

Integrating formal qualitative analysis techniques within a procedural narrative generation system

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October 9, 2013



**gr@m - Games Research at
McGill**

Introduction

- Goals

- REGEN

Narrative Validation

- Process

- Effects

Structural Narrative Metrics

- Process

- Effects

Construction of Game World

- Process

- Effects

Conclusion

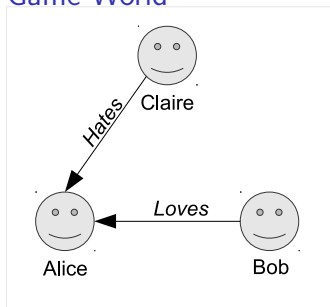
Future Work

Goals

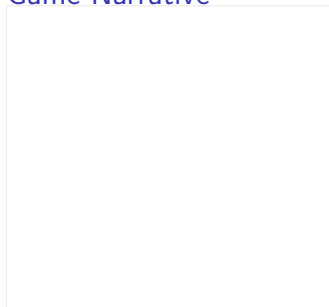
- ▶ Ensure that each narrative is *playable*
- ▶ Every modification should make the narrative *better*
- ▶ The game world should allow *better* narratives

REGEN

Game World



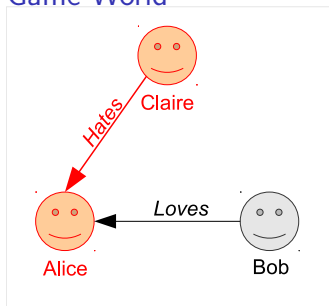
Game Narrative



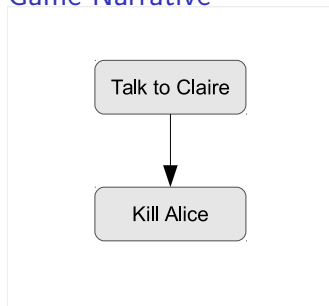
REGEN- Initial Rewrite Rules

Make a narrative

Game World



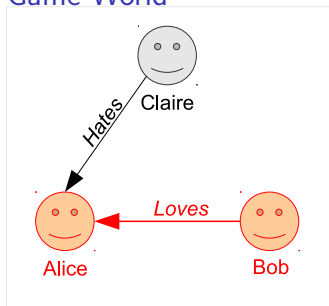
Game Narrative



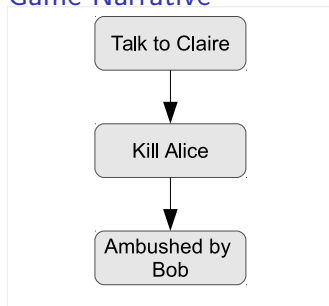
REGEN- Secondary Rewrite Rules

Add narrative “twists”

Game World



Game Narrative

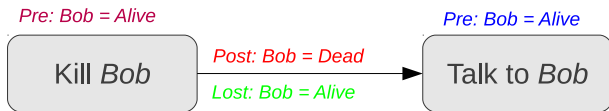


Goal 1

Ensure that each narrative is *playable*

- ▶ *Solution: Use formal narrative validation*

Validation



1. Generate *Pre*, *Post* and *Lost Conditions*
2. Compute

$$out(e) = post(e) \cup (out(\overleftarrow{e}) - lost(e))$$

3. Assert

$$pre(e) \subseteq out(\overleftarrow{e})$$

Effect

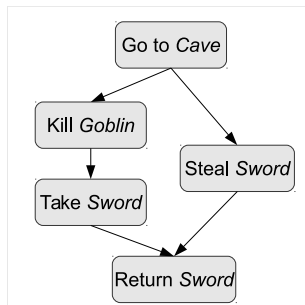
- ▶ Monitored number of invalid rewrites for each narrative
- ▶ Reject any invalid rewrites
- ▶ Fluctuation between 0 to 15%

Goal 2

Every modification should make the narrative *better*

- ▶ *Solution: Always pick optimal narrative at each iteration*

Structural Metrics



Example:

- ▶ Length = 3.5
- ▶ Branches = 1

- ▶ Length = Average number of narrative events for all possible paths
- ▶ Branches = Average number of branching nodes for all possible paths

Metric Enhanced Rewriting

Evaluate narratives based on structural properties

1. User weights importance of each metric
2. At each rewrite stage, evaluate all possible narratives
3. Pick best narrative rewrite

Scoring Function

$$\text{score}(n, m) = \frac{m(n)}{m(\hat{n})} \times w(m) \quad (1)$$

Effects

Metric	Weight	Normal	MER	Summary
Branches	5	0.61	0.78	22%
Length	4	5.02	5.09	1%

- ▶ Pro: MER creates overall measurably better narratives
- ▶ Con: Unpredictable, no direct correspondence to weights

Goal 3

The game world should allow *better* narratives

- ▶ *Solution: Explore effects of game world construction on narrative quality*

Process

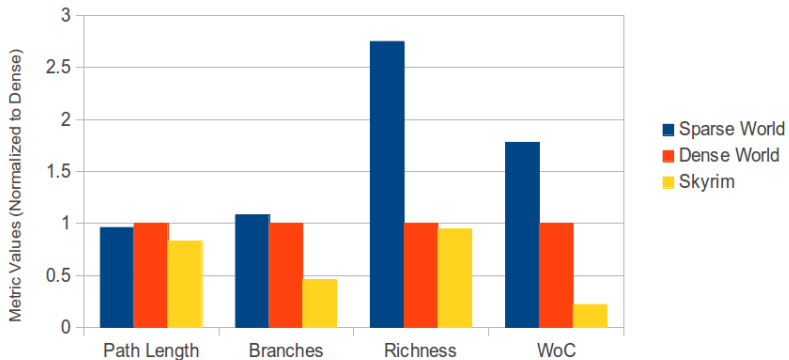
- ▶ Create three different game worlds:
 - ▶ Hand Authored Sparse world
 - ▶ Hand Authored Dense World
 - ▶ Commercial sized game world from SKYRIM
- ▶ Average metric results over generation

Inter-Narrative Metrics

- ▶ *Richness* - Narratives influenced by player actions
- ▶ *Weight of Choices (WoC)* - Effect of choices on final game world

Effects

Metric Comparison for Different Game Worlds



Conclusion

- ▶ Used formal methods to create better narratives
 1. Ensured valid narratives using condition analysis
 2. Developed customizable metric enhanced rewriting
 3. Explored effects of game worlds on narrative quality

Future Work

- ▶ Validation of narrative metrics
- ▶ Effects of rules on quality
- ▶ Optimize Richness and WoC for large game worlds

Questions?