Narrative Comprehension, Causality, and Coherence

Essays in Honor of Tom Trabasso

Edited by

Susan R. Goldman
Vanderbilt University

Arthur C. Graesser
The University of Memphis

Paul van den Broek
University of Minnesota

LAWRENCE ERLBAUM ASSOCIATES, PUBLISHERS
1999 Mahwah, New Jersey London
Goals as Generators of Activation in Narrative Understanding

Gordon H. Bower
Stanford University
Mike Rinck
Technical University, Dresden, Germany

Over the course of his highly productive career, Tom Trabasso has contributed greatly to advances in numerous areas of cognitive, developmental, and educational psychology. Indeed, the breadth and depth of his contributions is astonishing to contemplate and more than enough to have filled several research careers. The contributors to this volume honor Tom by writing about their research on discourse processing, an area in which Tom’s research has had an appreciable and sustained impact. We have chosen to write about our research regarding “focus in mental models” of narrative discourse, and to relate our recent studies to the “causal path analysis” of narratives provided in very influential papers published by Tom and his associates in the mid-1980s.

One goal of research on language comprehension is to analyze the way in which readers (or listeners) construct and use internal mental models of the situation being described by the writer (or speaker). People interpret, react to, and remember texts or discourses according to the internal models they construct of them, and so these personal models are critical for explaining a person’s behavior.

Research on mental models has advanced most rapidly in one specific area, namely, analysis of the way people comprehend simple narratives about human characters solving personal problems (Johnson-Laird, 1983; Sanford & Garrod, 1981; van Dijk & Kintsch, 1983; Zwaan & Radvansky,
Stories Involve Characters Solving Problems

Simple narratives usually center around a main character who has a complicated problem to solve, and the story describes his or her actions in overcoming obstacles to the solution. Readers are presumed to act as "intuitive psychologists," trying to understand the actions of story characters in terms of lay theories. These theories suppose that people’s actions are intentional and part of a deliberate plan aimed at achieving an outcome viewed as instrumental to some goal. Human goals tend to stem from a small set of desires and motives such as self-preservation, satisfaction of biological needs, achievement, entertainment, reciprocity, revenge, and so forth. Many motives and plans come in bundles associated with particular roles or occupations (e.g., a policeman, a doctor, a mother) and interpersonal themes and relationships (e.g., love, family, duty, enemies). Schank and Abelson (1977) and Wilensky (1978) wrote most thoroughly about the place of such themes and beliefs in readers’ understanding of characters’ actions in narratives.
A basic premise of Schank and Abelson (1977) is that readers of narratives are trying to explain characters’ actions as part of a plan to accomplish a goal. Thus, for each action or event in a story, readers implicitly ask themselves: Is this action part of a plan that I know the actor is currently pursuing? If not, then is this the start of a new plan? If so, is it in service of an ongoing goal that I know the actor has? If not an ongoing goal, is it a new goal that this character is likely to have? Is this new goal consistent with the roles or thematic relationships which I can attribute to this character? Schank and Abelson, and Wilensky (1978) in his PAM program (for “Plan Applying Mechanism”), analyzed the elaborate knowledge structures, beliefs, and inference rules people routinely use to explain and understand many plan-based phenomena. These phenomena include hierarchical subgoaling, goal substitution, goal interruption and suspension, goal resumption or abandonment, and so on. By using such explanations, readers build a network of causal connections among the events in the story—from some initiating events (e.g., a policeman stumbles across a robbery in progress) through the various goals, subgoals, and actions of the main character (e.g., he chases the robber), overcoming obstacles (e.g., the robber shoots at him), arriving at some final resolution (he captures and arrests the robber). Each goal is viewed as causing or enabling some actions or states it caused or enabled, or how many caused or enabled it. An example of the causal network for one of these stories (“The Father, His Son, and Their Donkey”) is shown in Fig. 8.1. The numbered nodes refer to successive clauses of the story, and the arrows reflect direct causal connections or enablements between the numbered clauses. In such networks, it is obvious that some clauses have very few connections (e.g., clauses numbered 7, 8, 49), whereas others have very many (e.g., clauses 2, 25, 62).

Brown and Smiley (1977) collected “importance” ratings from their adult participants for each clause in each story. Importance was defined somewhat vaguely as the centrality of the given clause in contributing to the overall meaning of the story. Trabasso and Sperry (1985) wanted to predict these importance ratings from their causal network analyses of the six folktales. Figure 8.2 from Trabasso and Sperry shows the average importance rating for clauses as a function of the number of causal connec-
For the clause. For events on the main causal chain as well as for those on "dead-end" side branches, a strong linear relation appeared between the importance rating of a clause and its number of causal connections. Across the six folk tales, the number of connections accounted for a large portion of the variance in importance ratings of the clauses. Moreover, in other work, Trabasso and his associates showed that the number of causal connections accounted for which clauses were likely to be recalled and also included in a brief summary of the story.

These results represent a very significant advance in our understanding of story memory. Psychologists have known for a long time (certainly since studies by Bartlett, 1932) that people tend to recall mainly the gist or important ideas of a text. However, that generalization is incomplete until we can specify what are the important ideas in a text. Trabasso's causal analysis provides us with a fairly mechanical procedure for deciding what are the important ideas in a story; this can be done by simply analyzing the causal and semantic structure of the narrative itself. This analysis represents
a remarkable advance over the earlier days of Bartlett when psychologists had no procedure for specifying the gist of a story.

**Effects of Goal-Action Relatedness**

The power of causal linkages in determining story representation leads to an interest in analyzing various kinds of causes—a topic to which Trabasso and his colleagues have made important contributions (Trabasso & Nickels, 1992; Trabasso et al., 1989). Causes can be either necessary but not sufficient ("enabling states") or directly sufficient in the circumstances, or both. Causes can be either physical ones (gravity, earthquakes, tornadoes) or psychological ones. The results can be either a state change of some physical object, or a mental change of an animate agent. The mental change can either enable or directly cause (or "be a reason for") an action.

We believe that the most important causes of actions in stories are characters' goals. In general, goals generate intended plans, and actions occur when plans are activated. But there are often multiple plans that will satisfy a given goal, and people have appreciable common-sense knowledge about what kinds of plans work for what kind of goals. (Much of the Schank & Abelson, 1977, book is devoted to describing this knowledge.)

How rapidly an action is understood depends on how expected and familiar it is as a method for achieving a known goal of the actor. In earlier work carried out with Carolyn Foss (Bower, 1982; Foss & Bower, 1986), this intuitive notion of goal-to-action relatedness was translated into the notion of psychological "distance" or the number of steps between a goal and an action in a subgoal (or plan) hierarchy. The idea was that the more subgoals and enablements readers needed to infer in order to fill in the connection between the actor's goal and his action, the longer readers would take to understand that action. Thus, from the goal, "John was hungry," it is a close, familiar step to "He ate a pizza." On the other hand, a far longer inference is required to relate that hunger motive to a remote action such as "He took out the yellow pages"—presumably to look up the address or phone number of a restaurant.

This relatedness notion was tested in an experiment in which college students read short, four-line vignettes in which a character was introduced, was assigned one of two goals, and then performed an action (Foss & Bower, 1986). Participants paced their line-by-line reading by pressing a button to present successive sentences of the vignettes to themselves. Participants' reading time of the action statement presumably indicates the time they required to comprehend the statement and integrate it into their interpretation of the text. The action statements were fixed, but across vignettes different participants read a preceding goal statement that was either psychologically "near" to (closely related) or "far" from the target action. Two example vignettes are shown next; a given participant read either the Near or the Far goal statement:

- (Opening) John was unemployed and desperate.
- (Near) He decided to rob a bank.
- (Far) He decided to steal some money.
- (Action) He checked out the security guards at the Wells Fargo Branch.
- (Ending) He tried to round up some accomplices.

- (Opening) Marge was concerned about the environment.
- (Near) She decided to participate in an anti-nuke protest rally.
- (Far) She wanted to stop construction of a nuclear power plant.
- (Action) She painted a protest sign.
- (Ending) Marge believed atomic power plants are harmful.

Each vignette was followed by two easily answered, true-false questions to ensure comprehension. In developing the materials, Foss and Bower tried to select Near goals that would be nested within the Far goal-to-action chain of subgoals. For example, robbing a bank is a more specific subgoal of the top goal of stealing money; participating in an anti-nuke protest rally is a more specific subgoal of stopping construction of a nuclear power plant.

Fourteen Stanford University students participated in this experiment reading 48 vignettes, with half the participants reading the Near and half the Far goal version of each vignette. Their action reading times confirmed the predictions: Participants took an average of 2.10 seconds to read the target action following the Far goal, but only 1.78 seconds to read it following the Near goal. Therefore, as predicted, participants needed more time to integrate a target (action) sentence into an ongoing goal-plan the greater was its inferential distance from the actor's stated goal. The result supports the general notion that people comprehend actions by connecting them to the actor's goals.

**The Number of Goals**

Schank and Abelson (1977) also proposed that story understanders set up a goal list for each character, and monitor this goal list as they progress...
through the narrative. Readers monitor what goals a character probably has by virtue of his or her roles, occupation, and thematic relationships to other characters (e.g., relatives, loved ones). Readers add new goals to the list as circumstances create them; they also delete old goals from a character’s goal stack as they are achieved or abandoned; still other goals may simply be left unresolved by the story’s end. In this way readers construct and continuously update what Schank and Abelson called a “goal-fate” chart for each character. The evaluation and significance of story events is largely reflected in the goal-fate graph of the main characters.

If readers are indeed explaining and evaluating actions in light of a goal list for an actor, it is reasonable to suppose that the time readers require to check the fit of an action to an actor’s goals would increase with the number of goals the story has made active for that character at the time. The hypothesis is that when a target action is encountered in the text, the reader must “scan the goal stack” in memory for that character to see if he has at least one goal that would explain that action. If no such goal can be found in that character’s stack, then the action will be inexplicable and the story possibly incoherent at this point. The prediction here is very much like that seen in the list-scanning task of Sternberg (1966), except participants are judging whether successive goals could explain the action probe.

To test this implication, Sharkey and Bower (1987; cited in Bower, 1982) presented readers with a goal-action decision task. On each of a series of trials, participants were presented with one, three, or five independent goals being attributed to a novel character. The goals were presented as single statements; an example of a three-goal series might be: “Heather wanted to overcome her shyness; she wanted to live extravagantly; she wanted to have some time on her own.” Each goal (“wanted”) statement was presented for 5 seconds. At the end of the one, three, or five goal statements, the computer beeped and then presented a test action statement. This named the actor and an action in the format “And so (Heather) (took classes in social skills).” The participants’ task was to decide as quickly as possible whether that action satisfied one of the goals they had just read for this character. The decisions were easy in that a given action was either clearly consistent with one of the goals (e.g., classes in social skills help overcome shyness) or was inconsistent and completely independent of them (e.g., “So Heather lit a match” would not obviously satisfy any of the goals). Participants judged a large number of such trials, half of which had “Yes, True” answers and half of which had “No, False” answers.

The average decision times for both true and false answers are shown in Fig. 8.3. The decision times increase with the number of goals to be searched through for that character. It is as though the participant conducts a self-terminating search through that character’s goal stack, checking one after another goal to see whether it would explain the action. The search terminates when an explanatory goal is found (which explains the faster “true” decisions); otherwise, the search proceeds to the end of the goal list at which time a “false” judgment is rendered. The effect here is akin to Sternberg’s list-scanning time or the “fan effect” (Anderson, 1976), with the proviso that some reasoning or stored knowledge is needed to relate a goal to an action.

In a later experiment, Sharkey and Bower (1987) varied whether the three goals assigned to a character were independent or whether they could all be satisfied by a single action (were “related”). As an example, the three goals might be “Brian wanted to be of service to the community, wanted to drive a big shiny truck, and wanted to wear a uniform.” These would all be satisfied by the action “And so Brian became a fireman.” With these related goals, the action will satisfy any (and all) of the three goals. In such cases, decisions were expected to be very rapid. And results showed that indeed
they were: In the experiment, decision times averaged 1,230 ms for a single
goal, 1,475 ms for three independent goals, but only 1,240 ms for three
related goals for which the action satisfied any (and all) of the three.
Decision times for three related goals equaled that for one goal and was
closer than that for three independent goals.
Clearly, the slower decision time for three goals was not due to a greater
memory load for three compared to one goal. Rather, it appeared due to
participants having to search through the stack of three goals when they
were independent but not when they were related (for which any goal
produces a yes answer). This analysis was further bolstered by testing
actions that satisfied just one of the three related goals (e.g., the action “And
so Brian became a social worker” satisfies the service goal but not the other
two goals). In this case, we found that the decision times increased to equal
those observed for three independent goal-action units.
The results from this series of experiments thus consistently support the
general view that readers track characters’ goals by keeping active in memory
an associated list of goals, and that they try to understand a character’s actions
by searching through his or her goal stack. The more goals to be searched and
rejected, the slower the comprehension time; actions that satisfy several goals
at once are understood more readily as a consequence.

SPATIAL SITUATION MODELS

The second aspect of models of stories consists of the representation of
spatial situations. The spatial model includes a more or less sketchy mental
map of the places, landmarks, and objects as they are laid out in space and
the locations of the characters as they move about. In our research, we have
examined the properties of the spatial model as it is updated by readers as
they comprehend story events. Specifically, we have studied how readers
update their mental model as they follow the actions of the characters from
one place to another in pursuit of their goals. Our approach assumes that
readers construct in imagination a sort of theater stage or “dollhouse” with
landmarks and rooms filled with expected objects, plus any special objects
mentioned in the text.

Focus in Spatial Models

Storytellers relate their account from a specific perspective, usually that of
a main character (protagonist) whose goals are accorded priority and
importance. In describing the sequence of story events, the storyteller
sweeps the “here-and-now” of the narration point across an ordered
progression of episodes. The protagonist’s movements in space may be thought
of as causing in the reader a shifting “spot of light” or focus of attention
that moves over corresponding parts of the mental model. The objects in
this internal focus of attention are momentarily highlighted or fore-
grounded. Our notion of “focus” is much like the concept of “foreground-
ing” proposed by the linguist, Wally Chafe (1972, 1994). We explore some
implications of this focus hypothesis for processing; specifically, we be-
lieve that concepts and entities in the focus of attention should be more
active in memory and thus more readily retrieved.

We have used a spatial priming methodology for studying the influence
of this shifting focus of attention. Objects currently in the focus of attention
should be more accessible than other known objects in the mental map. This
increased accessibility may be conceived as reflecting subconscious activ-
ation of the representations of objects in or near the focus of attention in
the mental map. Moreover, objects that were recently in the focus should
have a decaying level of activation, declining in accessibility as time passes
since they were last in focus.

Starting with research by Morrow, Greenspan, and Bower (1987), a
program of studies has provided considerable evidence in favor of this
hypothesis; namely, items in the current focus of a mental model are more
activated as revealed by priming. We use an experiment by Morrow, Bower,
and Greenspan (1989) to illustrate the effect. In this experiment, college
student participants first memorized a map of a research-laboratory building
(see Fig. 8.4) of 10 rooms each containing four named objects. Participants
then sat before a computer screen and presented themselves with a series
of 20-line stories in which a protagonist was introduced and given some
goal (e.g., to search the building for some lost notes, or an intruder, or to
clean the rooms) that required him or her to walk around from room to room
in this building. Our hypothesis caused us to be especially interested in the
“movement” sentences, such as “Wilbur walked from the conference room
into the library” (see Fig. 8.4). The place the protagonist just left is called the
source room, the place he passes through is called the path room, and the
place where he ends up after the motion event is called the goal room.
Any other room in the building is called another room.

We expected the reader’s mental representation of the goal room, on
which the focus is now centered, to be most active; the path and source
rooms were expected to be less active than the goal room but more active
than other rooms of the building more distant from the motion event.
To test these predictions, we examined participants' times to answer simple questions about the locations of objects in the map they had memorized earlier. Periodically, the participants' line-by-line reading was interrupted by a pair of test words (naming objects in the building) rather than the next line of text. Participants were instructed to decide whether the two objects were in the same room (with each other) or in different rooms, and so indicate by pressing one of two keys marked same or different. Such probe tests occurred two to four times per story; they followed most of the motion sentences, but also occurred at other places in the text to prevent participants from giving special attention to the motion sentences. Several of the probes tested for the current location of the protagonist (e.g., "Wilbur, Copier") to ensure that participants tracked his current location. Half the probes were same-room and half different-room. At the end of each story, participants answered two easy yes—no questions about it to ensure that they had read for comprehension. Participants who made more than 10% errors on these comprehension questions were excluded from the analysis.

The average probe reaction times for same-room probes in this experiment are shown in Figure 5. This shows an orderly gradient: Objects in the goal room are most accessible; those in the path room are next most accessible; those in the source room are next; and objects in other rooms distant from the current focus are least accessible. The fact that objects in the path room are relatively more activated suggests that readers are leaving tracks or "a trail of activation" along a path as they imagine the character moving over those intermediate places. This effect arises despite the fact that the path room was not explicitly mentioned in the motion sentence just before the probe test.

In later experiments, Morrow et al. (1989) asked whether the reader's attentional focus is determined by the protagonist's physical location or by his "mental location," the place the protagonist is thinking about. Having located the protagonist in some room (call it A), the critical sentences were of the form: The protagonist "was thinking about (doing some activity) in room B," such as painting the walls there or repairing the furniture there. Probe questions would then occur testing the accessibility of objects in the protagonist's physical location, mental location, or some other room of the building. The results of that experiment showed shorter answer times for questions about objects in the character's mental location than for questions about his physical location. Thus, it appears that readers take the main character's perspective; they follow the character's thoughts, activating the same concepts that the character is thinking about.
Spatial Gradient in Anaphor Resolution

The method for measuring priming in the foregoing experiments was "two-object" probes, asking "Are Object 1 and Object 2 in the same room?". The disadvantage of this method is that it interrupts the normal flow of reading and emphasizes for readers the locations of objects and the protagonist. A less intrusive measure was introduced by Rinck and Bower (1995), who simply recorded participants' time to read critical sentences that contained an anaphoric reference to some object in the building. The anaphor was the mention of the object in a definite noun phrase, as in "the copier" or even "the copier in the library." In order to refer to objects in rooms differing from the location of the protagonist, we adopted the "thinking about" format used in the previous experiment. That is, after having moved the protagonist from source room A through path room B into goal room C, the story would then include a statement such as "(The protagonist) just then remembered that he had to clean up [the object] [in

the location]," as in "Wilbur remembered he had to clean up the shelves in the library." The object was chosen to be at varying distances (number of intervening rooms) away from the protagonist's location, and was always a unique object in the map memorized earlier. The critical sentence always used a conceptualizing verb such as remembered, thought, or decided. In different conditions, the phrase mentioning the location room was added or not. The crucial behavioral measure was simply how long participants took to read and comprehend such critical anaphor sentences, as they paced themselves line-by-line through the story by pressing the "mouse button."

The results across a number of experiments have been exceedingly orderly and regular. Figure 8.6 shows the results from one experiment: Reading times for critical anaphor sentences are separated according to whether they did or did not contain the location-room phrase. The total reading time for differing types of sentences has been adjusted by dividing total time by the length (in syllables) of the sentence, so that time per syllable is plotted in Fig. 8.6.

The results show a strong effect of location (room) of the referent as well as facilitation due to mentioning the room containing the anaphoric object. The room location (goal, path, source, other) is just a proxy for the distance
between the locations of the current focus (on the protagonist) and the object referred to by the target sentence. The speed-up due to mention of the referent's room is understandable if the room name is viewed as a second cue helping retrieve from memory the representation of the anaphoric object. In later research, we have exploited this anaphor technique to investigate several issues regarding access to features of situational models. However, space limitations preclude us from reviewing that research.

Goal Activation of Model Objects

In the foregoing experiments, we have shown differential activation of objects depending on whether they were foregrounded as something the protagonist was thinking about. Most assuredly, one way to get readers to appreciate what is on the protagonist's mind is to attribute an active goal (wish, desire, plan) to him or her. Thus, if the story states that the protagonist was hungry, we would expect that items associated with eating would be assigned priority in the protagonist's mind and consequently in the reader's model of the protagonist. In particular, memorized representations of food items in the building should be activated and ready to be referred to. Similarly, if the protagonist needed to make a call, telephones should be primed; if he needed to sweep up, brooms should be primed; and so on.

An experiment to test this conjecture was carried out at Stanford University with the able assistance of Erin Graves. We describe this experiment in some detail, because it has not been previously reported. The experiment orthogonally varied the distance from the protagonist to the probe object and the relevance of the probe object to a recently mentioned goal of the protagonist. The experiment followed a simple 2 x 2 design with spatial distance (near vs. far objects) and goal relevance (relevant vs. irrelevant objects) varied as within-subject factors. The 40 participants first memorized the layout of a 10-room research building (similar to Fig. 8.4) with two named objects in each room. They then read 15 unrelated stories (3 practice, 12 experimental stories) with the stories presented sentence-by-sentence self-paced on a computer screen and sentence reading times were recorded.

The 12 crucial narratives contained 20 experimental "blocks" of critical sentences. Each block started with a three-room motion sentence, moving the protagonist from a source room through a path room to a goal (or current location) room, such as "Then he walked from the repair shop into the experiment room." Next, a pair of brief sentences attributed some goal or desire to the protagonist. This goal would require use of some object that was either in the location room (near) or in the source room (far). As one example, the pair of goal statements might be: “Looking at his list, he noticed that he had wanted to make copies of his presentation hand-out for the directors. He decided to make the copies immediately before he forgot.”

In this example, the goal object (the Xerox machine) is in the current location of the protagonist. Alternatively, the pair of goal statements might require use of an object in the source (far) room. Assuming the protagonist is now located in the experiment room, an example of a distant goal prime would be: “He remembered that he wanted to practice his presentation by videotaping the talk he had to give to the directors. He decided to go and start setting that up immediately before he forgot.” These sentences should activate the camcorder that is located in the repair shop, which was the source room which the protagonist had recently left. Notice that the goal sentences never mentioned the goal object (Xerox machine or camcorder) explicitly, but rather only implied it, as we were interested in goal-object activation by relevance, not in simple name repetition.

Immediately after the goal sentences, the accessibility of objects was measured by “object-in-room” probes, asking participants to indicate whether they had learned earlier that the named object was in the named room. Participants pressed a yes or no key on the keyboard as quickly as they could to indicate their decision. For the 20 critical probes, the correct answer was always yes; many filler probes were used at other places in the stories to equate the number of yes and no answers. As noted, in the critical probes, the object could be either near (location room) or far (source room), and relevant or irrelevant to the preceding goal. To illustrate, if the goal were to videotape one's lecture, then camcorder would be relevant and far, whereas Xerox machine would be near and irrelevant. But if the goal were to copy some notes, then camcorder would be irrelevant and far, whereas Xerox machine would be near and relevant. Each participant judged five test probes in each of the four (2 x 2) conditions. To counterbalance experimental conditions and materials, each object was tested across participants equally often in each of the four conditions. Errors were well below 10% for all probe conditions.

The average results for these four probe decision times are shown in Fig. 8.7. Here we see strong effects of both factors on decision times: There is a distance effect, with the location of objects in the near (“location”) room being verified faster than those in the far (“source”) room ($F(1,39) = 5.84$, $p < .05$); there is also a strong effect of goal relevance, with objects relevant
to a current goal being primed more strongly \( F(1,39) = 5.96, p < .05 \); and the two factors are additive, with no interaction between them in this experiment \( F(1,39) < 1 \). Figure 8.7 displays the main result we were seeking, and it reveals that both factors are important in activating objects in memory representation.

A second finding in this experiment concerns the time participants took to read and comprehend the sentence that immediately followed the probe test. Each of these "following" sentences provided a smooth continuation of the story whichever of the goal statements had been introduced earlier. This following sentence was usually of the form, "After he had finished that task, he [returned and] made sure that the experimenters would be busy conducting studies tomorrow so the directors would see how industrious they were." For different goal participants, of course, "that task" was referring to either Xeroxing or videotaping; if the goal activity took the protagonist back to the source room, then the "returned" verb was inserted into the following sentence as noted earlier. Filler words were added to the following sentence so that it had approximately the same number of syllables regardless of the location of the preceding goal-activity.

The average reading times for these "following" sentences are shown in Fig. 8.8 grouped according to the preceding type of probe test. Here we see again a robust effect of having shifted the reader's attention to another location, that is, the source room \( F(1,39) = 15.67, p < .001 \), and to an object of varying relevance to the protagonist's goal \( F(1,39) = 41.47, p < .001 \).

The effect of probe-object location here was probably due to readers being required to shift their focus of attention back to the current location room from which the action of the main narrative then proceeded. The effect of the goal-relevance of the preceding probe object was probably caused by a similar reshifting from the irrelevant probe object to the proper probe location implied by such phrases as "After he had finished that task..." To illustrate, suppose the goal implied use of the Xerox machine in the experiment (location) room, but the probe asked whether the camcorder is in the source room (an "irrelevant source room" probe). To answer that, participants must access the location of the camcorder and shift focus to the queried source room. Then the following sentence's phrase "finished that task" required participants to reinstate the goal (to copy notes on the

---

**FIG. 8.7.** Time to answer "Object X in Room Y?" questions depending on whether object X is in the Location or Source room and whether it is relevant or irrelevant to the protagonist's current goal. From an experiment by Rinck, Bower, and Graves.

**FIG. 8.8.** Time to read the sentence that follows the four different object-in-room questions. From an experiment by Rinck, Bower, and Graves.
Xerox machine) and then shift attention back to the location room where the protagonist has just now finished that Xeroxing task. We may thus explain the reading-time results for the following sentences as due to implied distance-effects in shifting focus of attention within the mental model.

Do Goals Underlie Spatial Priming?

We may ask whether the spatial priming of objects in the situation model is in reality just a kind of “relevance” effect. Readers may direct their attention or internal focus to places where significant events are likely to occur. Thus, when a character moves to some location, the objects there may be activated because we would normally expect them to be relevant to the character’s goal. This strategy is shaped and supported by the arrangement of human living spaces in which different parts of a building, say a residence, are set aside to satisfy recurrent goals, as revealed in our labeling of such rooms as the kitchen, bedroom, laundry, toilet, and entertainment center.

According to this speculation, then, spatial priming in narratives would be a derivative of readers’ subconscious expectations that characters go to a place in order to carry out some goal-plan with the people or objects there. By this idea, we have returned to our earlier starting place, one that was foreshadowed in Tom Trabasso’s earlier research on causal analyses of narratives. This is the hypothesis that relevance in narrative comprehension is largely determined by the goals and plans of the central characters. Readers use the characters’ goals to draw causal connections among events and to focus attention on actors, places, and objects in the situation model that are likely to be relevant to achieving or thwarting those goals. This is as it should be: Readers are simply carrying into their story understanding the same processes and biases that they use in understanding the behaviors and plans of the social actors in their everyday lives.

ACKNOWLEDGMENTS

Preparation of this chapter was supported by NIMH Grant 1R37-MH-47575 to Gordon Bower, and by Grant Ri 600/3-3 from the German Research Foundation (DFG) to Mike Rinck. We would like to thank Erin Graves for her help in preparing and conducting the experiment on goal activation of situation model objects.

REFERENCES

One of the enduring problems in American education is fostering the development of children's literacy skills. Many children of otherwise normal intelligence and academic ability come to the formal schooling environment with weak and underdeveloped skills in comprehending discourse (National Assessment of Educational Progress, 1995). This often places these children at risk for subsequent school failure (Juel, 1992; Slavin, 1994). Thus, a significant challenge for educators is how to design learning environments that support the development of literacy skills for all students, especially those whose initial skills place them at risk. Responding to such a challenge requires detailed knowledge of the development of children's capabilities for representing simple and complex forms of discourse, coupled with ways to adequately assess those capabilities. The work we report in this chapter attempts to address some of these key concerns by focusing on the representation and assessment of children's understanding of complex stories.

Our work is set in the larger context of the literatures on cognitive development and discourse processing, both of which have been signifi-