Game AI

An introduction course

BEFORE YOU BEGIN

What is a game AI?

A set of rules.

What is a game AI?

It is NOT intelligent!

What is the purpose of a Game AI?

Enhance the player experience.

What is the purpose of a Game AI?

It is NOT intelligent!

What is the goal?

Create a tool to challenge the player.

What is the goal?

It is NOT intelligent!

Before you begin

Know your game.

WHAT ROLE DOES IT PLAY?

AI as an NPC

- Doesn’t have the same motivation as the player

Examples:

- The guards patrolling the fortress
- The quest giver
- The goomba walking

Automated opponent

- Bots
- Sub-Human
- Has access to every information
- Can cheat
- Beatable

AI as a player

- External to the game environment
- Perceives the game as a player
- Same possible actions as the player
- It doesn’t cheat

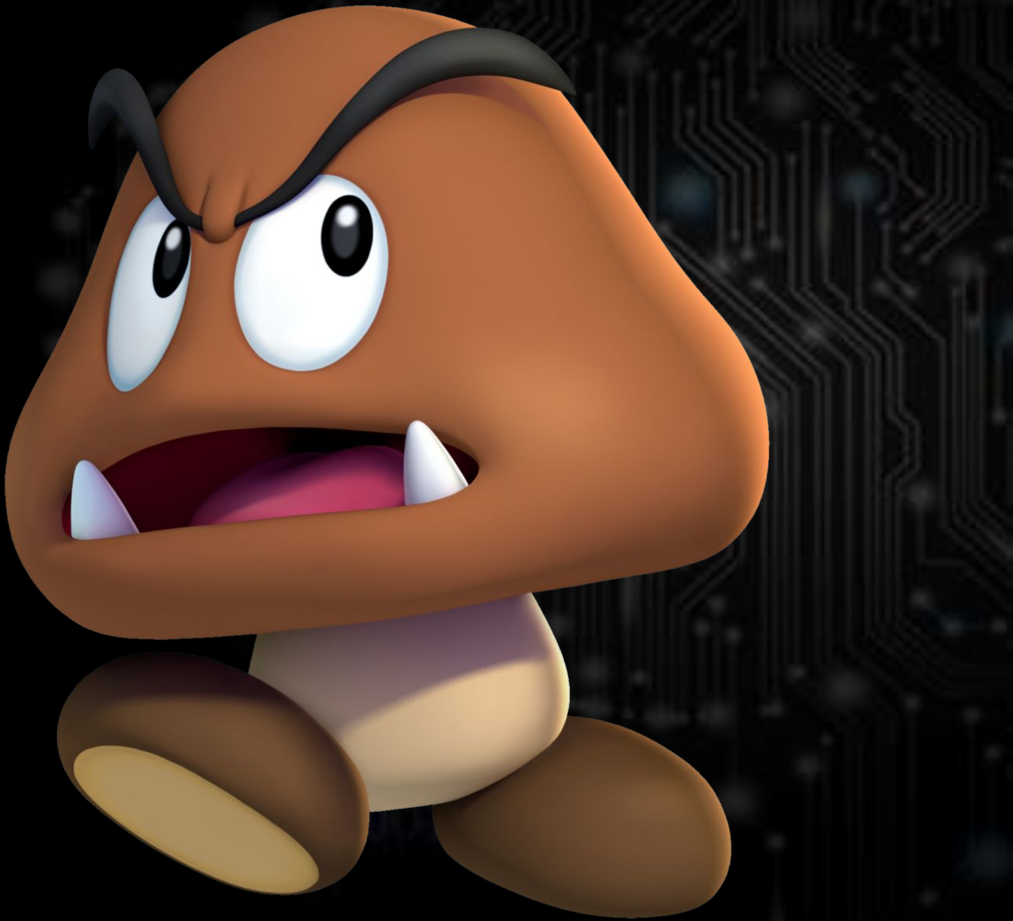
AI as a creator

- Used to control the game
- Content creation
- Scene management

TYPES OF AI

Rules-Based Systems

- Very simple set of rules
- Predictable for the player
- Easy to control by the designer.
- No decision-making
- **Doesn’t always take the player’s action in account**



Rules-Based Systems

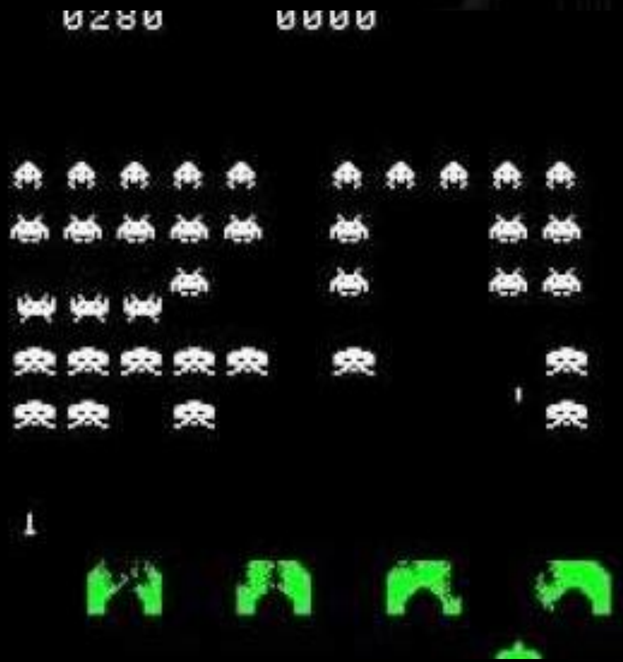
Pros

- Minimal set-up
- Very predictable for the player

Cons

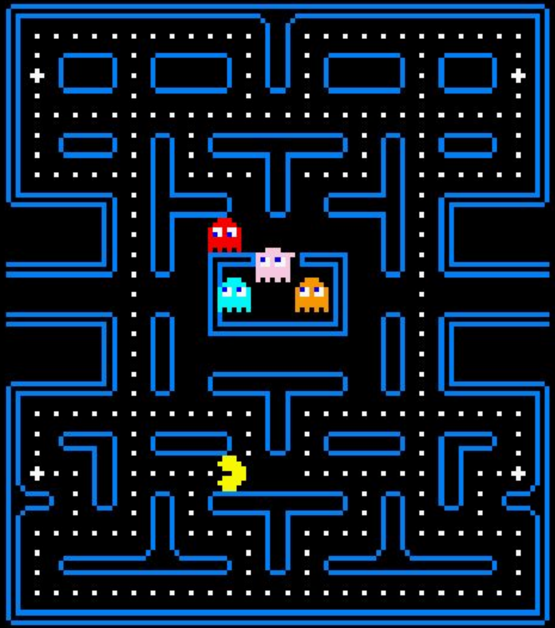
- Gets incredibly hard to adjust past the very basics
- Complex behavior is out of reach.

Game Example



Space Invaders (1978)

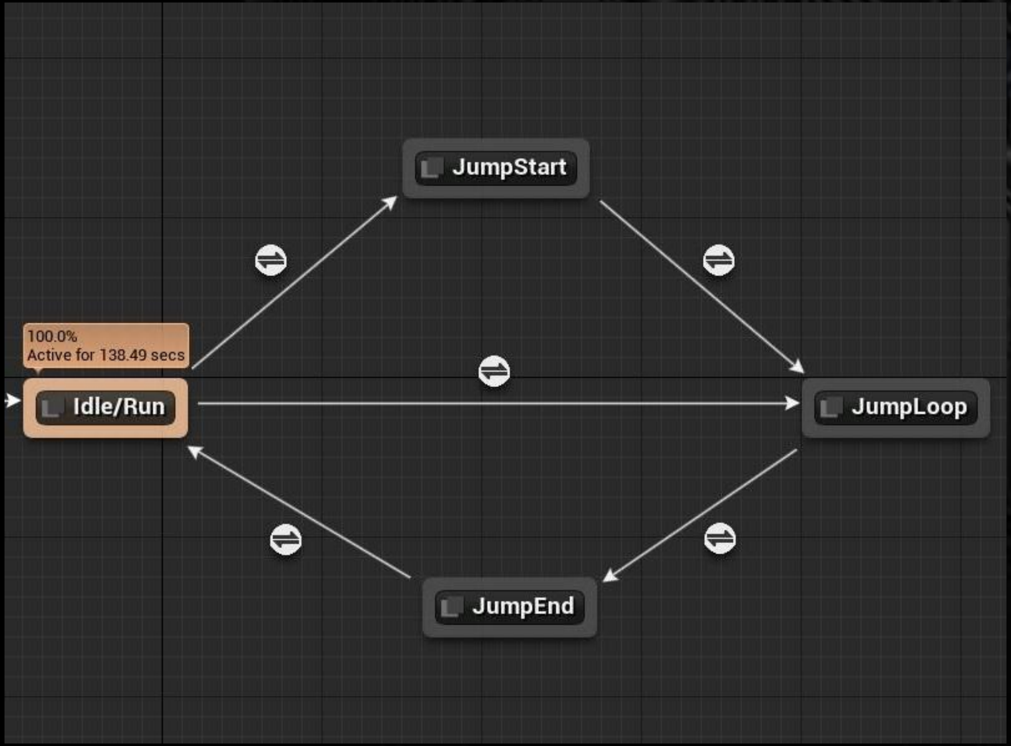
Game Example



Pac-Man (1982)

Finite State Machines

- States linked by logical transitions
- Conditions lead from one state to another
- Each state contains its own rules



Finite State Machines

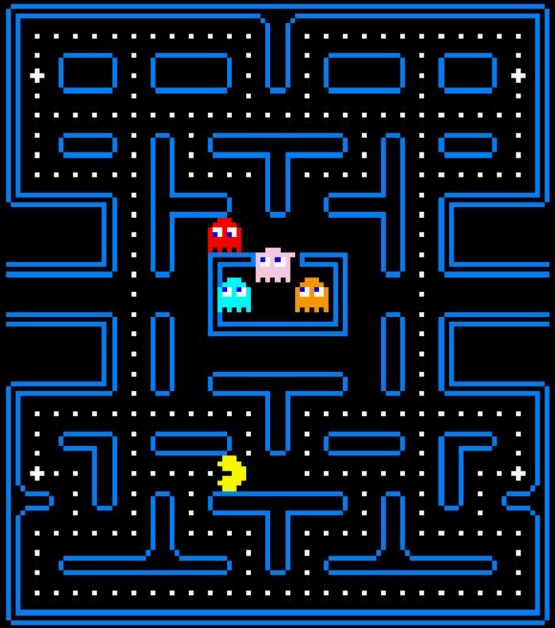
Pros

- Easy to understand and build

Cons

- Adding new states gets more and more troublesome

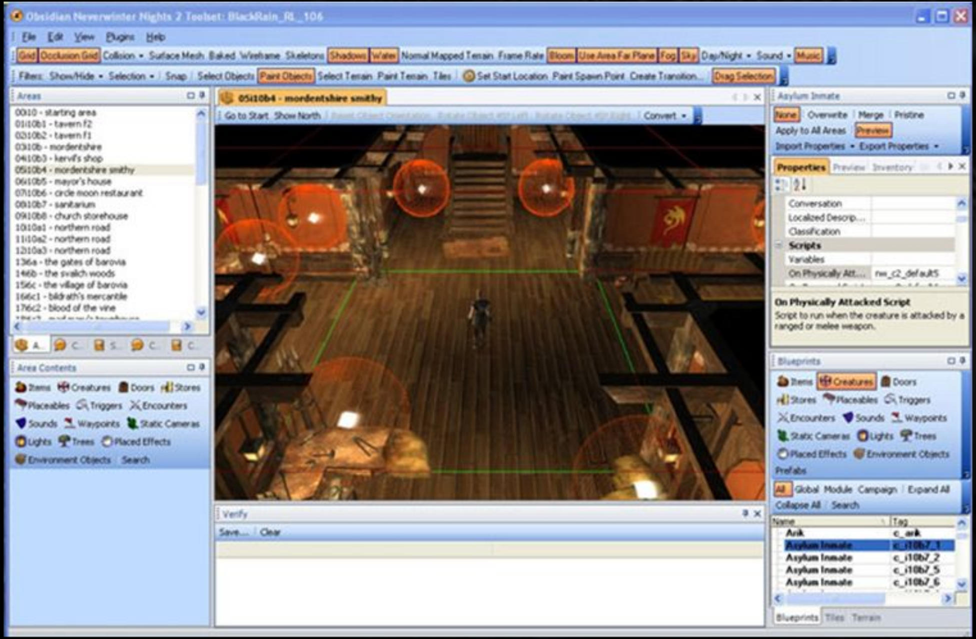
Game Example



Pac-Man (1982)

Scripting

- Scripting needs a triggers
- Plays a specific sequence of action
- A trigger is a simple condition
- There is only one trigger
- There can be a lot of actions in the sequence


Obsidian Neverwinter Nights 2 Toolset: BlackRain_RL_106
File Edit View Plugins Help
Grid Occlusion Grid Collision Surface Mesh Baked Wireframe Skeletons Shadows Water Normal Mapped Terrain Frame Rate Bloom Use Area Far Plane Fog Sky Day/Night Sound Music
Filters: Show/Hide Selection Snap Select Objects Paint Objects Select Terrain Paint Terrain Tiles Set Start Location Paint Spawn Point Create Transition... Drag Selection
Areas
05i10b4 - mordentshire smithy
Go to Start Show North Convert
Area Contents
Items Creatures Doors Stores Placeables Triggers Encounters Sounds Waypoints Static Cameras Lights Trees Placed Effects Environment Objects Search
Verify
Save... Clear
Asylum Inmate
None Overwrite Merge Pristine
Apply to All Areas Preview
Import Properties Export Properties
Properties Preview Inventory
Blueprints
Items Creatures Doors Stores Placeables Triggers Encounters Sounds Waypoints Static Cameras Lights Trees Placed Effects Environment Objects Prefabs
All Global Module Campaign Expand All Collapse All Search
Blueprints Tiles Terrain

00i10 - starting area
01i10b1 - tavern f2
02i10b2 - tavern f1
03i10b - mordentshire
04i10b3 - kervil's shop
05i10b4 - mordentshire smithy
06i10b5 - mayor's house
07i10b6 - circle moon restaurant
08i10b7 - sanitarium
09i10b8 - church storehouse
10i10a1 - northern road
11i10a2 - northern road
12i10a3 - northern road
13i6a - the gates of barovia
14i6b - the svalich woods
15i6c - the village of barovia
16i6c1 - bildrath's mercantile
17i6c2 - blood of the vine

Conversation	
Localized Descrip...	
Classification	
Scripts	
Variables	
On Physically Att...	nw_c2_default5

On Physically Attacked Script
Script to run when the creature is attacked by a ranged or melee weapon.

Name	Tag
Arik	c_arik
Asylum Inmate	c_i10b7_1
Asylum Inmate	c_i10b7_2
Asylum Inmate	c_i10b7_5
Asylum Inmate	c_i10b7_6

Scripting

Pros

- Highest level of control by the designer

Cons

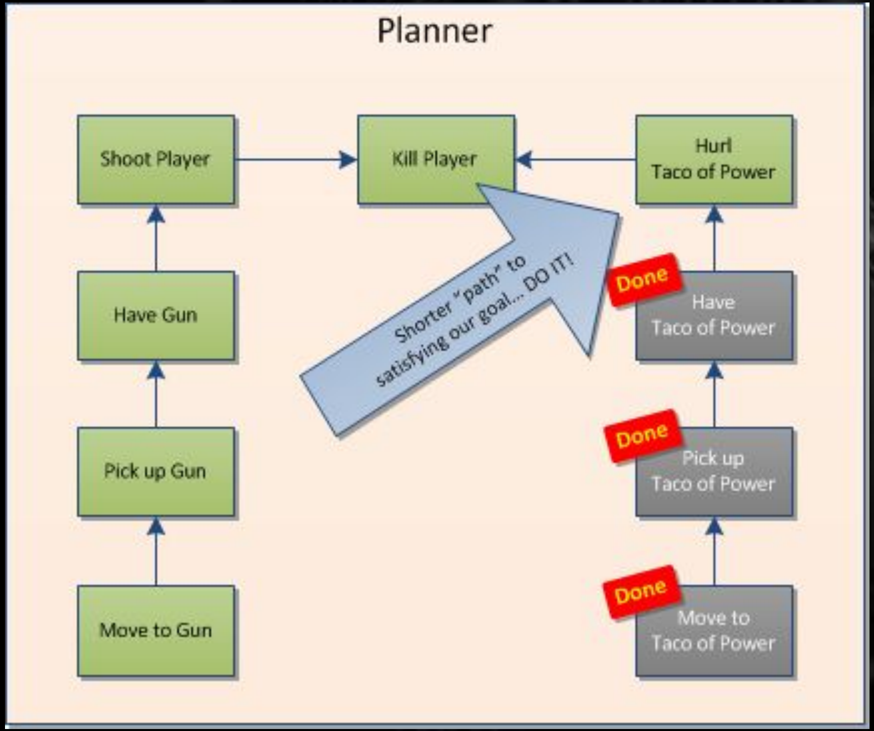
- No decision-making

Game Example

F.E.A.R (2005)

Planners

- Goal-Oriented
- Build a map of possible actions to reach the goal
- Choose the optimal path to the goal



Planners

Pros

- AI «discovers» solutions on the fly
- Handles unique situations
- Easy to accommodate new actions

Cons

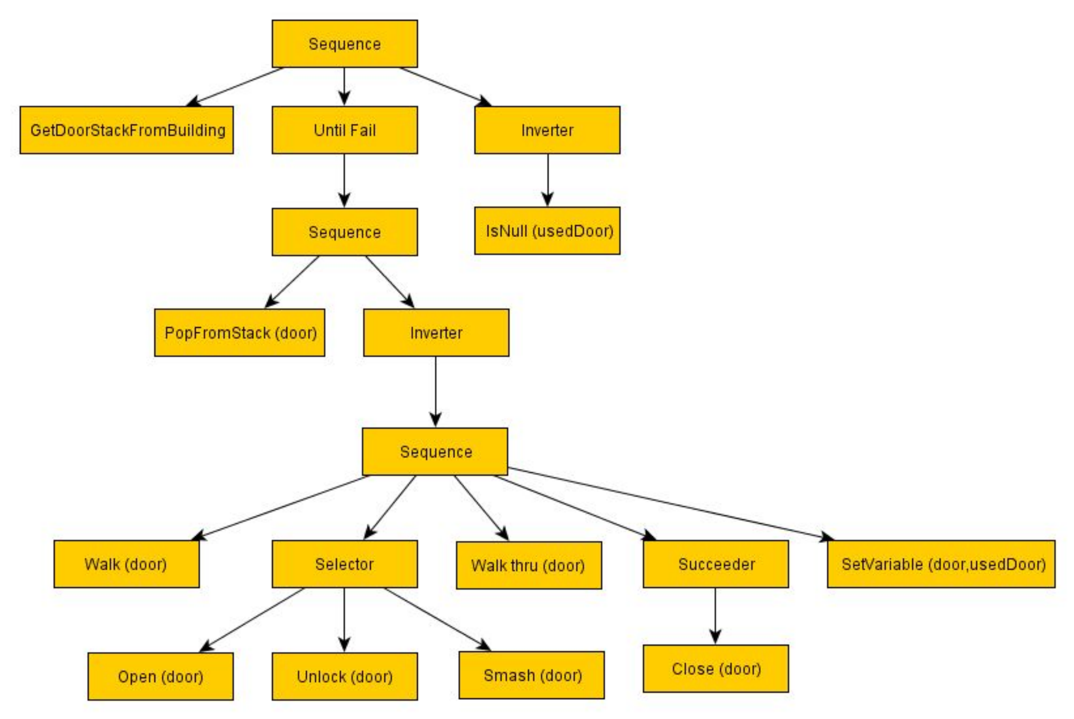
- Loss of designer control
- Can become quite processor intensive

Game Example

F.E.A.R (2005)

Behavior Trees

- Goal oriented
- Composed of Sequences (And) & Selectors (Or)
- Ends with scripted behavior



Behavior Trees

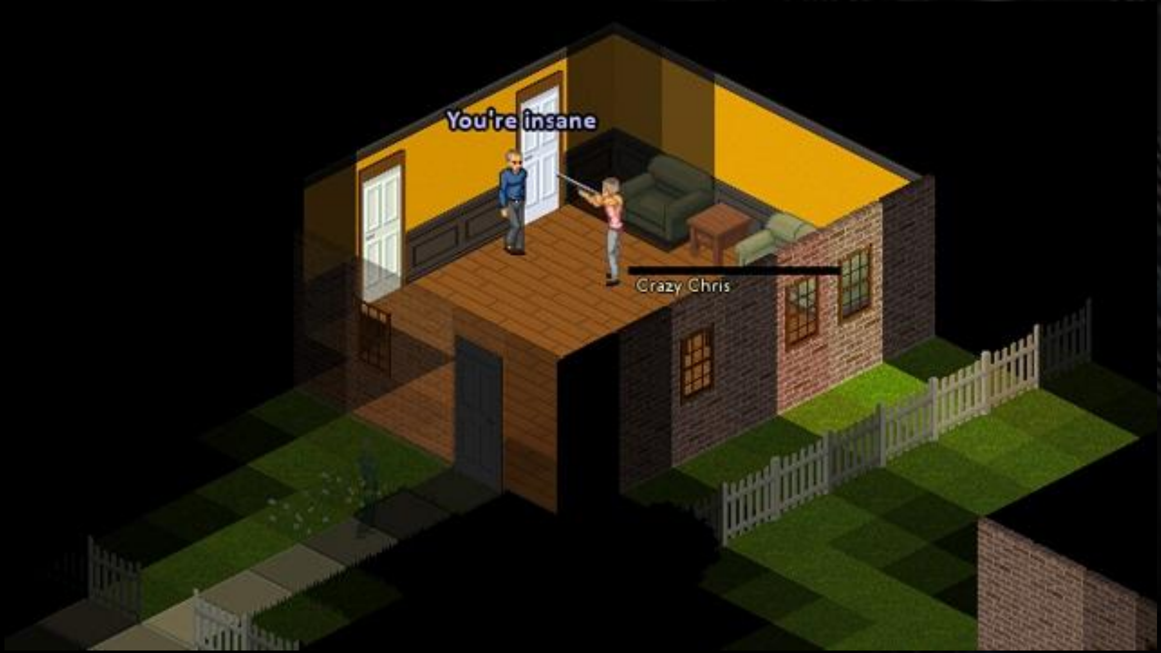
Pros

- Separates decision logic from state code
- Easy to understand, build and edit

Cons

- First time set up can be daunting

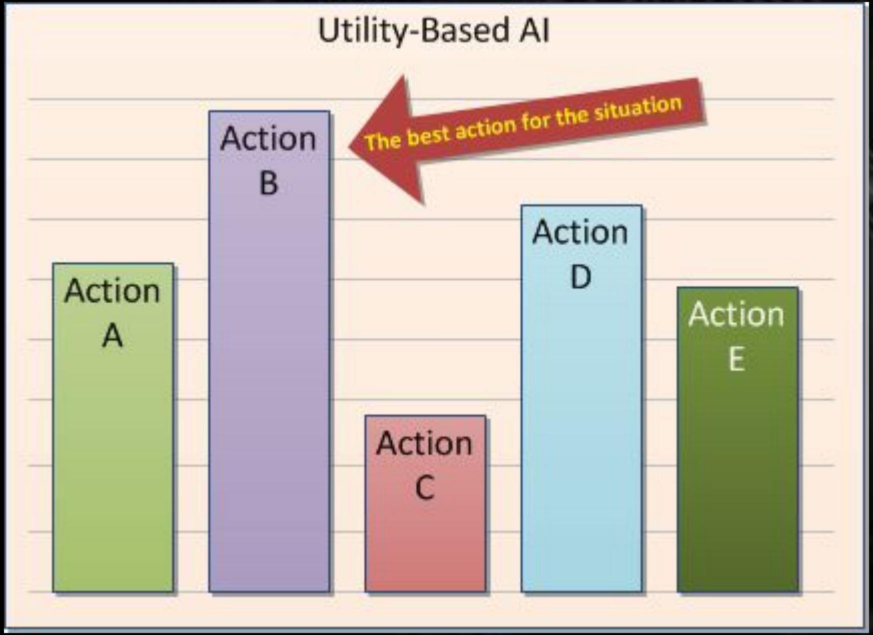
Game Example



Project Zomboid (2013)

Utility Based AI

- Based on the utility theory in economics
- Attribute a utility score to each action based on the context
- The formula for score attribution can be different for each action
- The agent performs the action with the highest score



Utility Based AI

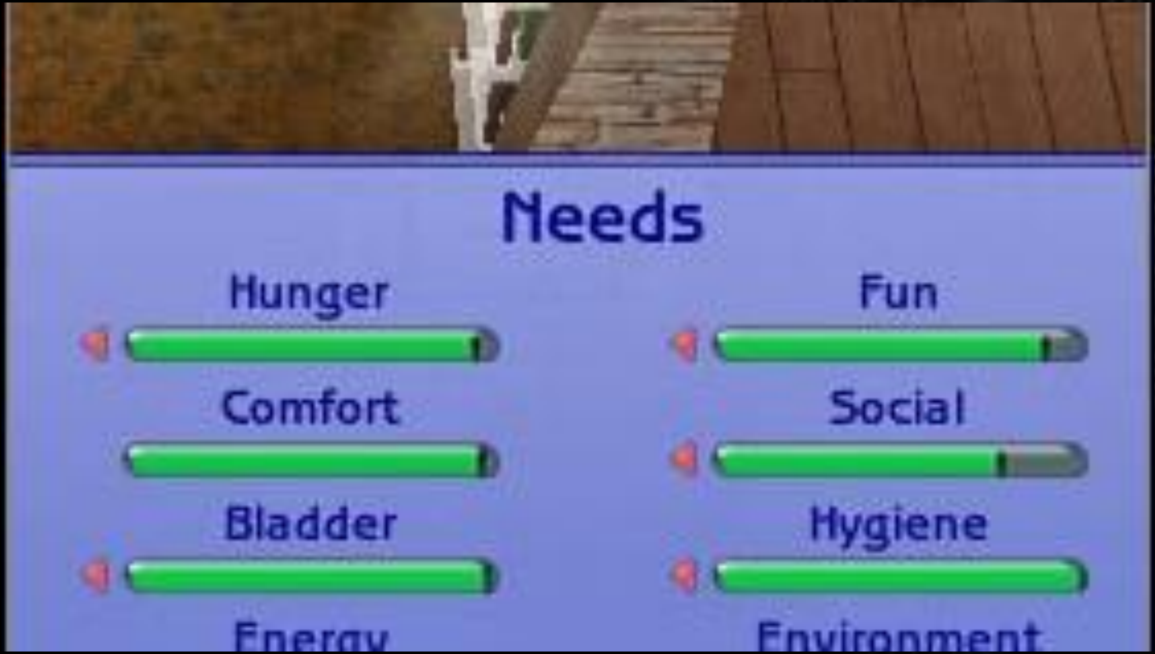
Pros

- AI constantly weight all actions
- Possibility to weight every action differently

Cons

- Tuning is time consuming
- Can be processor intensive with lots of agents

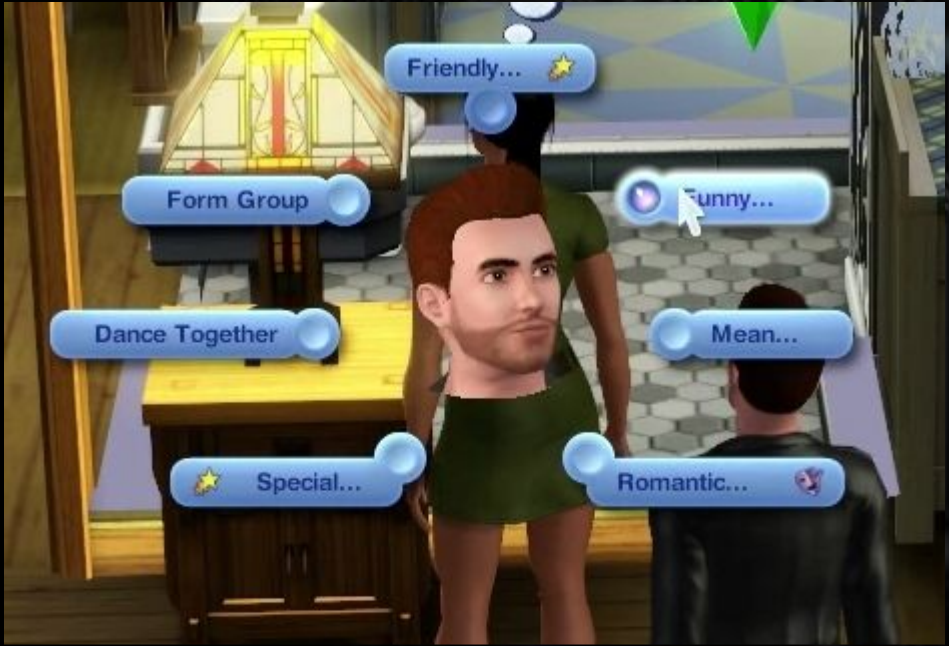
Game Example



The Sims series

Smart Terrains / Objects

- Objects used instead of character using objects
- Objects broadcast the characters how to interact



Smart Terrains / Objects

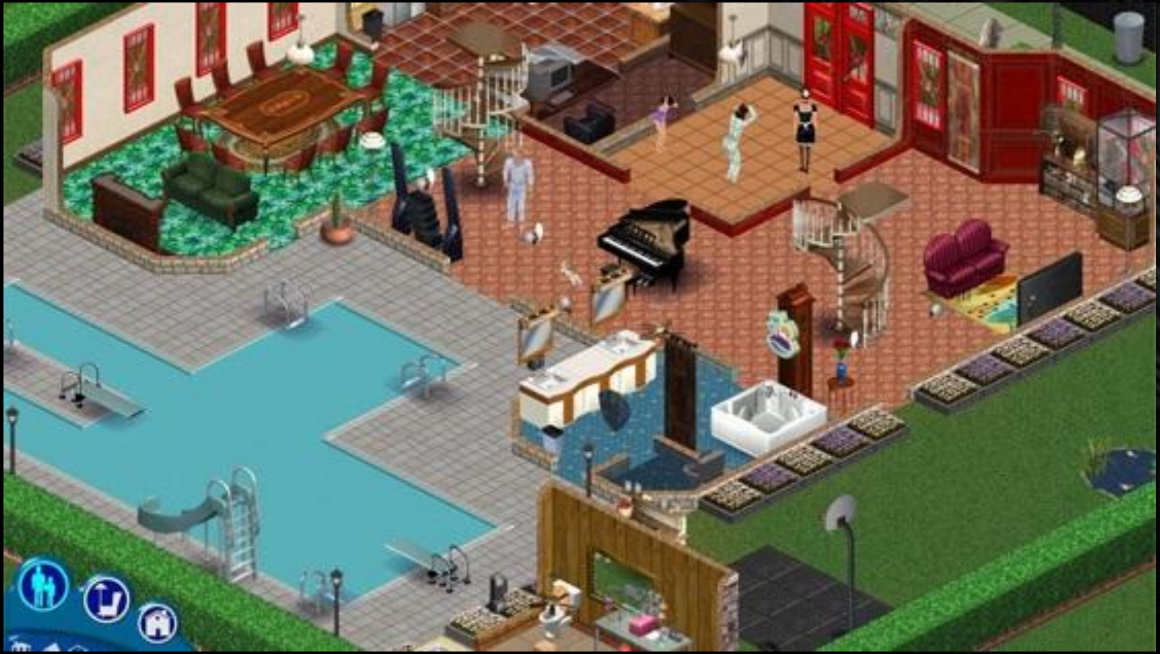
Pros

- AI constantly weight all actions
- Handles new situations gracefully
- Easily extensible

Cons

- Loss of designer control

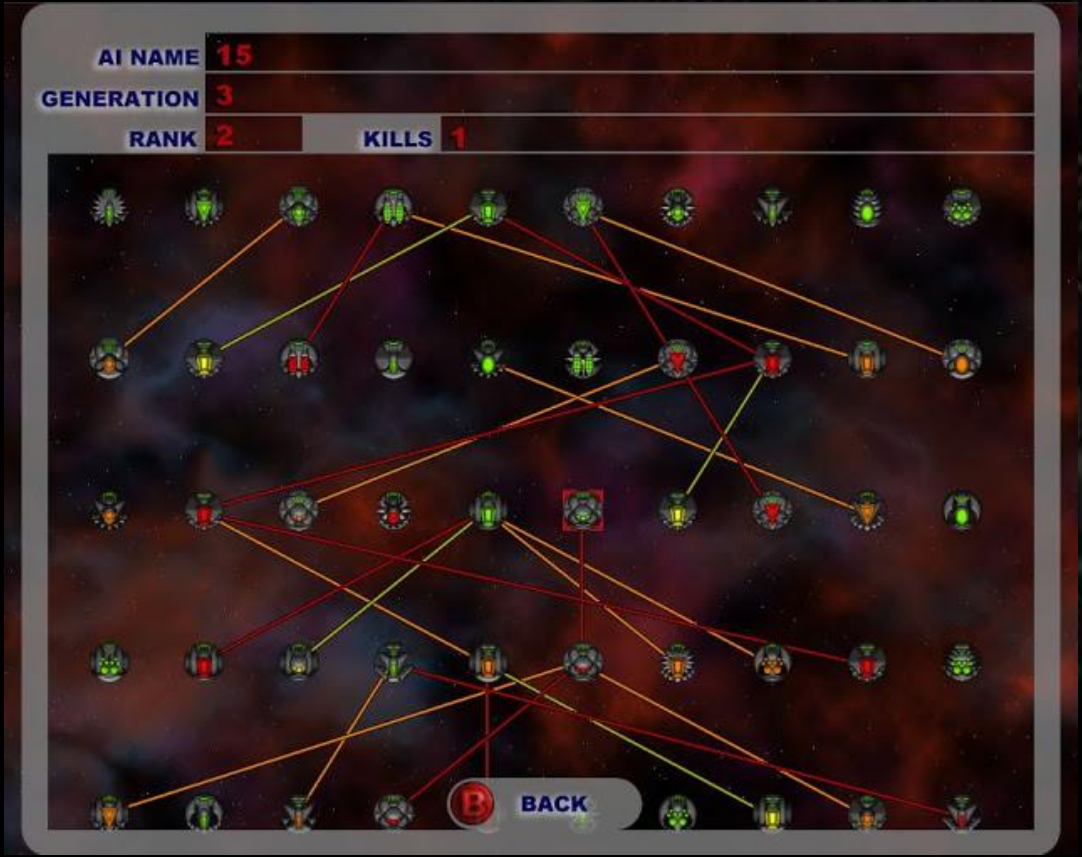
Game Example



The Sims series

Genetic Algorithms

- Natural evolution mechanism
- Few versions of the AI are generated
- Each of them is tested
- The algorithm blends the best version and a new generation
- The steps are repeated until satisfying result



AI NAME 15

GENERATION 3

RANK 2

KILLS 1

Genetic Algorithms

Pros

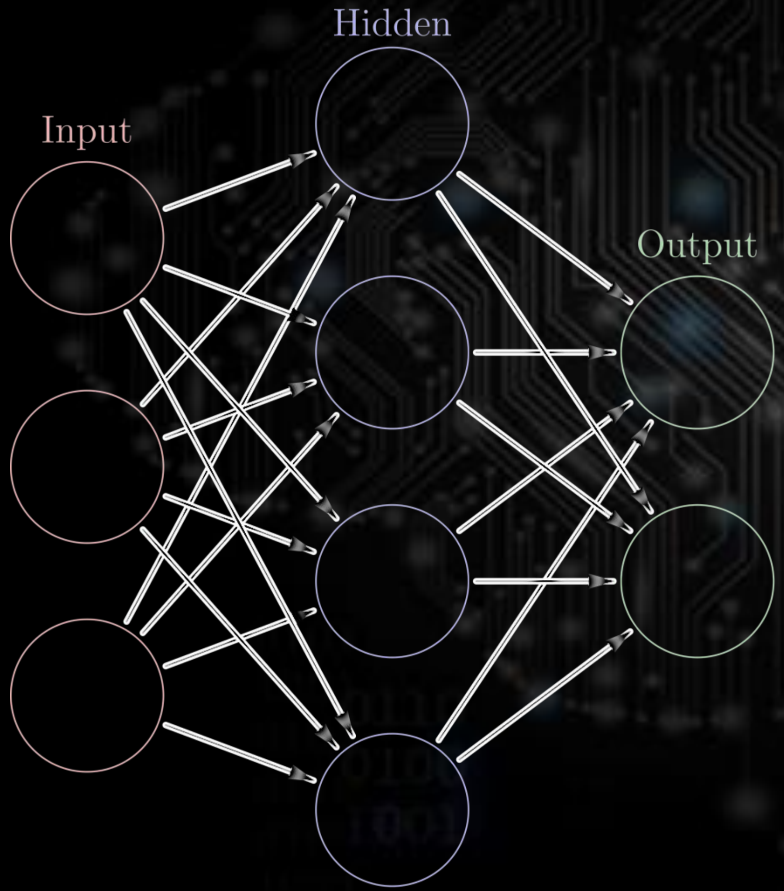
- Automates balancing of the AI
- Can provide unintended behavior

Cons

- It is the same as gambling your AI
- The designer loses control over the behavior

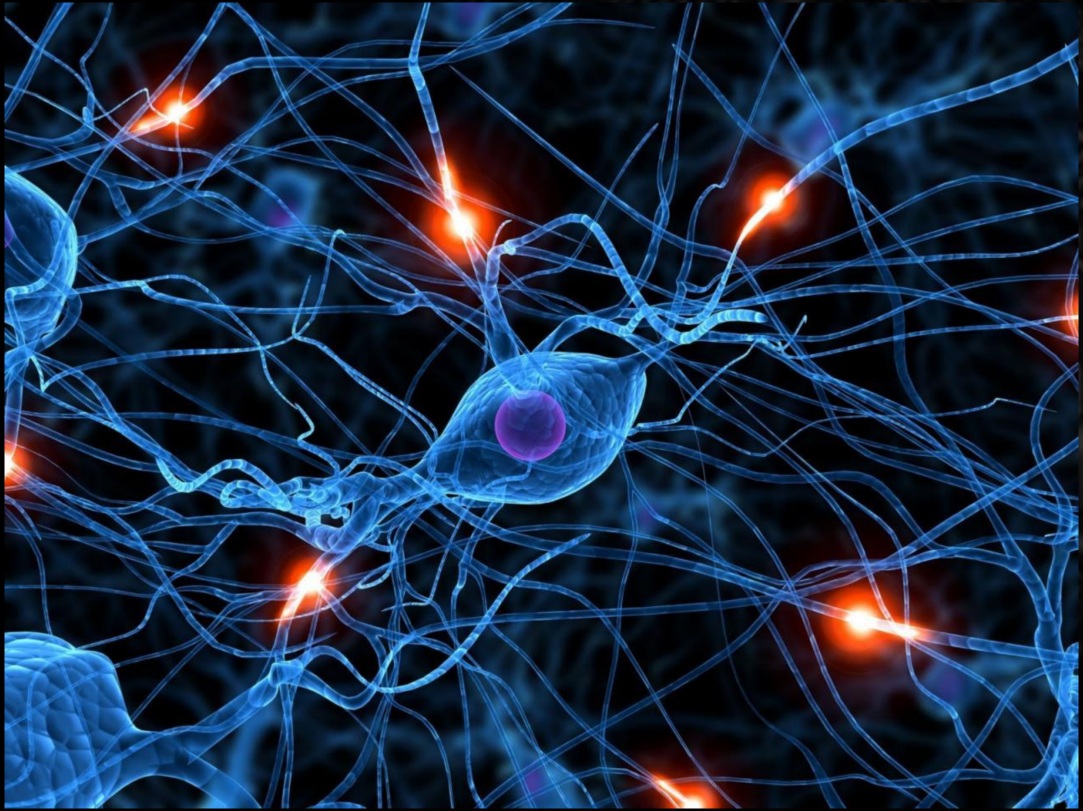
Artificial Neural Networks

- A synthetic brain
- Inputs are digital values in the game
- Outputs are actions
- Hidden layers are series of perceptrons linked together



Perceptrons

- Perceptrons have a threshold
- When their threshold is reached they trigger
- Pushing a value to linked perceptrons of the next layer
- Learning is achieved by tweaking the value pushed on each linked of the network



Artificial Neural Networks

Pros

- Can learn realistically
- Does not require a lot of programming time

Cons

- Complete loss of designer control
- Impossible to edit

Game Example

Black & White (2001)

Additional Content

Facing Your F.E.A.R. [AI & Games Lecture #3]

https://www.youtube.com/watch?v=rf2T_j-FlDE

Behavior trees for AI: How they work

http://www.gamasutra.com/blogs/ChrisSimpson/20140717/221339/Behavior_trees_for_AI_How_they_work.php

Understanding Pac-Man Ghost Behavior

http://gameinternals.com/post/2072558330/understanding-pac-man-ghost-behavior