

Game AI as Storytelling

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Conclusion

Post questions to the discussion board!

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Wait.... what?

1 Introduction

2 Motivation

- Reasoning about Experience as Proxy for Designer and Player
- Leveraging Storytelling

3 Narrative Intelligence and Narratological Foundations

4 Computation of Narrative Structure

- Narrative as Plans
- Preserving Designer Intent

5 Experience Management

- Anticipating Necessary Narrative Plan Adaptions
- Computation of Contingencies
- Example: Little Red Riding Hood

6 Player Modeling

- Learning about the Player
- Using a Player Model

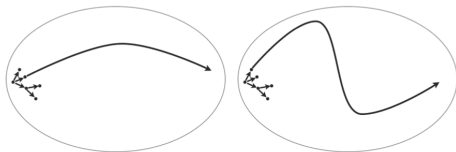
7 Conclusions

Experience Manager and Trajectories

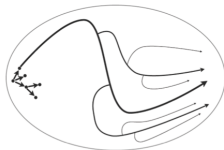
- “Story on Rails” vs player agency
- *Experience Manager*: Generalization of the Drama Manager. Looks forward into the narrative and determines what should happen to bring about an enjoyable experience.
- Trajectories: The Experience Management problem is to compute trajectories through state space.

Experience Manager and Trajectories

- “Story on Rails” vs player agency
- *Experience Manager*: Generalization of the Drama Manager. Looks forward into the narrative and determines what should happen to bring about an enjoyable experience.
- Trajectories: The Experience Management problem is to compute trajectories through state space.



(a) A possible trajectory through state space. (b) A trajectory that visits areas of state space, yielding one with certain properties.



(c) Accounting for player interaction.

Qualities of Narratives

Two nearly universal qualities of narratives:

- 1 Logical causal progression. A certain degree of causal coherence is required for the audience to follow the succession of events.
- 2 Character believability. Goal-oriented behavior is a primary requirement for believability.

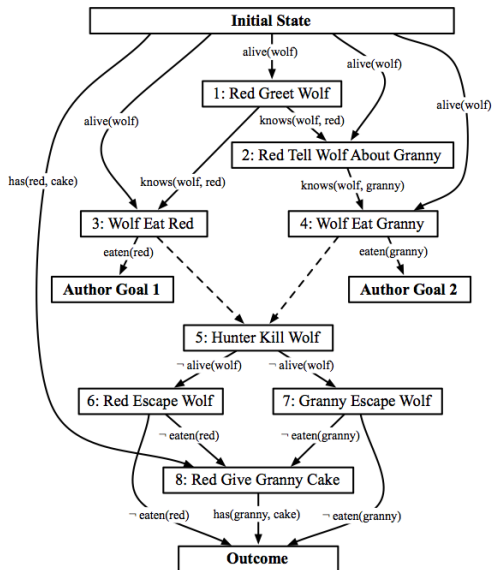
Narrative as Plans

A model of a *Partial-Order Casual Link* (POCL) is the basis for the plan. It is a DAG where the nodes are actions which, when executed change the world state. Edges are *casual* and *temporal* relations between actions.

- Casual: $a_i \rightarrow^c a_j$. The execution of a_i will cause condition c to be true in the world which is needed for subsequent action a_j .
- Temporal: Ordering constraints between actions.

Additionally, there are preconditions and effects.

Red Riding Hood



Partial Order Planning

Authors chose Partial Order Planning (POP) to solve the planning problem.

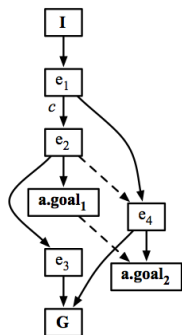
PARTIAL ORDER PLAN(P)

- 1 // Start with an Empty Plan P
- 2 **while** flaw exists
- 3 // Repair the flaw by producing 0 or more plans
- 4 **if** flaw = *open condition*
- 5 // Find or Instantiate an event that satisfies precondition
- 6 **else** flaw = casual threat: $\exists a_k \exists \neg c \exists \langle a_i, a_j \rangle [a_i \rightarrow^c a_j \neq \text{TRUE}]$
- 7 Repair: Add temporal constraint to force a_k before a_j
- 8 or after a_j

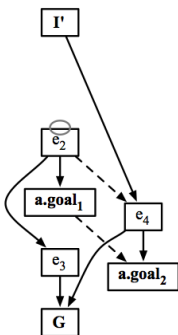
POCL Extension

Author Events: Partially specified intermediate states that the story must pass through before the goal.

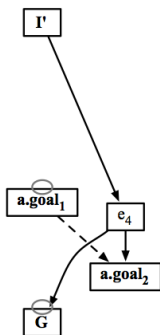
Offline Replanning



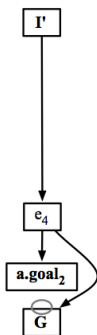
(a) Exemplar



(b) Tier i



(c) Tier ii

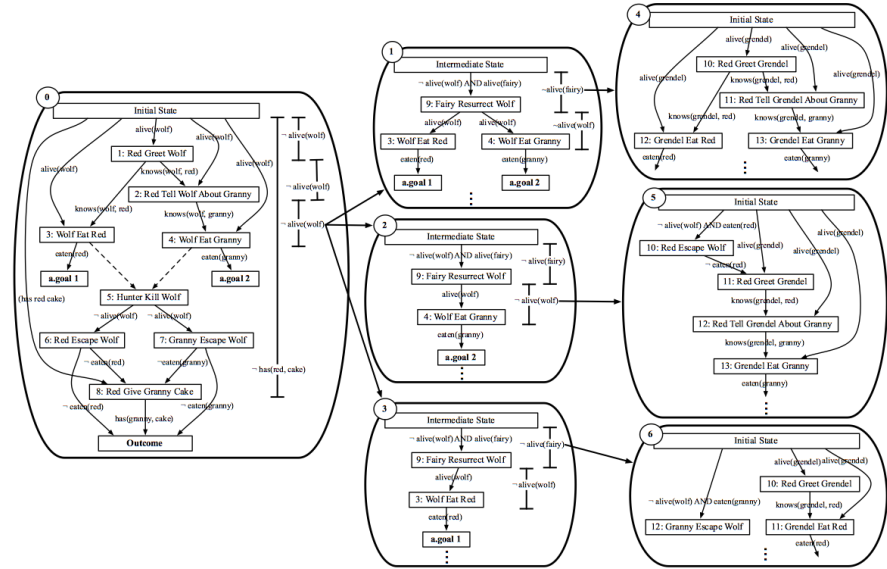


(d) Tier iii

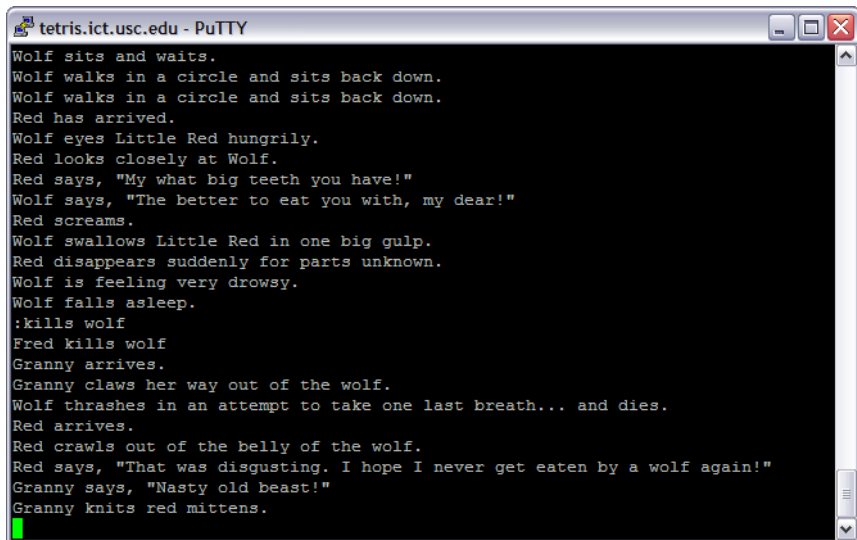
Exemplar Trajectory

The human game designer's preferred story; the best possible experience according to the designer.

Contingencies



MOO in AUTOMATED STORY FRAMEWORK



tetris.ict.usc.edu - PuTTY

```
Wolf sits and waits.  
Wolf walks in a circle and sits back down.  
Wolf walks in a circle and sits back down.  
Red has arrived.  
Wolf eyes Little Red hungrily.  
Red looks closely at Wolf.  
Red says, "My what big teeth you have!"  
Wolf says, "The better to eat you with, my dear!"  
Red screams.  
Wolf swallows Little Red in one big gulp.  
Red disappears suddenly for parts unknown.  
Wolf is feeling very drowsy.  
Wolf falls asleep.  
:kills wolf  
Fred kills wolf  
Granny arrives.  
Granny claws her way out of the wolf.  
Wolf thrashes in an attempt to take one last breath... and dies.  
Red arrives.  
Red crawls out of the belly of the wolf.  
Red says, "That was disgusting. I hope I never get eaten by a wolf again!"  
Granny says, "Nasty old beast!"  
Granny knits red mittens.
```

Metrics

- Based on exemplar narrative, **1319** branches generated with a contingency depth of 5!
- With a depth of 5, the contingency tree can handle five exceptional player actions in one play session before reverting into *an emergent, unmanaged world*.
- Offline planning takes **43 minutes** (11 minutes of garbage collection) on:
 - ▶ Intel Core2 Duo 3GHz
 - ▶ 3GB of RAM
 - ▶ 100GB of virtual memory
 - ▶ running ALLEGRO CL[®] 8.0

Modeling

Based on PASSAGE system, use a theory of playing modeling based on a vector of scalars.

Player Model

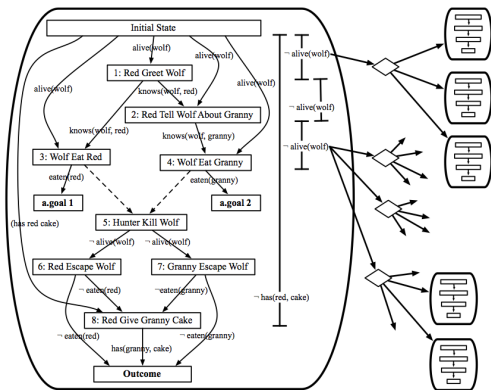
Let a model PM be a vector of scalars, $\langle f, m, s, t, p \rangle$ where:

- Fighter (f) - for players who enjoy engaging in combat
- Method Actor (m) - for players who enjoy having their personality tested
- Storyteller (s) - for players who enjoy considering complex plots
- Tactician (t) - for players who enjoy thinking creatively
- Power Gamer (p) - for players who enjoy gaining special items and abilities

Incorporating the Player Model

Extend POP model with the Player Model:

- Calculate all four strategies at once, vice a tiered approach
- Use the Player Model Vector to decide which branch to take
- Still requires *a priori* calculation with a $O(n)$ increase in branches
- Increased burden on human designer: more author goals. (Deemed negligible since AIs will have less reliance on humans ...)



Conclusions ... For real ...

Author's Conclusions:

- Created a system where player can exert agency that are inconsistent with the original narrative
- However, the AI is able recover *and* bring the narrative trajectory in line with the player's inferred desires.
- Games that value experience over state (Anchorhead vs. chess), modeling the AI is a beneficial approach.