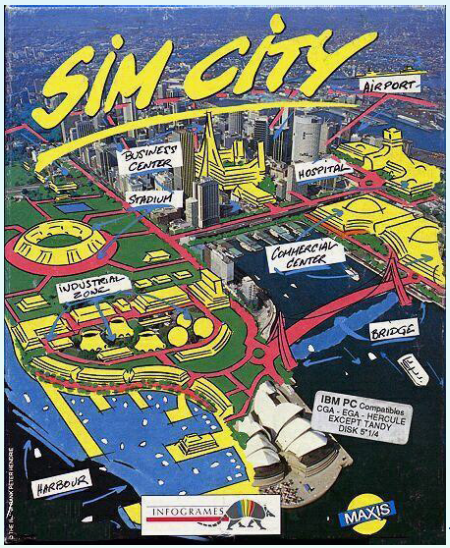
Artificial Intelligence in The Sims series

Yoann Bourse

Plan de la présentation

Introduction

Will Wright's genius : Simulating life



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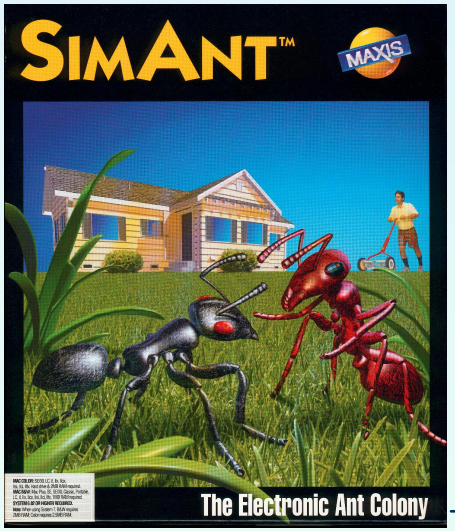

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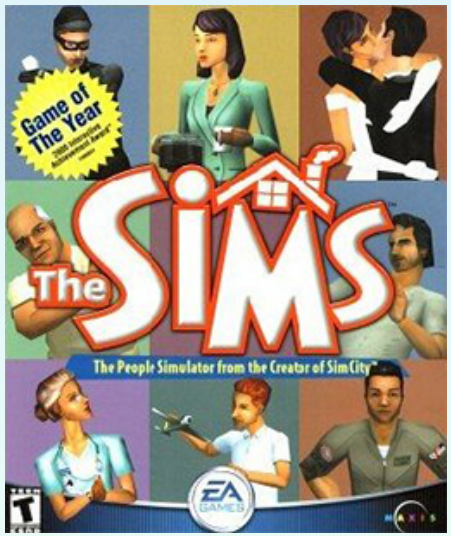


Simcity (1989) $\longrightarrow$ SimAnt (1991) $\longrightarrow$ The Sims (2000)

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
$\Rightarrow$ best selling PC game :
6.3 million then, 16 million now

One of the most influencial AI

The player controls the life of a family of sims

Player vs. AI

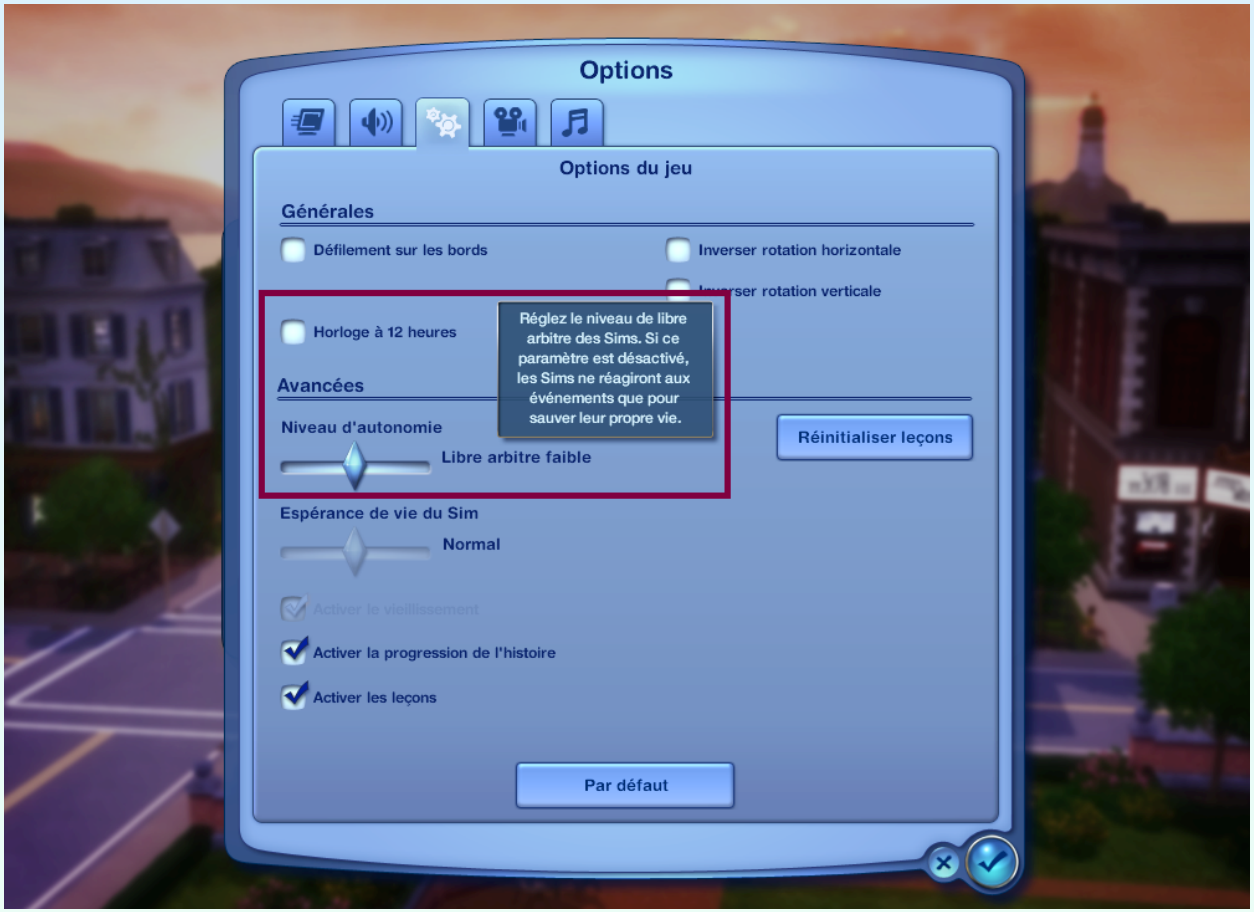
The player :

- Design characters
- Design buildings
- Give order to his characters

The computer :

- Controls game mechanics
- Controls non-played characters
- Elementary actions (pathfinding)
- Free will

The free will



Untill ordered otherwise, sims can survive by themselves (narrative aspect)

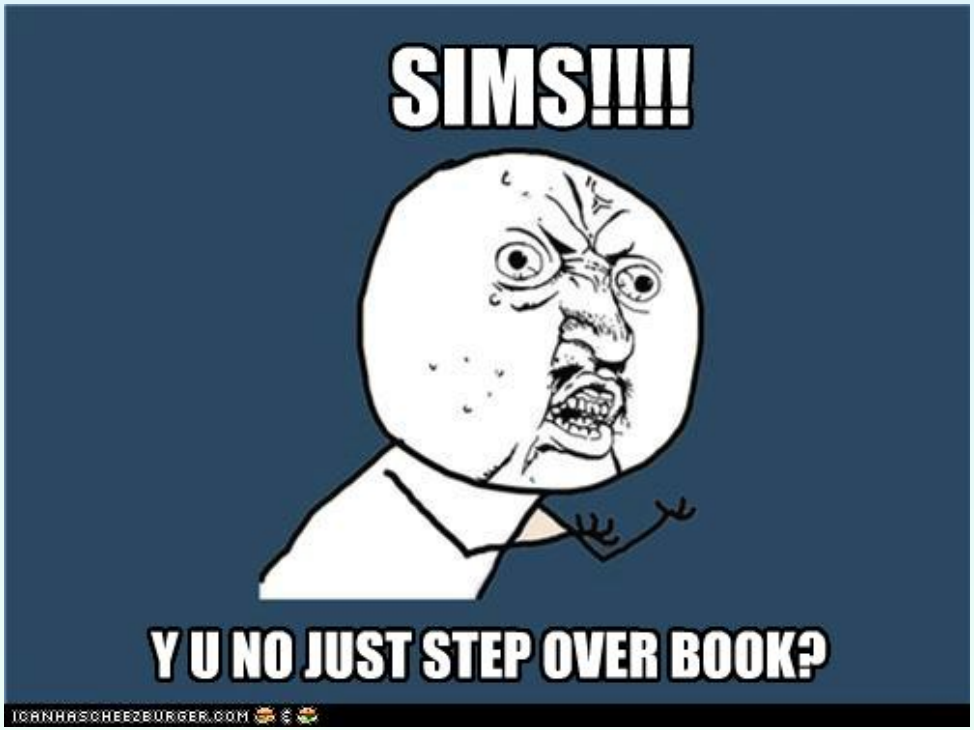
But not too well, otherwise no incentive to play

Presentation plan

1. Pathfinding
2. Decision making (smart objects)
3. Social interactions
4. Evolution of the series : controlling non-played characters.

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*

Most games adapt A* into **Hierarchical Pathfinding A*** (2004)
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

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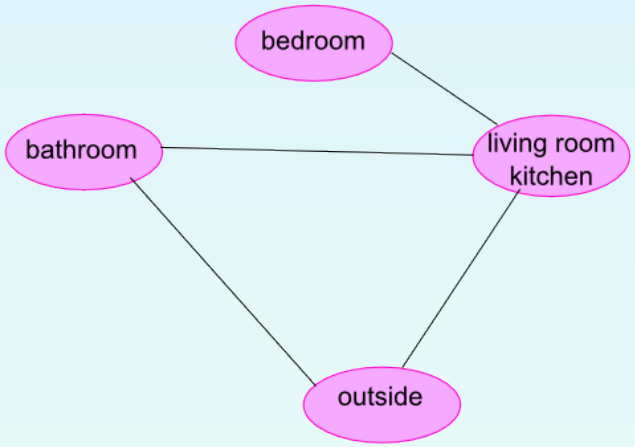
bedroom
bathroom
living room
kitchen
outside
35 m
Dim. 09:50
3 697 §

1. Room Graph



2. Within a room : multi-scale A*

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Proof

Demonstration video :
http ://www.youtube.com/watch ?v=iI-R4M-yIzo

Decision making

How does a sim take decisions without supervision ?

Modeling human needs

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

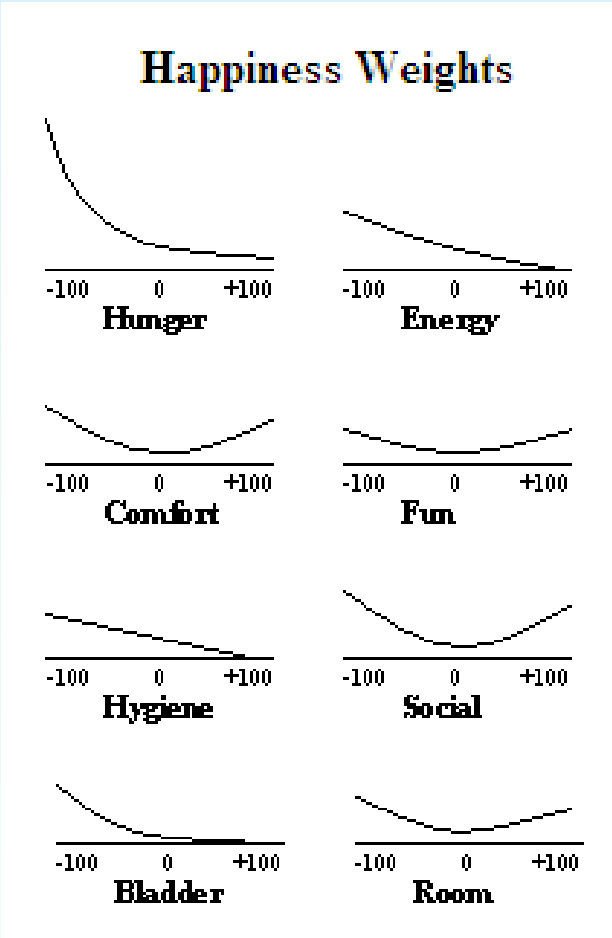
Physical

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

Mental

- **Energy** (sleeping)
- **Fun** (playing)
- **Social** (interacting with others)
- **Room** (architecture, furniture)

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.

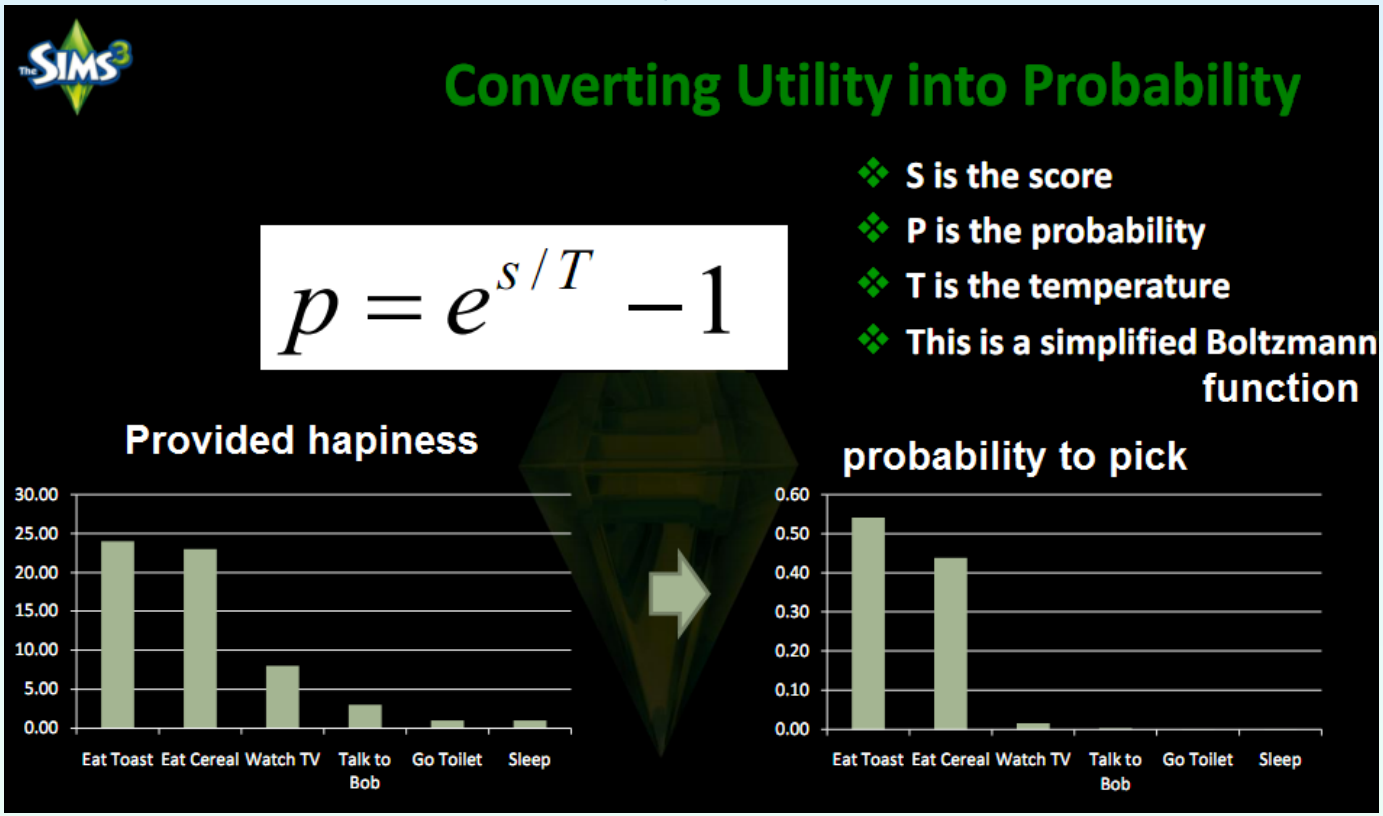
What to do ?

$\Rightarrow$ the activity that can increase happiness the most !

Actually, we need not to be perfect :
Choose **randomly** amongst the **4 activities** providing the most hapiness.

Improvement (the Sims 3)

Choose with a probability propotional to the hapiness gain :



Temperature/activity based on Maslow's Hierarchy of Needs.

Smart Object paradigm

No logic in the sim $\Rightarrow$ 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...)

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

The Happyscape - Smart Terrain

3. Pick randomly amongst the max

Taking personalities into account

Taking personalities into account

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

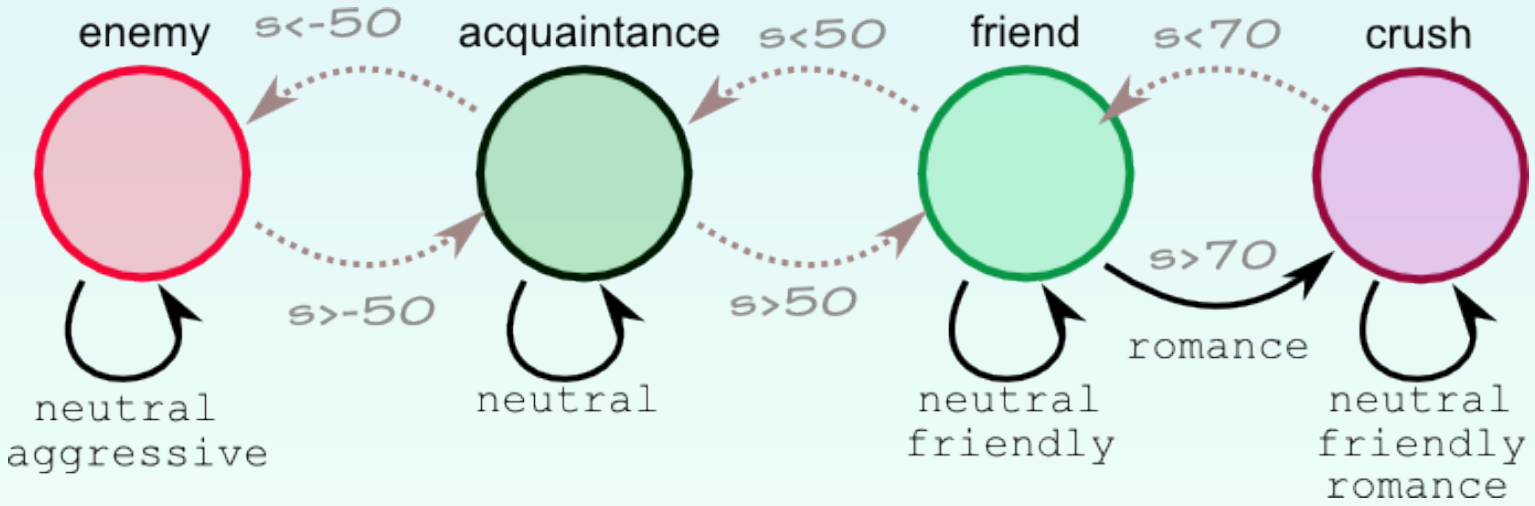
Note : **distance** between the sim and the object is also taken into account by a small multiplicative factor

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 mecanism

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

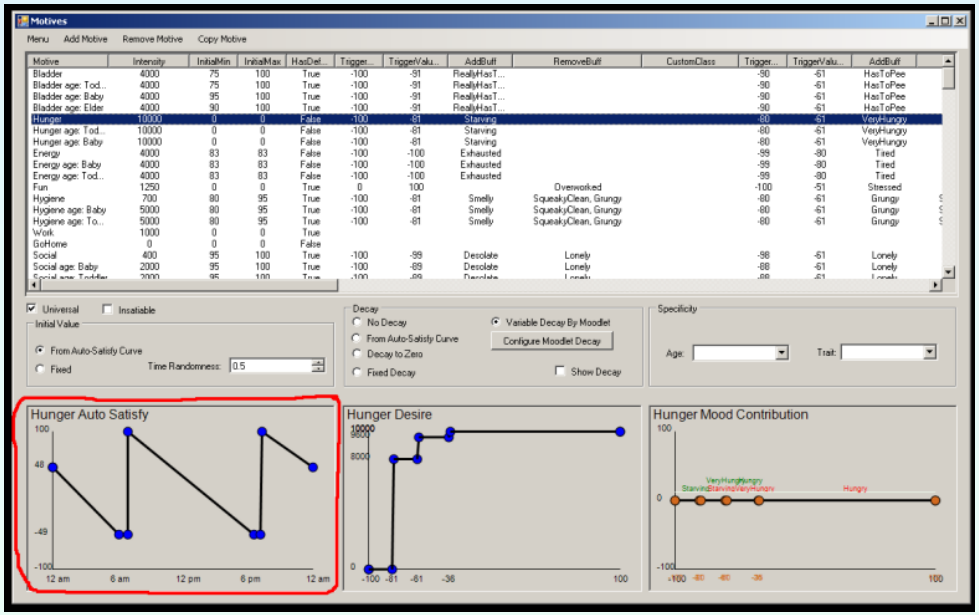
Evolution in the franchise

What changed between the versions ?

Aging $\Rightarrow$ evolution of the whole town

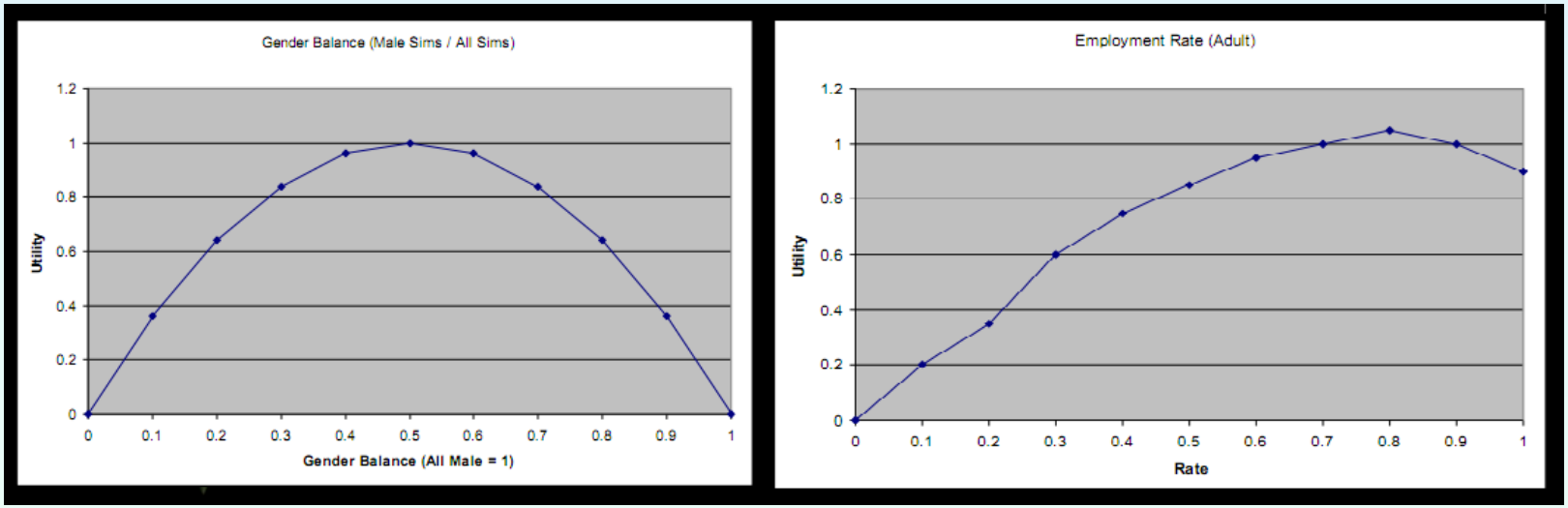
Level of detail

Huge simulation : use different **level of details**
"Script" an average behaviour



Town as an object

The town has **underlying desires** (gender ratio, employment rate) and can satisfy them by **actions** (birth, death, get job...)



Improvements

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.

Commodity	Interactions
Bladder	Use(ToiletStall) Use(ToiletStall) Use(ToiletStall) Use(ToiletStall)
Hunger	Have Refreshing Drink(BarModern) Have Refreshing Drink(BarModern) (FridgeDrawer) (FridgeDrawer)
Energy	Nap(ChairLivingDesigner) Nap(ChairLivingDesigner) Drink Delicious Half-Caf Chocolate Lite Frothiccino with Caramel Spri
Hygiene	Take Shower(ShowerLoft) Take Bath(BathtubModern) Take Delightful Bubble Bath(BathtubModern) Take Shower(Shower
Fun	Pump Iron(WorkoutBench) Dance(StereoExpensive) Turn On(StereoExpensive) Strength Training(StereoExpensive) Take

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 mecanisms

$\Rightarrow$ Reinforcement learning for babies ?

Questions

Thank you for listening

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