blatantly false. Under these conditions, the recipient is likely to reassess the meaning that the communicator intended to convey. In some cases, this can lead a person to draw different interpretations than the literal meaning indicates. This possibility, widely recognized in previous research on the pragmatics of social communication (Higgins, 1981; Schwarz, 1994; Strack, 1994; Wyer & Gruenfeld, 1995), is captured by the following postulate.

> *Postulate 13.* Statements made in a social context that are spontaneously identified either as redundant with previous knowledge or as false will be perceived to violate normative expectations for communications to be informative and truthful. This will stimulate cognitive processing to construe the reason for the violation. This activity can alter perceptions of the source's knowledge, the source's objectives, or the meaning of the message itself.

This postulate may appear to be a reiteration of the assumption made by Grice (1975). However, it takes on additional importance in the context of Postulates 9 and 10. These postulates state the conditions in which people spontaneously identify a statement as true or false. Thus, they specify the conditions in which people spontaneously engage in the additional processing to which Postulate 13 alludes. Consequently, the postulate provides a link between initial comprehension and more goal-directed processes that are stimulated by conversational norm violations. This link has not previously been established.

The importance of providing this link is evident from research in several areas of social communication. These areas concern (a) information conveyed in the public media, (b) the recognition of statements as humorous, (c) emotional communication, and (d) responses to opinion statements.

Reactions to Communications in the Public Media

In a study cited earlier, Gruenfeld and Wyer (1992) found that when people read statements from newspapers that denied the validity of ideas they already believed to be false, they increased

[15] The restriction of the present discussion to informativeness and truthfulness does not preclude the other normative principles of communication (Grice, 1975; see also Green, 1989; Higgins, 1981; Sperber & Wilson, 1986). A conceptualization of additional principles and their impact on social cognition has been provided by Wyer and Gruenfeld (1995; see also Schwarz, 1994; Strack, 1994).

their beliefs in the proposition being denied. Apparently, people who read the denials spontaneously identified them as uninformative and searched for reasons why the assertions might have been made. In doing so, they speculated that there might be some reasons that the propositions were actually true, and this weakened their beliefs in the propositions rather than strengthening them.

In some instances, the validity of statements that people read is not open to question. For example, the assertion that "The minimum voting age in America is 18" cannot possibly be false. Therefore, people are unlikely to infer that the speaker considers its invalidity to be a possibility. Rather, they may attribute other motives to the communicator. For example, they might infer that the speaker wishes to remind them of a state of affairs she or he considers undesirable ("The minimum voting age in America is far too low") or to indicate that America is less progressive than other countries ("The minimum voting age in other countries is much higher"). These interpretations may affect people's own attitudes and opinions. Evidence of this was also obtained by Gruenfeld and Wyer (1992).

More general differences in the recognition of statements as sarcastic can also be interpreted in terms of the theory we propose. For example, social norms dictate that people typically manifest favorable behavior toward one another. Thus, statements asserting the occurrence of this behavior or attributes that imply it (e.g., "A fine friend you are") are more likely to be recognized immediately as true—and, therefore, uninformative—than statements that assert negative behaviors and attributes (e.g., "You're a terrible friend"). Thus, as Craws and Glucksberg (1989) have found, positive statements are more often recognized as sarcastic than negative ones.

It is important to emphasize that not all statements are spontaneously recognized as true or false. This occurs only if the situation model constructed meets the criteria specified in Postulate 10. When these conditions are not met, the statements are presumably comprehended and representations of them are retained in memory as part of general knowledge without their validity being assessed.

Humor Elicitation

The recognition that a communication violates a norm to be informative and truthful is common in informal conversation. Indeed, the recognition of such norm violations is often a precondition for the identification of a witticism. Although a detailed theory of the factors that underlie humor has been provided elsewhere (Wyer & Collins, 1992), certain observations are worth repeating here.

Suppose someone says "Central Illinois is certainly a pleasant place to live in the summer." Most people with a previously formed mental representation of Central Illinois summers would recognize this as untrue. Thus, according to Postulate 13, they should wonder why the assertion was made and, in so doing, might infer that it was meant to be sarcastic. This reinterpretation might elicit mild amusement.[16]

Note, however, that this should occur only if the representation of the statement differs sufficiently from previously formed representations (see Postulate 10). When people have little prior knowledge of Central Illinois, this may not be the case. Then the statement would be comprehended without recognizing its invalidity, and the speaker's attempt to be witty will not be appreciated.

Similar considerations may underlie people's ability to distinguish between teasing and expressions of hostility. Suppose John's friend remarks that John is "uglier than King Kong." If John thinks he is reasonably attractive, he may identify the statement as false and interpret it as a tease. Alternatively, if he has doubts about his attractiveness, then he might not recognize the statement as false (Postulate 10). Consequently, he might interpret it as an expression of hostility without considering the speaker's personal beliefs. Thus, the proposed conceptualization helps to explain why people are more likely to react negatively to a tease when they have doubts about themselves with respect to the attribute to which the tease is relevant than when they do not.

Emotional Communication in Close Relationships

The reinterpretation of communications that recipients perceive to violate norms of informativeness and truthfulness does not always elicit humor (see Footnote 15). Watzlawick, Beavin, and Jackson (1967) pointed out that partners in close relationships often construct a private meaning system that permits them to convey affect and emotion to one another without other listeners being aware of it. This is often done through statements whose literal meaning is uninformative to the recipient but not to others.

For example, suppose that during a dinner party, the host happens to mention that "It's 60 degrees in here." To a guest, this statement might simply be interpreted as an observation about the room temperature and accepted at face value. To his wife, however, who set the thermostat, the statement conveys redundant information. Consequently, she might interpret it as an expression of irritation at her obsession with saving energy. Although Postulate 10 does not explain the specific nature of these reactions, it helps to circumscribe the conditions in which they are likely to occur.

Validity Judgments and Memory

Statements that are spontaneously recognized as false often elicit attempts to understand why they were made. However, these attempts do not always result in a reconstrual of the statement's literal meaning. Unless a statement is blatantly inconsistent with prior knowledge and cannot possibly be correct, a recipient may conclude that it reflects the source's true opinion. Under these circumstances, the person may be stimulated to conduct a search of prior knowledge about the statement's referent to determine whether the statement could be true.

However, an attempt to reconcile a statement with previous knowledge takes effort, and this effort is likely to lead the situation model to become more accessible in memory. In the present theory, this increased accessibility could result from either increased residual resonance of the situation model or a decrease in the model's activation threshold. In either event, the statement is

[16] Wyer and Collins's (1992) theory of humor elicitation assumes that a necessary condition for humor to be elicited is that the implications of a reconstrued meaning of a statement be somehow diminished in value or importance relative to those of its literal meaning. Thus, the statement "Switzerland is clearly an unpleasant place to live in the summer," which is obviously false, might be interpreted as ironic but might not elicit humor because its intended meaning is enhanced relative to its literal meaning.

easier to recall later than statements that have not stimulated this cognitive activity.

Note that an attempt to reconcile information with prior knowledge occurs spontaneously only if the information is recognized as false in the course of comprehending it. Otherwise, the information may be thought about in other ways that are more directly relevant to one's processing goals. A study by Wyer et al. (1992) is worth considering in this light. Participants were told that a target person had either favorable or unfavorable personality traits. In addition, the person's social and political ideology (liberal vs. conservative) was conveyed. The remaining information described both (a) a number of favorable and unfavorable behaviors and (b) liberal or conservative opinions on a number of issues about which participants had prior knowledge. After reading this information and reporting their impressions, people were asked to recall the information.

People presumably interpreted the behavior and opinion statements in terms of situation models and generalized representations stored in memory. However, only the opinion statements could be interpreted in terms of prior knowledge about their referents, and so only these statements were likely to be identified as true or false. When people read behavior statements whose validity was not assessed, they thought about the statements with reference to the concept they had formed of the actor and recalled these behaviors better when they were inconsistent with this concept. However, when the people read opinion statements, they appeared to think more extensively about those statements they identified as false (i.e., inconsistent with their prior knowledge about the issues). This more extensive processing increased their recall of these statements regardless of their consistency with the concept of the target.

Social Inference

Situation models can also be used to make inferences about their referents. A complete account of these processes is beyond the scope of this article. However, some social phenomena that can be interpreted in terms of our theory are worth noting briefly.

Explanation and Prediction

The situation model that a person forms of an event might consist of a single event. However, the features of this segment may resonate with a segment of a previously formed episode model. Once this latter model is activated, segments describing events that precede the segment corresponding to the stimulus event might be used to infer the causes of this event, whereas segments that follow the stimulus event might be used to infer its consequences. These inferences require the substitution of features of the stimulus event for features of the model that is activated for construing antecedents and consequences. These operations are performed by the inference maker.

A large number of the situation models one constructs involve oneself as a participant. Thus, many inferences about the causes and effects of others' experiences may be based on one's own experiences in similar situations. For example, people who have heard someone describe a misfortune may comprehend this description in terms of a previously formed episode model of a similar misfortune that has befallen them personally and may infer causes and consequences of the other person's situation that are similar to those that characterize their own. Although this tendency seems egocentric, it is a likely by-product of the comprehension processes we assume.

More generally, people may be more inclined to use information as a basis for inferences if they can easily construct a situation model of it than if they cannot. The effects of this may be particularly evident when a large amount of information is presented that is difficult to assimilate unless a model of it can be constructed. Two studies bear on this possibility. In an experiment by Pennington and Hastie (1986), people were asked to reach a verdict on the basis of evidence presented in a criminal trial. The same information was conveyed in all conditions. However, the order of presenting the evidence varied. Specifically, prosecution evidence was either organized according to the witness who provided it (witness order) or according to the time in the sequence of events surrounding the crime (story order). The order of presenting defense testimony was varied similarly. When the two sets of evidence were presented in different ways, people were much more inclined to decide in favor of the side whose evidence was conveyed in story order.

In a study by Adaval and Wyer (1998), people read vacation travel brochures. The features of one vacation were conveyed in the form of a narrative, whereas the features of the other were simply listed. People preferred the former vacation to the latter, and this difference was particularly pronounced when pictures accompanied the text, making a situation model of the first vacation easier to construct. Thus, both studies suggest that people are more influenced by information if they can easily construct an episode model of the events it describes.

Stereotype-Based Inferences

The stereotypes that influence social judgments and decisions are often assumed to be represented in memory by a set of attributes that characterize members of the stereotyped group (Hamilton & Sherman, 1994). In our theory, the knowledge that people are most likely to use consists of situation models involving particular persons and events. As such, the sorts of abstract, trait-based representations that are assumed to define a stereotype are relatively unlikely to enter into either the comprehension of new information about members of the stereotyped group or inferences about them.

Instead, people may base their judgments and decisions on the implications of situation models constructed about exemplars of the stereotyped group. These models could be formed as a result of direct experience, hearing others' account of the events, or watching television. Thus, suppose one is asked whether one would hire a woman for a job. One may not base one's judgment on a categorical representation of women. Rather, one may activate a situation model one has previously formed of the events that surround a particular woman's job performance and the difficulties (if any) encountered and base the decision on the implications of this representation (see also Abelson, 1976; Nisbett & Ross, 1980).

This is not to say that categorical representations are never used. A person who is asked to describe a member of a social category may retrieve and use a categorical (e.g., trait-based) representation to perform the task. However, behavioral decisions made in social situations outside the laboratory may more commonly be based on

episode models than on categorical representations (for an elaboration of this argument, see Reid & Wyer, 1998).

Perceptions of Social Reality

A major source of the situation models that people construct is television. The average American watches 4 hr of television daily (Nielsen, 1993). Because information acquired from television is typically not thought about extensively (Kubey & Csikszentmihalyi, 1990), many of the situation models that are constructed about fictitious people and events are unlikely to be tagged as such. As such, these models may be stored in much the same form as models of events that have occurred in real life. If this is so, people may fail to engage in source monitoring (Johnson, Hashtroudi, & Lindsay, 1993), and the models of fictitious events will be retrieved and used as a basis for inferences without regard to the context in which they were formed.

For example, suppose people are asked to estimate the rate of violent crime. To do so, they may retrieve situation models of this type of event and may use the ease with which they come to mind as an indication of their relative frequency (Tversky & Kahneman, 1973). Consequently, because the number of situation models of crimes from television is greater than from other sources, people are likely to overestimate their incidence in the world.

Some evidence of this was obtained by Shrum and O'Guinn (1993; Shrum, O'Guinn, Semenik, & Faber, 1991; Shrum, Wyer, & O'Guinn, 1998). In these studies, people estimated the incidence of different situations that were overrepresented on television (i.e., violent crimes, number of doctors and policemen, etc.). As expected, people overestimated these events, and the magnitude of their overestimates increased with the amount of television they watched.

Concluding Remarks

This article provides a detailed conceptualization of how people comprehend and validate information about familiar persons and events. The theory can be incorporated into a revised theory of social cognition of the sort proposed by Wyer and Srull (1989). At the same time, it is a substantial departure from the earlier version of this model as well as other theories that focus on the semantic implications of social information without considering the context in which this information is conveyed or recipients' prior knowledge about its referents. The primary postulates of the theory have empirical support, and a number of unique predictions of the theory have been confirmed.

As a general theory of comprehension processes, the theory has certain limitations. For example, it does not specify how the components of a situation model are actually structured from other bits of information in memory. This issue is important when people encounter information that is completely unfamiliar (e.g., "A purple rabbit climbed up the side of the Sears Tower"). Comprehension of such information requires the integration of knowledge not previously encountered in combination. These processes were addressed by Barsalou (1993) but are beyond the scope of the social comprehension model proposed here.

In the context of research on social information processing, however, our theory calls attention to several issues that have not previously been confronted adequately.

1. By postulating situation models as the primary form in which social knowledge is represented, the theory provides a close link between the verbal and nonverbal components of knowledge. Although there have been some recent efforts to specify the intersection between different types of mental representation (Carlston, 1994), the present theory considers explicitly both nonverbal and verbal information and suggests a way such information could interact in the comprehension of new information.

2. The theory recognizes that most of the knowledge used in social cognition is referent specific (see also E. R. Smith, 1990). At the same time, more general knowledge representations are not precluded.

3. The theory postulates an inherent relation between the comprehension of social information and the recognition of this information as true or false. In doing so, it permits a conceptualization of people's spontaneous reactions to information they receive in a social context that violate expectations for communications to be informative and truthful and when these normative violations are likely to be detected.

The theory permits phenomena at a number of levels of specificity to be conceptually integrated. For example, it not only can account for responses to single statements about people and events that are presented out of their social context but can also be applied to people's reactions to communications that are conveyed in the public media or in informal conversation. Additional research needs to be done to refine the assumptions of the theory and to evaluate its implications. However, its potential use as a framework for conceptualizing social information processing justifies its continued consideration.

References

Abelson, R. P. (1976). Script processing in attitude formation and decision-making. In J. S. Carroll & J. W. Payne (Eds.), *Cognition and social behavior.* Hillsdale, NJ: Erlbaum.

Abelson, R. P. (1981). The psychological status of the script concept. *American Psychologist, 36,* 715–729.

Adaval, R., & Wyer, R. S. (1998). The role of narratives in consumer information processing. *Journal of Consumer Psychology, 7,* 207–245.

Albrecht, J. E., & Myers, J. L. (1995). The role of context in accessing distant information during reading. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21,* 1459–1468.

Albrecht, J. E., & O'Brien, E. J. (1993). Updating a mental model: Maintaining both local and global coherence. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19,* 1061–1070.

Anderson, A., Garrod, S. C., & Sanford, A. J. (1983). The accessibility of pronominal antecedents as a function of episode shifts in narrative text. *Quarterly Journal of Experimental Psychology, 35A,* 427–440.

Anderson, J. R. (1974). Retrieval of propositional information from long-term memory. *Cognitive Psychology, 6,* 451–474.

Anderson, J. R. (1983). *The architecture of cognition.* Cambridge, MA: Harvard University Press.

Baggett, P. (1979). Structurally equivalent stories in movies and text and the effect of the medium on recall. *Journal of Verbal Learning and Verbal Behavior, 18,* 333–356.

Bargh, J. A. (1994). The four horsemen of automaticity: Awareness, intention, efficiency, and control in social cognition. In R. S. Wyer &

T. K. Srull (Eds.), *Handbook of social cognition* (2nd ed., Vol. 1, pp. 1–40). Hillsdale, NJ: Erlbaum.

Bargh, J. A. (1997). The automaticity of everyday life. In R. S. Wyer (Ed.), *Advances in social cognition* (Vol. 10, pp. 1–62). Mahwah, NJ: Erlbaum.

Bargh, J. A., Bond, R. N., Lombardi, W., & Tota, M. E. (1986). The additive nature of chronic and temporary sources of construct accessibility. *Journal of Personality and Social Psychology, 50,* 869–878.

Barsalou, L. W. (1983). Ad hoc categories. *Memory & Cognition, 11,* 211–227.

Barsalou, L. W. (1993). Flexibility, structure, and linguistic vagarity in concepts: Manifestations of a compositional system of perceptual symbols. In A. F. Collins, S. E. Gathercole, M. A. Conway, & P. E. Morris (Eds.), *Theories of memory* (pp. 29–102). Hillsdale, NJ: Erlbaum.

Barwise, J., & Perry, J. (1983). *Situations and attitudes.* Cambridge, MA: MIT Press.

Black, J. B., & Bower, G. H. (1980). Story understanding as problem solving. *Poetics, 9,* 223–250.

Black, J. B., Turner, T., & Bower, G. H. (1979). Point of view in narrative comprehension, memory, and production. *Journal of Verbal Learning and Verbal Behavior, 18,* 187–198.

Bransford, J. D., Barclay, J. R., & Franks, J. J. (1972). Sentence memory: A constructive versus interpretative approach. *Cognitive Psychology, 3,* 193–209.

Bransford, J. D., & Johnson, M. K. (1972). Contextual prerequisites for understanding: Some investigations of comprehension and recall. *Journal of Verbal Learning and Verbal Behavior, 11,* 717–726.

Bransford, J. D., & Stein, B. S. (1984). *The ideal problem solver: A guide to improving thinking, learning, and creativity.* New York: Freeman.

Brewer, M. B. (1988). A dual process model of impression formation. In T. K. Srull & R. S. Wyer (Eds.), *Advances in social cognition* (Vol. 1, pp. 1–36). Hillsdale, NJ: Erlbaum.

Brewer, W. F., & Dupree, D. A. (1983). Use of a plan schemata in the recall and recognition of goal-directed actions. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 9,* 117–129.

Carlston, D. E. (1980). Events, inferences and impression formation. In R. Hastie, T. Ostrom, E. Ebbesen, R. Wyer, D. Hamilton, & D. Carlston (Eds.), *Person memory: The cognitive basis of social perception* (pp. 89–120). Hillsdale, NJ: Erlbaum.

Carlston, D. E. (1994). Associated systems theory: A systematic approach to cognitive representations of persons. In R. S. Wyer (Ed.), *Advances in social cognition* (Vol. 7, pp. 1–78). Hillsdale, NJ: Erlbaum.

Clark, H. (1973). The language-as-fixed-effect fallacy: A critique of language statistics in psychological research. *Journal of Verbal Learning and Verbal Behavior, 12,* 335–359.

Clore, G. L., Schwarz, N., & Conway, M. (1994). Affective causes and consequences of social information processing. In R. S. Wyer & T. K. Srull (Eds.), *Handbook of social cognition* (2nd ed., Vol. 1, pp. 323–417). Hillsdale, NJ: Erlbaum.

Collins, A. M., & Loftus, E. F. (1975). A spreading activation theory of semantic processing. *Psychological Review, 82,* 407–428.

Conway, M. A. (1996). Failures in autobiographical remembering. In D. J. Herrmann, C. McEvoy, C. Hertzog, P. Hertel, & M. K. Johnson (Eds.), *Basic and applied memory research: Theory in context* (Vol. 1, pp. 295–315). Mahwah, NJ: Erlbaum.

Craws, R. J., & Glucksberg, S. (1989). How to be sarcastic: The echoic reminder theory of verbal irony. *Journal of Experimental Psychology: General, 118,* 374–386.

de Vega, M. (1995). Backward updating of mental models during continuous reading in narratives. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21,* 373–385.

Ebbesen, E. B. (1980). Cognitive processes in understanding ongoing behavior. In R. Hastie, T. Ostrom, E. Ebbesen, R. Wyer, D. Hamilton, & D. Carlston (Eds.), *Person memory: Cognitive basis of social perception* (pp. 179–225). Hillsdale, NJ: Erlbaum.

Ebbinghaus, H. (1964). *Memory: A contribution to experimental psychology* (H. A. Ruger & C. E. Bussenius, Trans.). New York: Dover. (Original work published 1913)

Fletcher, C. R., & Bloom, C. P. (1988). Causal reasoning in the comprehension of simple narrative texts. *Journal of Memory and Language, 27,* 235–244.

Friedman, W. J. (1993). Memory for the time of past events. *Psychological Bulletin, 113,* 44–66.

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

Gernsbacher, M. A. (1990). *Language comprehension as structure building.* Hillsdale, NJ: Erlbaum.

Gernsbacher, M. A., Goldsmith, H. H., & Robertson, R. W. (1992). Do readers mentally represent characters' emotional states? *Cognition and Emotion, 6,* 89–111.

Gilbert, D. T. (1991). How mental systems believe. *American Psychologist, 46,* 107–119.

Glenberg, A. M. (1997). What memory is for. *Behavioral & Brain Sciences, 20,* 1–55.

Glenberg, A. M., Kruley, P., & Langston, W. E. (1994). Analogical processes in comprehension: Simulation of a mental model. In M. A. Gernsbacher (Ed.), *Handbook of psycholinguistics* (pp. 609–640). San Diego, CA: Academic Press.

Glenberg, A. M., Meyer, M., & Lindem, K. (1987). Mental models contribute to foregrounding during text comprehension. *Journal of Memory and Language, 26,* 69–83.

Graesser, A. C. (1981). *Prose comprehension beyond the word.* New York: Springer-Verlag.

Graesser, A. C., Gordon, S. E., & Sawyer, J. D. (1979). Memory for typical and atypical actions in scripted activities: Test of a script pointer + tag hypothesis. *Journal of Verbal Learning and Verbal Behavior, 18,* 319–332.

Graesser, A. C., & Nakamura, G. V. (1982). The impact of a schema on comprehension and memory. In G. H. Bower (Ed.), *The psychology of learning and motivation* (Vol. 16). New York: Academic Press.

Graesser, A. C., Singer, M., & Trabasso, T. (1994). Construction inferences during narrative text comprehension. *Psychological Review, 101,* 371–395.

Green, G. M. (1989). *Pragmatics and natural language understanding.* Hillsdale, NJ: Erlbaum.

Grice, H. (1975). Logic and conversation. In P. Cold & J. Morgan (Eds.), *Syntax and semantics: Vol. 3. Speech acts* (pp. 68–134). New York: Academic Press.

Gruenfeld, D. H., & Wyer, R. S. (1992). The semantics and pragmatics of social influence: How affirmations and denials affect beliefs in referent propositions. *Journal of Personality and Social Psychology, 62,* 38–49.

Hamilton, D. L., Katz, L. B., & Leirer, V. O. (1980). Cognitive representation of personality impressions: Organizational processes in first impression formation. *Journal of Personality and Social Psychology, 39,* 1050–1063.

Hamilton, D. L., & Sherman, J. W. (1994). Stereotypes. In R. S. Wyer & T. K. Srull (Eds.), *Handbook of social cognition* (2nd ed., Vol. 2, pp. 1–68). Hillsdale, NJ: Erlbaum.

Hasher, L., Goldstein, D., & Toppin, T. (1977). Frequency and the conference of referential validity. *Journal of Verbal Learning and Verbal Behavior, 16,* 107–112.

Higgins, E. T. (1981). The "communication game": Implications for social cognition and persuasion. In E. T. Higgins, C. P. Herman, & M. P. Zanna (Eds.), *Social cognition: The Ontario Symposium* (Vol. 1, pp. 342–392). Hillsdale, NJ: Erlbaum.

Higgins, E. T., Bargh, J. A., & Lombardi, W. (1985). The nature of priming

effects on categorization. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 11,* 59–69.

Higgins, E. T., & King, G. (1981). Accessibility of social constructs: Information processing consequences of individual and contextual variability. In N. Cantor & J. F. Kihlstrom (Eds.), *Personality, cognition and social interaction.* Hillsdale, NJ: Erlbaum.

Higgins, E. T., & Rholes, W. S. (1978). "Saying is believing": Effects of message modification on memory and liking for the person described. *Journal of Experimental Social Psychology, 14,* 363–378.

Higgins, E. T., Rholes, W. S., & Jones, C. R. (1977). Category accessibility and impression formation. *Journal of Experimental Social Psychology, 13,* 141–154.

Hintzman, D. L. (1986). "Schema abstraction" in a multiple-trace model. *Psychological Review, 93,* 411–428.

Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin, 114,* 3–28.

Johnson-Laird, P. N. (1983). *Mental models: Towards a cognitive science of language, inference and consciousness.* Cambridge, MA: Harvard University Press.

Johnson-Laird, P. N. (1989). Mental models. In M. I. Posner (Ed.), *Foundations of cognitive science* (pp. 469–500). Cambridge, MA: MIT Press.

Kelley, C. M., & Lindsay, D. S. (1993). Remembering mistaken for knowing: Ease of retrieval as a basis for confidence in answers to general knowledge questions. *Journal of Memory and Language, 32,* 1–24.

Kintsch, W. (1988). The role of knowledge in discourse comprehension: A construction–integration model. *Psychological Review, 95,* 163–182.

Kintsch, W. (1998). *Comprehension: A paradigm for cognition.* Cambridge, England: Cambridge University Press.

Klein, S. B., & Loftus, J. (1993). The mental representation of trait and autobiographical knowledge about the self. In T. K. Srull & R. S. Wyer (Eds.), *Advances in social cognition* (Vol. 5, pp. 1–49). Hillsdale, NJ: Erlbaum.

Klin, C. M. (1995). Causal inferences in reading: From immediate activation to long-term memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21,* 1483–1494.

Klinger, E. (1975). Consequences of commitment to and disengagement from incentives. *Psychological Review, 82,* 1–25.

Kubey, R., & Csikszentmihalyi, M. (1990). *Television and the quality of life? How viewing shapes everyday experience.* Hillsdale, NJ: Erlbaum.

Loftus, E. F., & Palmer, J. (1974). Reconstruction of automobile destruction. *Journal of Verbal Learning and Verbal Behavior, 2,* 467–471.

Logan, G. L. (1988). Toward an instance theory of automatization. *Psychological Review, 95,* 492–527.

Loken, B. A., & Wyer, R. S. (1983). Effects of reporting beliefs in syllogistically related propositions on the recognition of unmentioned propositions. *Journal of Personality and Social Psychology, 45,* 306–322.

Lutz, M. F., & Radvansky, G. A. (1997). The fate of completed goal information in narrative comprehension. *Journal of Memory and Language, 36,* 293–310.

Macrae, C. N., Bodenhausen, G. V., Milne, A. B., & Jetten, J. (1994). Out of mind but back in sight: Stereotypes on the rebound. *Journal of Personality and Social Psychology, 67,* 808–817.

Magliano, J. P., Dijkstra, K., & Zwaan, R. A. (1996). Generating predictive inferences while viewing a movie. *Discourse Processes, 22,* 199–224.

Martin, L. L. (1986). Set/reset: Use and disuse of concepts in impression formation. *Journal of Personality and Social Psychology, 51,* 493–504.

Myers, J. L., & Duffy, S. A. (1990). Causal inferences and test memory. In A. C. Graesser & G. H. Bower (Eds.), *Inferences and text comprehension* (pp. 159–173). New York: Academic Press.

Myers, J. L., O'Brien, E. J., Albrecht, J. E., & Mason, R. A. (1994). Maintaining global coherence during reading. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20,* 876–886.

Myers, J. L., Shinjo, M., & Duffy, S. A. (1987). Degrees of causal relatedness and memory. *Journal of Memory and Language, 26,* 453–465.

Neisser, U. (1967). *Cognitive psychology.* New York: Appleton-Century-Crofts.

Newtson, D. A. (1976). Foundations of attribution: The perception of ongoing behavior. In J. Harvey, W. Ickes, & R. Kidd (Eds.), *New directions in attribution research* (Vol. 1, pp. 223–247). Hillsdale, NJ: Erlbaum.

Nielsen, A. C. (1993). *Nielsen report on television.* Northbrook, IL: Author.

Nisbett, R. E., & Ross, L. (1980). *Human inference: Strategies and shortcomings of social judgments.* Englewood Cliffs, NJ: Prentice Hall.

Pennington, N., & Hastie, R. (1986). Explanation-based decision making: Effects of memory structure on judgment. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 12,* 521–533.

Raaijmakers, J. G. W., & Shriffrin, R. M. (1981). Search of associative memory. *Psychological Review, 88,* 93–134.

Radvansky, G. A., Gerard, L. D., Zacks, R. T., & Hasher, L. (1990). Younger and older adults' use of mental models as representations for text material. *Psychology and Aging, 5,* 209–214.

Radvansky, G. A., Spieler, D. H., & Zacks, R. T. (1993). Mental model organization. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19,* 94–114.

Radvansky, G. A., Wyer, R. S., Curiel, J. M., & Lutz, M. F. (1997). Mental models and abstract relations. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 23,* 1233–1246.

Radvansky, G. A., & Zacks, R. T. (1991). Mental models and the fan effect. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 17,* 940–953.

Radvansky, G. A., & Zacks, R. T. (1997). The retrieval of situation-specific information. In M. A. Conway (Ed.), *Cognitive models of memory* (pp. 173–213). Cambridge, MA: MIT Press.

Radvansky, G. A., & Zwaan, R. A. (1998). *Situation models.* Manuscript in preparation.

Ratcliff, R. (1978). A theory of memory retrieval. *Psychological Review, 85,* 59–108.

Reder, L. M., & Anderson, J. R. (1980). A partial resolution of paradox of interference: The role of integrating knowledge. *Cognitive Psychology, 12,* 447–472.

Reder, L. M., & Ross, B. H. (1983). Integrated knowledge in different tasks: The role of retrieval strategies on fan effects. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 9,* 55–72.

Reid, L., & Wyer, R. S. (1998). Stereotype suppression in a social context. In R. S. Wyer (Ed.), *Advances in social cognition* (Vol. 11, pp. 176–192). Mahwah, NJ: Erlbaum.

Ross, L., Lepper, M., Strack, F., & Steinmetz, J. (1977). Social explanation and social expectation: Effects of real and hypothetical explanations on subjective likelihood. *Journal of Personality and Social Psychology, 35,* 817–829.

Rundus, D. (1971). Analysis of rehearsal processes in free recall. *Journal of Experimental Psychology, 89,* 63–77.

Schaeken, W., Johnson-Laird, P. N., & d'Ydewalle, G. (1996). Mental models and temporal reasoning. *Cognition, 60,* 205–234.

Schank, R. C. (1990). *Tell me a story: A new look at real and artificial memory.* New York: Scribner.

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

Schank, R. D., & Abelson, R. P. (1995). Knowledge and memory: The real story. In R. S. Wyer (Ed.), *Advances in social cognition* (Vol. 8, pp. 1–85). Hillsdale, NJ: Erlbaum.

Schmalhofer, F., & Glavanov, D. (1986). Three components of understanding a programmer's manual: Verbatim, propositional and situational representations. *Journal of Memory and Language, 25,* 279–294.

Schwarz, N. (1994). Judgment in a social context: Biases, shortcomings and the logic of conversation. In M. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 26, pp. 123–162). San Diego, CA: Academic Press.

Scott, C. K., Fuhrman, R. W., & Wyer, R. S. (1991). Information processing in close relationships. In G. J. O. Fletcher & F. D. Fincham (Eds.), *Cognition in close relationships* (pp. 37–68). Hillsdale, NJ: Erlbaum.

Sherman, S. J., Skov, R. B., Hervitz, E. F., & Stock, C. B. (1981). The effect of explaining hypothetical future events: From possibility to probability to actuality and beyond. *Journal of Experimental Social Psychology, 17,* 142–158.

Shrum, L. J., & O'Guinn, T. C. (1993). Process and effects in the construction of social reality: Construct accessibility as an explanatory variable. *Communication Research, 20,* 436–471.

Shrum, L. J., O'Guinn, T. C., Semenik, R. J., & Faber, R. J. (1991). Process and effects in the construction of normative consumer beliefs: The role of television. *Advances in Consumer Research, 18,* 755–763.

Shrum, L. J., Wyer, R. S., & O'Guinn, T. C. (1998). Cognitive processes underlying the effects of television consumption. *Journal of Consumer Research, 24,* 447–458.

Singer, M., & Halldorson, M. (1996). Constructing and validating motive bridging inferences. *Cognitive Psychology, 30,* 1–38.

Smith, E. E., Shoben, E. J., & Rips, L. (1974). Structure and process in semantic memory: A feature model for semantic decisions. *Psychological Review, 81,* 214–241.

Smith, E. R. (1990). Content and process specificity in the effects of prior experiences. In T. K. Srull & R. S. Wyer (Eds.), *Advances in social cognition* (Vol. 3, pp. 1–59). Hillsdale, NJ: Erlbaum.

Smith, E. R. (1994). Procedural knowledge and processing strategies in social cognition. In R. S. Wyer & T. K. Srull (Eds.), *Handbook of social cognition* (2nd ed., Vol. 1, pp. 99–151). Hillsdale, NJ: Erlbaum.

Sperber, D., & Wilson, D. (1986). *Relevance: Communication and cognition.* Oxford, England: Basil Blackwell.

Srull, T. K., & Brand, J. F. (1983). Memory for information about persons: The effect of encoding operations on subsequent retrieval. *Journal of Verbal Learning and Verbal Behavior, 22,* 219–230.

Srull, T. K., & Wyer, R. S. (1980). Category accessibility and social perception: Some implications for the study of person memory and interpersonal judgment. *Journal of Personality and Social Psychology, 38,* 841–856.

Srull, T. K., & Wyer, R. S. (1983). The role of control processes and structural constraints in models of memory and social judgment. *Journal of Experimental Social Psychology, 19,* 497–521.

Srull, T. K., & Wyer, R. S. (1989). Person memory and judgment. *Psychological Review, 96,* 58–83.

Strack, F. (1994). Response processes in social judgment. In R. S. Wyer & T. K. Srull (Eds.), *Handbook of social cognition* (2nd ed., Vol. 1, pp. 287–322). Hillsdale, NJ: Erlbaum.

Strack, F., Schwarz, N., & Gschneidinger, E. (1985). Happiness and reminiscing: The role of time perspective, affect and mode of thinking. *Journal of Personality and Social Psychology, 49,* 1460–1469.

Suh, S. Y., & Trabasso, T. (1993). Inferences during reading: Converging evidence from discourse analysis, talk-aloud protocols, and recognition priming. *Journal of Memory and Language, 32,* 279–300.

Taylor, H. A., & Tversky, B. (1992). Spatial situation models derived from survey and route descriptions. *Journal of Memory and Language, 31,* 261–292.

Trabasso, T., & van den Broek, P. W. (1985). Causal thinking and the representation of narrative events. *Journal of Memory and Language, 24,* 612–630.

Trafimow, D., & Wyer, R. S. (1993). Cognitive representation of mundane social events. *Journal of Personality and Social Psychology, 64,* 365–376.

Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology, 5,* 207–232.

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

Wänke, M., & Wyer, R. S. (1996). Individual differences in person memory: The effects of socio-political ideology and ingroups vs. outgroups membership on responses to socially relevant behavior. *Personality and Social Psychology Bulletin, 22,* 742–754.

Watzlawick, P., Beavin, J. H., & Jackson, D. D. (1967). *Pragmatics of human communication.* New York: Norton.

Wegner, D. M. (1994). Ironic processes of mental control. *Psychological Review, 101,* 34–53.

Whitney, P. (1986). Processing category terms in context: Instantiations as inferences. *Memory & Cognition, 14,* 39–48.

Whitney, P., & Callas, G. (1984). Processing category terms in context: Instantiation and the structure of semantic categories. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 10,* 95–103.

Wyer, R. S., & Bodenhausen, G. V. (1985). Event memory: The effects of processing objectives and time delay on memory for action sequences. *Journal of Personality and Social Psychology, 49,* 304–316.

Wyer, R. S., & Budesheim, T. L. (1987). Person memory and judgments: The impact of information that one is told to disregard. *Journal of Personality and Social Psychology, 53,* 14–29.

Wyer, R. S., Budesheim, T. L., Lambert, A. J., & Swan, S. (1994). Person memory and judgment. Pragmatic influences on impressions formed in a social context. *Journal of Personality and Social Psychology, 66,* 254–267.

Wyer, R. S., & Carlston, D. E. (1979). *Social cognition, inference and attribution.* Hillsdale, NJ: Erlbaum.

Wyer, R. S., & Carlston, D. E. (1994). The cognitive representation of persons and events. In R. S. Wyer & T. K. Srull (Eds.), *Handbook of social cognition* (2nd ed., Vol. 1, pp. 41–98). Hillsdale, NJ: Erlbaum.

Wyer, R. S., & Collins, J. E. (1992). A theory of humor elicitation. *Psychological Review, 99,* 663–688.

Wyer, R. S., & Gordon, S. E. (1984). The cognitive representation of social information. In R. S. Wyer & T. K. Srull (Eds.), *Handbook of social cognition* (Vol. 2, pp. 73–150). Hillsdale, NJ: Erlbaum.

Wyer, R. S., & Gruenfeld, D. H. (1995). Information processing in social contexts: Implications for social memory and judgment. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 27, pp. 49–91). San Diego, CA: Academic Press.

Wyer, R. S., Lambert, A. J., Budesheim, T. L., & Gruenfeld, D. H. (1992). Theory and research on person impression formation: A look to the future. In L. Martin & A. Tesser (Eds.), *The construction of social judgments* (pp. 3–36). Hillsdale, NJ: Erlbaum.

Wyer, R. S., Shoben, E. J., Fuhrman, R. F., & Bodenhausen, G. V. (1985). Event memory: The cognitive representation of social action sequences. *Journal of Personality and Social Psychology, 49,* 857–877.

Wyer, R. S., & Srull, T. K. (1986). Human memory in its social context. *Psychological Review, 93,* 322–359.

Wyer, R. S., & Srull, T. K. (1989). *Memory and cognition in its social context.* Hillsdale, NJ: Erlbaum.

Wyer, R. S., Swan, S., & Gruenfeld, D. H. (1995). Impression formation in informal conversations. *Social Cognition, 13,* 243–272.

Wyer, R. S., & Unverzagt, W. H. (1985). The effects of instructions to disregard information on its subsequent recall and use in making judgments. *Journal of Personality and Social Psychology, 48,* 533–549.

Zwaan, R. A. (1994). Effect of genre expectations of text comprehension. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20,* 920–933.

Zwaan, R. A. (1996). Processing narrative time shifts. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22,* 920–933.

Zwaan, R. A., Langston, M. C., & Graesser, A. C. (1995). The construction of situation models in narrative comprehension: An event-indexing model. *Psychological Science, 6,* 292–297.

Zwaan, R. A., Magliano, J. P., & Graesser, A. C. (1995). Dimensions of situation model construction in narrative comprehension. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21,* 386–397.

Zwaan, R. A., & Radvansky, G. A. (1998). Situation models in language comprehension and memory. *Psychological Bulletin, 123,* 162–185.

Zwaan, R. A., Radvansky, G. A., Hilliard, A. E., & Curiel, J. M. (in press). Constructing multidimensional situation models during reading. *Scientific Studies of Reading.*

Zwaan, R. A., & van Oostendorp, H. (1993). Do readers construct spatial representations in naturalistic story comprehension? *Discourse Processes, 16,* 125–143.

Received February 8, 1996
Revision received May 13, 1998
Accepted May 13, 1998 ■

New Editors Appointed, 2000-2005

The Publications and Communications Board of the American Psychological Association announces the appointment of three new editors for 6-year terms beginning in 2000.

As of January 1, 1999, manuscripts should be directed as follows:

- For **Experimental and Clinical Psychopharmacology**, submit manuscripts to Warren K. Bickel, PhD, Department of Psychiatry, University of Vermont, 38 Fletcher Place, Burlington, VT 05401-1419.
- For the **Journal of Counseling Psychology**, submit manuscripts to Jo-Ida C. Hansen, PhD, Department of Psychology, University of Minnesota, 75 East River Road, Minneapolis, MN 55455-0344.
- For the **Journal of Experimental Psychology: Human Perception and Performance**, submit manuscripts to David A. Rosenbaum, PhD, Department of Psychology, Pennsylvania State University, 642 Moore Building, University Park, PA 16802-3104.

Manuscript submission patterns make the precise date of completion of the 1999 volumes uncertain. Current editors, Charles R. Schuster, PhD; Clara E. Hill, PhD; and Thomas H. Carr, PhD, respectively, will receive and consider manuscripts through December 31, 1998. Should 1999 volumes be completed before that date, manuscripts will be redirected to the new editors for consideration in 2000 volumes.