

Being Reminded of Thematically Similar Episodes

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Some of our knowledge of the world appears not to be derivable from the circumstances of an episode; rather, the point of the episode lies deeper, in the more abstract relations between concepts. For example, the thematic information involved in the notion of "retaliation" is independent of any particular situation; one can imagine retaliation occurring in a wide variety of settings. A terrorist group retaliating against a government crackdown with a bombing incident is quite different from a child, feeling wronged, tattling on a sibling. However, every episode that embodies the theme of "retaliation" is, at some (more abstract) level, equivalent.

The thematic level of knowledge.

Schank (1982) proposes thematic knowledge structures to account for first, the thematic pattern within an episode, and second, how generalizations are made across episodes that vary greatly in some respects while sharing more abstract similarities. Thematic Organization Points or *TOPs*, are defined as interacting patterns of goals and plans, with certain conditions attached to the pattern. In "retaliation," each side has goals and plans to achieve those goals under the condition of mutual antagonism. *TOPs* are related to earlier versions of "themes" (Abelson, 1973; Schank & Abelson, 1977), and differ from other structures proposed to capture thematic information (e.g. Lehnert, 1981; Wilensky, 1982) in the emphasis on the overall pattern of goal and plan interaction, the importance of the attached conditions, and their functionality as structures in memory.

Table 1 : Sample Episodes Based on a *TAU* Structure.

Story 1: Academia

Dr. Popoff knew that his graduate student Mike was unhappy with the research facilities available in his department. Mike had requested new equipment on several occasions, but Dr. Popoff always denied Mike's requests. One day, Dr. Popoff found out that Mike had been accepted to study at a rival university. Not wanting to lose a good student, Dr. Popoff hurriedly offered Mike lots of new research equipment. But by then, Mike had already decided to transfer.

Story 2: Wedding Bells

Phil was in love with his secretary and was well aware that she wanted to marry him. However, Phil was afraid of responsibility, so he kept dating others and made up excuses to postpone the wedding. Finally, his secretary got fed up, began dating, and fell in love with an accountant. When Phil found out, he went to her and proposed marriage, showing her the ring he had bought. But by that time, his secretary was already planning her honeymoon with the accountant.

Test sentences:

Conclusion: by then, Mike had already decided to transfer

Conclusion: his secretary fell in love with an accountant

In the experiments presented in this paper, we examined one kind of *TOP*, namely the Thematic Abstraction Units (*TAUs*) proposed by Dyer (1982). *TAUs* are the patterns of goals and plans reflected in common adages. For example, the adage "Closing the barn door after the horse is gone" expresses the point of the stories in Table 1. The similarity in the two stories involves some general planning information about a common error: waiting too long to execute a plan, causing its failure.

We chose *TAUs* as structures to be used in these experiments for two reasons. First, while *TAU* structures are abstract, they are still reasonably well-defined; Table 2 shows the goal-plan structure, with attached conditions, for the *TAU* of the two stories in Table 1 and the barn door adage (Dyer, 1982).

Table 2: Goal and Plan Structure of a Thematic Affect Unit

TAU-BARN-DOOR

Adage: Closing the barn door after the horse is gone.

- (1) x has preservation goal G active since enablement condition C is unsatisfied.
- (2) x knows a plan P that will keep G from failing by satisfying C.
- (3) x does not execute P and G fails.
 x attempts to recover from the failure of G by executing P.
 P fails since P is effective for C, but not in recovering from G's failure.
- (4) In the future, x must execute P when G is active and C is not satisfied.

Second, the patterns of goal-plan interactions represented in *TAUs* have been shown to be easily recognized by Seifert and Black (1982). Thus, the thematic level of knowledge can be captured by structures that contain relatively abstract information about goal and plan relationships. Further, these structures may organize episodes that contain similar thematic information. The premise that thematic structures are useful in encoding and organizing related episodes suggests that these structures serve as the connection between related episodes.

Connecting thematically similar episodes.

Let's examine a thematic structure and a proposal for how episodes may be stored under it. Given the two episodes in Table 1, and a general structure to encode them, the resulting organization in memory is suggested to be the pattern shown in Figure 1 (Dyer, 1982).

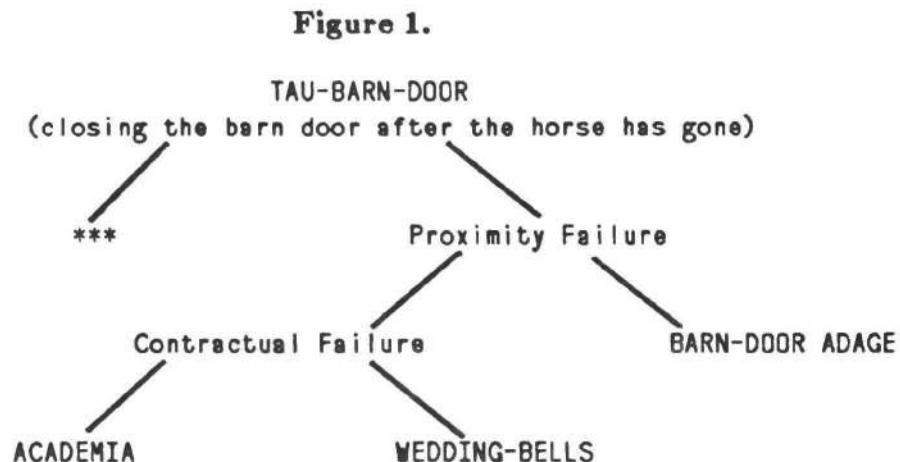


Figure 1. The memory organization of a *TAU* structure and related episodes.

Recalling an episode will activate the associated structure; in addition, this model suggests similarities may result in the activation of not only a structure but a related episode. The role of accessing episodes in

memory has been analyzed by Schank (1982) using the phenomenon of reminding. Reminding occurs when a particular situation causes you to remember another experience that is similar in some way. The relationship between the new input and the old memory retrieved can be at any level of abstraction or similarity. For example, seeing a bearded man in a red suit may "remind" you of Santa Claus, going into Burger King for the first time could "remind" you of McDonald's, and seeing "West Side Story" may "remind" you of "Romeo and Juliet". Schank proposes that in understanding the new situation, you are led to structures in memory that categorize the input; then, under some circumstances, you may find an episode from the past stored in the same way.

Consider the similarities between "West Side Story" and "Romeo and Juliet" (Schank, 1982). The thematic structure is based upon relationships between the goals in the episodes, and interesting deviations in the situation. In these two stories, the two characters are pursuing the same goal while outsiders oppose them. When an episode involves such a complex goal pattern, similar episodes that had been understood using that goal pattern may be brought to mind. Then, the old experience can be further used to aid in processing the current episode. The reminding can provide expectations about the problems the lovers will encounter, ways to prevent making the same mistakes in a similar situation, actions from the old situation that might be possible in the new, warnings of problems to watch for, and predictions about what will happen next. The reminding may also add to understanding by pointing out similarities in the two experiences that hadn't been noticed. In addition, relevant episodes are often poignant illustrations of the generalizations contained in the memory structures. In this way, matching a new situation to a previous experience provides understanding and possibly a way of solving a problem. Without the preservation and access to the old episodes in memory, a system will not be able to change dynamically to learn from the new episodes it encounters (Schank, 1982).

When is reminding based on thematic similarity likely to occur? What kinds of thematic structures are built from episodes? Progress on a theory of memory organization of episodes has relied upon the analysis of protocols of reminding experiences. Examining reminding empirically depends upon developing a methodology that will provide both a naturalistic task which is analogous to reminding and a successful measure of the activation of episodes. In the experimental paradigm reported here, a task analogous to reminding is produced by having subjects study a set of stories based upon thematic structures (old experiences), and then read a series of new stories. By manipulating whether these stories are related in theme, the question of whether the stories are connected based upon their thematic similarity can be addressed. In order to capture the activation of episodes in memory, priming in item recognition is used as a measure of the relatedness of two target episodes in memory (McKoon and Ratcliff, 1980), allowing the empirical examination of episodic reminding.

Experimental Reminding

In two experiments, prestudied stories were paired with two test stories. One of these stories was based on the same thematic structure as the prestudied story; the other was based on a different thematic structure. For both stories, the test sentence was the conclusion of the prestudied story, as shown in the examples in Table 1. We hypothesized that, in the Same-Theme condition, reading a test story with the same thematic structure as the prestudied story may remind subjects of the old story, leading to faster response times for the test sentence.

Method. Detailed discussions of these two experiments are reported in Seifert, McKoon, Abelson, and Ratcliff (1984). There were three phases to Experiments 1 and 2, a pre-study phase, a study-test phase, and a final free recall phase. In the pre-study phase, eight target stories, each of a different *TAU* pattern such as in Table 2, and three practice stories, each from a pool of stories based on similar thematic patterns, were given to subjects to read, answer questions, and then write a one or two sentence summary of each story.

In the study-test phase, stories were presented one word at a time on a microcomputer at a natural reading rate and were followed by a test sentence. All the stories presented were new to the subject, but all the test sentences referred to the target stories presented during the pre-study phase. Eight of the new

stories were paired with the eight prestudied stories so as to have the same thematic pattern (Same-Theme condition), and another eight were paired with the prestudied stories so as to have a different thematic pattern (Different-Theme condition). Thus, each conclusion sentence from a prestudied story was presented for testing twice, once in the Same-Theme condition and once in the Different-Theme condition. Order of presentation was counterbalanced with relatedness using two groups of subjects.

Two different tasks were used as reaction time measures. In Experiment 1, subjects were asked to verify whether test sentences were true according to the story they were from. Negative test sentences were selected from the prestudied story set. In Experiment 2, an identification task was used; subjects had only to press a response key as soon as they could remember which story the test sentence referred to. After responding, they wrote a one-sentence description of the story referred to by the test sentence.

In the final free recall phase of the experiments, subjects were instructed to recall, in any order, the stories from the prestudy phase, and to write an identifying phrase for each story recalled. In addition, subjects in Experiment 2 were instructed to recall the stories from the study-test phase. Eighteen subjects participated in Experiment 1 and eight in Experiment 2.

Results. Data obtained in the pre-study phase (answers to questions about the stories and summaries of the stories) showed that each subject had responded adequately. For the study-test phase, all analyses and statistics for the data for the test sentences were based upon mean response times for each subject and each test sentence in each condition.

In both experiments, responses in the Same-Theme condition were faster than responses in the Different-Theme condition. In Experiment 1 (verification), the mean response time in the Same-Theme condition was 2376 msec (3 % errors), and in the Different-Theme condition, 2554 msec (1 % errors). This difference was significant with subjects as a random variable, $F(1,17) = 11.5$, $p < .01$, and with test sentences as a random variable, $F(1,7) = 5.6$, $p < .05$, though $\min F'(1,15) = 3.8$, $p < .08$, was marginally significant. The difference in error rates was not significant, $F's < 1$.

In Experiment 2 (identification) mean response time in the Same-Theme condition was 1253 msec, and in the Different-Theme condition, 1474 msec. These means were significantly different, $\min F'(1,14) = 5.4$, $p < .05$. All subjects had completed the accuracy check of writing an identifying phrase from the story after hitting the response key.

In the final free recall phase, subjects were able to generate 75% of the prestudied stories in both experiments. In Experiment 2, subjects recalled 27% of the study-test phase stories. Further, the probability of recall for study-test phase stories that matched the prestudied stories in thematic structure was higher than the probability of recall for study-test phase stores that did not match, .35 versus .19. This difference is significant with subjects as a random variable, $F(1,17) = 10.07$, $p < .01$, but not with test sentences as a random variable, $F(1,7) = 2.45$.

Conclusion

These experiments provide strong evidence for the effect of thematic similarity in activating previous episodes. In both the verification task and the simpler identification task, response times for a test sentence from a prestudied story were faster when the story preceding the test sentence matched the test sentence's story in thematic structure. New stories appeared to activate stories already encoded in memory on the basis of their thematic similarity.

Other experiments on the role of thematic similarities between episodes (Seifert, McKoon, Abelson, and Ratcliff, 1984) have indicated the importance of a functional purpose for reminding in the experimental task. This parallels the processing goals in everyday tasks such as problem solving and analogical understanding. The design reported here appears to motivate similar processing within the experimental situation. This technique of using similar episodes to remind the reader of previously learned episodes allows the investigation of the kinds of structures organizing the episodes in memory. Reminding in the experimental context can be used to determine when connections are made between episodes and to

compare types of organizing structures.

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