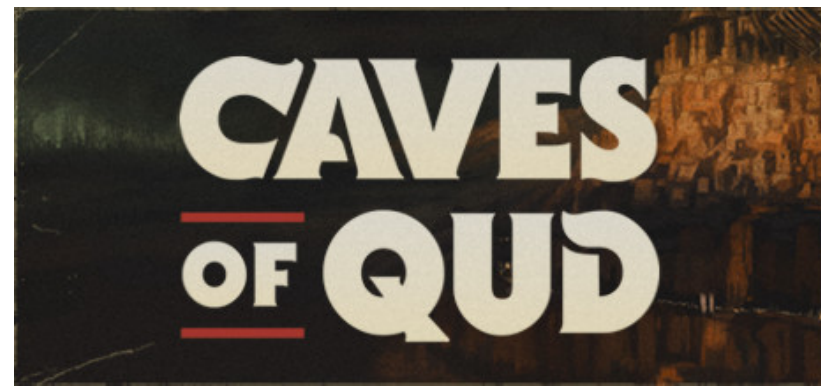


Teaching Procedural Storytelling

Computational Media
UC Santa Cruz

Michael Mateas
Professor
Department of Computational Media
UC Santa Cruz

What is Procedural Storytelling?

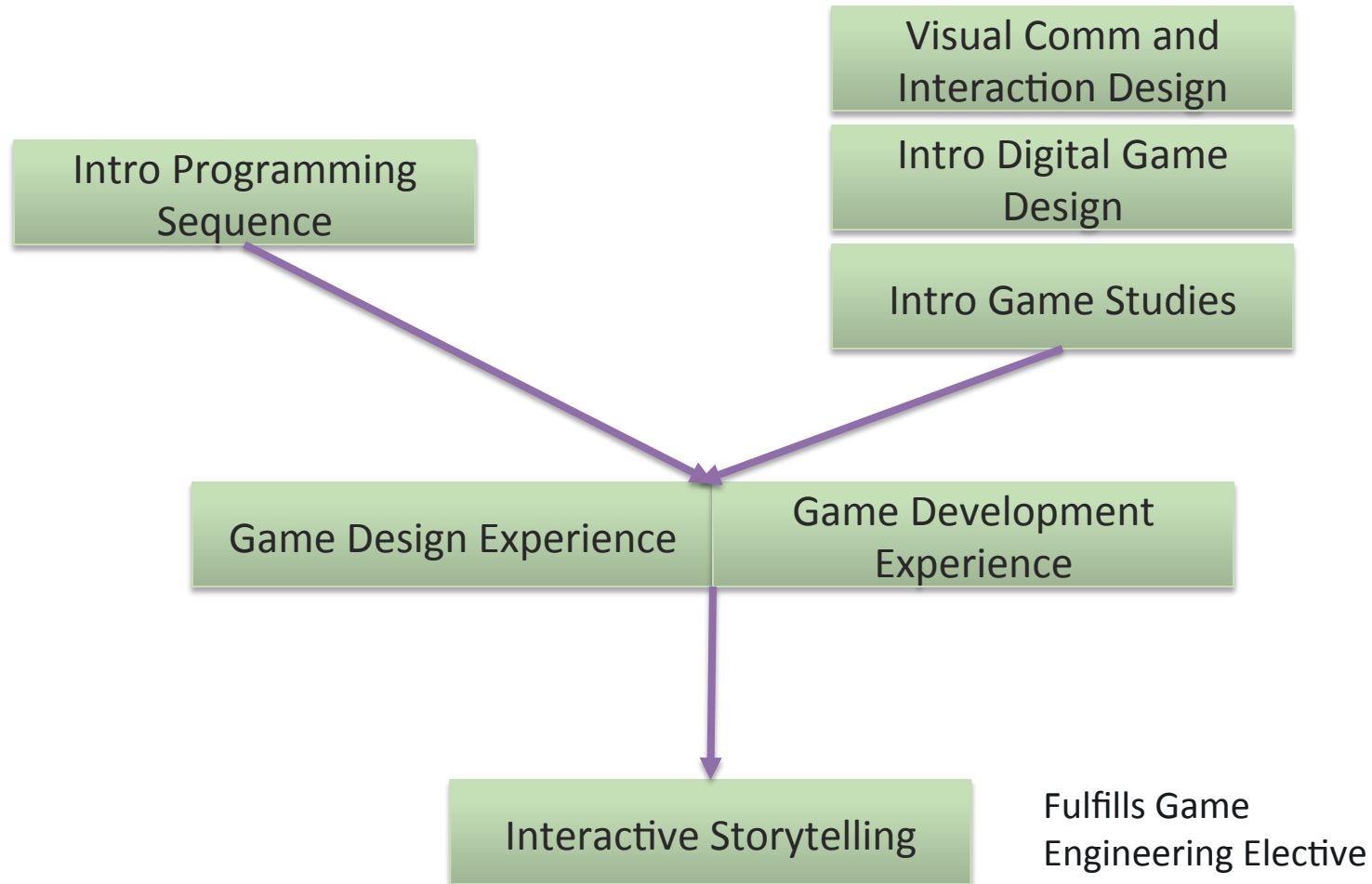


CM 148: Interactive Storytelling

- Introduce game vs. story dilemma and procedural storytelling approaches
- 10 weeks long
- Upper division elective (typically juniors and seniors)
 - B.S. Computer Game Design
 - B.A. Games and Playable Media

<https://canvas.ucsc.edu/courses/6862>

Location in curriculum



Overview of Syllabus

- Theory and analysis
 - What is story?
 - What is interaction?
 - Games vs. story
- Procedural approaches to storytelling
 - Inform 7 project
 - Story grammars with Tracery
 - Social simulation with Ensemble

Story vs. Game Debate Still Alive



Video Games Are Better Without Stories
Ian Bogost, April 25, 2017, *Atlantic Monthly*

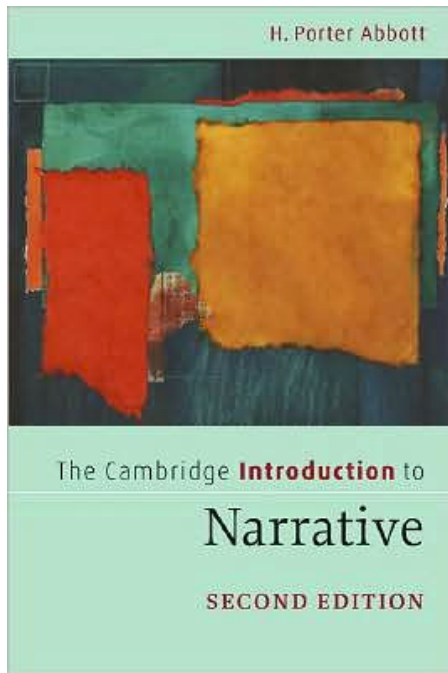


The unique power of emergent storytelling. Simon Parkin, Feb. 27, 2017, *Gamasutra*

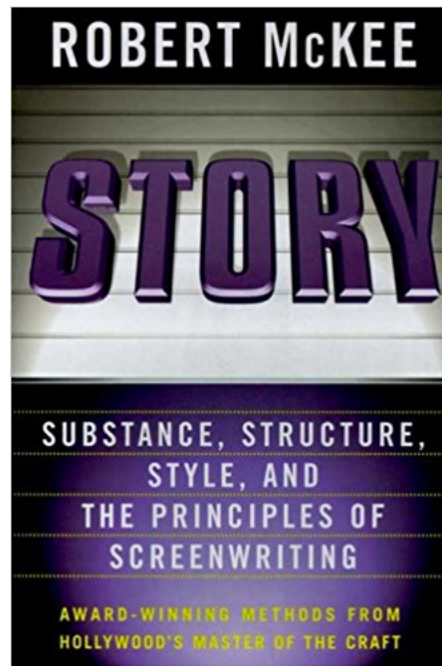


Story – What is it Good For?
Thomas Grip, May 4, 2017, *Frictional Games Blog*

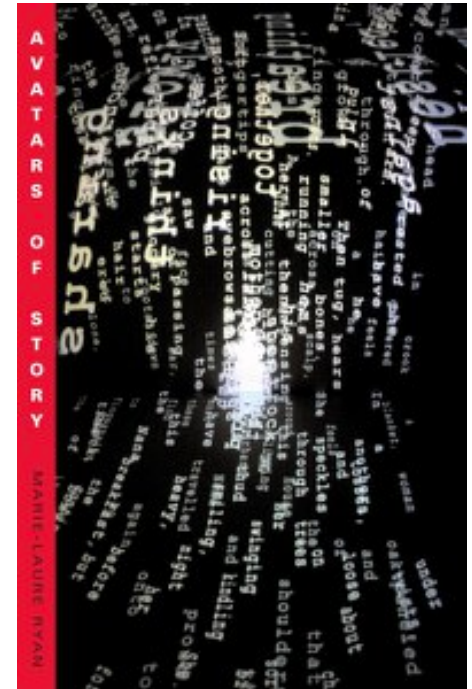
What is story?



Narratology



Dramatic structure



Cognitive structure

Story Analysis Assignment



Story vs. Discourse

Characters and relationships

Player relationship to focalizer

Major events in diegetic universe vs. discourse

Which events happen during play vs. outside of play

Story Analysis Assignment



Dramatic Storytelling

What type of plot and why

Protagonist, object of desire, and conflict

Climax, dependence on player activity, protagonist resolution

What is the story value and does the value change during play

Story Analysis Assignment



Narrative Dimensions

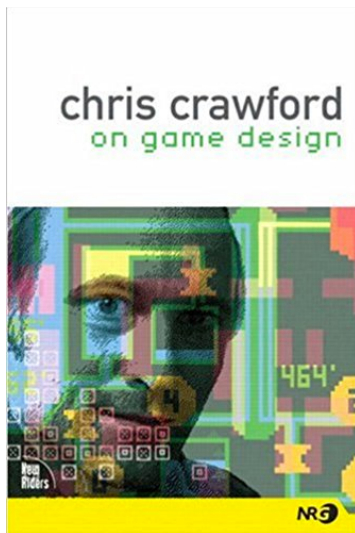
Spatial

Temporal

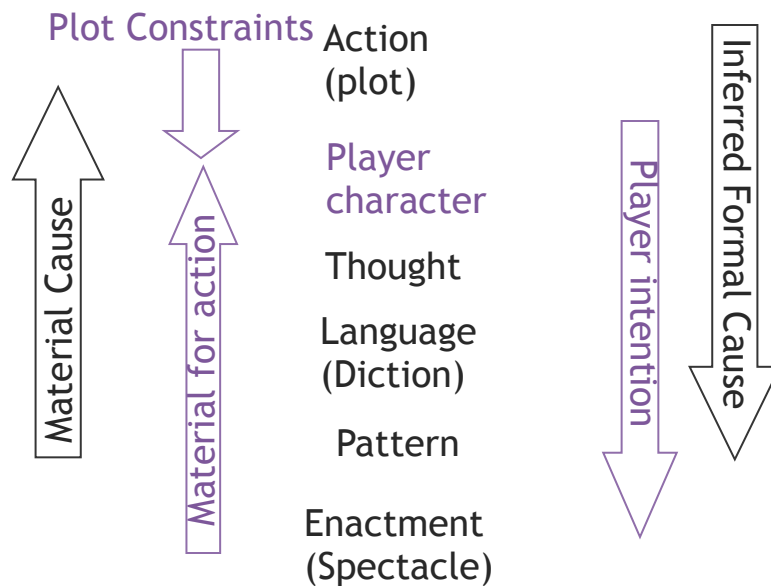
Mental

Formal and pragmatic

What is Interaction?

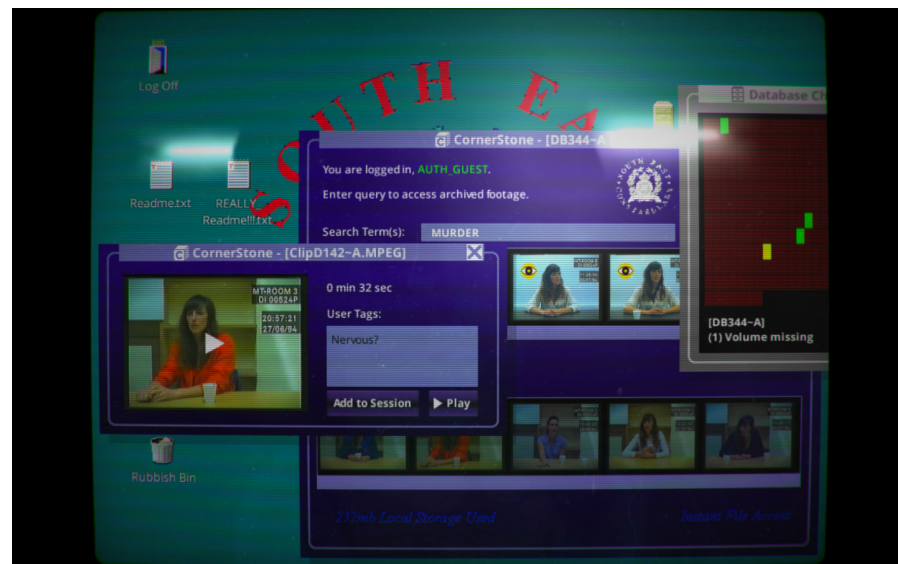


Process Intensity
Conversational Metaphor



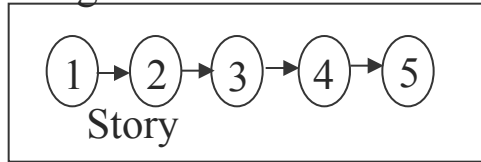
Agency

Mechanical vs. Psychological



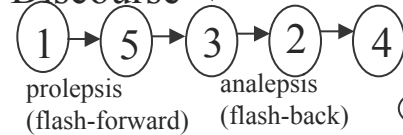
Game vs. Story

Diegetic universe



Focalization

Discourse



Interpretation



Game universe



Interpretation
Configuration
(goals)

≠

Introduction to Ludology

Incompatibility of Games and Stories

Beyond Myth and Metaphor: The Case of Narrative in Digital Media - Marie-Laure Ryan

A Narrative Theory of Games - Espen Aarseth

Locus of Control and Effect on World

Variation in Narratological Categories

Interaction & Game/Story Analysis Assignment



Mechanical Properties & Agency

Listen → Think → Speak loop

Procedural and Instantial Elements

Material and Formal Affordances

Interaction & Game/Story Analysis Assignment



Game vs. Story

Manipulation and goal rules

Locus of control & ontological/exploratory effect

Narrative/Ludic spectrum for narratological categories

First Half of Class

- Provide students with lenses for moving beyond opinion
- Motivate and position procedural approaches
- Take home midterm

Inform 7 Project

Go!

Replay

Release

Q

Source

Translation succeeded: 10 rooms, 1 thing

Story started at 14:41

Q

Documentation

Contents

Source

Contents

Actions

Kinds

Phrasebook

Rules

Scenes

World

"1691"

Fort James is a room. "The enclosure of Fort James is a large, roughly hexagonal court walled with heavy stone. The walls face the entrance to Port Royal Harbour, and the battery of guns is prepared to destroy any enemy ship arriving."

[Unless we arrange otherwise, this will be the first room in the game because it is the first we have defined.]

[For subsequent rooms, we do not have to say explicitly that they are rooms, as long as they are connected to a room on the map. For instance, this will automatically make Thames Street End a room:]

Thames Street End is south of Fort James. "The ill-named Thames Street runs from here -- at the point of the peninsula -- all the way east among houses and shops, through the Fish Market, edging by the round front of Fort Carlisle, to the point where the town stops and there is only sandy spit beyond. Lime Street, wider and healthier but not as rich, runs directly south, and to the north the road opens up into the courtyard of Fort James."

Water Lane is east of Thames Street End. "Here Thames Street -- never very straight -- goes steeply southeast for a portion before continuing more directly to the east."

Water Lane runs south toward Queen Street, and facing onto it is the New Prison -- which, in the way of these things, is neither. It did serve in that capacity for a time, and in a measure of the villainy which has been usual in Port Royal from its earliest days, it is nearly the largest building in the town."

[If we have some concern that the room name will be confused with an existing name, we can be more explicit about it using "called":]

East of Water Lane is a room called Thames Street at the Wherry Bridge. Thames Street at the Wherry Bridge has the description "To the southwest is the fishmarket; directly across the street is the entrance to a private alley through a brick archway."

The Private Alley is south of Thames Street at the Wherry Bridge. "You're just outside the tavern the Feathers. To the north, under a pretty little archway, is the active mayhem of Thames Street, but the alley narrows down to a dead end a little distance to the south."

[And now we get "inside", which generates a space treated as its own area on the map.]

The Feathers is inside from the Private Alley. "Newly built with brick, replacing the older Feathers tavern that used to stand here. It sells wines in quantity, as well as serving them directly, and the goods are always of the best quality. There's a room upstairs for those wanting to stay the night." The Feathers Bedroom is above the Feathers.

[And if we like we can declare a number of rooms for which we will come back and write the descriptions later. There is no obligation for the first description to occur at the first definition of the room.]

Lime Street is south of Thames Street End.

[For efficiency, we can also write multiple sets of connections at once:]

Queen Street East is east of Queen Street Middle and south of Private Alley.

[Clicking Go will translate this description into a sketchy but working simulation of Port Royal, in which we can type movement commands like EAST or SOUTH to explore the streets. Looking at the World tab of the Index, we can also see a schematic map of the simulation as it currently stands. Like the rest of the Index, this is provided entirely for the author's benefit, and is not visible to the player. (Though if we do decide that we want players to have access to a printed map while they play, Inform can help: we will return to the layout of Port Royal in the chapter on Publishing.)]

1 Mp

2 Gz

World Index

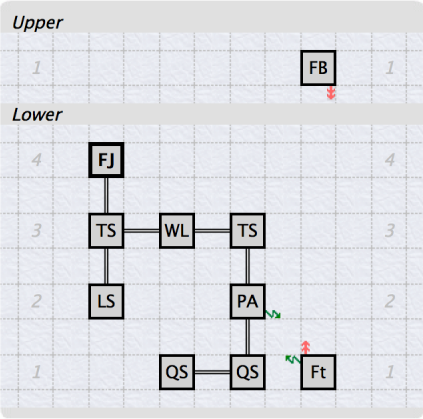
Like locations, props and actors in a movie

1 Mp

Map — A map of the world

Upper

Lower





Fort James – room where play begins

yourself – person



Thames Street End



Water Lane



Thames Street at the Wherry Bridge

Source

Results

Testing

Index

Documentation

Extensions

Settings

Source

Results

Story

Testing

Index

Documentation

Extensions

Settings

Why Inform 7

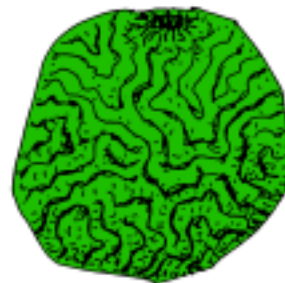
- Rules-based approach to world simulation
- Focus on story structure and NPC interaction
- Accessible to a range of backgrounds

Motivating Examples

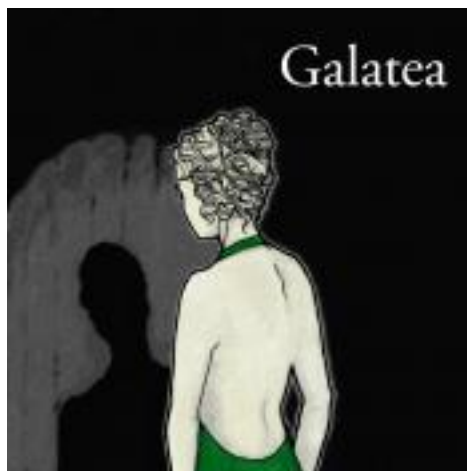
Photopia



MAP
by Ade McT



LIME ERGOT



Design Document

- Story arc
- Player character role
- Locations
- Significant objects
- NPCs
- Player interaction and story structure

Example: *Invasive Thoughts*

>look

Memory of the Crime Scene

You enter the Brain Control Room and gain control to Evan's Mind. On the screen in front of you, you can see his most recent memory; the Crime Scene.

You remember the victim, [Lack of Detail]. You didn't get a glimpse of the killer's face, but you remember he was wearing a [Lack of Detail].

Memory of Work on the Day of the crime is west of here.

>w

...

Memory of Gabriel on Invasive Thoughts

Gabriel [Verb Orb - Anger] the McPhearson group for inventing the Invasive Thought machine. He said it can easily be used to [Verb Orb - Exploiting] people by making them [Verb Orb - forgetting].

Memory of Gabriel confiding is south of here. Memory of Gabriel's Talents is west of here.

>take exploiting

...

>place helping

...

>look

Memory of Gabriel on Invasive Thoughts

Gabriel [Verb Orb - Anger] the McPhearson group for inventing the Invasive Thought machine. He said it can easily be used to [Verb Orb - Helping] people by making them [Verb Orb - forgetting].

Memory of Gabriel confiding is south of here. Memory of Gabriel's Talents is west of here.

Example: *Method Actor 2000*

Backyard

It looks like your mom has been doing a good job of keeping the weeds at bay in your absence. Although you can't claim to be an expert gardener, you dabbled in some weed pulling, back in the day. Maybe if you end up getting fired, you'll be able to make a living doing chores around the house...

In the middle of your mother's garden lies a gopher hole, undoubtedly causing your dear sweet mother no end of grief... You can also see a Hose and a Spigot here.

>put hose in hole

>turn on spigot

The water pressure eventually forces the gopher to pop out of the ground in a comedic, cartoon-like fashion... You have gained a new transitive verb: "To Pressure".

>I
the things you have learned:

To Lift

To Pressure

...

Clyde, as the Reader, decides **To Woo** you as he says "Why should you try to do that?"

You think back to your script. Your next line is: *"Oh, I don't know, I guess I feel an obligation."* .

How do you plan on coloring it?

>to pressure

You say your line with the intention **To Pressure** Clyde with your whole heart.
the audience seems happier now.

Tracery – Grammar-Based Generative Text

My Grammar

login landscape json

```
{
  "origin":["[myPlace:#path#]#line#"],
  "line":["#mood.capitalize# and #mood#, the
#myPlace# was #mood# with #substance#",
"#nearby.capitalize# #myPlace.a# #move.ed#
through the #path#, filling me with #substance#"],
  "nearby":["beyond the #path#", "far away", "ahead",
"behind me"],
  "substance":["light", "reflections", "mist", "shadow",
"darkness", "brightness", "gaiety", "merriment"],
  "mood":["overcast", "alight", "clear", "darkened",
"blue", "shadowed", "illuminated", "silver", "cool",
"warm", "summer-warmed"],
  "path":["stream", "brook", "path", "ravine", "forest",
"fence", "stone wall"],
  "move":["spiral", "twirl", "curl", "dance", "twine",
"weave", "meander", "wander", "flow"]
}
```

expansion landscape summer-warmed, the fence was blue with shadow

origin

line

myPlace:#path# mood mood myPlace mood substance
fence summer-warmed and summer-warmed ,the fence was blue with shadow

origin 1 reroll step 1807691

Summer-warmed and summer-warmed, the fence was blue with shadow

tracery.io
Kate Compton

Uses of Tracery

Cheap Bots, Done Quick!

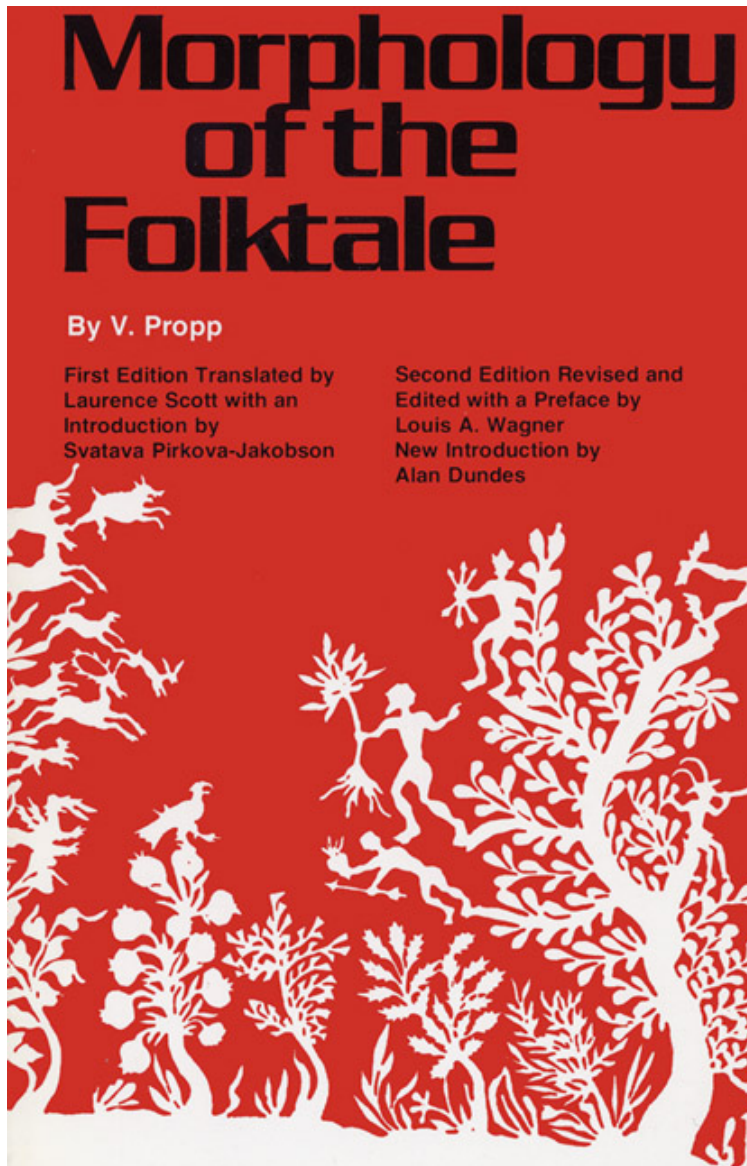
This site will help you make a Twitterbot! They're easy to make and free to run.

To use it, [create a Twitter account](#) for your bot to run under and then sign in below. The bots are written in [Tracery](#), a tool for writing generative grammars developed by [Kate Compton](#). This site is run by [George Buckenham](#) - he can be contacted at vtwentyone@gmail.com. You can support this site on [Patreon](#).

Nevercake caramel biscuits sprinkled with cashews	Walnut Butter Toast macademia nut butter on toast in the shape of a hawk
wine	Charcoal Pines Vinyard Syrah Forgotten, it is too late to reconcile with her. You can never kiss them again. You struggle against a tide of savory salt
Fallowfall Vines Frascati It smells of father's aftershave. Flavorful pear, with undertones of tobacco	Zeke's French Roast You are overpowered by juicy melon and you drown in a sea of fermented smoke. Served in a pile of discarded Kenia cums.
coffee	sections
Finn's Bold Roast All you can taste is loss and you remember the immateriality of all things. Served in a moka pot.	artisan toast
	dessert
	wine
	coffee
	actions

Generated recipes for a hipster restaurant management sim

Story Grammars – Start with Propp



A tsar, three daughters (α). The daughters go walking (β^3), overstay in the garden (δ^1). A dragon kidnaps them (A^1). A call for aid (B^1). Quest of three heroes ($C \uparrow$). Three battles with the dragon (H^1-I^1), rescue of the maidens (K^4). Return ($\downarrow$), reward (w°).

Examples of Proppian Morphemes

- An interdiction is addressed to the Hero
 - “you dare not look in this closet”
 - “Take care of your little brother. Do not venture from this courtyard.”
 - “Don’t pick up the golden feather.”
- The villain makes an attempt at reconnaissance
 - A bear says “What has become of the Tsar’s children?”
 - A priest during confession: “How were you able to get well so quickly?”
- The villain causes harm or injury to a member of the family
 - The villain abducts a person
 - The villain seizes or takes away a magical agent
 - The villain pillages or spoils the crops

Why Story Grammars

- In interactive storytelling circles, Propp commonly referenced by game designers and academics
- But the theory is underspecified and structurally far too simple to use directly
- Context free story grammars support analyzing points of variation (tropes) in a fully-specified, generative framework

In Class Exercise



Assignment

- Analyze a serial story to create an episode description generator for that story world
- Rubric
 - Coherence and progression
 - Detail (example of desired detail given)
 - Variation
 - Clever content reuse rewarded, but not required
- Grammars in the range of 30 – 100 lines tended to produce the desired level of detail and variation

Examples

My Grammar

login

landscape

json

```
{
  "name": ["Bob Newport", "Jeff Humphrey", "Ted Grups", "Henry Hendriks", "Greg Smith", "Larry Britain", "Jared Hopper"],
  "unassumingOccupationHouse": ["groundskeeper", "caretaker", "neighbor"],
  "unassumingOccupationMuseum": ["janitor", "curator", "professor"],
  "unassumingOccupationCarnival": ["caretaker", "performer", "employee"],
  "setMonster": ["[theMonster:Great Ghost][clue1: #ghostClue#][noise:#ghostlyNoises#][explainMonster: #explainGhostClue#]", "[theMonster:Deadly Phantom][clue1: #phantomClue#][noise:#ghostlyNoises#][explainMonster: #explainPhantomClue#]", "[theMonster:Horrible Ghoul][clue1: #ghoulClue#][noise:#monsterNoises#][explainMonster: #explainGhoulClue#]", "[theMonster:Hairy Monster][clue1: #monsterClue#][noise:#monsterNoises#][explainMonster: #explainMonsterClue#]", "[theMonster:Big Foot][clue1: #bigFootClue#][noise:#monsterNoises#][explainMonster: #explainBigFootClue#]", "[theMonster:Spooky Spectre][clue1: #spectreClue#][noise:#ghostlyNoises#][explainMonster: #explainSpectreClue#]", "[theMonster:Headless Man][clue1: #headlessClue#][noise:#manNoises#][explainMonster: #explainHeadlessClue#]",
  "ghostClue": ["balloons and a helium tank"],
  "phantomClue": ["magic trick tools"],
  "ghoulClue": ["magic trick tools"],
  "spectreClue": ["magic trick tools"],
  "headlessClue": ["magic trick tools"],
  "monsterClue": ["magic trick tools"]
}
```

expansion
Meanwhile, Daphne and Fred walk cautiously around the carnival. 'This place is pretty creepy, Fred' Daphne says. 'We just have to stick together', says Fred.

clueRoom
Eventually, they find the back shed. 'Look,' says Daphne, 'It's a carnival ride part' 'Thats definitely a clue' says Fred.

reunite

clue2
While inspecting the carnival ride part, they hear sound scared yelling. 'whats that?' asks Fred.

bumpInto

'It must be Velma, Shaggy and Scooby!' says Daphne. Suddenly, Velma, Shaggy and Scooby crash into them. 'You were right!' says Fred.

Now that the gang has reunited, they compare the clues they've found. 'I think I know what's going on here,' says Fred. 'But first we have to capture that

theMonster

Great Ghost
' says Velma. 'You're right,' Fred agrees, 'And I have a plan to catch him' Together, the gang helps Fred build a

trap

theMonster
contraption full of ropes and pulleys to capture the Great Ghost. 'The last peice to this trap is luring the Great Ghost

origin

1

reroll

step

9792706

The gang was driving to a concert when the engine started making a wierd noise, so the gang pulled over to have a look. Shaggy and Scooby go to find a bathroom. From out of the shadows, a ghost rushes toward them. 'Zoinks!', Shaggy screams! Shaggy and Scooby run back to tell the gang. The gang goes to check out what they saw, but the ghost wasn't there! Suddenly the Great Ghost appears, seemingly out of no where! The gang quilcky finds a hiding spot. 'You were right Shaggy! There's definitely something creepy going on here!' Scooby sniffs something out on the ground. 'What you got there Scoob?' Fred asks. 'its a carnival prize!' says Daphne. 'That settles it,' Fred says. 'We have got to check out that carnival'. The gang heads off to the carnival, but when they get there, all the lights are off. 'Maybe it's closed?' Vlema suggests. Suddenly the lights on all the rides turn on at once. 'We should split up and look for clues,' says Fred. While Velma, Shaggy and Scooby are walking around the carnival, They hear a ghostly scream comming from the back of the room. 'like, what was that?' says Shaggy. Suddenly the Great Ghost appears! 'it really is real!' Velma says as they run and hide behind a box. The Great Ghost uncovers the hiding place, but Shaggy quickly hands the Great Ghost a sandwich. They run away as the Great

Ensemble: Social Simulation Assignment

Ensemble Tool

Console

Social Record Viewer

Rules Viewer

Rules Editor

Commands: [set](#) • [unset](#) • [volitions](#) • [next](#) • [show](#) • [actions](#) • [doAction](#)

> [volitions\(hero\)](#)

hero has more volition (+6) to increase strength	Because: Weak people desire strength (3) Everyone Desires Strength (3)	hero would accept (6), because: Weak people desire strength (3) Everyone Desires Strength (3)
hero has more volition (+6) to increase intelligence	Because: Everyone desires intelligence (3) Unlearned people desire more intelligence (3)	hero would accept (6), because: Everyone desires intelligence (3) Unlearned people desire more intelligence (3)

> [volitions\(hero,love\)](#)

hero has more volition (+10) to increase closeness for love	Because: The hero REALLY wants to increase closeness to the love (10)	love would accept (5), because: New Volition Rule (5)
hero has more volition (+5) to increase closeness for love	Because: New Volition Rule (5)	love would accept (5), because: New Volition Rule (5)

> [volitions\(hero,rival\)](#)

hero has more volition (+5) to increase closeness for rival	Because: New Volition Rule (5)	rival would accept (5), because: New Volition Rule (5)
hero has less volition (-10) to increase closeness for rival	Because: The hero doesn't particularly want to get closer to the rival (-10)	rival would accept (5), because: New Volition Rule (5)

New Schema

Load Schema

ACTIVE SCHEMA

feeling actionable, directed, numeric 0-->100 (default 0)
closeness • attraction

attribute actionable, undirected, numeric 0-->100 (default 0)
strength • intelligence

trait undirected, boolean
named hero • named love • named rival • anyone

socialRecordLabel directed, boolean, single turn
romantic-failure • romantic-advance

socialRecordLabelUndirected undirected, boolean, single turn
self-involved • selfless • self-improvement-failure

mood undirected, boolean, duration 5
confident • unsure • embarrassed

+ New

ACTIONS

studyMath studyAnatomy
weightLiftSuccess weightLiftFail
pushup1 kissSuccess kissFail
writeLoveNoteAccept
writeLoveNoteReject

CHARACTERS

Hero Love Rival

Rules + Utility Approach to Social Sim



A Family Supper

Dinner with the Quinns



The first course is ready laid out on the table, with salmon at one end and a dish of turbot at the other, together with a dish of macaroni, muffin pudding, and larded sweetbreads.

Elizabeth is at the Quinn dinner table, with their other guests.

The meal has only just begun, but a curious sort of unease hangs over the room; a sense of apprehension whose source she cannot identify.

New objective: Make an impression on your dining companions

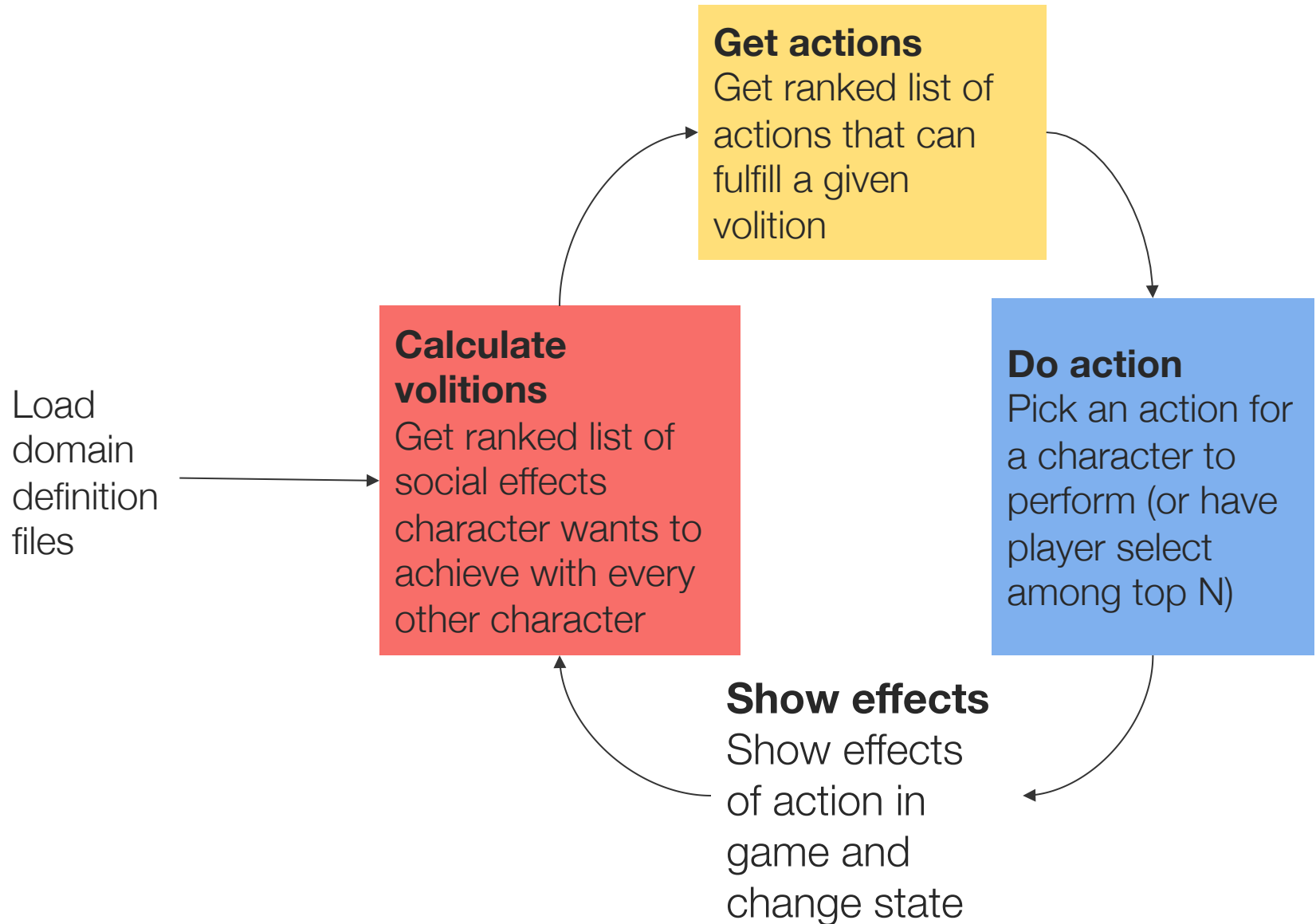
Brown (to Mr Quinn): This will interest you, I know! I have begun work on a new poetic composition. It is to be an epic, and it concerns a young man who is entitled to a fortune, but who is generally believed to be a bastard, due to the lies of his father.



Act Now

More

Ensemble Decision Cycle



Ensemble Assignment

- Assignment rather than project
- Modify an existing simple “dating sim” domain
- Walk students through details of
 - Experimenting to determine sequences of social actions necessary to achieve different social goals
 - Add trigger and volition rules to address unhandled aspects of domain (moods, social record labels)
 - Verify that unachievable social goal at beginning of assignment is now achievable

Review Course Structure

- Theory and analysis
 - What is story?
 - What is interaction?
 - Games vs. story
- Procedural approaches to storytelling
 - Inform 7 project
 - Story grammars with Tracery
 - Social simulation with Ensemble

Thanks!