How does the mind construct and represent stories?

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Narrative discourse has received a large amount of attention in discourse psychology during the last 25 years (Bruner, 1986; Gerrig, 1993; Goldman, Graesser, & van den Broek, 1999; Graesser, Golding, & Long, 1990; Mandler, 1984; Rumelhart, 1977; Schank & Abelson, 1977, 1996). For several reasons, narrative has a privileged status among the various types of discourse. The situations and episodes in narrative have a close correspondence to everyday experiences, so the comprehension mechanisms are much more natural than those recruited during the comprehension of other discourse genre (such as argumentation, expository text, and logical reasoning). Narrative is the primary genre of oral discourse and is easiest genre to remember (Graesser & Ottati, 1996; Rubin, 1995). Not surprisingly, therefore, the wisdom of cultures was passed from generation to generation through stories for several millennia (Rubin, 1995). The plots and themes in these stories reflect the conflicts, solutions to problems, humor, and values of the culture. Perhaps the easiest way to understand the mind of a culture is to understand its stories.

Discourse psychologists have systematically dissected the representations and processing components of narrative discourse. A good theory in discourse psychology is sufficiently detailed that it specifies (a) how the meaning of a story is mentally represented in the mind of the comprehender, (b) how these meaning representations are constructed during the process of comprehension, and (c) how the meaning representations are subsequently used in different tasks (such as retrieving the story from long-term memory, judging whether a statement is true or false, and answering questions about the story). A good theory generates predictions that match empirical data. Some of the predictions also need to be distinctive. That is, the patterns of data predicted by theory T are distinctive if they differ from everyday intuitions and from other theories. A good theory also has straightforward practical applications. For example, the theory would inform us how to write stories that are coherent, informative, persuasive, memorable, emotionally salient, and/or interesting. The purpose of this chapter is to introduce the reader to

some theories and models of narrative comprehension that have recently been developed in the field of discourse psychology.

It is widely acknowledge in the discourse psychology community that the explicit text does not adequately capture the meaning representation of a narrative. The meaning representation taps background world knowledge and includes information that goes beyond the explicit information. The inferences are inherited from a large inventory of world knowledge that is known to members of the culture. There undoubtedly is some fluctuation in the representations and inferences that get constructed among adults. After all, people do differ in cognitive abilities, social backgrounds, and personal histories. However, this chapter focuses on the similarities more than the differences among comprehenders. The working assumption is that comprehension mechanisms are quite stable across individuals within and between cultures. There allegedly is some consistency in the mechanisms that are recruited when different narratives are comprehended, even narratives that radically differ in complexity, modality, and medium. For example, the process of comprehending the plots and points of narratives are quite similar in narratives that range in complexity from simple folktales to literary short stories; the process is similar when comprehending oral narrative, written narrative, comic strips, and film (Gernsbacher, 1997; Graesser & Wiemer-Hastings, 1999).

Inference mechanisms have had a controversial status in psychological studies of narrative comprehension. Twenty years ago there was very little scientific knowledge about inferences during text comprehension. Most research efforts concentrated on the representation of explicit text and the process of linking anaphoric expressions (e.g., noun-phrases, pronouns) to previous explicit text constituents. Times have changed in the world of discourse psychology. There have been serious efforts by discourse psychologists to dig deeper and understand how readers construct "situation models," i.e., mental models of what the text is about. The situation model for a story is a microworld with characters who perform actions in pursuit of goals, events that present obstacles to goals, conflicts between characters, emotional

reactions of characters, spatial settings, the style and procedure of actions, objects, properties of objects, traits of characters, and mental states of characters. Much of this content is filled in by background world knowledge that is relevant to the explicit text. The situation model is coherently organized by constructing themes and messages that convey interesting points to comprehenders.

Recent research on inferences has produced a wealth of theoretical positions in discourse psychology, each of which makes distinctive claims about situation model construction and inference generation. This chapter will focus primarily on our pet theory, the constructionist theory (Graesser, Singer, & Trabasso, 1994; Graesser & Wiemer-Hastings, 1999). However, our discussion of comprehension and of the constructionist theory will set the stage for identifying salient highlights of other theories, models, or hypotheses in discourse psychology. These theoretical frameworks include the minimalist hypothesis (McKoon & Ratcliff, 1992), the resonance model (Myers, O'Brien, Albrecht, & Mason, 1994; O'Brien, Raney, Albrecht, and Rayner 1997), the structure building framework (Gernsbacher 1997), the event indexing model (Zwaan, Langston, & Graesser, 1995; Zwaan & Radvansky, 1998), the landscape model (van den Broek, Young, Tzeng, and Linderholm, 1999), the construction-integration model (Kintsch, 1998), the schema copy plus tag model (Graesser, Kassler, Kreuz, & McLain-Allen 1998), and structural-affect theory (Brewer & Ohtsuka, 1988). Although we will focus on the constructionist theory, we will point out how other theoretical positions fit into the landscape of comprehension research.

An Example Story and Levels of Representation

There is an interesting folktale that has percolated throughout the city of Memphis during the last decade. The story is paraphrased below.

A young start-up company in Memphis was doing quite well and growing at a very fast pace, thanks to a brilliant idea of its founder and president. However, the president of the company

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was seriously worried about covering the payroll during one of the months. So the president flew

to Las Vegas and placed a $40,000 bet on one hand of blackjack. He won. So the lucky

president flew back to Memphis and paid the monthly salary of his employees. Today, the

company is a multi-billion dollar enterprise.

Those of us in Memphis know what this story is about. It is a story about Fred Smith in the early days of

Federal Express Corporation. For several years, the first author of this chapter believed the story was

true. Eventually, the truth was known and the folktale was exposed as fiction. But the factuality of the

story was somewhat irrelevant to the significance of the story in the city of Memphis. Fred Smith was a

hero in the eyes of the citizens of the city, and the story is a touchstone of the risks taken by this financial

wizard. Fred Smith helped lift the city from poverty to a modern distribution center. The truth of this story

does not lie in the matter of placing a large bet on a blackjack table. The story is fiction, but there is a

truth in the story that meshes with the history and culture of Memphis.

There are many levels of discourse in this story of a risky gamble. Table 1 lists and succinctly

defines six levels that are frequently adopted in discourse psychology. Each of these six levels is allegedly

constructed in the mind of the reader during the course of comprehension. There are linguistic and

discourse features affiliated with each level of representation. These features impose constraints and

prevent unbridled hallucinations when the meaning representations are constructed. The composition of

each level of representation has a theoretical format or code that is declared by the discourse analyst. The

precise nature of these theoretical formats and codes is sometimes hotly debated, but most researchers

agree that the six levels in Table 1 are needed.

INSERT TABLE 1 ABOUT HERE

Surface Code

This level of cognitive representation preserves most, if not all, of the exact wording and syntax of

the explicit text. In the case of oral discourse, the intonation patterns are preserved as well. In the

example story about Fred Smith, the winning hand is articulated as "He won", but alternative expressions capture approximately the same meaning, such as "The president won" or "His hand beat the dealer's". The surface code would contain the explicit wording in the text, hopefully in sufficient detail to distinguish it from alternative wordings. Some of the alternative surface forms would be vague and underspecified ("He did it"), whereas others would be stilted and overspecified ("The total points in the hand of the president exceeded the total points in the hand of the blackjack dealer"). These alternative surface forms are awkward when they are substituted in the example story. A text is "inconsiderate" and difficult to comprehend to the extent that its surface code is not in harmony with the other the levels of representation in Table 1, and also to the extent that the other levels are not in harmony with each other.

A small change in wording can potentially have dramatic repercussions on other levels of representation. Experimental psychologists sometimes overlook this very important fact about discourse. In an effort to create texts that satisfy various controls and counterbalancing constraints, experimental psychologists have an unfortunate tendency to create bizarre texts that are inconsiderate at some level (e.g., they are pointless, lack coherence, are uninteresting, or violate linguistic and communication norms). Discourse psychologists are more sensitive to the possibility of researchers working with texts that are inconsiderate (if not pathological).

Textbase

This level preserves the meaning of the explicit propositions in the text, but in a stripped down form that glosses over the details of the surface form. The textbase is cognitively represented as a structured set of propositions (Britton & Black, 1985; Graesser & Clark, 1985; Kintsch, 1974). A proposition contains a predicate (e.g., main verb, adjective, connective) that interrelates noun-like arguments (referring to people, objects, locations, etc). A proposition refers to a state, event, or action that may or may not be true about the storyworld. The following propositions would capture the sentence "The lucky president flew back to Memphis and paid the monthly salary of his employees."

P1 (predicate: <u>fly</u>, agent: <u>president</u>, goal-location: <u>Memphis</u>)

P2 (predicate: <u>lucky</u>, person: <u>president</u>)

P3 (predicate: <u>pay</u>, agent: <u>president</u>, recipient: <u>employees</u>, object: <u>salaries</u>)

P4 (predicate: possess, person: <u>president</u>, person: <u>employees</u>)

P5 (predicate: <u>monthly</u>, object <u>salaries</u>)

P6 (predicate: <u>and</u>, event: P1, event: P3)

Propositions P1 and P3 are actions in the plot, whereas propositions P2, P4, and P5 are static propositions. Proposition P6 links together other propositions in the text (P1 and P3). There is some evidence that these proposition units are natural cognitive units because they are encoded holistically and retrieved from memory in an all-or-none fashion (Graesser & Clark, 1985; Kintsch, 1974).

Twenty five years ago, most of the research in discourse psychology was limited to the surface code and textbase levels of representation (Kintsch, 1974; Rumelhart, 1977). We know, for example, that the surface code decays from memory rather quickly, lasting less than a minute, whereas the textbase hangs around for an hour or so (Kintsch, 1998; Graesser & Nakamura, 1982). In contrast, the deeper levels of text representation, as discussed below, are preserved in memory for several days, months, or years. We know that reading times increase as a function of the number of propositions in text excerpts, after statistically controlling for auxiliary variables, such as number of content words, syntax, topic familiarity, and discourse genre (Graesser, Hoffman, & Clark, 1980; Haberlandt & Graesser, 1985; Kintsch, 1974). When a new argument is introduced in the textbase for the first time, such as a new character or location, it takes extra time to insert and ground the referent in the storyworld (Gernsbacher, 1997; Haberlandt & Graesser, 1985; Kintsch, 1998). It also takes extra time to link a pronoun (e.g., he, it) to previous text constituents (e.g., Fred Smith, company), particularly when there is some ambiguity about which referent is an appropriate match to the pronoun (Gernsbacher, 1997). Gernsbacher's structure building framework (Gernsbacher, 1997) and Kintsch's construction-integration model (Kintsch, 1998)

have adequately modeled the process of constructing the textbase and subsequently retrieving it from memory.

<u>Situation Model</u>

The situation model is a deeper level of representation than the surface code and textbase. As mentioned earlier, the situation model is the mental microworld of what the story is about. The situation model includes the spatial setting and the chronological sequence of episodes in the plot. In most plots, there are characters who perform actions in pursuit of goals, events that present obstacles to goals, conflicts between characters, clever methods of resolving conflicts, and consequences of these resolutions. The following plot structure could be assigned to the gambling story.

Conflict: President was worried about covering the payroll of his employees

Goal: President wanted to cover the payroll

Action: President placed a large bet in blackjack

Outcome: President won the bet.

Consequence: The company is now a multi-billion dollar enterprise.

In addition to the core plot, the situation model includes explicit and inferred information that fleshes out the plot and adds color. Such ornamentation includes the spatial setting (Memphis), the style and procedure of actions (flying to Las Vegas as opposed to driving), props (blackjack table), objects (chips), properties of objects ($40,000 bet), and traits of agents (the president being lucky). Discourse psychologists have reported evidence that the main causal chain that chronologically unfolds in the plot is retained in memory much longer than the ornamental details (Graesser & Clark, 1985; Kintsch, 1998; Trabasso & van den Broek, 1985). So the citizens of Memphis may forget whether Fred Smith was playing craps or blackjack, and whether the bet was $40,000 or $32,000. But they will remember that he placed a large bet and he won. More will be said about what gets encoded and retained in the situation model later in this chapter.

The situation model in narrative includes the chronological order of episodes that causally unfolds. In most narrative discourse, the order of mentioning the propositions in the textbase is in synchrony with the chronological order of episodes in the situation model. Most readers routinely assume that an incoming episode occurs after the preceding episode (Givon, 1993; Graesser, Kassler, Kreuz, & McLain-Allen, 1998; Ohtsuka & Brewer, 1992), unless there are explicit cues in the text that signal asynchronies. When asynchronies occur, as in the case of flashbacks ands flashforwards, there are temporal discourse markers that signal deviations from the implicit chronological synchrony between the textbase and situation model (e.g., Many years earlier, Later on in her life, just before she died, …). Such asynchronies often occur when a story is told from the point of view of a particular character, when there is a stylistic focus on a pivotal episode, and when the narrative is crafted to elicit a particular emotion from the comprehender (Brewer, 1980, 1996).

Thematic Point

This is the moral, adage, or main message that emerges from the plot configuration. For example, the thematic point of the gambling story might be an ironical or paradoxical message: The fate of a large, invincible, corporate giant once rested on the outcome of a split-second risky bet. One of the computational challenges has been to determine how the thematic point is derived from the plot structure (Dyer, 1983; Lehnert, 1981). That is, how does the point of a story systematically emerge from the configuration of important goals, actions, obstacles, conflicts, and resolutions expressed in the plot? The relationship between these two levels appears to be as mysterious and complicated as the relationship between word meanings and sentence meanings.

Discourse psychologists have occasionally studied the processing of thematic points but there are significant gaps in the literature. Schank and Abelson (1996) suggested that one of the primary goals in everyday conversations is to tell a story that is thematically similar to the previous story. That is, one way of having coherent and entertaining conversations is to take turns telling similar stories. Story N in the

conversation has a thematic structure that reminds a person about a structurally similar story N'; story N'

is told if it is a bit more interesting than story N (Schank, 1982). There may be a "one-upsmanship game"

in the delivery of stories, with the stories having progressively more interesting structural analogues. The

ability to do this rests on several premises: That a person is capable of interpreting thematic points during

comprehension, that analogical remindings occur, and that the person is capable of generating the

structurally similar stories.

One or more of the above premises may fail, however. One central question for the discourse

psychologist to investigate is the process of constructing the thematic points during comprehension (Seifert,

McKoon, Ratcliff, & Abelson, 1986). Is the thematic point routinely constructed during the process of text

comprehension (i.e., "on-line" processing)? Or is it constructed only when the comprehender has the

opportunity to reflect on the narrative experience after comprehension is completed (i.e., "off-line"

processing)? Another research challenge for the discourse psychologist is to assess whether

comprehenders are capable of constructing a particular theme, even when they have had time for

reflection. Available empirical evidence indicates that it is very difficult for many children and adults to

construct a theme spontaneously during comprehension (Seifert et al., 1986). It is also difficult for some

individuals to construct a theme after comprehension is completed (Goldman, 1985; Williams, 1993).

When adults are asked to sort a large set of short stories (i.e., 100-250 words) on similarity of theme, the

adults show high agreement on the patterns of classification; these categories tap the deep plot structure

rather than the surface features of the stories (Seifert et al., 1996). However, these same themes are

rarely generated on-line. It appears that comprehenders can judge whether a theme is appropriate for a

story, but most children and adults have difficulty generating a theme during comprehension, and many

have difficulties generating themes after narrative comprehension is completed. Nevertheless, when an

appropriate theme is identified, it does have a major influence on the comprehension and memory of story

events (Narvaes, 1998; Williams, 1993).

<u>Agent Perspective</u>

This level of narrative representation is considerably less salient in the minds of most comprehenders. Because of the low salience, many researchers unfortunately miss some important distinctions and mechanisms. Comprehenders potentially construct multiple <u>agents</u> in their cognitive representations when they read narrative (Clark, 1996; Graesser, Bowers, Olde, & Pomeroy, 1999; Keysar, 1994). (For the present purposes, we will assume the narrative is being read, rather than being embedded in oral conversation.) Each agent has human qualities, such as speaking, perceiving, believing, knowing, wanting, liking, acting, and experiencing emotions. One set of agents consists of the society of characters in the storyworld. Each character views the storyworld from his or her point of view, or what is sometimes called character perspective (Duchan, Bruder, & Hewitt, 1995; van Peer & Chatman, 1999). When participants are asked to recall a story that has different characters, such as a burglar versus a home buyer, the content that ends up being recalled depends on whether it is told from the perspective of the burglar or the home buyer (Anderson & Pichert, 1978; Owens, Bower, & Black, 1979). A different set of agents, called <u>pragmatic agents</u>, participate in acts of communication during the telling (reading) of the story. The story is told from the narrator to narratee (and arguably from the author to the reader). The narrator is an imaginary agent who communicates the story to an imaginary recipient or addressee (called the narratee). The author and reader agents are pretty much self-explanatory. It should be acknowledged, however, that the narrator is conceptually separate from the author and the narratee is conceptually separate from the narratee (van Peer & Chatman, 1999).

The character agents are fused with the pragmatic agents in some narrative forms, but not in others. This becomes apparent when we contrast first-person, second-person, and third-person narration.

<u>First-person narration</u>. I flew back to Memphis and paid the monthly salaries of my employees.

<u>Second-person narration</u>. You fly back to Memphis and pay the monthly salaries of your employees.

<u>Third-person narration</u>. The lucky president flew back to Memphis and paid the monthly salaries
of his employees.

In first-person narration, the narrator is fused with one of the character agents. The narrator takes the

point of view of one character (e.g., Fred Smith) and speaks to the narratee through the character's eyes.

The comprehender ends up viewing the world and experiencing consciousness from the perspective of the

one character. In contrast, third-person narration keeps the various agents functionally separate. The

narrator sits perched above the microworld and omnisciently reports the actions, events, and states of the

situation model to an imaginary narratee. In the case of second-person narration, there is a fusion of four

agents: narrator, narratee, character, and reader. That is, the referent of "you" is not one single agent, but

rather corresponds to all four agentive roles. The narrator is in the process of talking to himself (narrator

to narratee) and links "you" to both a character in the plot (who also is the narrator) and to the reader.

Second-person narrative is rarely used as a perspective in this culture, but has some intriguing potential

consequences on comprehension and memory.   The author uses this fusion of agents to sweep up the

reader as a participant in the microworld and thereby increase reader involvement. Because there is a

fusion of multiple agentive roles, the agent should be more salient and accessible in memory.

Graesser, Bowers, Olde, and Pomeroy (1999) has reported that a narrator is indeed more salient

in memory when it is fused with more agentive roles. They used a source memory test (i.e., memory for

"who said what") to assess the salience of agents in memory. College students read published literary

short stories and later completed a test on who said what. That is, statements in the story (e.g., Glenda is

pregnant, David often has a cigarette after sex) were either expressed by a narrator or by particular

characters. The source memory test listed a set of alternative agents (i.e., narrator, character A,

character B, neither) and the participant decided who expressed the statement. Source memory should be

more accurate for those agents that are more salient in memory. According to a fusion facilitation

hypothesis, the predicted gradient in memory is: second-person > first-person > third-person. This

prediction was in fact supported when comparing first-person and third-person narration; second-person narration has not yet been tested because of the difficulty of finding second-person short stories. Interestingly, the frequency of perspective forms in literature is just the opposite: third-person > first-person > second-person.

Another agent, which is perhaps least visible to the reader, will be articulated by a metaphor to a camera operator in a film crew. There is an imaginary camera operator who positions the camera at some location in the microworld and views each focal action, event, or setting from that perspective (Duchan et al., 1995; Black, Turner, & Bower, 1979). The systematic positioning of the mental camera appears to becoming more common when professional authors write short stories and novels, probably because of the lucrative potential for film adaptations. The mental camera operator is frequently fused with a particular character or the narrator, but not always (Duchan et al., 1995). When the gambling story states that "the president flew to Las Vegas", the camera is positioned somewhere in Memphis and views the exit of the president from the Memphis scene. The camera would also be positioned in Memphis if the action were articulated as "the president went to Las Vegas". However, if the action was articulated as "the president came to Las Vegas", the camera is positioned in Las Vegas, rather than Memphis, and it views the arrival of the president's flight. Thus, the selection of the main verb "went" versus "came" signals the deictic location of the mental camera. There is some empirical support for the existence of this mental camera operator (or something analogous to it). Reading time studies have shown that it takes additional processing time for the operator to shift the mental camera from one location to another location in the storyworld, to shift the "mind's eye perspective" from one character to another, and to shift the perspective from a character stance to a narrator stance (Black, Turner, & Bower, 1979; Millis, 1995; Morrow, Greenspan, & Bower, 1987). Narrative text is awkward or confusing when there is not a coordinated positioning of the mental camera (e.g., After Fred arrived in Las Vegas, he drove to the Golden Nugget casino, and came to the blackjack table).

The reader is obviously a critical agent for the author to consider while composing narratives. The author needs to know what a typical reader knows. Communication will not succeed if the writer fails to keep track of the common ground (shared knowledge) between reader and writer, and when a speaker fails to keep track of the common ground between speaker and listener (Clark, 1996; Schober, 1999). The emotions of the reader are monitored by a good author in addition to keeping track of the knowledge of the reader. The author of narrative crafts the story in a fashion that has a particular emotional impact on the reader. According to Brewer's structural affect theory, for example, the emotions of the reader are determined by the configuration of the plot and the knowledge states of the various characters (Brewer, 1996; Brewer & Ohtsuka, 1988). Consider the emotion of suspense. There is an initiating event that has the potential to lead to a significant outcome; the outcome is either very good or bad for a central character. In the gambling story, the initiating event would be the president placing a $40,000 bet on one hand of blackjack. The comprehender might be held on a precipice of suspense before the actual outcome is expressed (he won); that is, the suspense could be drawn out by a number of intervening episodes between the precipitating event and the outcome, e.g., the dealer might need to reshuffle, a drink may be served, or Fred Smith may need to leave to handle a phone call. A good writer can prolong the suspense with many episodes. In the case of suspense, as well as other reader emotions, the author controls the tension and arousal level of the reader by manipulating the plot and character knowledge (Vorderer, Wulff, & Friedrichsen, 1996). The suspense can even be recreated (i.e., re-enacted, re-experienced) when the story is comprehended on multiple occasions and the comprehender already knows the outcome (Gerrig, 1993).

Genre

The term genre simply means the category of text under consideration. Narrative is frequently contrasted with persuasion (argumentation), expository, and description, but scholars in rhetoric have developed rich taxonomies of genre that attempt handle large corpora of texts. Within the category of

narrative, there are many hierarchical levels of nested subcategories. A particular genre G, at whatever level of specificity, has conventional features that members of a community learn. These linguistic/discourse features guide the comprehenders attention, comprehension, and memory. For example, we would expect a writer of a mystery to withhold telling who the culprit is until late in the story, and to honor the implicit agreement that statements that are mentioned out of the blue are likely to be important clues.

It is possible to classify narratives and other discourse genre according to their different pragmatic functions (Biber, 1988; Brewer, 1980). The use of stories for persuasion is well documented. For example, studies on jury decision making have shown that stories help the juror make sense of the evidence and to formulate a verdict of guilt or innocence (Pennington & Hastie, 1992, 1993; Voss, Wiley, & Sandak, 1999). In fact, a coherent story sometimes has a greater impact on the jury than the quality of the evidence (Kuhn, Weinstock, & Flaton, 1994). Adults frequently confuse the quality of the evidence with a narrative explanation that coherently binds the various facts about a case (Brem & Rips, 1997).

A different pragmatic function of narrative is simply to inform the listener.   As mentioned earlier, the wisdom of a culture is often passed down, from generation to generation, in the form of stories (Rubin, 1995). Prior to the invention of print, stories were the primary form of dissemination of knowledge. Narrative still reigns supreme in civilized literate cultures because stories are easy to comprehend and remember (Graesser & Ottati, 1996; Rubin, 1995; Schank & Abelson, 1996).   There are some powerful demonstrations of the special status of the narrative genre. In one study by Graesser, Hauft-Smith, Cohen, & Pyles (1980), college students read 12 texts that were selected from published collections of stories and from encyclopedias. The texts were approximately 275 words in length. The texts varied in narrativity, with half being in the narrative genre and half in the expository genre. Orthogonal to this genre split was a dimension of familiarity; half had familiar content and half had unfamiliar. Ratings of narrativity and familiarity by college students confirmed this orthogonal classification of texts. Within 5

minutes of reading each text, the participants recalled the text in writing. Recall proportions were computed by observing the proportions of propositions in the explicit text that were in the recall protocols. The recall proportions correlated .92 with the narrativity ratings, whereas the correlation with the familiarity ratings was low and nonsignificant. Sentence reading times were collected on the same passages in a study by Graesser, Hoffman, and Clark (1980). The sentence reading times had a robust negative correlation with narrativity ratings (r = -.87), but was not correlated with familiarity ratings. The results of these studies are compatible with the claim that narrative text is recalled approximately twice as good as expository text and is read approximately twice as fast.

It remains somewhat of a mystery why narrative text is so easy to comprehend and remember. Perhaps it is because the content of narrative text has such a close correspondence with everyday experiences. Perhaps it is because the language of oral conversation has a closer similarity to narrative text than other discourse genres. Perhaps it is because there are more vivid mental images, or a more elegant composition of the conceptual structures. Narratives are more interesting, so perhaps they are more motivating to read. This latter explanation is a bit suspect, however, because interestingness ratings failed to have much of an impact on recall and reading times in the above studies by Graesser, Hauft-Smith, et al (1980) and by Graesser, Hoffman, and Clark (1980). Researchers have not yet provided a satisfying answer to the question of why narrative has such a privileged status in the cognitive system.

It is somewhat of a paradox that narrative is so easy to comprehend and remember because there are so many levels of representation. In this section we have identified the surface code, the textbase, the situation model, the thematic point, a society of character agents and pragmatic agents, the manipulation of reader response, and genre. Somehow the constraints from these different levels need to mesh in harmony as the cognitive representations get constructed during comprehension. It no doubt takes a massive amount of world knowledge, associated with the various levels, for the complex puzzle of comprehension to fall into place. Comprehension breaks down and the quality of the text suffers when

there are asynchronies among levels. We believe that the conventions of a genre play an important role in facilitating synchrony among levels. The conventions guide both the creation of narrative text and the comprehension of the narrative text, so the same constraints operate at both ends of the communication process. If there were no conventions associated with the genres, communication would be a very difficult achievement.

Pragmatic context

This level of representation is absolutely critical, but lies outside of the scope of the narrative per se. The pragmatic context frames the telling of the narrative. When a story is told in oral conversation, there is a particular speaker who tells the story to a particular listener or audience. The story is told for a purpose, whether it be to entertain, to gripe, to inform, or to persuade the listener. Stories in print have similar functions, although the stories are "decontextualized" in the sense that the authors and readers are not experiencing the story at a shared time and place (Clark, 1996).

An analysis of the pragmatic functions of a story is needed to explain why the surface code is articulated in a particular fashion and why some episodes in the narrative are emphasized. The Federal Express story would be told quite differently if the speaker were trying to shock the listener versus amuse the listener. The Federal Express story no doubt fluctuates in content and form each time that a given speaker tells it to different audiences, or even the same audience (Norrick, 1998; Schiffrin, 1984).

The remarkable achievement of narrative comprehension is undeniable. However, we will also argue in this chapter that there are limitations on what the human mind can accomplish in the arena of narrative comprehension. Several facts about the human mind are widely acknowledged in the field of cognitive science and discourse psychology. Table 2 lists and describes a number of components and assumptions that have been adopted in most of the contemporary models of discourse psychology (as will be discussed later). These place constraints on a plausible cognitive theory of narrative comprehension. For example, the human mind has a working memory with a limited capacity. It has a consciousness that

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can focus on only one or two ideas at a time. These bottlenecks force the comprehender to retain in working memory only the recent episodes and the important episodes in the plot. As another example, it takes a nontrivial amount of time (a handful of seconds) to construct a rich mental image of a setting in the minds eye. Therefore, a detailed spatial mental model cannot be constructed on-line when a reader reads at a rate of 250-400 words per minute. Consequencely, the mental representation of the situation is not the fine-grained depiction of reality that could be produced by a high-resolution video.

As yet another example, a situation model is easy to construct when it has verisimilitude, that is, it is believable from the standpoint of everyday experiences and knowledge about the world. When a narrative substantially deviates from everyday experiences, it is difficult for the mind to quickly make adjustments and propagate inferences with new ground rules about reality. Therefore, a writer of science fiction might attempt to paint a society that defies our normal assumptions about time, space, and causality, but some of these transformations are extremely challenging for the mind to track (Graesser, Kassler, & Kreuz, & McLain-Allen, 1998). For example, it is difficult for us imagine what our life would be like if the future was certain rather than uncertain, or if we had amnesia and entirely forgot our past. It is nearly impossible for the mind to imagine a world in which the future causes the past at the same time that the past causes the future. Most readers would be bewildered with a science fiction novel that has a high density of flash forwards and flashbacks and that has pervasive causality at a distance.

INSERT TABLE 2 ABOUT HERE

The remainder of this chapter will concentrate on the construction of situation models during the comprehension of narrative discourse. We will inquire about the classes of inferences that are routinely constructed in the situation model during comprehension. What sort of inferences are constructed on-line during comprehension, and what aren't? It is unreasonable to assume that the comprehender constructs an exhaustive rendering of the setting and plot -- a rendering that would be provided by a high-resolution video, along with snapshots of the mental status of the society of agents (both character agents and

pragmatic agents). It is incorrect to assume that "anything goes" or "everything goes". Instead, there are

cognitive constraints that determine what inferences are constructed. That being so, a theory worth its

weight in gold should be able to predict and explain which inferences make it into the representation. The

next section presents a constructionist theory (Graesser et al., 1994) that offers discriminating predictions

about the nature of inference generation during comprehension.

<u>The Constructionist Theory of Building Situation Models and Knowledge-based Inferences</u>

Graesser et al.'s (1994) constructionist theory attempts to account for the process of building

situation models when narrative text is comprehended. A central goal lies is in specifying the set of

knowledge-based inferences that are routinely activated and encoded during this process. Knowledge-

based inferences are those inferences that are inherited from generic knowledge structures (e.g., scripts,

stereotypes) and from specific episodic structures created in the past (i.e., from prior texts, discourse, and

experiences). For example, the Fred Smith story activates a "gambling" script and a "company president"

stereotype. The generic script on gambling would include typical actions that are performed while

gambling (placing chips on a board, giving the dealer money), the typical setting (casino), prompts (tables,

chairs), goals (make more money). A generic script has typical information about an activity that a person

frequently enacts or witnesses. Similarly, a generic stereotype contains typical information about a class

of people. In contrast to the generic packages of knowledge, episodic structures are associated with

episodes that a person experiences at a particular time and place. The knowledge-based inferences in the

situation model are inherited from the generic and episodic knowledge structures (which constitute world

knowledge). .

Knowledge-based inferences are not the same sort of inferences as the products of syllogistic

reasoning, statistical reasoning, and other challenging computational systems. These latter inferences are

not routinely made on-line during comprehension because they are difficult and require effortful reflection.

Sometimes they are only made with the assistant of a physical artifact (e.g., paper and pencil, a truth table, Venn diagrams, a computer). In contrast, knowledge-based inferences are constructed more quickly and with much less effort. Examples of knowledge-based inferences will be presented shortly.

Some of the components and assumptions of the constructionist theory are not controversial because they are also adopted by alternative theoretical frameworks in discourse psychology. The components and assumptions in Table 2 that are uncontroversial are 1-7. That is, models in discourse psychology normally assume that there are multiple information sources, multiple levels of representation, multiple memory stores, a discourse focus, convergence, constraint satisfaction, and automaticity through repetition. As with other positions in discourse psychology, the constructionist theory assumes that the inferences and content of the situation model are systematically influenced by variations in reader goals. Assumptions 1-7 are pretty much boiler plate assumptions in the discourse psychology community. They are adopted in the resonance model (Myers, O'Brien, Albrecht, & Mason, 1994; O'Brien, Raney, Albrecht, and Rayner 1997), the structure building framework (Gernsbacher 1997), the event indexing model (Zwaan, Langston, & Graesser, 1995; Zwaan & Radvansky, 1998), the landscape model (van den Broek, Young, Tzeng, and Linderholm, 1998), and the construction-integration model (Kintsch, 1998), for example.

The constructionist theory has two distinctive assumptions that substantially narrow down the set of inferences that are routinely generated on-line during narrative comprehension. These are the coherence assumption (number 8 in Table 2) and the explanation assumption (number 9). Inferences have a high likelihood of being generated in the situation models if they participate in building coherent meaning representations or in building explanations.

Coherence

According to the coherence assumption, the comprehender attempts to build a situation model that establishes both local and global coherence among the actions, events, and states that are explicitly

mentioned in the text. Local coherence is established if an incoming explicit statement (S) can be linked conceptually to a recent proposition (P) that resides in working memory (WM). Comprehenders monitor several conceptual dimensions simultaneously during the attempts to achieve local coherence (i.e., linking S to a P in working memory). Studies by Zwaan (Zwaan, Magliano, & Graesser, 1995; Zwaan & Radvansky, 1998) reported that reading time increases for an explicit sentence in a narrative text if it involves a break in coherence (or continuity) on any one of the following five dimensions.

(1) Protagonist. The protagonists in explicit statement S are not among the protagonists

(main character agents) in WM.

(2) Temporality. The action or event expressed in S involves a gap or shift in the

chronological timeline.

(3) Causality. The action or event expressed in S does not causally flow from the content

in WM.

(4) Motivation. The action expressed in S is not part of an agent's plan in WM.

(5) Spatiality. The action or event expressed in S is in a different spatial region from the

content in WM.

Reading times experiments have revealed that a break on any one dimension is sufficient to increase reading time (Zwaan, Magliano, & Graesser, 1995). Reading time also increases to the extent that there are continuity breaks on an increasing number of dimensions. Zwaan's event indexing model specifies both (1) the process of monitoring these 5 dimensions during comprehension and (2) the extent to which the multidimensional representation can explain the strength of association between pairs of events in narrative.

Global coherence is established when local segments of discourse can be organized into higher order chunks. In the simplest case, there is a hierarchical organization of episodes, chunks, super-chunks, and thematic points. For example, Flying to Las Vegas, placing a $40,000 bet on a hand of blackjack,

winning the hand, and returning to Memphis could funnel into a single chunk expressed as "obtaining the needed money from a risky casino gamble". At a higher level, the chunks would funnel into super-chunks. The chunks of encountering a financial deficit for making payroll, obtaining the needed money from a risky gamble, and paying the employees could funnel into a super-chunk of "the president solving a financial problem for his company." At the highest level, the super-chunks would support the thematic point: A large corporation was saved by a risky gamble of its president." Of course, there could be other thematic points that take slightly different slants: "The fate of a large, invincible, corporate giant once rested on the outcome of a split-second risky bet", "a small shift in fate can be enough to stop a large enterprise from growing", or "the powerful were once fragile." A thematic point has a high coverage to the extent that its subordinate "nodes" (i.e., super-chunks) and its descendents at lower levels in the tree structure (i.e., chunks, episodes) cover a high proportion of the explicit episodes in the text (Lehnert, 1981; Schank, 1982). It should be noted, however, that the structure need not be a strict hierarchy. There can be more complex, scruffy networks that deviate from strict hierarchies (see Lehnert, 1981). Regardless of the exact structural composition, a good thematic point has tentacles that cover a large proportion of the episodes, whereas a poor theme covers a small subset of the episodes (Graesser & Clark, 1985; Lehnert, 1981). Unfortunately, there currently is not enough empirical data to assess whether the quality of thematic points is highly correlated with such metrics of coverage. Nevertheless, this is the working assumption of the constructionist theory.

In order to establish global coherence, the incoming explicit statement S sometimes needs to be linked to content several sentences or pages earlier in the discourse context, content that is no longer in WM (Singer, Graesser, & Trabasso, 1994). To what extent can an adult reader successfully link the current sentence with earlier, far-reaching discourse constituents? If a reader is comprehending statement S on page 72 in a novel, can the reader reinstate relevant content from page 13? Available research has not completely resolved this question. The constructionist theory assumes that such global linkages can be

achieved if the story is well written in the sense that there is harmony among the levels of representation in Table 1, but not if the narrative is pointless, choppy, and difficult to relate to general world knowledge. The reader settles for local coherence under these adverse conditions. According to the resonance model (Myers et al., 1994; O'Brien et al., 1997), an incoming statement S can reinstate a statement (P) several pages earlier if (1) there are a rich set of features in statement S, (2) there is a high overlap between the features of S and the features of P, and (3) the features of P are readily discriminable from other episodes in the prior discourse context. Stated differently, statement S will reinstate statement P if S has a high resonance (i.e., similarity) with P and if P has few (if any) competitors.

Explanation

The second distinctive assumption of the constructionist theory is the explanation assumption. Comprehenders attempt to explain why the explicit actions, events, and states occur in the narrative. Comprehenders also attempt to explain why the author bothers to mention explicit information and why any unusual surface features are expressed in the text. Thus, comprehension is driven by why-questions to a much greater extent than other types of questions (when, where, how, what-happens-next). The causal explanation of an intentional action includes the motives (superordinate goals) for performing the action and the events/states that initiate these motives. In the theoretical language of attribution theory, these are the motives, dispositions, traits, and situational events that explain why agents perform actions (Alicke, 1992; Burger, 1981; Hilton, Smith, & Kim, 1995; Read & Marcus-Newhall, 1993). It is important to distinguish the intentional actions of agents from unintentional events that occur in the material world. The causal explanation of an unintentional event includes the causal antecedents that lead up to event. Inferences are more likely to be made if they are more recent events on a causal chain (i.e., they more directly lead to event being explained) and if the inferences are connected to many other events on the chain (Graesser & Clark, 1985; Trabasso & van den Broek, 1985; van den Broek et al., 1999).

The words that get expressed in a text need to be explained in addition to an explanation of the episodes in the situation model. A causal explanation of an unusual, nonstandard, or unexpected constituent in a text (e.g., word, phrase, clause, sentence) justifies why an author bothered to mention something or why it was expressed in an atypical style. In detective stories, the writer sometimes mentions some fact out of the blue. A clever reader will regard this as a clue and use it to explain an important narrative episode later in the story.

According to the explanation assumption, why-questions are fundamental questions that drive comprehension. The strong version of this assumption is that why-questions drive the comprehension of all genres of text, not just narratives. Stated differently, explanation-based reasoning is an invariant feature of all comprehension, whether the input be narrative text, expository text, film, or physical and social activities in everyday life. The weaker version of the explanation assumption is that why-questions drive comprehension whenever the input involves episodes that causally unfold over time. Why-questions may be important for narrative text, but other question categories (such as where or what-happens-next) might be more natural for other discourse genres. It is beyond the scope of this chapter to identify the precise conditions in which the explanation holds up. However, we do claim that its scope is much broader and invariant than many psychologists would predict. For example, Graesser and Bertus (1998) reported that why-questions drive the comprehension of expository texts that describe scientific or technological mechanisms.

The Status of Example Inferences: Are they Constructed in the Situation Model during Comprehension?

In order to illustrate various explanation-based inferences, as well as some other classes of inference, consider once again the gambling story presented earlier. Listed below is a set of potential inferences at the point in the story when the president placed the $40,000 bet on one hand of blackjack. Each inference is evaluated from the standpoint of being constructed in the situation model. Once again,

these predictions are based on the constructionist theory (Graesser et al., 1994). The predictions would be different for other theoretical positions.

(1) <u>Fred Smith wanted to pay his employees</u>. This is a <u>superordinate goal</u> of the act of placing the $40,000 bet. It is part of the following explanation: Fred Smith placed the bet in order to win $40,000, which would then be used to pay his employees the monthly salaries that he owed them on the payroll. Superordinate goals explain <u>why</u> intentional actions are performed by human agents, so this inference would have a high likelihood of being constructed on-line in the situation model.

(2) <u>Fred moved his chips into the circle</u>. This action elaborates the <u>subplan</u> (i.e., subgoal, procedure, method, style) of the act of placing the $40,000 bet. A more complete subplan would involve lifting $1000 chips, moving them to the circle, counting the chips, signaling to the dealer, and so on. This information specifies <u>how</u> the bet was made, but does not explain <u>why</u> it was made. Therefore, it would have a low likelihood of being constructed in the situation model according to the constructionist theory. It is mere ornamentation, not part of the explanatory guts of the plot. Such inferences are only made if the reader has a comprehension goal that encourages the construction of such procedural details.

(3) <u>Fred needed a large amount of cash.</u> This is an important <u>causal antecedent</u> that leads to Fred's placing the $40,000 bet. It is on the causal chain that helps explain <u>why</u> the bet was made, so it should be constructed on-line according to the constructionist theory.

(4) <u>Fred lost his business</u>. This is a plausible <u>causal consequence</u> (expectation) of placing the $40,000 bet. It answers a what-happens-next question, but not a why-question, so it is theoretically not generated on-line in the situation model. The expectation ends up being incorrect when we comprehend the next event. Sometimes expectations are confirmed and sometimes they end up being disconfirmed. Graesser and Clark (1985) collected expectations during story comprehension by having students answer "what-happened next" question after each sentence in the story. Most of these expectations ended up being disconfirmed when the full story was known. If these expectations had been actually been

generated on-line during normal comprehension, the comprehender would have ended up doing cognitive work to no avail. There would have been a large amount of cognitive wheel spinning with very little payoff because there is an extensive degree of uncertainty in most narrative texts, particularly the interesting ones. Instead of viewing the comprehension of narrative as a "situation model guessing game," where the comprehender attempts to predict the future, it is more appropriate to view the comprehender as a "Monday morning quarterback," attempting to explain what has happened. It should be noted that expectations vary in specificness (e.g., Fred lost versus Fred lost his business) and causal distance from the action/event being comprehended (e.g., Fred lost the hand versus Fred lost the business). All of these expectations would not be generated on-line according to constructionist theory. The constructionist theory does predict that a small number of expectations are generated on-line, but these will not be identified in this chapter. The distinctive, and perhaps counterintuitive, claim of the constructionist theory is that expectation-based causal consequences are not routinely drawn on-line during comprehension. Humans are not very good at forecasting the future; this not a prominent activity during comprehension.

(5) Fred was in front of the table. This is a plausible spatial location for Fred Smith as he made his $40,000 bet. But it fails to explain why the bet occurred, so theoretically it will not be constructed in the situation model.

(6) The bet was extremely risky. The risk is conveyed by the large $40,000 bet and the fact that it was placed on only one hand of blackjack. A low risk bet would not explain why the author bothered mentioning the large amount and why the author mentioned there was only one hand. The storyteller might have simply mentioned that Fred went to Las Vegas, gambled, and won $40,000. But that would not convey the dramatic risk. The risk is conveyed by the author's explicit mention of particular details which are explained by the inference of risk.

These six examples show how the constructionist theory provides a principled and decisive foundation for predicting what knowledge-based inferences are encoded in the situation model during

narrative comprehension. The comprehender generates inferences selectively rather than indiscriminately. The comprehender may not be consciously aware of these inferences and how they are generated. But they are generated in the sense of being activated and encoded in the situation model. When viewed probabilistically or quantitatively, the constructionist theory has a principled way of predicting the gradient of encoding strengths for different classes of inferences; however, we will stick with the more discrete and simpler framework for the present purposes. The explanation-based inferences and coherence-based inferences are products of an overlearned, automatized comprehension strategy that attempts to explain the text and to integrate the content of the text coherently. The comprehension strategy may either be conscious or unconscious, depending on the degree to which the skill has been automatized. For most adults, the strategy is entrenched in the cognitive system, overlearned, automatized, and unconscious.

There may be other inferences that are products of passive activations of knowledge, such as an inference that is activated by multiple information sources (Kintsch, 1998) or an inference that is very typical of a package of relevant world knowledge (Bower, Black, & Turner, 1979; Graesser & Nakamura, 1982; Schank & Abelson, 1996). The constructionist theory has a separate set of assumptions to handle the inferences that are products of these passive activations (see assumptions 5 and 6 in Table 2). Such inferences can be isolated methodologically and distinguished from explanation-based or coherence-based inferences. For example, in a normative task, free association data or free generation protocols are collected on each noun, main verb, and adjective in the text (Graesser & Clark, 1985; Kintsch, 1998); the content that is triggered by these isolated words are operationally defined as inferences via passive activation. If several content words activate an inference, then it is a product of convergence from multiple information sources. However, if an inference does not match any content via passive activations of knowledge, then we can have a fair test of the distinctive predictions of the constructionist theory. The passive-activation inferences are predicted by most theoretical models, so they are not unique to the constructionist theory.

The distinctive claim of the constructionist theory is that readers routinely attempt to achieve explanation and coherence, and that particular classes of inference are products of these efforts. These comprehension strategies are automatized in the comprehension mechanism, so they tend to be invariant among readers, text genres, and reading situations. On the other hand, these inferences would probably not be constructed during comprehension under very unusual conditions: when the reader is skimming the text rather than comprehending it, when working memory capacity is seriously exceeded to the point of the reader giving up, when the reader is convinced the author is not coherent, or when the reader has an unusual reading goal (e.g., tracking the spatial location of a particular character).

Empirical Tests of the Constructionist Theory

There is empirical evidence for the distinctive predictions of the constructionist theory. The predictions have been supported in narrative text (Graesser et al., 1994; Long, Golding, & Graesser, 1992; Magliano, Baggett, Johnson, & Graesser, 1993), expository text (Graesser & Bertus, 1998; Millis & Graesser, 1994), and short vignettes composed by experimental psychologists (Singer et al., 1994; Singer & Halldorson, 1996). Two types of evidence will be briefly described. One form of evidence taps conscious reflections of readers while they read text. The other type of evidence taps unconscious processes that occur within a second after a sentence is comprehended.

The first type of empirical test collects "think aloud" protocols from readers as they comprehend stories, sentence by sentence. The think aloud protocols provide a snapshot of the conscious content of the reader at different points in the story. The content in the think aloud protocols for stories includes a higher incidence of knowledge-based inferences than of the explicit text statements (Trabasso & Magliano, 1996; Zwaan & Brown, 1996). But more to the point, Trabasso and Zwaan have reported that explanation-based inferences account for lion's share of the content of think aloud protocols. Such inferences include superordinate goals and causal antecedents. There is a much lower incidence of expectations about future plot (i.e., causal consequences) and nonexplanatory associations (such as spatial

inferences).   Therefore, most of the content that pops into consciousness during reflective comprehension consists of explanations, not expectations or nonexplanatory associations.

Think aloud protocols do not tap the unconscious processes that are quickly executed during comprehension. The second type of empirical evidence examines the time-course of inferences being activated when an explicit statement is being comprehended. An unconscious inference would be activated quickly (i.e., within 600 milliseconds), before there is time for conscious reflection. Studies have collected reaction time data on test items that are presented during the process of narrative comprehension. The test item is a word or letter string that appears immediately after a sentence in the text when the story is read. In a word naming task, a test word is presented and then the reader quickly names the word out loud. The word naming latency is the time between the onset of the test word and the onset of the voice. In a lexical decision task, the test item is either a word (WORD) or nonword (WROD) and the participant quickly decides whether the test item is a word or nonword; they register their decisions by pushing one of two response keys. The test items of particular interest to the researcher are the words that match distinctive words in the inferences. For example, consider the six examples of gambling story inferences presented above. The distinctive test words might be "employee" (superordinate goal), "chips" (subplan), "cash" (causal antecedent), "lost" (causal consequent, expectation), "table" (spatial), and "risky" (wording-based). We would expect the word naming latencies and the lexical decision latencies to be comparatively fast for those inferences that are predicted to be constructed on-line. All things being equal, the constructionist theory would predict faster latencies for words from superordinate goals, causal antecedents, and wording-based inferences than from subplans, causal consequences, and spatial inferences. Available evidence support such predictions. For example, inference words that refer to superordinate goals have comparatively short latencies, whereas subplans do not (Long et al., 1992). Inference words that refer to causal antecedents show a facilitation in latencies

whereas there is no such facilitation for most categories of causal consequent inferences (Magliano et al., 1993).

Discourse psychologists impose special controls over the timing of stimulus presentations in the empirical tests of inference generation that collect reaction times. Careful control over study time is imposed by using a rapid serial visual presentation (RSVP) task, with each word being presented for a short duration (250-500 milliseconds per word). Researchers can trace the time-course of inference activation and encoding by presenting test words at specific durations after the end of the sentence (e.g., 150, 500, 1000 versus 2000 milliseconds). The extent to which an inference is encoded can be measured by subtracting the latency for a word in an inference condition from the latency for the same word in an unrelated text condition; this difference score is called the inference encoding score.

Discourse psychologists have also provided control over the information sources that produce the inferences. Word-triggered inferences are derived from the lexical knowledge and scripts associated with individual words. For example, the inference about "moving chips into the circle" may be derived from the blackjack script. Word-triggered inferences emerge in normative tasks that involve word associations (i.e., What words come to mind when you hear the word blackjack?) or free generation of attributes (e.g., Please list the properties, actions and ideas associated with the game of blackjack). These normative data are collected on all of the explicit content words (nouns, adjectives, main verbs) in the text, but not in the context of the story. Novel situational inferences occur in the think aloud protocols when stories are comprehended, sentence by sentence, but the inferences are not triggered by any of the words. It is important to keep track of and control whether the knowledge-based inferences are word-triggered inferences versus novel situational inferences (Graesser & Clark, 1985; Long et al. 1992; Magliano et al., 1993; Millis & Graesser, 1994). Such control is necessary to segregate inferences that are products of passive activations (see assumptions 5 and 6 in Table 2) from inferences that are products of the coherence and explanation assumptions (assumptions 8 and 9 in Table 2). The most rigorous test of the

constructionist theory would include the latter inferences. Of course, an inference may be a product of both of these mechanisms, but such cases do not help us in testing the constructionist theory.

Spatial inferences have traditionally received a large amount of attention in the literature on situation models (Glenberg, Meyer, & Lindem, 1987; Morrow et al., 1987; Zwaan & Radvansky, 1998), so the question arises what the constructionist theory claims about this class of inference. According to the constructionist theory, the comprehender does construct a spatial setting for the story episodes, but the representation is stark and fuzzy unless there is substantial support from explicit information and auxiliary information sources. The mental representation of the spatial setting can be quite elaborate if (a) it is described explicitly in the text, (b) the reader has prior experience with the setting (e.g., a story about Memphis for the co-authors of this chapter), (c) the reader has memorized a map of the setting, or (d) the reader has a special goal of tracking spatiality at a fine-grained level. Otherwise, the setting is a barebones, stark, and fuzzy frame rather than a rich sensuous image (that would be easy to capture on film). The spatial setting for the $40,000 bet in the Federal Express setting would be a casino, but there would be no details about the floorplan, location of characters, location of objects, and visual properties of entities. The constructionist theory assumes there is a rudimentary topological organization of global spatial regions, but no details about layout of entities and visual features unless they are explicitly mentioned in the text, are strongly activated by passive constraint satisfaction mechanisms, or are intentionally tracked by the reader.

It should be quite apparent that the constructionist theory does make discriminating claims about the content that gets constructed in the situation model during story comprehension. Adult readers have a comprehension strategy that constructs those inferences that provide explanations and coherence. These are the signature inferences of the constructionist theory. It should be emphasized, once again, that additional inferences are constructed by virtue of particular reader goals and passive activations of knowledge from multiple information sources; such inferences would be predicted by most models in

discourse psychology, so they are not unique to the constructionist theory. However, for the sake of completion, it is important to briefly point out these other classes of inferences. We will refer to these inferences as <u>reader goal-driven</u> inferences (see assumption 7 in Table 2) and <u>passive activation</u> inferences (see assumptions 5 and 6 in Table 2).

<u>Inferences via Reader Goals</u>

Readers sometimes read narrative text in order to satisfy particular reader goals. When they do, they generate inferences that address the goals. For example, there is a phenomenon known as identification, where a reader identifies with a particular character. The reader might identify with a particular character for several different reasons, such as the reader being similar to the character, the reader worshipping what the character represents, or the reader's having faced a very similar situation to the character in the past. Readers would presumably have little difficulty reporting whether they have a strong identification with a particular character in a story. When this process of identification occurs, there should be an increased focus on the explicit information and inferences that have a direct bearing on that character. The reader is predicted to paint a very detailed portrait of the physical features, traits, motives, emotions, and episodes associated with the character. The reader is predicted to construct a large number of inferences about the character that otherwise would not be constructed, and that are not constructed about other characters.

The fact that there are reader goal-based inferences is widely accepted and not particularly controversial. However, the theoretical status of this class of inferences is somewhat limited. The researcher needs to know what the reader's goals are before discriminating predictions can be made. Also, some classes of inferences may be too difficult too construct because of the limitations of cognition, even though these inferences are relevant to the reader's goals. One of the interesting directions for future research is to formulate and test some discriminating predictions about the reader goal-driven inferences.

Inferences via Passive Activation of Knowledge

Discourse psychologists have extensively investigated the inferences that are products of assumptions 5 and 6 in Table 2. These inferences are quite predictable from standard theories of memory and cognition. Consider an inference that is activated by several content words in the text. For example, the inference "person X gambled" would be activated by the following content words in the Fred Smith story: Las Vegas, bet, and blackjack. This inference is not merely activated by a single content word, but is re-activated by several additional content words. Virtually any theory of cognition would predict that such a word would end up being encoded in the meaning representation, assuming that it does not conflict with other information in the text. The strength of encoding would also be expected to increase as a function of the number of information sources that trigger the inference (presumably following a logarithmic function). Next consider an inference that is activated by a single information source, but fits the constraints imposed by other information and levels of representation. That is, it survives a process of constraint satisfaction (Graesser & Clark, 1985; Kintsch, 1998; Rumelhart & McClelland, 1986), a process that is routinely incorporated in models of cognition. Such an inference would have a higher likelihood of being encoded as an inference than would a comparable inference that clashes with the constraints of other information and levels of representation. Kintsch's construction-integration model (Kintsch, 1988, 1998) does an excellent job modeling the construction of inferences that emerge when there is activation from multiple sources of information and convergence via a constraint satisfaction mechanism.

Psychologists have extensively investigated inferences that are inherited from generic packages of world knowledge, such as scripts, stereotypes, and other types of schemata (Bower, Black, & Turner, 1979; Davidson, 1994; Graesser & Nakamura, 1982; Hastie & Kumar, 1979; Schank & Abelson, 1977; Strangor & McMillan, 1992; Wyer & Gordon, 1984). Consider a script for "gambling in a casino", which is very likely to be activated while reading the Fred Smith story. This script is automatized by most adults because they have either directly participated in gambling or have experienced gambling vicariously

through film or other people's stories. When this script is activated, a wealth of additional information is also activated very quickly because it is very typical of the gambling script. There are typical goals (X wants to win money), actions (X buys chips), action sequences, props (tables, chips), settings (casino layout), expectations (X loses money), and so forth. Information that is <u>very</u> typical of the gambling script is encoded as an inference routinely. That is, it is included in the meaning representation with a high encoding strength even when it is never expressed explicitly.

Graesser and Nakamura (1982) reported recall and recognition data that strongly support the claim that very typical script actions are routinely encoded as an inference. College students listened to stories that contained a series of scripted activities. There were two different versions of each story so that a test action was presented in one version but not the other. After the story, the participants were given a memory test on the actions in the story. When recognition tests were administered, the participants were given test actions and asked to judge whether or not each test action had been presented in the stories. As virtually any theory would predict, hit rates and false alarm rates increased as a function of an action's increasing typicality. A hit rate is the likelihood that participants claimed that an action was presented and the action was in fact presented; a false alarm rate is the likelihood that participants incorrectly decided that a nonpresented action had been presented. The more interesting finding, however, involved the very typical script actions. Hit rates were found to be equivalent to the false alarm rates for these very typical test actions. The fact that hits and false alarms were equivalent indicated that the participants were entirely unable to discriminate whether a very typical action was explicitly presented versus merely inferred. In contrast, memory discrimination (i.e., the difference between hit and false alarm rates) was higher for moderately typical script actions and very high for atypical actions (i.e., actions that are irrelevant to or that clash with the script). When recall tests were administered, the likelihood of recalling a very typical script action that had been presented was nearly equivalent to one that had not been presented. That is, the recall likelihood was nearly the same as the intrusion likelihood.

Whereas very typical script actions are routinely encoded as an inference, moderately typical actions require some confirmation from additional information sources. Suppose that a "gambling in a casino" script is activated during the comprehension of the Fred Smith story. There initially would be an activation of the various typical items (e.g., X win money, X buys chips, tables, chips, X loses money). However, the activation levels of these inferences would eventually die out unless there is additional input that supports their encoding. The story explicitly stated that "the president placed a $40,000 bet on one hand of blackjack." This explicit input confirms the activation of "X buys chips" so this inference would be more likely to be encoded in the meaning representation (rather than having its activation die out). The story explicitly states that "He won", which ends up disconfirming (i.e., deactivating) the inference "X loses money." Once again, most of the typical script nodes that are initially activated will only be encoded as an inference in the meaning representation if they are reinforced by convergence from multiple information sources and by constraint satisfaction. If these confirmatory mechanisms were not recruited, then the comprehender's meaning representation would inherit a large amount of inappropriate information from the generic packages of world knowledge. Once again, Kintsch's construction-integration model has simulated these processes quite effectively (Kintsch, 1998).

The Relevance of the Constructionist Theory to Jury Decision Making

Pennington and Hastie (1992, 1993) have proposed a story model of jury decision making that is compatible with the major claims of the constructionist theory. According to the story model, stories play a critical role in persuading members of a jury to arrive at a decision. A good story explains the evidence put before the jury and coherently integrates the various pieces of evidence. A coherent explanatory story has a more robust impact on the decisions of a jury than any other variable, model, or mechanism that was tested by Pennington and Hastie. The fact that coherence and explanation are central to their story model has a direct parallel to the distinctive assumptions of the constructionist theory (see assumptions 8 and 9 in

Table 2). Moreover, world knowledge is accessed and inferences are generated during the construction of the coherent explanatory story.

Pennington and Hastie's story model of jury decision making has three sequential phases.   In phase 1, evidence is evaluated by constructing a story that attempts to capture the various pieces of evidence. Partic ipants viewed a filmed murder trial on a particular case in some studies, and read statements from the prosecution and defense in others. This information (i.e., evidence) was categorized into Initiating Events (J and Ca are in a bar, Ca threatens J, J has no weapon, J leaves), Goals (J intends to find Ca, J intends to kill Ja), Actions (J goes home, J gets a knife, J goes back to the bar, Ca hits J, J stabs Ca), and Consequences (Ca is wounded, Ca dies). The participants had variable interpretations of the stories they constructed. Think aloud protocols revealed the sort of story structures that each participant constructed. The story structure determined what pieces of evidence were extracted from the text, the importance of each piece of evidence, and the relationships between pieces of evidence.

In phase 2, the participants receive the different verdict categories and the attributes of each category. Example categories are: first-degree murder, second-degree murder, manslaughter, and not guilty, Example attributes are: killing in pursuance of a resolution, intent to kill, interval between resolution and killing, and person identity.

In phase 3, the participants mentally compute a match between the story features from phase 1 and the verdict attributed from phase 2. The verdict that has the highest match to the story features is the verdict that the vast majority of the participants ended up selecting. The stories ended up predicting the verdicts much more robustly than alternative quantitative models of decision making (such as a Bayesian or linear updating models).

Given that the composition of the story has such a robust influence on jury decisions, Pennington and Hastie dissected the content and structure of the story representations in great detail. They mapped out the causal structures and goal structures that explain the evidence. Their concern with causal and

intentional structures parallels the explanation assumption of the constructionist theory. Pennington and

Hastie also suggested some metrics that measure the <u>coverage</u> and <u>coherence</u> of a story. These are

analogous to the assumptions about local and global coherence in the constructionist theory. A story's

coverage of the evidence refers to the extent to which the story can account for a higher proportion of the

pieces of evidence. Pennington and Hastie's analysis of coherence has three dimensions: Consistency,

plausibility, and completeness. Consistency is the extent to which the story does not have internal

contradictions. Plausibility is the extent to which the story is consistent with events in the real world (i.e.,

world knowledge structures outside of the scope of the murder trial). Completeness is the extent to which

a story has all of its parts. In summary, the central components of Pennington and Hastie's story model

are directly analogous to the distinctive assumptions of the constructionist theory.

Jury decisions should be sensitive to the weighting of coverage, consistency, plausibility,

completeness and other dimensions (such as the status of the lawyer). However, additional research is

needed to explore these dimensions. Kuhn et al. (1994) reported that some individuals quickly construct a

story that handles most of the evidence, and subsequently are resistant to conflicting evidence that comes

in; consistency is not an important parameter for these individuals. Other individuals are more flexible in

coordinating stories with evidence, and are open to story revisions and multiple stories. These individuals

ended up being less confident in their decisions.

The plausibility parameter is relevant to the intriguing paradox of the difference between truth and

fiction. Consider an individual who assigns a high weight to the plausibility parameter. This person would

be carefully scrutinizing each piece of evidence and determining how well it meshes with what the person

already knows (i.e., the person's background world knowledge). Adults presumably do this when they

read a newspaper. At the other extreme is the individual who assigns a low weight to plausibility and

evaluates the internal consistency of a story on its own terms. One of the hallmarks of narrative fiction is

that the reader should have a "willing suspension of disbelief" (Coleridge, 1967). That is, instead of the

reader constantly evaluating the truth or falsity of information in relation to the reader's general world knowledge, the reader should suspend such evaluations and become absorbed in the hypothetical world. Whether adults can do this is currently being investigated empirically (Prentice, Gerrig, & Bailis, 1997; Wheeler, Green, & Brock, 1999). On the flip side, there is the question of whether fiction can influence our beliefs about reality. For example, Prentice et al. (1997) reported that blatantly false statements (e.g., Eating chocolates makes you lose weight, A college education will reduce your chances of getting a good job.) received higher agreement ratings from college student if they were embedded in conversations in a fictional narrative. This result is remarkable because the material is classified as fiction, yet it changed our beliefs about the real world. The fine line between truth and fiction was also a complex matter in the story of Fred Smith at the beginning of this chapter. There is something that rings true about the Fred Smith Story even though he never did make that $40,000 gamble in Las Vegas. Instead of asking <u>whether</u> there is truth in fiction, the alternative question to ask is: <u>where</u> is the truth in fiction?

<div align="center"><u>Summary</u></div>

During the past 25 years, discourse psychologists have investigated the processing of narrative text at different levels of representation. These levels of cognitive representation include the surface code, textbase, situation model, thematic point, agent perspective, and discourse genre. In addition, acts of communication are embedded in a pragmatic context that include speakers and listeners in oral discourse, authors and readers in printed text, and directors and viewers of film. Comprehension is successful when there is synchrony among these different levels of representation. Comprehension breaks down to the extent that there are incongruities within and between levels.

The process of constructing the situation models of stories is not as mysterious as it was 25 years ago. The situation model is a microworld that includes a spatial setting, agents in pursuit of goals, and causal chains of events that unfold chronologically. These microworlds are systematically constructed

through mechanisms that are widely accepted in contemporary theories in cognitive science (see Table 2).

When it comes to delineating the inferences in situation models for stories, the constructionist theory of

Graesser et al. (1994) provides one account of the systematicity. Readers reliably generate inferences

that provide local and global coherence, that explain why episodes in the text occur, and that explain why

the author uses particular linguistic and discourse forms. Readers also construct inferences that are

relevant to their comprehension goals. Some inferences are products of passive activations of knowledge,

as has been modeled by Kintsch's construction-integration model (Kintsch, 1998). The distinctive

components of the constructionist theory, namely the coherence and explanation assumptions, are also

incorporated in some contemporary theories in social psychology that attempt to account for causal

attribution and jury decision making.

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Author Note

Table 1.

Levels of Representation.

Surface code   This code preserves the exact wording, syntax, and intonation of the

explicit text (written or oral)

Textbase   This level captures the meaning of the explicit text in the form of a set of

propositions and a small number of text-connecting inferences that link the

propositions.

Situation model   A mental microworld of what the story is about, including the setting, the

characters, and events in the plot.

Thematic point   The moral, adage, or main message of the story. A story may support

multiple thematic points.

Agent perspective   The agent who tells the story creates a point of view (i.e., perspective)

From which the story is told. The agent may be a character in the story or

a pragmatic entity (e.g., narrator, narratee, writer, reader).

Genre   The category of narrative (e.g., mystery, folktale, romantic novel) has a

typical content and structure.

Table 2

Components and Assumptions of Models in Discourse Psychology (see Graesser, Singer, & Trabasso,

1994).

(1) Information sources.   Three important information sources are the explicit text, relevant background

knowledge structures (both generic and episodic), and the pragmatic context of the message.

(2) Levels of representation. Table 1 lists and defines these levels.

(3) Memory stores. The three memory stories are short-term memory (which holds the current clause

being processed), working memory (which has both dynamic processing operations and passive storage),

and long-term memory.

(4) Discourse focus. The concept or proposition that is directly in consciousness (i.e., the mind's eye or

focus of the mental camera).

(5) Convergence and constraint satisfaction. Both explicit information and inferences are encoded more

strongly in the meaning representation to the extent that they are activated by several information sources

and satisfy the constraints imposed by various information sources.

(6) Repetition and automaticity. Repeated activation of an idea, proposition, or structure increases the

speed of accessing it and the elements within it. Automatized packages of knowledge (such as a schema,

script, stereotype or other generic knowledge structure) is holistically accessed and utilized at very little

costs to the processing resources in working memory and the discourse focus.

(7) Satisfaction of comprehender goals. Readers are motivated by one or more comprehension goals

when reading a text. The goals either are dictated by the discourse genre, are default comprehension

goals, or are idiosyncratic goals of the reader. Readers allocate more resources to explicit information and

the generation of inferences that address the reader's comprehension goals.

(8) Local and global coherence.   The comprehender tries to construct a meaning representation that

establishes local and global coherence among the actions, events, and states expressed in the text. Local

text coherence is established when contiguous clauses can be connected conceptually, whereas global coherence spans larger chunks of text. Global coherence can be successfully achieved to the extent that (a) the linguistic and discourse features of the explicit text support a coherent representation, (b) the reader has relevant world knowledge, and (c) the reader has the goal of comprehending the meaning of the text.

(9) <u>Explanation</u>. The comprehender attempts to explain why episodes in the text occur and why the author explicitly mentions particular information in the text. Such explanations include motives of characters' actions, causes of events, and pragmatic justifications of the explicit mention of information. Stated differently, why-questions guide comprehension to a greater extent than other types of questions (e.g., where, when, how, and what happens next).