

A Computational Model of Narrative Generation for Suspense

Yun-Gyung Cheong

Advisor: Dr. R. Michael Young

Liquid Narrative Group

Department of Computer Science

North Carolina State University

Suspense in Narrative Experience

- The feeling of excitement or anxiety experienced when anticipating the uncertainty of a significant event
- Suspense is an important factor to the enjoyment of a narrative by its readers [Brewer and Lichtenstein, 1982; Alwitt, 2002]
- MINSTREL [Turner, 1992]
 - Creates suspense by detailing the protagonist's fear emotion and showing the failure of the protagonist's plan to achieve a goal

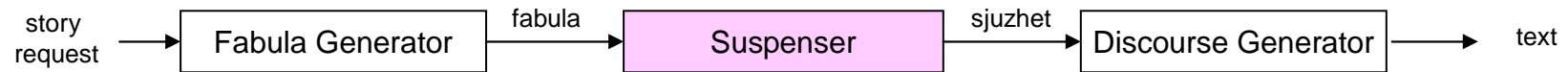
Background

- Suspense is related to the number of perceived solutions to the protagonist's current problem [Gerrig, 1996; Gerrig and Bernardo 1994]
- Narrative theorists provide a three-level model of narrative [Rimmon-Kenan, 2002]
 - *Fabula* – a story world that includes all the events, characters, and situations
 - *Sjuzhet* – presented events and situations
 - Discourse – medium (e.g., text, animation, film)

Research Objective

- To produce a story that can manipulate a reader's suspense at a specific point in its telling
- Input: *fabula*, intended suspense level (high or low), a point in the story where suspense level shall be measured
- Output: a *sjuzhet* allowing the reader to reason an adequate number of solutions for the protagonist's goal at the point
- Core idea: approximate a user's narrative comprehension using a model of plan-space reasoning

Tripartite Story Generation Model



- Fabula

- A *fabula* F is a tuple $\langle S, B, O, C, D \rangle$ where

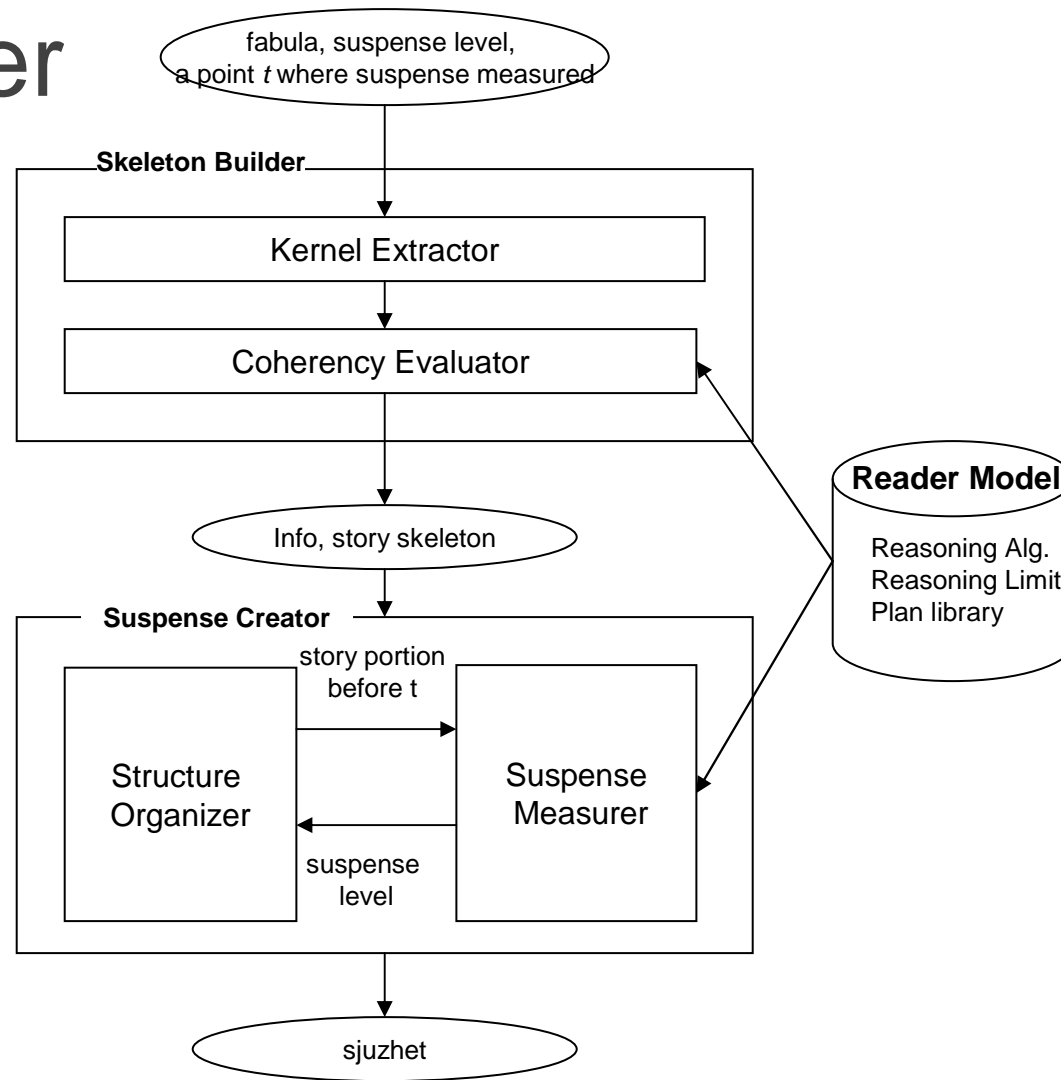
- S is a series of plan steps, B is a set of binding constraints, O is temporal ordering information, C is a list of causal links, and D is a list of decomposition links

- Sjuzhet

- A *sjuzhet* Z is a tuple $\langle F, S, T \rangle$ 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

Suspenser



A Framework for Summarizing Game Experiences as Narratives by Cheong, Yun-Gyung and Young, R. Michael. In the Second Conference on Artificial Intelligence and Interactive Digital Entertainment, 2006.

Reader Model

- Adapt basic framework from Cooperative Plan Identification [Young, 1999]
 - Reasoning algorithm: Crossbow—C# implementation of a hierarchical partial-order causal link planner [Young, Pollack and Moore, 1994]
 - Resource limit: number of nodes that can be searched in the plan space
 - Domain knowledge: Crossbow plan library

Suspense Creator

- Controls suspense by
 - Adding events that increase suspense to the sjuzhet
 - Deferring the telling of actions in the skeleton that decrease suspense beyond their time of execution
- Uses heuristic functions to identify actions that can influence the reader's suspense
- Components
 - Structure organizer: selects content and arranges ordering
 - Suspense measurer: estimates suspense level from the given content

Suspense Measurer

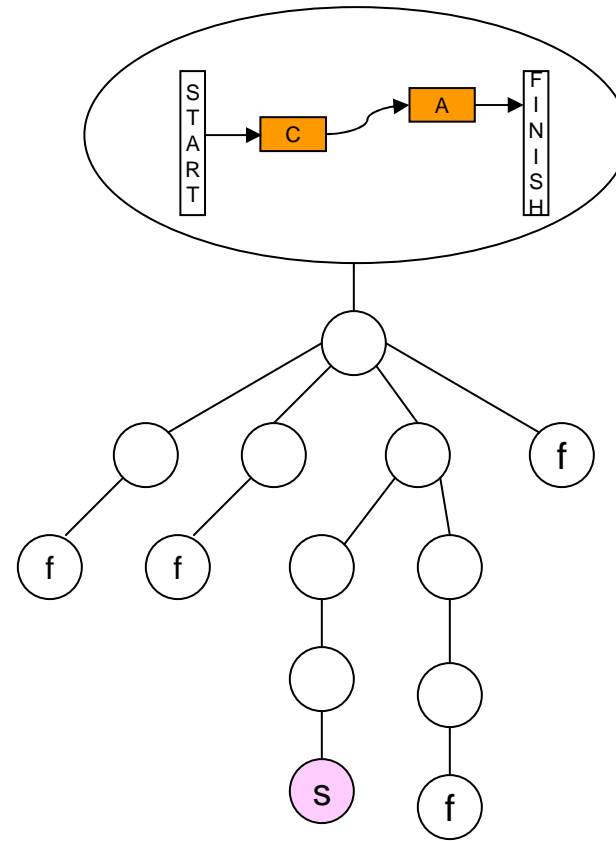
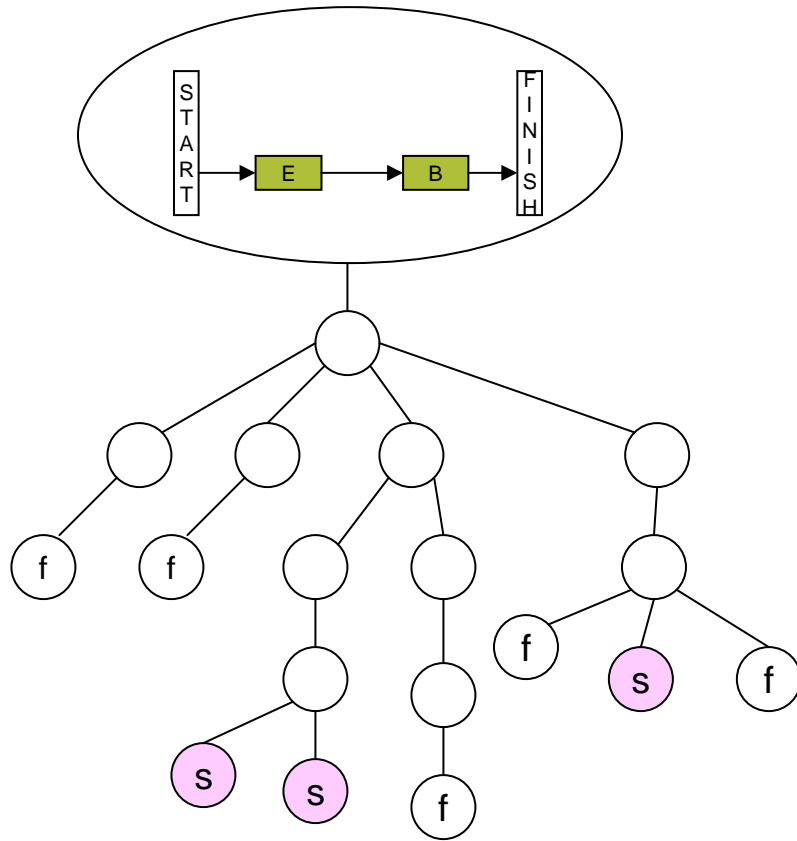
- Input: p (a partial plan constructed from *sjuzhet*), goal state
- Builds a plan space using Crossbow, setting the root node to the partial plan
- Output: suspense level
- Function to estimate suspense level
 - Motivated by Gerrig and Bernardo [1994] — the number of solutions and suspense level are in inverse relationship

$$\frac{1}{\text{success}(p, G)}$$

Success(p, G) returns the number of solutions for G that has sjuzhet as partial plans

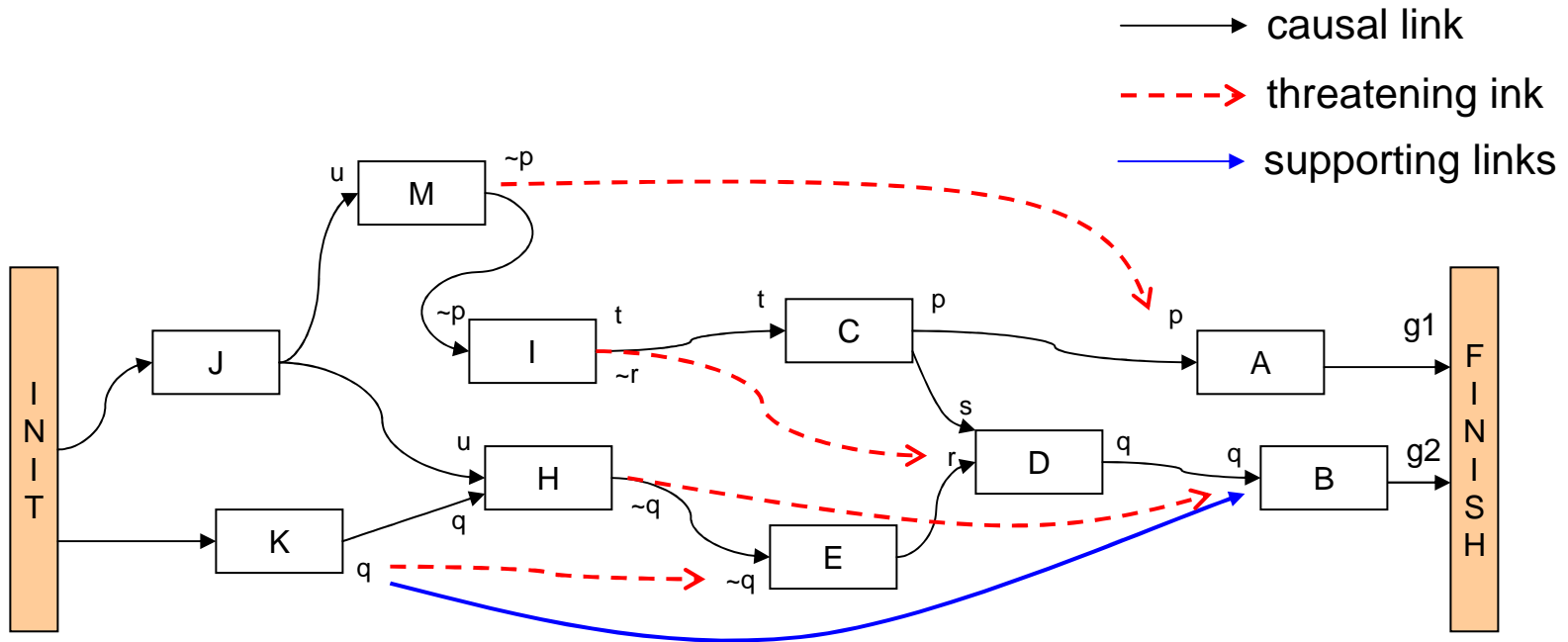
Plan space

- f Failed plan
- s complete plan



Potential Threat Estimation

- ❑ Threatening link is established when an effect of an action negates a precondition of another action
- ❑ Supporting link is established when an effect of an action is unified with a precondition of another action



Potential Threat Estimation

- Potential suspense for an effect of an action

$$ps(e, a, p) = \sum_{t \in Tlink(e)} \frac{w_t}{dist(d_t, p)} - \sum_{s \in Slink(e)} \frac{w_s}{dist(d_s, p)}$$

Tlink(e) returns effect *e*'s all threatening links

Slink(e) returns effect *e*'s all supporting links

dist(s) returns the number of minimum causal links between the threatened/supported action and the goal state

w_t , w_s are coefficients

Potential Threat Estimation

- Potential suspense for an action in a plan

$$h(a, p) = \sum_{e \in \text{effects}(a)} ps(e, a, p)$$

a: an action

p: the fabula plan

w(a): a's importance

- ▶ Presenting an action threatening the goal state increases suspense → Show those actions (e.g., Back to the Future)
- ▶ Presenting an action supporting the goal state decreases suspense → Hide those actions

Algorithm in High-suspense mode

Initialization: $Z = \langle F, S, O \rangle$ where F is the input fabula, $S = K$ where K is a set composed of event steps in the skeleton, $O = \{\}$

Termination: If S is empty or no candidates satisfying the following conditions are found, then return Z .

Event Selection:

- 1) Select an action e contained in F but not included in S which has the greatest *potential suspense*. If several candidates are found, non-deterministically select an action with the greatest *importance value*.
- 2) If the suspense level from a partial plan which has all the plan steps ($S + e$) is greater than the suspense level with a partial plan which has all the plan steps in S , then add e to S .

Presentation Order Arrangement:

- 1) Select an action e in K with the smallest *potential suspense*. If several candidates are found, non-deterministically select an action with the highest *importance value*.
- 2) If the suspense level from a partial plan which has all the plan steps in ($S - e$) is greater than the suspense level with a partial plan which has plan steps in S , then add a temporal order ($t < e$) to O .

Input Fabula

[1] Mr. Greenpeace traveled from the Amazon to the US Capitol. [2] Mr. Greenpeace made a speech about the importance of taking action immediately to save the world. [3] The President announced that he would raise funds to support Mr. Greenpeace's environmental foundation and whoever donated more than million dollars would be invited to the White House for a fund-raising celebration party. [4] Dr. Evil watched the TV and found out that a donation would get him invited to the White House. [5] Dr. Evil donated a million dollars to the White House. [6] The President traveled to the White House. [7] The President invited Dr. Evil to the fund-raising celebrating event. [8] The President gave the promised government financial support to Mr. Greenpeace's foundation. [9] Tom traveled to Dr. Evil's castle. [10] Tom traded his ring for Dr. Evil's toy; as a result, Tom obtained the toy that Ben wanted and Dr. Evil obtained the ring. [11] Tom traveled back to his house, and went up to the Christmas tree. [12] Tom put the toy under the Christmas tree. [13] Ben walked from his room to the Christmas tree. [14] Ben found his Christmas present—the toy that Tom left. [15] Dr. Evil went to a bank to withdraw money from his bank account. [16] Dr. Evil withdrew enough cash from his account to buy a gun and to register a hypnosis class. [17] Dr. Evil traveled to a gun store. [18] Dr. Evil bought a gun. [19] Dr. Evil registered for a hypnosis class to learn how to hypnotize people by waving a shiny object before their eyes. [20] Dr. Evil took a hypnosis class; as a result, he knew how to hypnotize people by waving a shiny object before their eyes. [21] Dr. Evil traveled to the White House. [22] Dr. Evil used the ring of power to put all the Secret Service agents to sleep; as a result, there was no one guarding the president. [23] Mr. Greenpeace traveled to the White House. [24] Dr. Evil fired his gun at the President. [25] At the last moment, Mr. Greenpeace rescued the President by pushing him out of the way.

A story generated by Suspenser

Mr. Greenpeace made a speech about the importance of taking action immediately to save the world. The President announced that he would raise funds to support Mr. Greenpeace's environmental foundation and whoever donated more than million dollars would be invited to the White House for a fund-raising celebration party. Dr. Evil watched the TV and found out that a donation would get him invited to the White House. Dr. Evil donated a million dollars to the White House. The President invited Dr. Evil to the fund-raising celebrating event. Tom traded his ring for Dr. Evil's toy; as a result, Tom obtained the toy that Ben wanted and Dr. Evil obtained the ring. Ben found his Christmas present—the toy that Tom left. Dr. Evil went to a bank to withdraw money from his bank account. Dr. Evil bought a gun. Dr. Evil registered for a hypnosis class to learn how to hypnotize people by waving a shiny object before their eyes. Dr. Evil traveled to the White House. Dr. Evil used the ring of power to put all the Secret Service agents to sleep; as a result, there was no one guarding the president. Dr. Evil fired his gun at the President.

A Pilot Study

- To test if the current implementation of Suspenser generated story is comparable to human-generated stories for the same plot
- A story plan composed of 25 steps
- From the plan four stories are generated
 - Computers: high-suspense, low-suspense
 - Humans: one female English major master student, one male computer science major PhD student
- 39 Subjects from NCSU (ranging in age from 18 to 29)
- Suspense measure
 - Self-rating after reading the story at a point t on a four-scale basis

Results and Discussion

Story generator	Suspense Level				Total
	None	A little	Moderate	A lot	
Humans	4	4	4	1	13
Suspenser in high-suspense mode	2	7	5	0	14
Suspenser in low-suspense mode	5	4	3	0	12
Total	11	15	12	1	39

- Suspenser in high-suspense mode showed a better result than the other two story generators

Research Plan

- Progress to date
 - Literature review
 - Implementation
 - A pilot study
- Plan for completion
 - Implementation of the reader model
 - Evaluation

Contributions

- Present a computational model that creates dramatic effect (i.e., suspense) in narrative
- Suggest a model of plan-space reasoning to approximate a user's narrative comprehension
- Suggest heuristic functions that estimate the potential suspense of a step in a plan

Open Questions

- Evaluation Method
- Limitations
 - Quantitative aspect of suspense is not handled
 - The difficulty of achieving a solution is not considered
- Future work
 - Extend the system for interactive story worlds

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