A Computational Model of Narrative Generation for Suspense

Yun-Gyung Cheong
Department of Computer Science
North Carolina State University, NC 27695
ycheong@ ncsu.edu

Introduction

Suspense contributes significantly to the enjoyment of a narrative by its readers (Brewer and Ohttsuka 1988). Suspense is the feeling of excitement or anxiety that audience members experience when they are waiting for something to happen and are uncertain about a significant outcome. This paper presents a computational model of suspense, exploring the concept that a reader's suspense level is affected by the number of solutions available to the problems faced by a narrative's protagonists (Gerrig and Bernardo 1994; Comisky and Bryant 1982). In particular, my model focuses on plot-suspense, which differs from action-suspense in that the former is generated from the plot development and the latter is evoked from the reader by just observing physical action scenes such as car chase in film. As an example of plot-suspense given by Alfred Hitchcock (quoted in Gerrig, 1996), a scene that several men playing cards around a table would not evoke suspense from the viewers if they are ignorant of a bomb underneath the table.

My approach attempts to manipulate the level of suspense experienced by a story's reader by elaborating on the story structure — making decisions regarding what story elements to tell and when to tell them — that can influence the reader's narrative comprehension process. To construct a suspenseful story structure, I set out a basic approach built on a tripartite model: the *fabula*, the *sjuzhet*, and the discourse. A *fabula* is a story world that includes all the events, characters, and situations in a story. In my approach, the *fabula* (Definition 1) is represented as a plan structure generated by Crossbow, a hierarchical, partial-order causal link planner of the same type as the Longbow planner (Young et al., 1994). A *sjuzhet*, as in Definition 2, is a series of events selected from the *fabula* and their orderings to be presented to readers. The final layer, a discourse, can be thought of as the medium of presentation itself (e.g., text, film). Although not directly discussed in this paper, discourse is important for qualitatively effective presentation of a story for the reader.

The goal of my research is to develop a *sjuzhet* level module, Suspenser, generating a narrative structure from a given story world that should evoke the desirable level of suspense from the reader.

Copyright © 2006, American Association for Artificial Intelligence (www.aaai.org). All rights reserved.

Definition 1 (*Fabula*) A *fabula* F is a tuple $<S, C, O, B>$ where S is a series of plan steps, C is a list of causal links, O is temporal ordering information, and B is a set of binding constraints. S is represented as $<s_1, s_2, \quad , s_n>$ where s_i is an instantiation of a plan operator contained in a plan library. A plan operator *op* is a tuple $<N, P, E>$ where N is a unique string, P is a set of preconditions representing just those conditions that must hold for *op* to be able to happen, and E is a set of effects denoting just those conditions that changed by the action's successful execution. A causal link is represented as $(s_i \quad s_j; e)$, notating a plan step s_i establishes e, a precondition of a subsequent step s_j. Temporal ordering information is denoted as $(s_i < s_j)$ where s_i precedes s_j. A binding constraint is described as $<s_i; (p, c)>$ where a plan step s_i binds constant c for the step's parameter p.

Definition 2 (*Sjuzhet*) A *sjuzhet* Z is a tuple $<F, S, T>$ where F is a *fabula*, S is a subset of the plan steps of F, T is presentation ordering of the plan steps in S to be presented to the user. Presentation ordering information is denoted as $(s_i < s_j)$ where s_i precedes s_j. Z uses the ordering information of F, however, when presentation ordering information of T conflicts with ordering information of F, T takes precedence over the ordering of F.

Suspenser

Suspenser takes three inputs: a *fabula*, a desired suspense level (i.e., either high-suspense or low-suspense), and a given point t in the story plan that corresponds to the point where the reader's suspense is measured. Then Suspenser determines both the content and, to a given extent, the ordering of the discourse to be used to convey the story up to t to a reader in order to achieve the given level of suspense. My work follows the notion articulated by Gerrig and Bernardo (1994), in which they view an audience as problem-solvers: a reader's level of suspense is affected by the number of potential solutions for the dilemma faced by a narrative's protagonists. From their finding of the reader's suspense level in inverse proportion to her inferred number of solutions for a story's protagonists, I devise the following heuristic function for measuring the *level of suspense*.

Heuristic Function 1 (*Level of suspense*) The Suspense level function $SL(G, Z, L, R)$ returns $(1/success(G, Z, L, R))$ when $success(G, Z, L, R)$ returns non-zero value where G is a set of literals representing the goal of a narrative's protagonist, Z denotes the content of a *sjuzhet*, L denotes a plan library, R is an integer representing a reasoning bound, and *success(G, Z, L, R)* returns the number of paths to make *G* true with given *Z* and *R*. When *success(G, Z, L, R)* returns 0, *SL(G, Z, L, R)* returns 0.

In order to model the reader's inference process and anticipation of the protagonists' success, Suspenser uses Crossbow to model the reader's plan-related reasoning processes. Prior work has provided strong evidence that human task reasoning is closely related to partial-order planning algorithms (Rattermann, 2001) and that *refinement search* (Kambhampati et al, 1995), the type of plan construction process performed by Crossbow, can be used as an effective model of the plan reasoning process (Young, 1999).

Refinement search (Kambhampati, 1995) views the planning process as search through the plan space represented as a directed acyclic graph composed of nodes denoting partial plans. In our system, the root node of the graph is a partial plan that has plan steps as the content of a given *sjuzhet*; leaf nodes are either complete plans without flaws or plans with flaws that cannot be repairable due to inconsistency in the plan; internal nodes are partial plans with a number of flaws. A flaw in Crossbow is either a precondition of some step that has not been established by prior step in the plan, or a causal link that is threatened (i.e., undone) by the effect of some other step in the plan. In the graph, a child node is a refinement of its parent node to repair a single flaw in the parent plan. When the flaw is an open precondition, a causal link is established from either an existing step in the plan or an instantiated operator in the plan library which has an effect that can be unified with the precondition; in the second case, the instantiated step is added to the parent plan. When the flaw is a threatened causal link, a temporal ordering to resolve the threat is added or binding constraints are added to separate the threat involved steps so that no conflicts arise. This refinement search process continues until either it finds all the complete plans consistent with the given *sjuzhet* or the number of searching exceeds the reader's reasoning limit.

To construct the *sjuzhet* that enables the reader to find the minimum number of solutions for a story's protagonist, Suspenser processes in two phases: a skeleton building step and a story structure building step. In the skeleton building step, Suspenser identifies the *skeleton* of the *fabula*—a set of core story events that cannot be eliminated without harming the understandability of a story—by rating each individual event's importance based on the event's causal relationship to the protagonists' goals. In the second phase, Suspenser finds additional plan steps according to Hypothesis 1, which confine available solutions for the protagonist's goal. Suspenser also extracts plan steps in the skeleton, according to Hypothesis 2, which help the reader find more solutions for the goal within her cognitive limit. When and are identified, Suspenser composes the content of the *sjuzhet* of (skeleton +). Suspenser then modifies the *sjuzhet* to reflect the presentation ordering (*t* < *s*) for each step *s* in , which means that telling of is deferred after *t*.

Hypothesis 1 *SL(G, K+ , L, R*) is greater than *SL(G, K, L, R)* where *G* is a set of literals representing the goal of protagonists, *K* is a skeleton, *L* is a plan library, *R* is an integer representing reasoning bound, and is a set of actions in a given *fabula* which have effects negating some literals of *G*.

Hypothesis 2 *SL(G, K- , L, R)* is greater than *SL(F, G, K, L, R, t)* where *G* is a set of literals representing the goal of protagonists, *K* is the skeleton, *L* is a plan library, *R* is an integer representing reasoning bound, and is a set of actions included in *K* which have effects unifying some literals of *G*.

If these two hypotheses are correct, the *sjuzhet* generated in the high-suspense mode by Suspenser should evoke greater than the suspense level either from a story produced in the low-suspense model or a story composed of randomly selected events. To date, I have worked on the system implementation and an experimental design. When the system is completed, I will conduct experiments with human subjects to test their suspense level from the stories generated by Suspenser, comparing that from the stories created by humans. I hope that this work will motivate affective story generation to provide various emotions for the user.

References

Brewer, W. F. and Ohttsuka, K. 1988. Story structure, characterization, just world organization, and reader affect in American and Hungarian short stories. *Poetics*, 17, 395-415.

Comisky, P., and Bryant, J. 1982. Factors involved in generating suspense. *Human Communication Research* 9(1):49-58.

Gerrig, R. J. 1996. The Resiliency of Suspense. In Vorderer, P., Wulff, H. J., & Friedrichsen, M. (Eds.), *Suspense: Conceptualizations, theoretical analyses, and empirical explorations*, 93-105, Lawrence Erlbaum Associates.

Gerrig, R., and Bernardo, D. 1994. Readers as problem-solvers in the experience of suspense. *Poetics*, 22, 459-472.

Kambhampati, S., Knoblock, C. A., and Yang, Q. 1995. Planning as Refinement Search: A Unified Framework for Evaluating Design Tradeoffs in Partial-Order Planning. *Artificial Intelligence*, 76(1-2), 167-238.

Rattermann, M. J., Spector, L., Grafman, J., Levin, H. and Harward, H. 2002 Partial and total-order planning: evidence from normal and prefrontally damaged populations, *Cognitive Science*; 25(6); 941-975.

Young, R. M., Pollack, M. E. and Moore, J.D. 1994. Decomposition and causality in partial order planning, in *Proceedings of the Second International Conference on AI and Planning Systems*, 188-193.

Young, R. M. 1999. Using Grice's Maxim of Quantity to Select the Content of Plan Descriptions, *Artificial Intelligence*, No. 115, pp. 215-256.