Artificial Intelligence in The Sims series

Yoann Bourse
Plan de la présentation

1. The Game
2. Pathfinding
3. Decision making
4. Social interactions
5. Evolution in the franchise
6. Prospects and conclusion
Introduction

Will Wright’s genius: Simulating life

Starting a new franchise

Numerous expansions set and item packs
User-created content

Sequels
What is The Sims

- Sandbox
- God game
- Life simulation

Released in February 2000
⇒ best selling PC game:
6.3 million then, 16 million now

One of the most influential AI

The player controls the life of a family of sims
Player vs. AI

The player:
- Design characters
- Design buildings
- Give order to his characters

The computer:
- Controls game mechanics
- Controls non-played characters
- Elementary actions (pathfinding)
- Free will
Untill ordered otherwise, sims can survive by themselves (narrative aspect)

But not too well, otherwise no incentive to play
Presentation plan

1. Pathfinding
2. Decision making (smart objects)
3. Social interactions
Pathfinding

How does a sim go from A to B?
Pathfinding - Reminder : A*

In a graph, to go towards a goal, make the step towards the neighbour minimizing $d + h$

- $d$ being the **distance** to this neighbour
- $h$ an **underestimate** of the distance between this neighbour and the goal

An good underestimate is often the geometric distance ignoring obstacles
Pathfinding in the Sims: HPA*


**Idea**: Different level of detail: instead of working with waypoint, work first among groups of waypoints.

In the Sims:
- Shortest path at room level
- Divide the room into big chunks
- Divide the chunks into smaller chunks
- Smoothing
1. Room Graph
1. Room Graph
1. Room Graph

- bedroom
- bathroom
- living room
- kitchen
- outside

A*
HPA*
1. Room Graph
2. Multi-scale A*
2. Within a room: multi-scale A*
2. Within a room: multi-scale A*
2. Within a room: multi-scale A*
2. Within a room: multi-scale A*
Proof

Demonstration video:
http://www.youtube.com/watch?v=il-R4M-ylzo
Decision making

How does a sim take decisions without supervision?

HUNGRY

PUT DOWN PLATE OF FOOD TO COMPLAIN ABOUT BEING HUNGRY
Modeling human needs

8 basic needs evolving through time, under the influence of circumstances (sleeping? eating?):

**Physical**
- **Hunger** (eating)
- **Comfort** (sitting/laying down)
- **Hygiene** (bathing)
- **Bladder** (urinating)

**Mental**
- **Energy** (sleeping)
- **Fun** (playing)
- **Social** (interacting with others)
- **Room** (architecture, furniture)
The Game
Pathfinding
Decision making
Social interactions
Evolution in the franchise
Prospects and conclusion

Modeling human needs
Smart Objects
The Happyscape
Taking personalities into account

#### Need ⇒ Happiness

Different needs have **different impact on the mood**: 

*Being a little hungry is ok, but a great hunger will have a huge negative impact on mood.*
What to do?

⇒ the activity that can increase happiness the most!

Actually, we need not to be perfect:
Choose **randomly** amongst the **4 activities** providing the most happiness.
Improvement (the Sims 3)

Choose with a probability proportional to the happiness gain:

\[ p = e^{s/T} - 1 \]

Temperature/activity based on Maslow’s Hierarchy of Needs.
Smart Object paradigm

No logic in the sim ⇒ Logic in the **objects** (expandable!)

Inside an object (= 1 thread):
- Graphics/animation
- State
- Scripts (EDITH custom scripting language, in game editor)
- Advertising (what can it offer to the sim?)

Virtual objects (weather, conversations...)

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Object script

Example: the fridge

- Go to a counter
- Prepare the food
- Go to the stove
- Cook the food
- Go to the table (+ chair)
- Eat the food
- Go to the dishwasher
- Clean your plate
The Happyscape - Smart Terrain

1. Objects broadcast what they can offer
The Happyscape - Smart Terrain

2. Needs translated into happiness gain

- clean: +1 room => +1 happiness
- use: +2 hygiene => +1 happiness
- use: +2 hygiene => +3 happiness
- eat: +4 hunger => +2 happiness
- use: +3 bladder => +7 happiness
- use: +6 energy => +3 happiness
- use: +2 fun => +8 happiness

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The Happyscape - Smart Terrain

3. Pick randomly amongst the max

use : +2 fun => +8 happiness

use : +3 bladder => +7 happiness
Taking personalities into account

Maria Gonzales left SimCity because the mayor just couldn't keep crime levels low. She's much more happy in the suburbs and just got a new entry level job at a large corporation. She has no boyfriend right now but is looking. Now that she has time to study, she hopes to learn more about business.
Taking personalities into account

- Fun different between playful and serious people (pinball/chess)
- Outgoing people’s social need increase faster
- ...

Note: **distance** between the sim and the object is also taken into account by a small multiplicative factor
Social interactions

How do two sims interact with each other?
**Social interaction model**

- Based on a **relation score** between each two sims
- Score enables **different interactions**
- High-level automaton-like evolution
Social interaction model

- Actions have positive/negative effects depending on mood/personality/randomness
- Low-level rule-based mechanism

```
TryingToBe.Funny  ->  Neutral
TryingToBe.Funny  &&  Repetition  ->  Boring
TryingToBe.Funny  &&  LTR  <  -20  ->  Insulting
TryingToBe.Funny  &&  Target.GoodSenseOfHumor  ->  Funny
```
Evolution in the franchise

What changed between the versions?

Aging $\Rightarrow$ evolution of the whole town
Huge simulation: use different level of details
“Script” an average behaviour
The town has **underlying desires** (gender ratio, employment rate) and can satisfy them by **actions** (birth, death, get job...)

![Graph 1: Gender Balance (Male Sims / All Sims)](image1)

![Graph 2: Employment Rate (Adult)](image2)
Hierarchical planning:
Instead of considering all possible actions, choose a house, then choose an object, then choose an action.

Commodity-Interaction map:
Create one “smart-terrain” map per need.
Realistic simulation

New ”needs” according to personality, time...
Examples:
- Welcome and entertain guest
- Steal (kleptomaniacs)
- Embarass people (inappropriate sims)

Also affects the range of available actions
Post-Mortem

- **Pathfinding**: HDA*
  Moderate reactions: complaints about sims getting stuck
- **Decision making**: Smart Objects
- **Social interactions**: Automata and rules

Those two aspects created a **semi-autonomous groundbreaking AI** which allowed a light user control and the generation of narratives ("fishbowl")

- **Scaling up**: Level of detail
Prospects

Adaptation to the user:
Despite its user-centered experience, the Sims lacks user-based adaptation mechanisms

⇒ Reinforcement learning for babies?
| Questions | Thank you for listening | Yoann Bourse | Artificial Intelligence in The Sims series |
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