Thematic Relations Between Episodes

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Among the variety of knowledge structures proposed to capture information in episodes, a dichotomy between contentful structures and content-free structures appears useful in characterizing abstract relations in memory (Schank, 1982). The level of relatively content-free structures is needed to explain 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.

Plot Units (Lehnert, 1981) have been proposed to capture knowledge about thematic concepts that represent particular patterns of goal relationships and events. Plot units such as *competition, failure*, and *shared positive events* can be used to describe the goal situation in an episode. Their utility in understanding, generating, and summarizing narratives has been demonstrated (Reiser, Black, and Lehnert, 1982; Lehnert, Reiser, and Black, 1981).

Although plot units involve relatively abstract knowledge about patterns of goals, they appear to be at a low level of thematic information. Higher level patterns of thematic information seem to exist which provide interesting generalizations that plot units do not capture. These thematic patterns serve to capture a level of information that is useful in building memory structures; that is, to store episodes, thereby providing connections to related experiences. Plot units appear to play a role as components in the construction and recognition of these higher level thematic knowledge structures. Information at the plot unit level is needed to access appropriate thematic structures in memory. In fact, some combinations of plot-unit-like components are likely to be higher level thematic structures.

Let's examine an example of plot unit components to consider their possible incorporation into memory structures. The *failure* plot unit is the basis for countless episodes. Combining the *failure* plot unit with *shared negative event* specifies more of a plot, but still is a rather general experience. For example, this story is used in Reiser, Black and Lehnert (1982) as an exemplar of this pattern:

> Kennedy had struggled admirably to stay alive in the primaries, but his efforts
> were not able to win him the nomination. When his delegates finally accepted
> the inevitable defeat, there were more than a few tears and hollow hopes for 1984.

If this story is extended in a certain way, we introduce a theme which plot units do not capture. For example, this story could continue on to describe Kennedy's successful nomination in 1984. We would have a different thematic pattern, captured by the adage, *if at first you don't succeed, try, try again*, as well as a more interesting and memorable story. The thematic information captured by this adage is not expressed by the plot units *failure, shared negative event*, and *success*. The adage captures a pattern of goals and plans in which plot units appear as pieces. If the pattern is made more distinctive, such as trying over and over and never succeeding, adding the context of elections would probably remind some people of Adlai Stevenson. In this way, pieces of plot unit-like information are combined into specific patterns that not only appear to store episodes, but can produce remindings in appropriate contexts.

Here is another example of how a small change in an episode can change the meaning and result in a more distinctive, complex structure:

Minister's Complaint

In a lengthy interview, Reverend X severely criticized the then President Carter
for having "denigrated the office of president" and "legitimized pornography" by
agreeing to be interviewed in Playboy Magazine. The interview with Reverend X
appeared in *The Church Today* magazine.

This is another routine news report of a clergyman complaining about pornography. However, if a small change is made to the story -- if *The Church Today* magazine is changed to *Penthouse*-- the point or moral of the story is drastically different. When reading the changed story, the theme may bring other experiences or even adages to mind, such as: *The pot calling the kettle black, Practice what you preach*, and *Throwing stones when you live in a glass house.*

How can we determine which patterns of goal and plan situations are distinctive and useful in memory organization? Schank (1982) has suggested examining the similarities and common themes in everyday life that are revealed when one is reminded of thematically similar episodes. The patterns of goal and plan interactions that people recognize and share, and that remind people of other experiences, are sometimes captured in common sayings and remindings. Adages often serve as an effective way of characterizing the theme of an individual episode. It would seem that cultural sayings, based on the commonalities of experiences in a variety of settings, are a good place to begin looking for structures to organize episodes in memory.

Dyer (1982) has used this approach to develop Thematic Abstraction Units (TAUs) which seem to capture the thematic level of adages that is not captured by plot units. TAUs are based on the analysis of adages, in particular ones that represent expectation failures that occur due to errors in planning. A TAU contains an abstracted planning structure that tells where the error was, and can serve as a warning for the planner. They serve as episodic memory structures which organize events which involve similar kinds of planning failures.

For example, here is a TAU structure for the Minister's Complaint story (Dyer, 1982):

TAU-HYPOCRISY
X is counter-planning against Y
X is trying to get a higher authority Z to block or punish Y
  for using Plan P1 by claiming P1 is unethical
X has also used the unethical plan P1
therefore, X's strategy fails.

In the revised Minister's Complaint story, the minister tries to move public opinion against Carter by claiming Carter supports pornography. Since the Minister supported it to the same degree, his strategy fails.

In this manner, TAUs attempt to capture the goal and plan interactions that include particular errors in planning. These structures explain relations between elements within the story, and serve as the basis for connections between related episodes. From this point of view, the important questions for thematic knowledge structures are concerned with explaining their use in memory to store experiences, thereby providing a basis for bringing to mind related episodes needed for learning. But before we can address the use of thematic structures in the storing and retrieving of abstractly related episodes, it is appropriate to gather some evidence on whether people can recognize and use thematic similarity. Are the themes recognized as a wholistic pattern, rather than as related components? Do people perceive the thematic structure as more important than content similarities? We used the methodology in Reiser, Black and Lehnert (1982), employed to study plot units, to examine stories based upon TAU relations in the tasks of narrative generation and sorting.

Story Generation Experiment

Asking subjects to write stories based on prototypical stories should indicate whether they are able to abstract the thematic similarities in the prototypes and reproduce that theme in a new context. In this experiment, subjects were given three example stories based on TAUs suggested by Dyer (1982) and were asked to write "one new story that has the same type of plot." The subjects were told not to use the same events from the examples. Each subject was given three sets of example stories and was asked to write three stories. Fixty-six subjects participated in the experiment, though not all the subjects were able to complete the task in the allotted time (15 minutes).

Here is an example of a subject-generated story based on prototypes such as "the Minister's Complaint" story discussed above:

> Sue's basketball coach was outlining her pre-season training program. "Stay
> away from overeating, alcohol, and smoking. Everyone knows an athlete should
> respect her body," she said, as she drew on a cigarette.

Though some stories were based on contexts present in one of the nine exemplars for each subject, most stories had a context novel to the experiment; for example, crime, music, psychology experiments, and most popularly, "college life". The stories were scored by a trained coder who did not know which examples the stories were based upon. A proportion of how many of the stories had a recognizable and the correct TAU structure was determined, as shown in Table 1.

Table 1
Story Generation Results

TAU	Associated Adage	Proportion Based on TAU	Total Number of Stories
Hypocrisy	Pot Calling the Kettle Black	.96	26
Incompetent Advice	Blind Leading the Blind	.88	26
Unsupported Plan	Counting Chickens Before Hatched	.78	27
Acting Too Late	Closing Door after Horse Gone	.89	19
Plan Backfires	Cutting Off Nose to Spite Face	.80	15
Self-Deception	Hiding Your Head in the Sand	.60	15
Too Costly	Killing Fly With Elephant Gun	.88	8
Leave Alone	Cure is Worse than Disease	.70	10
Leaderless	Too Many Cooks Spoil Broth	.88	8

An example of a subject's story that confuses two TAUs demonstrates the possible interactions of TAU structures active in an episode. This story contains the elements of both *TAU-INCOMPETENT-ADVICE* and *TAU-UNSUPPORTED-PLAN*.

> Frank was at the horse races. He had heard from his friend, a jockey, of a sure win.
> He took $1000 from his bank account, because he was so sure he would win a sure
> thing. When the race time rolled around, his horse was neck and neck, but came in
> second, and he lost his money.

In general, subjects were very good at generating the matching internal TAU patterns in a new setting. A more interesting test is how subjects perceive a series of episodes. The story sorting task provides an indication of the thematic similarities the subjects attend to.

Story Clustering Experiment

Six subject-written stories were chosen randomly from six TAU groups: *TAU-HYPOCRISY, TAU-INCOMPETENT-ADVICE, TAU-UNSUPPORTED-PLAN, ACTING-TOO-LATE, TAU-PLAN-BACKFIRES,* and *TAU-SELF-DECEPTION.* The thirty-six unedited stories were presented in one of four random orders to a separate group of thirty-six subjects. Each subject was asked to sort the stories into groups with "similar plots" (Reiser, et al). Subjects were not told how many groups to form, but two to ten groups was suggested as a guideline. After completing the sorting task, subjects were asked to go back and label the groups with a descriptive phrase.

A hierarchical clustering analysis (Johnson, 1967) revealed how strongly pairs of stories were related (i.e., how often two stories were sorted into the same group by different subjects). The clustering results are shown in Figure 1.

Figure 1

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 1                                                                    .----------------------.
 |                                                     "SELF-CAUSED"                          |
 2                                                           .--------------------.           |
 3                                                           |                     |          |
 4                                                           |                     |          |
 5                                       "BAD DECISION"      |                     |          |
 6                                        .------------.     |                     |          |
 7                                        |            |     |          SELF-DECEPT |
 8      INCOMPETENT-ADVICE                |            |  .--------.     |          ---        |
 9              .-----.                   |            |  |        |     |          |   |      |
10              |     |                   |            |  |        |     |          |   |      |
11              |     |                   |   SELF-DECEPTION    |  |     |          |   |      |
12              |     |                   |            |  ---   |  |     |          |   |      |
13           .------.  |                  |            |  | |   |  |     |          |   |      |
14           |    |  | |                  |         ---  | |   |  | UNSUPPORTED-PLAN |   |     |
15           |    |  | |  ACTING-TOO-LATE PLANS-BACKFIRE| |   |  |  .----.  |       |   |     |
16           |    |  | |    .--------.    .----.   | |   | |   |  |  |    |  |       |  --      |
17           |    |  | |    |        |    |    |   | |   | |   |  |  |    |  |       | | |      |
18        .------.| |  |    |        |    |    |  .--. | |   | |   |  |  |    |  |       | | |   |
19        |    | | |  |    |        |    |    |  |  | | |   | |   |  |  |    |  |       | | |   |
20        |    | | |  |  .-----.    |    |    |  |  | | |   | |   |  | .---. |  |       | | |   |
21        |    | |.--.|  |     |    |    |    |  |  | | |   | |   |  | |   | |  |       | | |   |
22        |  .---.| | |  |     |    |    |    |  |  | | |   | |   |  | |   | |  |       | | |   |
23        |  | | | | |  |     |    |    |    |  |  | | |   | |   |  | |   | |  |       | | |   |
24        |  | | | | |  .--.  |    .---. |  |  | | |   | |   |  | |   | |  |       | | |   |
25        |  | | | | |  | |   |    | |  |  |  | | |   | |   |  | |   | |  |       | | |   |
26   HYPOCRISY| | | | |  | |   |    | |  |  |  | | |   | |   |  | |   | |  |       | | |   |
27        .----.| | | | | | |   |   .--.| |  |  | | |   | |   |  | .--.| |  |       | | |   |
28     .----.| | | |.--.| | | | |  .--.| || |  |  .--.| |   | .--. |  | | || |       | | |   |
29     .----.| | | | | | | | | | |  | || || |  |  | || |   | | | |  | | || |       | | |   |
30     | | | | | | | | | | | | |  | || || |  |  | || |   | | | |  | | || |       | | |   |
31     .---.| | | | | | | |.--.| |  | || || |  |  | || |   | | | |  | | || |       | | |   |
32   .--.| | | | | | | | | | | | |  | || || |  |  | || |   | | | |  | | || |       | | |   |
33   | || | | | | | | | | | | | |  | || || |  |  | || |   | | | |  | | || |       | | |   |
34   | || | | | | | | | | | | | |  | || || |  |  | || |   | | | |  | | || |       | | |   |
35   | || | | | | | | | | | | | |  | || || |  |  | || |   | | | |  | | || |       | | |   |
36   | || | | | | | | | | | | | |  | || || |  |  | || |   | | | |  | | || |       | | |   |
    1f 1d 1b 1a 1e 1c  2b 2a 2f 2c 2d 2e 3b  5b 5d 5c 5e 5a 5f  4f 4a 4c 4d 4e 4b 3d 6e 6c 6d 3e 3a 3f 3c 6a 6b 6f
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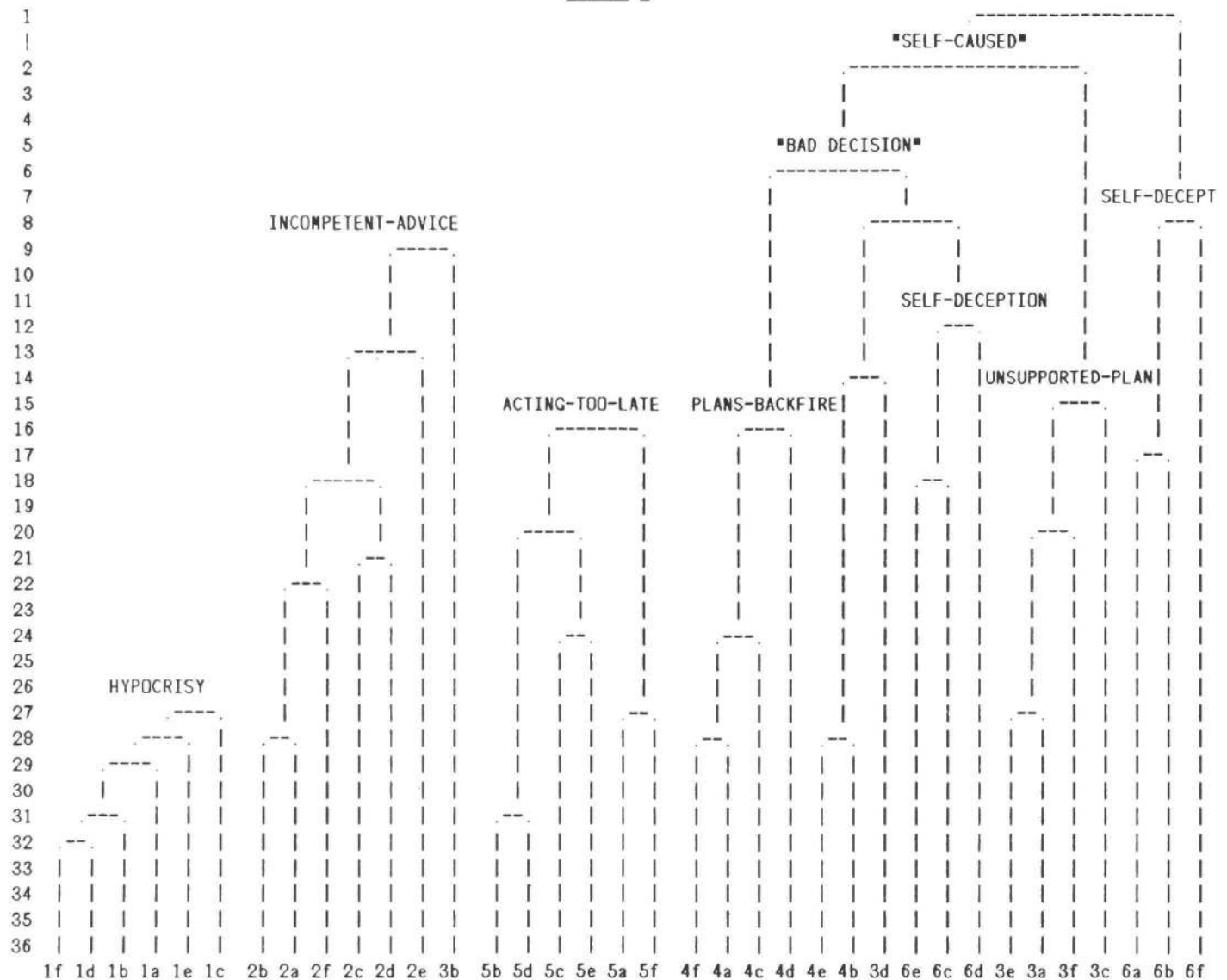
Figure 1: The hierarchical clustering diagram for the 36 subject-written stories sorted by 36 other subjects. The numbers on the horizontal axis represent similarity scores.

In general, subjects seemed to grasp the TAU structures as wholes rather than their subparts. This analysis produced three clearly defined clusters, each corresponding to a specific TAU, and a more complicated cluster involving the other three TAU structures. While two of the TAU groups are fairly well preserved in

this large cluster, one group *TAU-SELF-DECEPTION*, is split in half. A analysis of the commonalities in the labels for this group indicates subjects divided *self-deception* stories into two types: in one, the error is a bad decision which is the actor's own fault (self-caused); in the other, *self-deception* stories where the subject truly not aware they are deceiving themselves. An example of this dichotomy is a story where a student chooses to ignore her work, resulting in failure, compared to a story where a mother can't admit to herself that her son is delinquent, and he later gets in trouble. This factor of whether the actor *causes* his own disaster, or whether circumstances control his fate, is not treated systematically by TAUs. This causation factor must be incorporated into the TAU structure in order to explain the variations within tau-related episodes.

Within the TAU-based clusters, subjects tended to consider the stories more similar if they included content similarities as well. For example, stories 4b and 4e were based on *TAU-PLANS-BACKFIRE*, and were both about running away from home only to run into trouble. Other stories rated with high similarity also contained common content, such as 1d and 1f, which were both about smoking.

The analysis of the labels subjects used to describe the groups they formed revealed a high degree of agreement even in the words used. For example, 24 subjects used "hypocrisy" in their label, 24 used "too late", and 20 used "bad advice". Beyond the TAU-based labels, subjects appeared to form some groups using more general similarities, particularly "bad decision" and the "self-caused" distinction. In addition, many subjects used adages to label a group, including *practice what you preach*, *counting your chickens before they hatch*, and *the ostrich syndrome*.

Conclusion

In summary, subjects were able to preserve the TAU pattern in their stories so that it is recognizable to other subjects, and subjects were able to use TAUs as the basis for story similarity. These experiments, as an initial undertaking, demonstrate subjects' sensitivity to thematic patterns, and indicate the thematic level of information can be used when indicated. It is clear that the thematic information present in an episode plays a crucial role. Further experimentation on the representation and the specific processing functions of the thematic knowledge will serve to determine the nature of their role in understanding.

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