

RECOGNIZING THEMATIC UNITS IN NARRATIVES¹

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Abstract

Lehnert (1980) proposed a model thematic knowledge structures called "plot units", which are structurally defined sequences of mental states, positive events, and negative events. In a clustering experiment, subjects were asked to sort 36 stories into groups. These groups were labeled by the subjects, and that data used to identify the nature of each mental category. Plot units generally provided a good fit to the clustering patterns in the data, with higher level clusters corresponding to discriminations on the nature of the outcome and judgments about the "fairness" of the protagonist.

Much research in natural language processing has utilized an event-based level of description. Schank and Abelson's (1977) model of scripts, plans, and goals is one such model, which has been both embodied in Artificial Intelligence programs (see Schank and Riesbeck, 1981 for a review) and tested in psychological experiments (Bower, Black & Turner, 1979; Gibbs & Tenney, 1980; Graesser, Gordon & Sawyer, 1979; Graesser, Woll, Kowalski & Smith, 1980). Recently, the need for a thematic level of representation has been suggested (Dyer, 1981; Lehnert, 1980; Schank, in press). In Lehnert's (1980) system, a story can be represented as a graph of overlapping "plot units". A plot unit is structurally defined, representing a unique pattern of goal interaction and goal resolution of one or more characters. Plot units are composed of three types of causally linked "affect states", representing *mental states* (states of desire), *positive events* (events that result in positive affects) and *negative events* (events that result in negative affects). Since plot units are defined as patterns of affect states, they are abstracted from specific content situations. For example, the "competition" plot unit is defined as parallel mental states between two characters (representing mutually exclusive goals) where the goal of one character is realized as a positive event, and other goal is realized as a negative event. Thus, one character winning an argument with another about which TV program to watch, and someone getting a job for which another character had applied, are both examples of the competition plot unit.

To establish initial evidence for the use of a thematic representations in processing narratives, and for the plot unit system in particular, we employed a clustering task to investigate subjects' perceptions of similarity between plots of different stories. Clustering tasks have previously been

¹Ray Gibbs, Scott Robertson, Larry Hunter, and John Leddo provided valuable comments on an earlier draft of this paper. This research was supported by a grant from the Sloan Foundation.

used by cognitive psychologists to study the organization of the mental lexicon (Miller, 1972), and to examine the hierarchical structure of stories (Pollard-Gott, McClosky, and Todres, 1979). In this experiment, subjects read a group of stories and were asked to sort them into groups of stories with "similar plots". Stories of varying content were constructed using the same plot units. There are many dimensions which subjects could conceivably use to judge thematic similarity: type of plan, emotions of the characters, contextual settings, personality of the main character, desirability of the story situation, etc. We expected, however, that the plot unit analysis would predict judgments of thematic similarity, and therefore that stories built of the same plot units would be grouped together by the subjects.

Method.

Thirty six two or three sentence stories were constructed from six sets of plot units. Stories constructed of the same plot units concerned different types of problems, goals, and events.

The plot units used in these stories are:

1. Stories 1-6: Competition, Denial, Retaliation, Fleeting Success. X and Y have conflicting goals, and X's are satisfied. Y asks X to agree and satisfy his goals, but the request is turned down. Y retaliates by doing something which terminates X's original success.
2. Stories 7-12: Competition, Denial, Change of Mind, Success. X and Y have conflicting goals, and X's are satisfied. Y asks X to agree and satisfy his goals, but the request is turned down. Y finds another way to successfully satisfy his goals.
3. Stories 13-18: Request Honored with Nested Promise and Reneged Promise. X makes a request and has to promise something to Y in return for Y's granting the request. However, X never performs his part of the bargain.
4. Stories 19-24: Threat, Problem Resolution. X threatens Y, who finds a way to overcome the threat.
5. Stories 25-30: Failure, Shared Negative Event. X fails in achieving some goal, and Y shares in X's failure.
6. Stories 31-36: Regrettable Mistake, Problem Resolution. X does something (accidentally) which is a negative event for both Y and X. This motivates X to do something which is positive for Y.

Thirty six Yale undergraduates were each given these stories in one of four random orders. The subjects were told to read all the stories once, and then sort them into groups, placing stories with "similar plots" into the same group. They were told to construct roughly between two and twelve groups, although they were to consider that as only a guideline. After the subjects were finished classifying the stories into groups, they were asked to label each group with a phrase that described the stories in that group.

Results.

Johnson's (1967) hierarchical clustering analysis provides a method of assessing the prototypical or average sorting of the stories, which may be used to determine whether the plot unit graphs are successful in predicting which stories will tend to be sorted together. The analysis produces a tree structure, showing the progressive merging of items empirically less and less similar (i.e., sorted into the same group less frequently) into larger and larger clusters.

The "diameter" or "minimum" clustering algorithm (Johnson, 1967) was

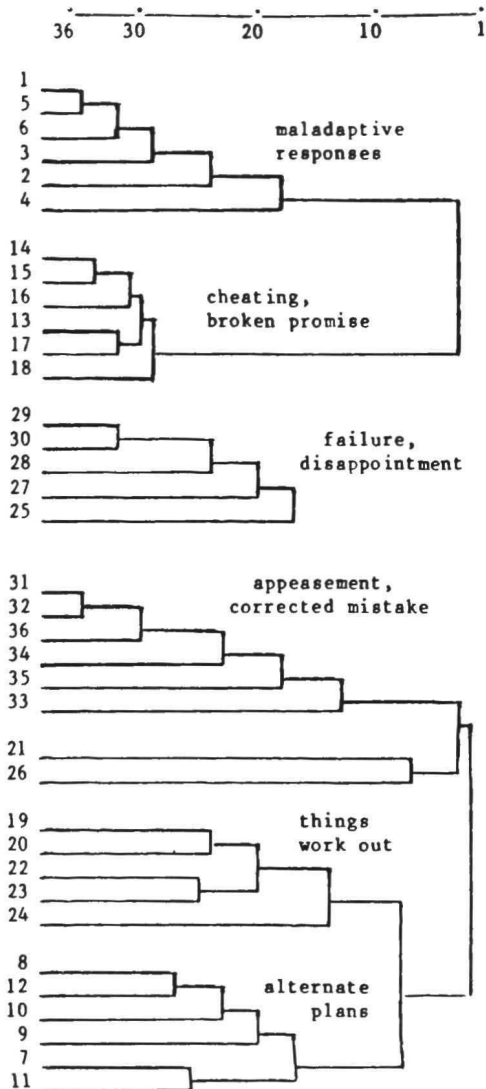


Figure 1. Hierarchical clustering diagram for the 36 stories sorted by subjects. The numbers on the horizontal axis represent similarity scores. If a cluster appears with score n , it means that each and every pair of its stories were sorted together by at least n subjects. Clusters are labeled with the most frequent tags given by the subjects that were common to all the stories in the cluster.

but leaves unspecified the nature of the problem situation (a threat). The aberrant story from this group (#21) may have been sorted with the group 6 stories because the problem solution is of a more cooperative nature, making it more like correcting a mistake than reacting to a threat.

The next component of the cluster was formed of the six stories of group 2, which were labeled with "alternate plans" and either "things work out" or "rational problem solution". These labels accurately capture both the "change of mind" plot unit, and the final "success" unit, without specifying the nature of the problem.

The third component of the cluster is formed of the six stories of group 6, which were labeled with "appeasement" and "corrected a mistake". "Appeasement" indicates a simple repayment, while "corrected a mistake" more accurately reflects the regrettable mistake and problem resolution plot units.

The stories of groups 2 and 4 are more similar to each other than to the stories of group 6, although all three components are weakly clustered together. Groups 2 and 4 appear to be linked since the stories groups contain positive and reasonable goal resolutions (finding an alternative solution, overcoming a threat). Group 6 also contains a reasonable goal resolution, although it differs in that the protagonist who resolves the problem situation had inadvertently created it (for himself and another character).

Discussion.

The six clusters of stories found in the data correspond very well with the six groups of stories as predicted by the plot unit representations. Further, some of the subjects' labels accurately capture the gist of a plot unit (e.g., "broken promise", "corrected mistake"), at the same level of abstraction.

The weaker (major) clusters found in the data indicate that subjects are also sensitive to other more abstract level of representation. The three major clusters may be described by the type of outcome, and some judgment of the "justifiability" of the protagonist's actions. Thus, in the major cluster composed of groups 1 and 3, there is a malicious (and probably judged to be unjustified) action on the part of the protagonist to achieve his goal. In contrast, in the major cluster composed of groups 2, 4, and 6, the protagonist adopts a justified plan. In groups 2 and 4, the protagonist finds a rational solution to a problem, while in group 6, the protagonist adopts a positive plan to rectify a problem situation he has accidentally created. In both of these major clusters, the protagonist's goal is achieved. In the cluster of the group 5 stories, the protagonist's goal results in failure. Subjects' labels also provide support for a classification by general type of outcome ("failure", "everything works out") and judgments of fairness and motive ("maladaptive responses", "rational behavior", "malicious behavior"). Thus, in sum, the three major clusters of stories correspond to (1) the protagonist's malicious achievement of a goal, (2) justified achievement of a goal, and (3) failure to achieve a goal.

In general, it seems that subjects were more sensitive to the types of actions and types of outcomes than they were to the types of initial problem situations. Thus, descriptions of actions and outcomes were used to label the groups, (e.g., "maladaptive responses", "reneged promise", "disappointment", "failure", "things work out", "corrected mistake", and "appeasement"), but the motivation of the problem situation (e.g., the competition, threat, or denied request) not mentioned in labeling the stories. Further, the stories of groups 1 and 2, which had the same problem situation (competition, denial) but different solutions (retaliation, alternate plans) were not clustered together, while similar solutions to different problems were connected in the three major clusters.

The experiment presented here indicates that there is a thematic analysis taking place during story understanding, at least in this somewhat artificial task. It seems likely that the knowledge structures exhibited in this task would be used in a more typical understanding situation. In particular, Lehnert, Black, and Reiser (1981) have shown that plot unit representations provide a generally good prediction of subjects' summaries of narratives.

References

- Bower, G. H., Black, J. B., & Turner, T. J. Scripts in comprehension and memory. *Cognitive Psychology*, 1979, 11, 177-220.
- Gibbs R. W. & Tenney, Y. J. The concept of scripts in understanding stories. *Journal of Psycholinguistic Research*, 1980, 9, 275-284.
- Graesser, A. C., Gordon, S. E., & Sawyer, J. D. Recognition memory for typical and atypical actions in scripted activities: Tests of a script pointer + tag hypothesis. *Journal of Verbal Learning and Verbal Behavior*, 1979, 18, 319-332.
- Graesser, A. C., Woll, S. B., Kowalski, D. J., & Smith, D. A. Memory for typical and atypical actions in scripted activities. *Journal of Experimental Psychology: Human Learning and Memory*, 1980, 6, 503-515.

- Lehnert, W. G. Affect units and narrative summarization. Research Report #179, Dept. of Computer Science, Yale University, 1980.
- Lehnert, W. G., Black, J. B., & Reiser, B. J. Narrative summarization. Manuscript submitted to IJCAI, 1981.
- Miller, G. A. English verbs of motion: A case in semantics and lexical memory. in A. W. Melton & E. Martin (Eds.), *Coding Processes in Human Memory*, Winston, 1972.
- Pollard-Gott, L. P., McCloskey, M., & Todres, A. K. Subjective story structure. *Discourse Processes*, 1979, 2, 251-281.
- Schank, R. C. *Dynamic Memory: A Theory of Learning in Computers and People*. in press.
- Schank, R. C. & Abelson, R. P. *Scripts, plans, goals, and understanding*. Hillsdale, NJ: Erlbaum, 1980.
- Schank R. C. & Riesbeck, C. K. (Eds.) *Inside computer understanding: Five programs plus miniatures*. Hillsdale, NJ: Erlbaum, 1981.