CE810 - Game Design 2

Procedural Generation

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Question
What do we mean by procedural generation?

The act of **creating** content for games using **algorithms** as opposed to being **hand-crafted** by a human creator.
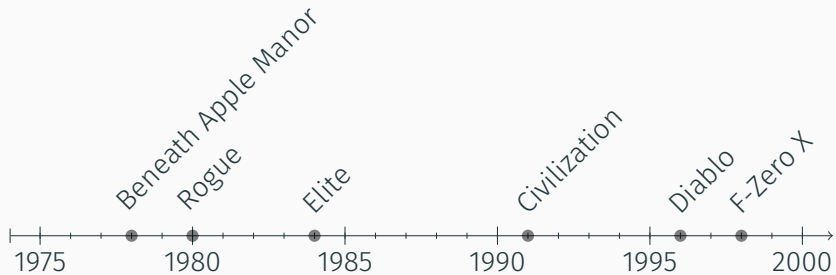
- Far too broad an area for a single lecture
- we'll try it anyway…
- Used in lots of modern (and old school) games
- When done well can add to a game

ok… maybe not that one.
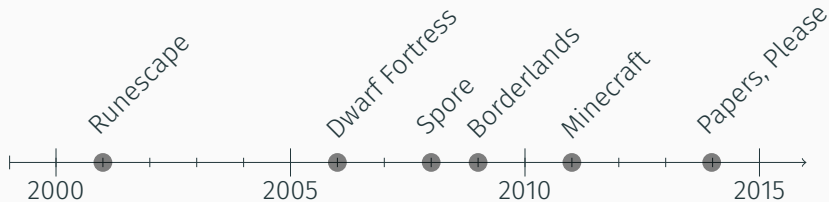
A timeline from 1975 to 2000 marking: Beneath Apple Manor (~1978), Rogue (~1980), Elite (~1984), Civilization (~1991), Diablo (~1996), F-Zero X (~1998).
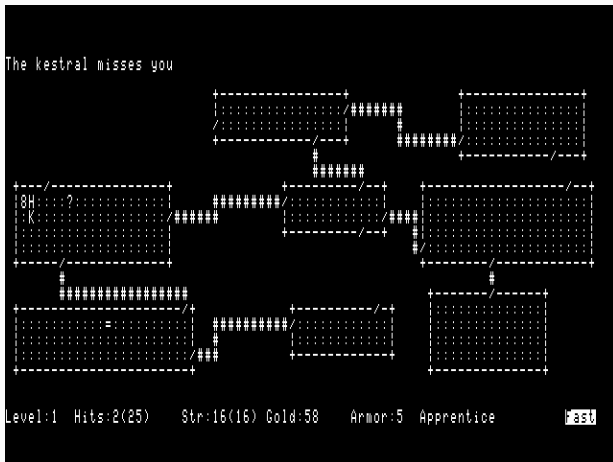
One of the most common uses for procedural generation is levels

Level Generation

Rogue

- Spawned an entire genre based on procedural generation.
- Randomly generated dungeons

Activity

Question
What methods are commonly used for generating levels?

- Binary Space Partitioning
- Random walks
- Cellular Automata
- Answer Set Programming
- Noise-based
- Grid Based

Cellular Automata

- Some states (2 or more)
- You need a rule (eg, if at least 4 of your neighbours are alive, then return alive, else return dead.)

```python
for tile in grid:
        neighbors = get_alive_neighbours(tile)
        grid[tile] = rule(neighbours)
```

Demo

- Split the map into blocks
- Pick (or generate) a template for each block
- Place template on grid

Examples: *UFO: Enemy Unknown*, *Spelunky*

- Generate noise (usually gradient Noise)
- Interpret noise as values
- Place template on grid

Examples: *The Dwarves of Glistenveld, Minecraft*

Assets

- Mostly game specific
- Not as much available publicly about how these are done.

- Used widely by games and film industry
- Mixed procedural generation and hand-crafted

A bit like this...

- Randomly generated weapons
- Over 17,750,000 different combinations
- Lots of properties which determines effects

- Generate Weapons based on particle systems
- Based on NEAT evolutionary algorithm
- Choices based on what the player does
- Adapt to the player's experience based on usage

Demo on their website

- Procedural generated people with procedurally generated documents
- Gameplay dependant on unpredictability
- Hand crafted story elements

Full Games

- Evolve rulesets for a given environment
- Uses learnability as predictor of fun

- What about games?
- We can try and generate those to
- Try to evolve games that need skill
- http://www.gamesbyangelina.org/games/