

Goal coordination in narrative comprehension

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In this paper, we report two experiments in which the consequence of maintaining multiple, unrelated character goals during comprehension were studied. This is in contrast to previous work that has focused on a single goal, or multiple related goals. The results showed that the presence of active subsequent goals can diminish the availability of earlier mentioned goals, even in the absence of semantic and other relations. In contrast, the status of earlier mentioned goals does not influence the availability of subsequent goals. These results support an explanation-based view of comprehension.

Understanding human behavior involves monitoring the goals of people around us. This is also true of understanding the actions of characters in stories that we read and hear. Narrative plots are typically centered around a character or group of characters that are engaged in a series of actions directed at overcoming some obstacle(s) (Stein & Glenn, 1979; Trabasso, van den Broek, & Suh, 1989). To appreciate a story plot, readers must understand how the characters' actions fit their goals (Graesser, Singer, & Trabasso, 1994; Magliano, Zwaan, & Graesser, 1998; Suh & Trabasso, 1993; Trabasso et al., 1989). There is substantial evidence that such goals are highly accessible during comprehension (Albrecht & Myers, 1995; Goldman & Varnhagen, 1986; Lutz & Radvansky, 1997; Radvansky & Curiel, 1998; Singer & Halldorson, 1996; Suh & Trabasso, 1993; van den Broek & Lorch, 1993).

There is currently a discussion regarding the factors that can influence the availability of goal information during comprehension. There are two classes of theories in this discussion: *memory-based theories* and *explanation-based theories*. Memory-based theories assume that comprehension is largely driven by bottom-up and automatic processes (Albrecht & Myers, 1995; 1998 Albrecht & O'Brien, 1993; Klin, 1995; McKoon, Gerrig, & Greene, 1996; Myers & O'Brien, 1998). Information that is associated with the current and immediately prior sentences activates information in long-term memory via a resonance process (e.g., Ratcliff, 1978). There are three primary factors that influence the retrieval process (Albrecht & Myers, 1995; Myers &

O'Brien, 1998): (1) the degree to which the current information semantically overlaps with information in long-term memory, (2) the degree to which prior information is (e.g., causally) elaborated in the prior context, and (3) the length of time since the last reference to the information.

Alternatively, explanation-based theories assume that, in addition to bottom-up processes, there are active constructive processes that routinely influence goal information availability (Graesser et al., 1994; Singer & Halldorson, 1996; Trabasso et al., 1989; van den Broek, 1990). One way in which this is done is by causal, explanatory reasoning (Graesser et al., 1994; Singer, Graesser, & Trabasso, 1994; Suh & Trabasso, 1993). People search for the causes of events and for the reasons for character actions on the basis of the information from the story context and world knowledge of human intentions and causation (Graesser et al., 1994; Singer & Halldorson, 1996; Trabasso et al., 1989; van den Broek, 1990), especially when more bottom-up mechanisms fail to produce adequate explanations (van den Broek, Risdien, & Husebye-Hartman, 1995). The second influence on availability is the status of a goal in a goal hierarchy (Suh & Trabasso, 1993; Trabasso et al., 1989). Because it is a major component of comprehension, goal information is kept in a relatively high state of availability (Lutz & Radvansky, 1997; Radvansky & Curiel, 1998; Suh & Trabasso, 1993). When comprehenders are managing multiple, related goals, the most immediate, unachieved goal is most available (Goldman & Varnhagen, 1986; Lutz & Radvansky, 1997; Suh & Trabasso, 1993).

The present experiments focus on the availability of multiple unrelated goals for assessing the extent to which goal coordination is described by memory-based and explanation-based theories. This is important because prior studies have involved either only a single goal or multiple related goals that are part of a common causal chain of events. However, it is often the case that characters have complex sets of goals that may be largely unrelated. The

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present study examines how the availability of an active uncompleted (failed) goal is influenced by the presence of another semantically and causally unrelated goal that is also active, inactive, or absent. In Experiment 1, we looked at how the availability of an initial goal is influenced by the status of a subsequent goal, whereas, in Experiment 2, we looked at how the availability of both a prior goal and a subsequent goal are influenced by the status of the other.

EXPERIMENT 1

In Experiment 1, we assessed whether the availability of an initial, failed goal is influenced by the status of a subsequent unrelated goal. Stories were used in which there were four episodes (see Table 1). There were dead-end, completed, and failed goal versions of each story (cf. Lutz & Radvansky, 1997). The first episode was the same for all three versions and introduced a goal that was never reached (e.g., *Betty wanted to move to the same city as her mother*). This goal was not causally relevant to the story from the second episode on. The dead-end, completed, and failed goal versions differed in the status of the second goal (e.g., *She wanted to give her mother a present*). For the dead-end and completed goal versions, the Episode 2 goal was accomplished by the end of that episode and was not relevant in the rest of the story. The dead-end goal version differed from the completed version because the goal was already completed when it was mentioned and was not causally connected to subsequent story events. After the completion of the third episode, the Episode 1 goal was the only unachieved

goal for both versions. For the failed goal version, the Episode 2 goal was not achieved until the end of the fourth episode. Furthermore, the Episode 2 goal was causally related to the character's actions in the fourth episode and therefore provided an explanation for them (e.g., *Betty pressed and folded the sweater because she wanted to give it to her mother*).

The availability of the critical Episode 1 goal was tested with probe questions. For example, for the Betty story, the critical probe was *Did Betty want to move close to her mother?* These questions occurred late in the stories, after the first or second sentence of Episode 4. This placement was chosen because prior studies have shown that the Episode 2 goal is highly available at this point for the failed goal versions, but not for the dead-end or completed goal versions (Lutz & Radvansky, 1997; Radvansky & Curriel, 1998; Suh & Trabasso, 1993).

There were two hypotheses regarding the latency in answering the probe question. A *retrieval hypothesis*, consistent with memory-based theories (e.g., Albrecht & Myers, 1995), predicts no effect of story version (*failed* = *completed* = *dead-end*). The absence of an effect is predicted because the Episode 1 goal is equally elaborated, equally distant, and equally interconnected in the memory representation across the story versions. Thus, the information should be equally available across the various conditions because the manipulated aspects of the text do not bear on the Episode 1 goal.

In contrast, a *goal dominance hypothesis* predicts that probe questions will be responded to faster for the dead-end and completed goal versions than for the failed goal versions (*failed* > *completed* = *dead-end*). For the dead-end and completed goal versions, the Episode 1 goal is the only unachieved goal at the probe sentence and so is at the top of the hierarchy. In contrast, for the failed goal versions, the Episode 2 goal is highly activated because it is the most recent unachieved goal, causally related to the character's actions in the current story sentence, and it provides a necessary and sufficient explanation for it. The increased activation of the Episode 2 goal interferes with the availability of the Episode 1 goal, leading readers to respond more slowly in the failed goal versions than in the dead-end and completed goal versions.

Method

Readers. Ninety-six native English speakers were recruited from the subject pool at Northern Illinois University.

Materials. The materials were 18 stories derived from Lutz and Radvansky (1997). Five sentences were added to the beginning of each story to introduce a new episode so that each narrative had four episodes. A goal was introduced in the first episode, but was never completed in the story. This goal was consistent with the story, but was unrelated to the later goals. An example of dead-end, completed, and failed goal versions of a story are shown in Table 1. Presentation of the versions of the stories was counterbalanced with a 3 × 3 Latin square. In addition to the experimental stories, there were 5 practice stories and 30 filler stories.

Each story had two probe questions regarding explicitly mentioned information. Half of the answers were *yes* and half were *no*. The critical probe question always came first and was about the Episode 1 goal. For example, for the Betty story the critical probe

Table 1
The Failed, Completed, and Dead-End Goal Versions
for a Sample Story Used in Experiment 1

Episode 1. Once there was a woman named Betty. Betty's mother had been sick lately. Betty wanted to move to the same city as her mother (goal 1). She went to the personnel office at her company. The office manager said he could not authorize her request. He told her that she needed to discuss the matter with the regional vice president.

Episode 2. The next day Betty realized that her mother's birthday was coming soon.

Failed goal. She really wanted to give her mother a present (goal 2). She went to the department store. She found that everything was too expensive. She could not buy anything for her mother. She was very sad.

Completed goal. She really wanted to give her mother a present (goal 2). She went to the department store. She found a pretty purse. She bought her mother the purse. She was very happy.

Dead-end goal. She bought the present she wanted to give her mother (goal 2). Then, she went to the department store. She found a pretty purse. She was very happy.

Episode 3. Several days later, Betty saw her friend knitting. Betty was also good at knitting. She decided to knit a sweater (goal 3). She selected a pattern from a magazine. She followed the instructions in the article. Finally, Betty finished a beautiful sweater.

Episode 4. She pressed the sweater. She folded it carefully.

Probe Question - Did Betty want to move close to her mother? She sent it to her mother (failed goal version). She put it in the closet for the next time she went out (neutral and completed versions). She was very happy.

was *Did Betty want to move close to her mother?* The answer to the critical probe was always *yes*.

Procedure. Stories were presented one sentence at a time on a computer screen. Readers were told to comprehend each sentence as it appeared. Reading was self-paced so that readers pressed the space bar with the left hand to advance to the next sentence. The readers were told that they would be interrupted by probe questions during the course of reading and that they should answer each question as quickly and as accurately as possible. Responses were made by pressing one of two buttons on a computer mouse with the right hand. The left button was for *yes* responses, and the right button was for *no* responses. Readers kept their right hands resting on the mouse. Probe questions were presented in red to distinguish them from the story itself.

Practice narratives were given in order to familiarize the readers with the procedure, but readers were not told that they were for practice. The experimental and filler narratives were then given in a different random order for each reader, with the constraint that each received all 18 experimental narratives, 6 of each version. After each story, the readers were given feedback on the accuracy of their responses. They were then given a distractor task of solving three-digit addition problems (e.g., $373 + 744 = ?$). This continued until 10 sec had elapsed. The distractor task served to decrease memory of the previous story.

Results and Discussion

Response times (RTs) for the probe questions were submitted to two analyses, one using subjects as a random factor (subscript 1) and the other using items as a random factor (subscript 2). Unless otherwise mentioned, a criterion of $p < .05$ was used. Only correct RTs were included in analyses. The RTs were 2,545 ($SE = 76$), 2,540 ($SE = 66$), and 2,658 msec ($SE = 68$) for the dead-end, completed, and failed goal versions, respectively. RTs to the failed goal versions were slower than those for the completed goal [$t_1(95) = 2.20$, $t_2(17) = 1.77$, $p = .10$] and dead-end versions [$t_1(95) = 2.26$, $t_2(17) = 2.26$], which did not differ from one another (both $ts < 1$). Overall error rates were 8%. A comparable analysis of the errors made to the probes was conducted, which revealed no significant differences (all $ts < 1$).

Consistent with the goal dominance hypothesis, information about the Episode 1 goal was less available when the Episode 2 goal was also not completed. This second active goal interfered with the availability of a prior goal, even though they were unrelated. This interference occurred in the failed versions because the second goal was the most recent unachieved goal and, more importantly, provided a causal explanation in the current story context. The Episode 1 goal was more available if the subsequent goal was successfully completed before the probe sentence.

EXPERIMENT 2

An alternative explanation for the results of Experiment 1 is that both unachieved goals interfered with each other. If this is true, the status of an initial goal (i.e., whether completed or not) should influence the availability of a subsequent goal in much the same way that, in Experiment 1, the status of a subsequent goal influenced the availability of the initial goal. A mutual retrieval

interference effect such as this could be accommodated within a memory-based model (Albrecht & Myers, 1998) because it would most likely be a result of automatic, activation-based processing (Anderson, 1974) rather than the result of causal processing. There is some evidence that the mechanisms of resonance are affected by automatic interference processes. Albrecht and Myers (1998) found that a retrieval cue is less effective when it overlaps semantically with information found in multiple episodes than when it overlaps with information in only one episode.

In order to test this, the availability of the Episode 1 goal was assessed when the Episode 2 goal was either failed or absent (i.e., not mentioned in the story), and the availability of the Episode 2 goal was assessed when the Episode 1 goal was either failed or absent. The availability of a goal was assessed only when it was failed, as in Experiment 1. Table 2 contains a sample story. When the Episode 1 goal question appeared in the failed goal condition, Episode 1 and 2 goals were unachieved and the Episode 2 goal is causally related to and provided an explanation for the current context. When this question appeared in the absent condition, the Episode 2 goal was not present in the story and so the Episode 1 goal was the only unachieved goal. However, that goal was not causally related to current action and so did not provide an explanation for it. These two conditions provided a

Table 2
Failed and Goal Absent Versions
for a Sample Story Used in Experiment 2

Episode 1. Once there was a woman named Betty.
Failed goal 1. Betty's mother had been sick lately. Betty wanted to move to the same city as her mother (goal 1). She went to the personnel office at her company. The office manager said he could not authorize her request. He told her that she needed to discuss the matter with the regional vice president.
Goal 1 absent. Betty moved to the city where she grew up. Her company had transferred her there. They were very helpful in moving her there. She was glad to be back in Madison again. She especially liked it in the autumn.
Episode 2. The next day Betty realized that her mother's birthday was coming soon.
Failed goal 2. She really wanted to give her mother a present (goal 2). She went to a department store. She found that everything was too expensive. She could not buy anything for her mother. She was very sad.
Goal 2 absent. She bought a present to give her mother (goal 2). Then, she went to a department store. She found a pretty purse. She bought herself the purse. She was very happy.
Episode 3. Several days later, Betty saw her friend knitting. Betty was also good at knitting. She decided to knit a sweater (goal 3). She selected a pattern from a magazine. She followed the instructions in the article. Finally, Betty finished a beautiful sweater.
Episode 4. She pressed the sweater. She folded it carefully.
Probe Question
Episode 1 Goal Question - Did Betty want to move close to her mother?
or
Episode 2 Goal Question - Did Betty want to give her mother a present?
She sent it to her mother. She was very happy.

partial replication of Experiment 1. When the Episode 2 goal question appeared in the failed goal condition, again both the Episode 1 and 2 goals were unachieved and the Episode 2 goal was causally related to and provided an explanation for the current context. When this question appeared in the absent condition, the Episode 2 goal was the only unachieved goal and again, it provided an explanation for the current context. These two conditions allowed an assessment of the extent to which the status of the Episode 1 goal influences the availability of the Episode 2 goal.

If the results of Experiment 1 were due to mutual retrieval interference, the probe questions will be responded to faster for the absent than for the failed goal versions (absent < failed) for both Episode 1 and 2 goals. Specifically, in the failed goal versions, there are two unachieved goals that could interfere with one another. If the results are consistent with the goal dominance hypothesis, response latencies will be faster for the absent versions than for the failed versions for the Episode 1 goal, but not for the Episode 2 goal. That is, the Episode 1 goal will become less available when the Episode 2 goal is causally relevant and highly available at the probe sentence (i.e., in the failed versions). On the other hand, the availability of the Episode 2 goal will not be affected by the status of the Episode 1 goal because the Episode 1 goal is not causally relevant at that point of the story.

Method

Readers. Seventy-eight English speakers were recruited from the participant pools at Northern Illinois University and the University of Notre Dame.

Materials, Design, and Procedure. The materials and procedure were similar to those used in Experiment 1. The stories were modified as described above and are shown in Table 2. Experiment 2 used a 2 (condition: other goal failed or absent) \times 2 (position: probe of Episode 1 vs. Episode 2) within-subjects design.

Results and Discussion

RTs to the probes were analyzed as in Experiment 1. Table 3 contains the means and standard errors for Experiment 2. A 2 (condition) \times 2 (position) within-subjects analysis of variance (ANOVA) was conducted. As expected (Lutz & Radvansky, 1997; Suh & Trabasso, 1993), there was a main effect of position [$F_1(77) = 34.86, p < .05; F_2(18) = 7.65, p < .05$] so that probes for the Episode 1 goal (mean = 2,599 msec) were responded to more slowly than for the Episode 1 goal (mean = 2,218 msec). Again, the Episode 2 goal was causally relevant to the current context, whereas the Episode 1 goal was not. The main effect of condition did not reach sig-

nificance [$F_1(1,77) = 2.60, p = .11; F_2(1,15) = 1.11, p = .31$]. The interaction was significant in a subject analysis [$F_1(77) = 4.05, p < .05$] and approached significance in an item analysis [$F_2(18) = 3.51, p = .08$]. Two planned contrasts were conducted using the overall error term from the subject analysis to assess the availability of the two goals under the two conditions. The response latencies for the Episode 1 goal were slower in the failed goal condition than in the absent condition [$t(77) = 1.99, p < .05$], but did not differ for the Episode 2 goal for either version (both $ps > .10$).

Overall error rates were 6%. An analysis of the error rates revealed a main effect of condition [$F_1(1,79) = 6.48, p < .05; F_2(1,15) = 3.10, p = .10$], with more errors being made when the other goal was a failed goal (8%) than when it was absent (4%). There was also a significant main effect of position [$F_1(1,79) = 10.16, p < .05; F_2(1,15) = 6.07, p < .05$], with more errors being made in response to probes of the Episode 1 goal (8%) than to probes of the Episode 2 goal (4%). The interaction was not significant (both $F_s < 1$).

The results of Experiment 2 serve as a partial replication and extension of those of Experiment 1 and are consistent with the goal dominance hypothesis. The decrease in availability of the Episode 1 goal in the failed goal condition relative to the absent versions cannot be explained solely in terms of interference between unachieved goals. Rather, the Episode 1 goal is less available because the Episode 2 goal is more active and is being causally connected to the current context. The status of the Episode 1 goal did not have an impact on the availability of the Episode 2 goal. The Episode 1 goal was less available at the probe sentence (Langston & Trabasso, 1998; Suh & Trabasso, 1993; Trabasso & Suh, 1993).

GENERAL DISCUSSION

Stories usually describe situations in which characters face problems that can spark a series of goals that need to be achieved (Stein & Glenn, 1979; Trabasso et al., 1989). In the present study, we assessed whether the availability of goal information is affected by the status of other semantically or causally unrelated goals. The results of Experiment 1 revealed a decrease in availability of the earlier goal when the later goal was also uncompleted and causally related to the current story context. The results of Experiment 2 replicated those of Experiment 1 but also revealed no effect of the status of an earlier goal on a later, uncompleted goal.

These results are more consistent with explanation-based theories of comprehension (Graesser et al., 1994; Trabasso et al., 1989). There are two possible reasons why the Episode 1 goal is less available when the Episode 2 goal is failed. One reason is that the Episode 2 goal is more immediate in the goal hierarchy. A second reason is that the Episode 2 goal is causally relevant to the current context (e.g., *Betty is wrapping the sweater because she wanted to give her mother a birthday present*). Of these

Table 3
Means (in Milliseconds) and Standard Errors for Experiment 2

Position: Goal that is assessed	Condition: Status of Other Goal				
	Failed		Absent		Difference F-A
	M	SE	M	SE	
Episode 1 goal	2,688	116	2,509	97	179
Episode 2 goal	2,201	72	2,235	76	-34

two factors, we suspect that the second was the primary reason for the decrease in accessibility of the earlier goal. Specifically, active causal processing of a foregrounded goal interferes with availability of backgrounded goal information. This explanation is supported by a recent connectionist model developed by Langston and Trabasso (1998). This model simulates the availability of information from a prior story context based on a causal network of relationships between prior story sentences. In modeling a wide variety of empirical data, Langston and Trabasso demonstrated that establishing a causal relationship between any two sentences dynamically changes the availability of other information in the prior story context. Specifically, information that is causally connected to information that is relevant to current processing becomes more available, whereas information that is not causally relevant to current processing becomes less available. This explanation for the present results is bolstered by the fact that the status of an Episode 1 goal did not influence the availability of the Episode 2 goal. Again, the Episode 1 goal was not causally relevant to the Episode 2 goal or to the current story context.

Although there is ample evidence that basic retrieval mechanisms, such as resonance, do operate during comprehension (e.g., Albrecht & Myers, 1995, 1998; Myers & O'Brien, 1998), an account based solely on these passive mechanisms does not explain the present data. Furthermore, these results cannot be interpreted as simple mutual retrieval interference between unachieved goals, a possibility that could be accommodated within a retrieval-based framework (Albrecht & Myers, 1998). Instead, the coordination of multiple unrelated goals during comprehension is guided, at least in part, by the degree to which the various goals are causally relevant to the current processing demands.

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