

## The Role of TAUs in Narratives

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### 1. Introduction

People often rely upon common sayings, or adages, when asked to characterize stories (either by way of summarization, or title selection). What are people doing in such cases? Why do adages often serve as an effective way of characterizing a story, and how are people able to accomplish this?

For instance, when asked to characterize the following story:

#### MINISTER'S COMPLAINT

In a lengthy interview, Reverend X severely criticized 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 Penthouse magazine.

readers often responded with adages such as:

- ADG-1: The pot calling the kettle black.
- ADG-2: Throwing stones when you live in a glass house.

Clearly, these adages are an effective characterization of MINISTER'S COMPLAINT. But how do we recognize this fact? By what process does an 'appropriate' adage come to mind, and to what purpose?

Furthermore, when supplied with an adage and a context, some individuals experience reminders from episodes in their lives. For instance, one individual was first presented with the following:

context: EDUCATION

- ADG-3: Closing the barn door after the horse has escaped.

and then asked to recall some episode from his life. He experienced this reminding:

#### ACADEMIA

Years ago, I was at University U-1, where I could never get the facilities I needed for the research I wanted to do. So I decided to apply to University U-2, which offered a much better research environment. When the chairman learned I had been accepted to U-2 and was actually leaving U-1, he offered to acquire the facilities I had wanted. By then, however, my mind was already made up.

Several observations are worth making here: First, for adage ADG-3 to have initiated this reminding, the ACADEMIA episode must have somehow been indexed in long-term memory in terms of some abstract situation characterized by that adage. Furthermore, this indexing could not have had anything to do with the specific semantic content of the adage, since ADG-3 ostensibly concerns a farmer, a horse and a barn door. In contrast, ACADEMIA involves a chairman, a researcher, and university facilities.

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To account for such phenomena, I will present a class of knowledge constructs, called TAUs (Thematic Affect Units), which share similarities with other representational systems under development at Yale, such as Schank's TOPs [8] and Lehnert's Plot Units [4] [5].

### 2. Thematic Affect Units

TAUs were first developed in the context of BORIS [3] [2], a computer program designed to read and answer questions about narratives that require the application and interaction of many different types of knowledge. In BORIS, TAUs serve a number of purposes: First, they allow BORIS to represent situations which are more abstract than those captured by scripts, plans, and goals as discussed in [7]. Second, TAUs contain processing knowledge useful in dealing with the kinds of planning and expectation failures that characters often experience in narratives. Finally, TAUs also serve as episodic memory structures, since they organize events which involve similar kinds of planning failures. For more detail on the use of TAUs in narratives, see [1].

In general, TAUs arise when expectation failures occur due to errors in planning. As such, they contain an abstracted planning structure, which represents situation-outcome patterns in terms of: (1) the plan used, (2) its intended effect, (3) why it failed, and (4) how to avoid (or recover) from that type of failure in the future. If we abstract out this planning structure from both the BARN-DOOR and ACADEMIA episodes, we get the following TAU:

#### TAU-POST-HOC

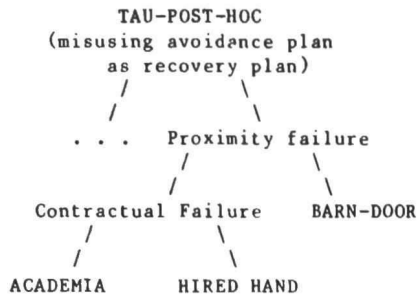
- (1) x has preservation goal G [7] active since enablement condition C unsatisfied
- (2) x knows a plan P that will keep G from failing by satisfying C.
- (3) x does not execute P and G fails.  
x attempts to recover from the failure of G by executing P.  
P fails since P is effective for C, but not in recovering from C's failure.
- (4) In the future, x must execute P when G is active and C is not satisfied.

TAU-POST-HOC captures the kind of planning failure that occurred for both the farmer who lost his horse, and the chairman who lost a graduate student. If the ACADEMIA story were told to an actual farmer who had lost his horse under the same planning circumstances, that farmer might well be reminded of his own experience. Whether this occurs or not, however, depends upon what other episodes are in long-term memory and what features are shared between them. Notice, for instance, that both BARN-DOOR and ACADEMIA share goals at some level. That is, both the farmer and the chairman had a goal requiring proximity on the part of another entity. Since these features are shared, one experience has a better chance of causing a reminding of the other to occur. For instance, the farmer would have recalled the HIRED HAND episode below before recalling the BARN-DOOR episode because of their shared features:

#### HIRED HAND

The hired hand always wanted a raise, but the farmer would not grant it. Finally, the hired hand got an offer to work at a neighbor's farm. When the farmer found out, he offered the hired hand a nice raise, but it was too late.

Although these episodes (i.e. HIRED HAND, ACADEMIA, BARN-DOOR) share the same TAU, HIRED HAND and ACADEMIA have more indices in common. One possible organization for them appears below:



In this way TAUs can account for cross-contextual reminders (as in the case of BARN-DOOR and ACADEMIA). Episodes are often related in memory because they share the same abstract planning error even though they differ in content. However, cross-contextual reminders can occur only where episodes are organized under the same TAU, yet do not share content features. Where content is shared, the "closer" episode will be recalled.<sup>2</sup> Consider the following episode:

IRANIAN EMBASSY

While holding 52 US hostages in Iran, the Iranian government condemned the take-over, by terrorists, of its embassy in Great Britain. "This is a violation of international law", protested Iran.

A reader was spontaneously reminded of this episode while reading MINISTER'S COMPLAINT (on page 1). Again, there is little in common between these stories at the content level. IRANIAN EMBASSY is about politics, while MINISTER'S COMPLAINT is about pornography. However, at the abstract planning level, they both share the following TAU:

TAU-HYPOCRISY

x is counter-planning against y  
 x is trying to get a higher authority z to either block y's use of a plan P-1 (or to punish y for having used P-1) by claiming that P-1 is an unethical plan  
 y claims that x has used an unethical plan P-2 similar to P-1  
 therefore, x's strategy fails

In the case of MINISTER'S COMPLAINT, x is Reverend R, y is President Carter, and the third party is 'public opinion'. In the case of IRANIAN EMBASSY, x is the Iranian militants, y is the British terrorists, and the third party is 'world opinion', such as the United Nations.

As argued in [8], the reminding process is useful for this reason: Once a situation has caused one to be reminded of an episode, all of the expectations associated with that episode become available for use in making predictions about what will occur next. In the case of TAUs, their associated expectations include advice on either how to avoid making the error predicted by the TAU, or on what alternative plan can be used to recover from the error once it has been made. The ability to store cross-contextual episodes make TAUs very general and powerful mechanisms. Once

<sup>2</sup>This does not imply that BARN-DOOR can't remind one of episodes unrelated to TAU-POST-HOC. Clearly, other indexing methods may be operating at the same time. The farmer may recall BARN-DOOR simply in terms of "experiences I've had with horses". Of course, this kind of indexing can not lead to cross-contextual reminders.

an episode has been indexed under a TAU, its recovery/avoidance heuristics become available for use in completely different situations. Thus, planning advice learned in one context can help processing in other contexts, if the experience was recognized in terms of an appropriate TAU in the first place.

3. Bad Planning is Widespread

An examination of adages reveals that many are concerned with planning failures. That is, adages advise us either how to recover from a failure, or how to recognize and thus avoid future failures. Often, this advice is given implicitly, simply by describing situations in which certain planning errors lead to goal failures. In most cases, adages capture what has been called meta-planning [10] -- i.e. planning advice on how to select or use plans in general. For example, some adages deal with the need for checking enablement conditions before plan execution:

ADG-4 Don't count your chickens before they're hatched.

Other adages stress choosing less costly avoidance plans over more costly recovery plans:

ADG-5 A stitch in time saves nine.

or weighing the risks involved with the goal to be achieved:

ADG-6 If it ain't broke, don't fix it.

ADG-7 The cure can be worse than the disease.

Many plans require cooperation or coordination with others. This can simplify planning but complicate plan execution:

ADG-8 Two heads are better than one.

ADG-9 Two many cooks spoil the broth.

Some plans involve selecting an appropriate agent:

ADG-10 The blind leading the blind.

ADG-11 Who pays the piper calls the tune.

Timing, enablement conditions, cost, plan coordinations, and agents are just a few of the areas in which plans can go wrong. Other areas, for example, include counter-planning against a foe,

ADG-12 Cut off your nose to spite your face.

anticipating planning failures when using high risk plans,

ADG-13 Don't burn bridges behind you.

the timing of plans,

ADG-14 The early bird catches the worm.

and tradeoffs between short-term and long-term planning strategies:

ADG-15 If you can't lick 'em join 'em.

ADG-16 Don't bite the hand that feeds you.

ADG-17 Honesty is the best policy.

ADG-18 Live by the sword, die by the sword.

Any story that involves these kinds of planning failures will end up being indexed under a TAU which contains abstract planning advice (and can be expressed in natural language by an adage.) When a related story is read and indexed under that TAU, its associated adage may come to mind. For instance, a story about how a ghetto riot protesting bad economic conditions resulted in black businesses being burned, would be indexed under TAU-GREATER-HARM, with an adage such as ADG-12 possibly coming to mind.

Plans and plan failures cut across all knowledge domains. This is because we are always choosing plans, adjusting old plans to new situations, recovering from errors in planning, finding explanations for why a plan failed, etc. Furthermore, we have a large storehouse of heuristic plans, and

there are many ways a plan can go wrong: You can't execute one plan until you have the right enablements satisfied; plan components must be executed in the right order; plans require agents, etc. This large and complex domain serves as a perfect terrain in which to index many episodes.

Many of these adages give what may appear to be superficial advice. It may seem strange that memories should be organized around such 'obvious' rules for planning, but then again, how often do we fail in our plans because we have violated some adage? How often, for instance, have we failed because we acted before we planned? ("Look before you leap.") How many times have we gotten into trouble for being late? When have we initiated a plan, only to discover we had miscalculated the amount of effort (or the side-effects) involved? ("Easier said than done.") How often have we delayed executing a simple plan, only later having to execute a more costly plan? The answer is: "very often". These adages are common because they point out the kinds of planning errors people are always making. By definition, plans which failed were "bad" plans. Good planners at the very least follow the general planning advice represented in the adages of their culture.

#### 4. TAU Implementation

The recognition of TAUs is complex. Clearly, goals and plans must be tracked. In many cases there is also an affect component. For instance, in TAU-POST-HOC it is the futility of the recovery plan, combined with the sense of "if only I had done things differently" that helps provide an access "key" to this TAU.

So far the BORIS project has emphasized the use of TAUs in narrative comprehension. Much work remains to be done in modeling reminders during comprehension. This is important for extracting the 'moral' or point of a story. A computer program which can only answer questions of fact about IRANIAN EMBASSY, such as:

Q: How many Americans are being held in Iran?  
A: Fifty-two.

Q: Who seized the Iranian embassy in Britain?  
A: Terrorists.

Q: What did the Iranians do?  
A: They protested the take-over.

is missing the point of why the IRANIAN EMBASSY is of interest. The point of IRANIAN EMBASSY is TAU-HYPOCRISY, and that's where it should be remembered in long-term memory (rather than just under "things I know about Iran", or "embassy events I have read").

#### 5. TAU Experiments

What is the psychological validity of TAUs? Do people have TAUs "in their heads" and, if so, how do they use them? Some initial exploratory experiments by Seifert [9] in the Yale psychology department indicate that people use TAUs to organize narratives.

In one experiment, subjects read groups of stories each sharing the same TAU, but differing in content. Subjects were able to generate new stories, using completely different contexts, yet capturing the same planning structure specified by each TAU. In a follow-up experiment, different subjects were asked to sort the resulting stories generated from the first experiment. A cluster analysis [6] revealed a strong tendency for subjects to sort stories together by TAUs. Where stories shared the same content (but not the same TAUs) they were still grouped by TAUs.

#### 6. Conclusions

In this paper I have presented a class of knowledge constructs, called TAUs, which are related to TOPs [8] and PLOT UNITS [5]. I have argued that TAUs organize episodes around failures in planning, and as such, TAUs account for at least one form of cross-contextual reminding phenomena. Furthermore, TAUs have adages associated with them, which express avoidance and/or recovery advice available once the TAU has been accessed. Since stories are indexed in terms of planning errors, this information often captures the moral or point of a story.

#### REFERENCES

- [1] Dyer, Michael G. Thematic Affect Units and Their Use in Narratives. paper submitted to IJCAI-81, 1981.
- [2] Dyer, Michael G. In-Depth Understanding: A Computer Model of Memory for Narrative Comprehension. PhD Thesis, Computer Science Department, Yale University, (forthcoming).
- [3] Lehnert, Wendy G., Dyer, Michael G., Johnson Peter N., Yang, C. J., and Steve Harley. BORIS -- An Experiment in In-Depth Understanding of Narratives. Technical Report 188, Yale University. Dept. of Computer Science, 1980.
- [4] Lehnert, W. G. Affect Units and Narrative Summarization. Technical Report 179, Yale University. Dept. of Computer Science, 1980.
- [5] Lehnert, Wendy G. Plot Units and Narrative Summarization. Cognitive Science, in press.
- [6] Reiser, Brian J., Lehnert, Wendy G., and Black, John B. Plot Units and the Understanding of Narratives. Cognitive Science Technical Report, Yale University (in preparation).
- [7] Schank, Roger C. and Abelson, Robert. Scripts, Plans, Goals, and Understanding. Lawrence Erlbaum Associates, Hillsdale, New Jersey, 1977. The Artificial Intelligence Series.
- [8] Schank, Roger C. Language and Memory. Cognitive Science 4(3), July, 1980.
- [9] Seifert, Colleen. Preliminary Experiments on TAUs. unpublished manuscript. Psychology Dept. Yale University, 1981.
- [10] Wilensky, Robert. Meta-Planning: Representing and Using Knowledge About Planning in Problem Solving and Natural Language Understanding. Technical Report Memo. No. UCB/ERL M80/33, Electronics Research Lab. Engineering College University of California, Berkeley, 1980.