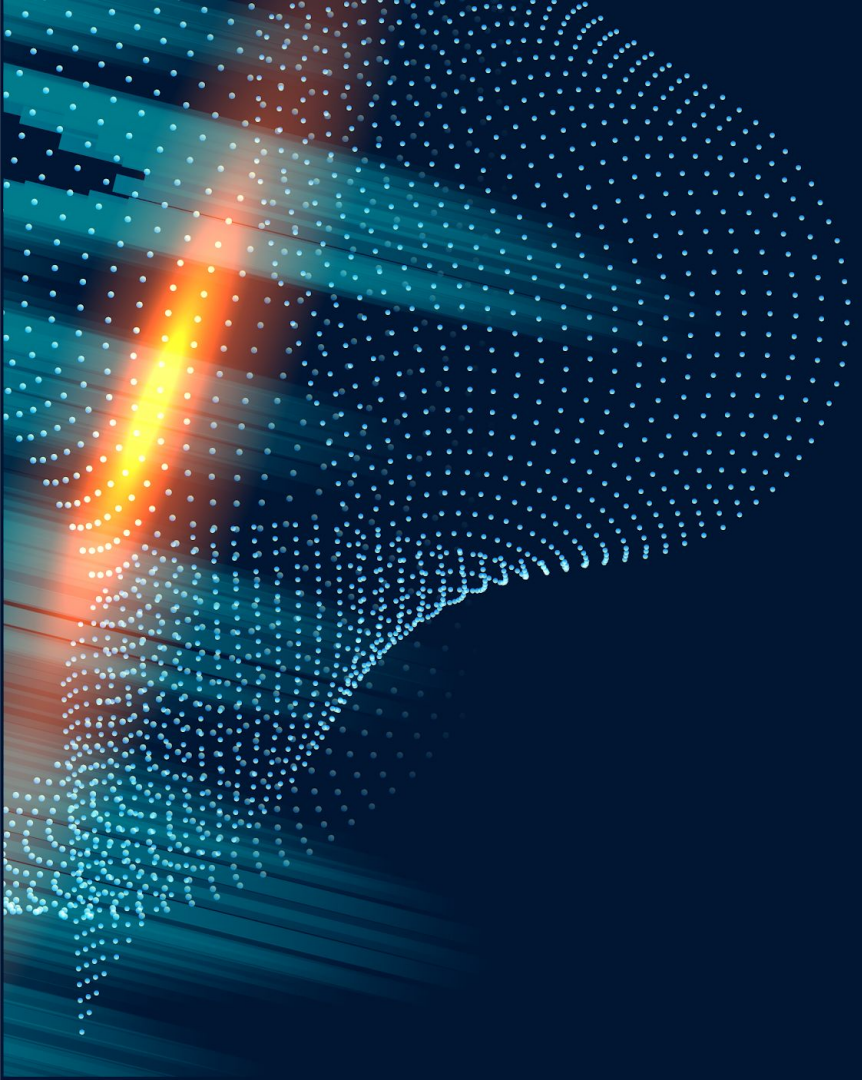
Agent-based modelling in Graphics ft. *The Sims 3*

MAS MANDATE - 1

IMT2019525 VIJAY JAISANKAR



Intent of this mandate

To showcase some of the intricacies and nuances of modelling agents in graphics applications.

ABMs focus on modeling agency and autonomous behaviour from the view-point of agents.

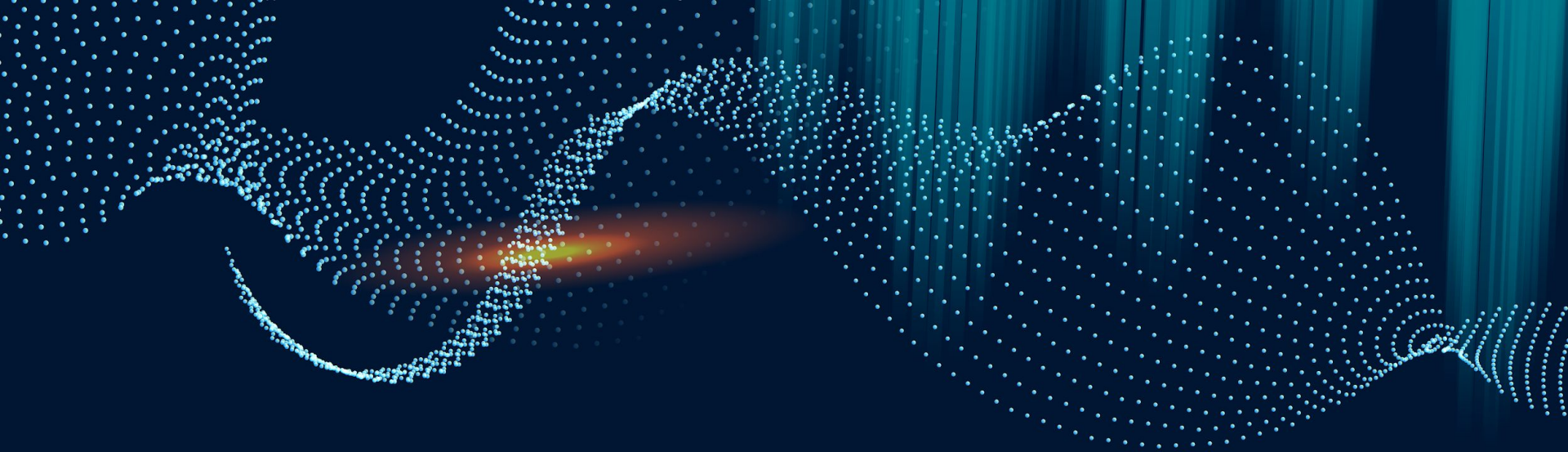
But, what are these agents?

A hardware/software-based computer system that has the following properties:

- Autonomy
  - Some kind of control over their actions and internal state
- Social ability
  - Interacting with other agents (and possibly humans)
- Reactivity
  - Perceive their environment and react to changes
- Proactiveness
  - Taking the initiative

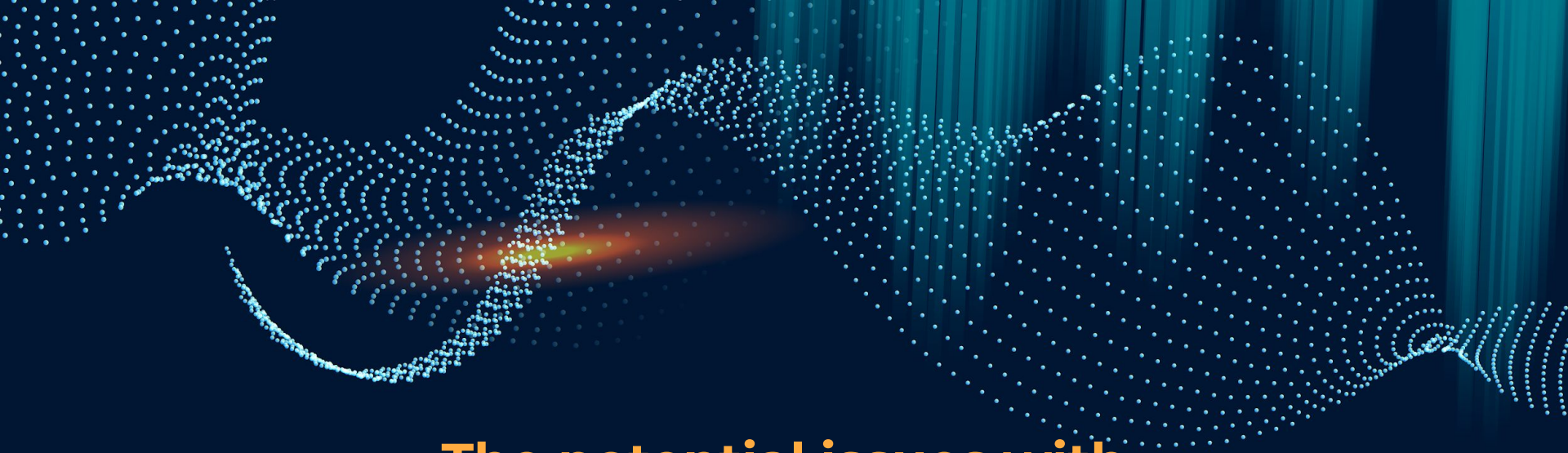
What do you notice?

How does the crowd behave?



Believability

The environment should be populated with life-like virtual characters

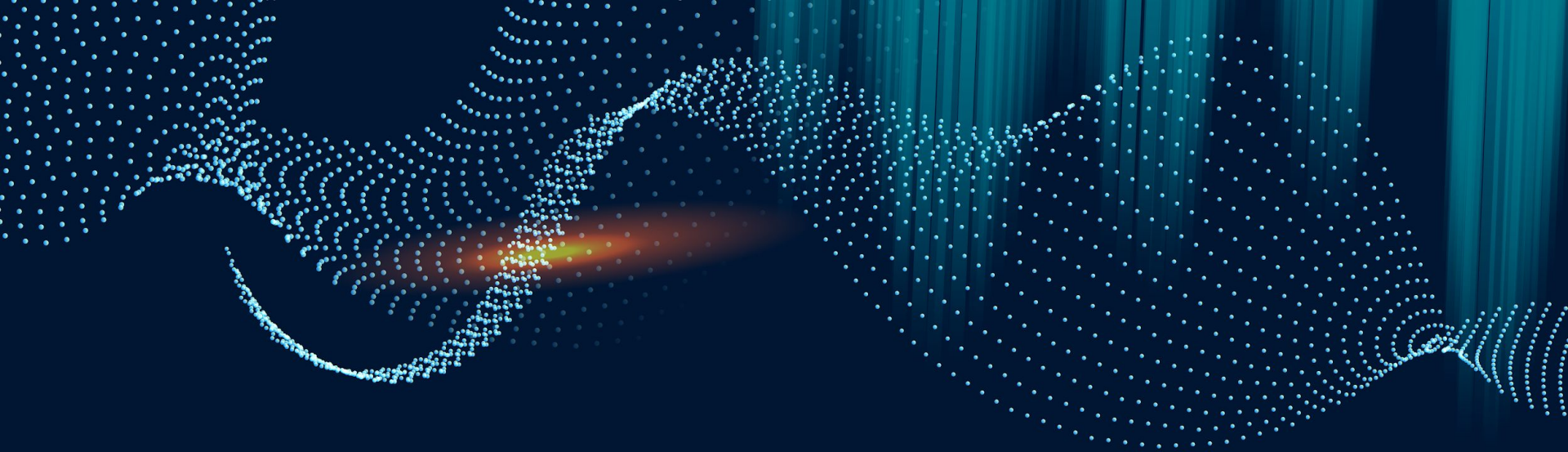


The potential issues with believability

Sometimes, we need to design the most **interesting and believable** character, as opposed to the **most efficient one**.

Artistic tendencies of characters

What if he snapped twice?



Virtual Fidelity

The virtual world needs to “ring true” with the real world as per the **requirements of the system** - different levels of realism in movies and games

Spectrum of Agents

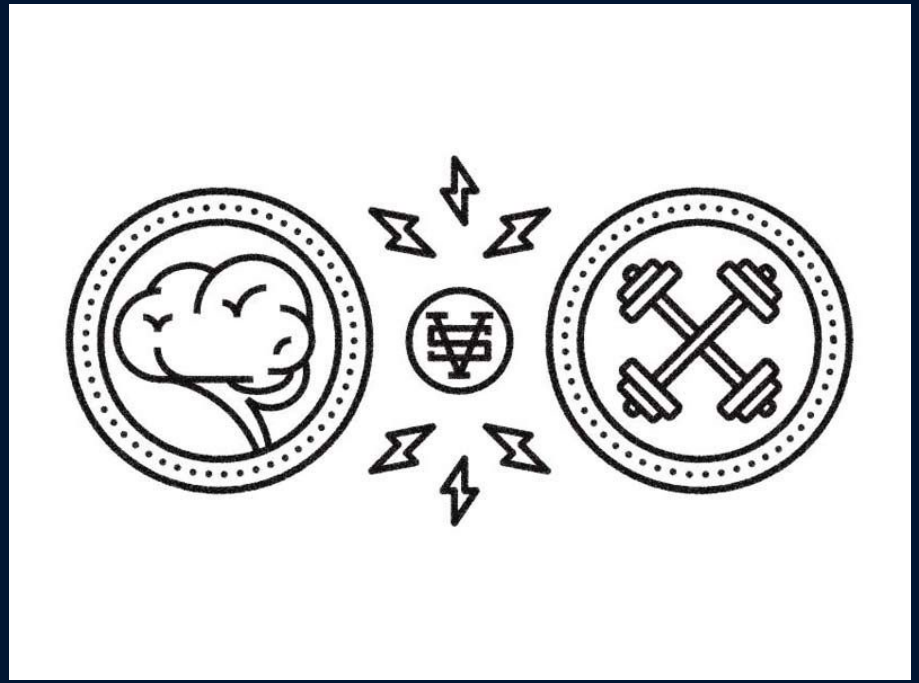
Physical agents

Simulation of believable physical behavior, like muscles and skeletons.

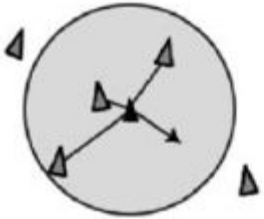
Cognitive agents

Simulation of decision making, planning, reasoning, and learning.

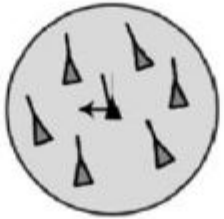
What do you think is more important for a game released in 2023?



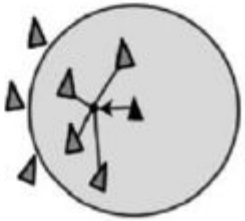
Emergence



Separation: steer to avoid crowding local flock-mates



Alignement: steer towards the average heading of local flock-mates



Cohesion: steer to move toward the average position of local flock-mates

Agent-Based Modelling in Computer Graphics and Games, Figure 1
The three rules used by Reynolds' original Boids system to simulate flocking behaviors

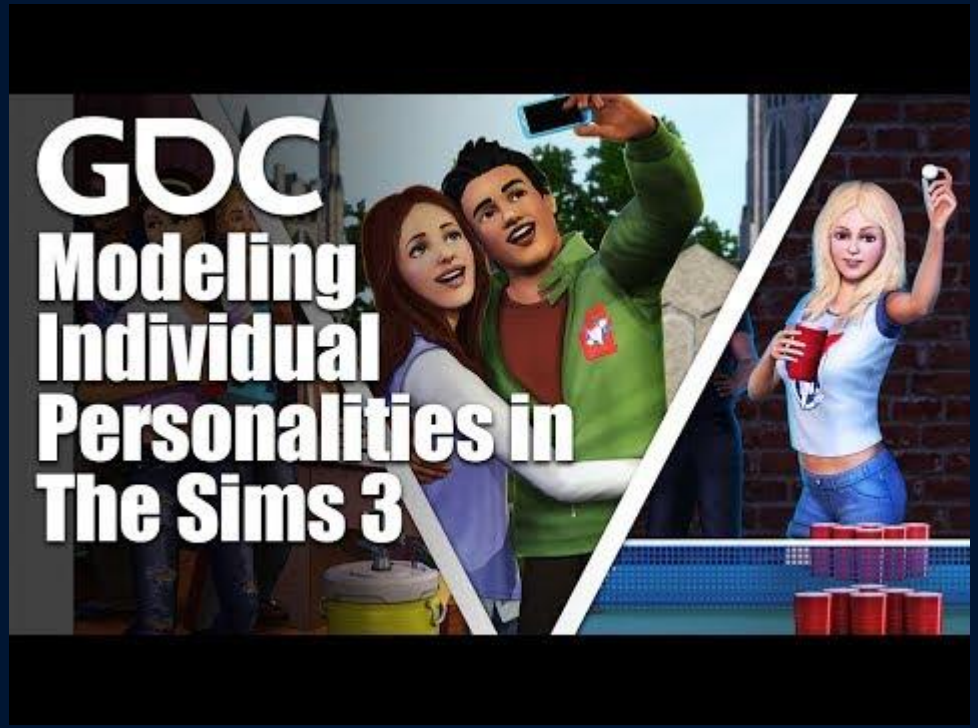
Emergence of complicated flocking behaviour!

The Sims franchise

Hugely popular **life simulation** game, where the player controls one or more *sims*.

Chief resource for this discussion

Game Developers Conference talk about The Sims 3



Chief design objectives

Having a system which enables **emergent narratives**

- Simulate a larger and varied living world
- Make unique sims
- Data-driven approach

Simulating a larger world

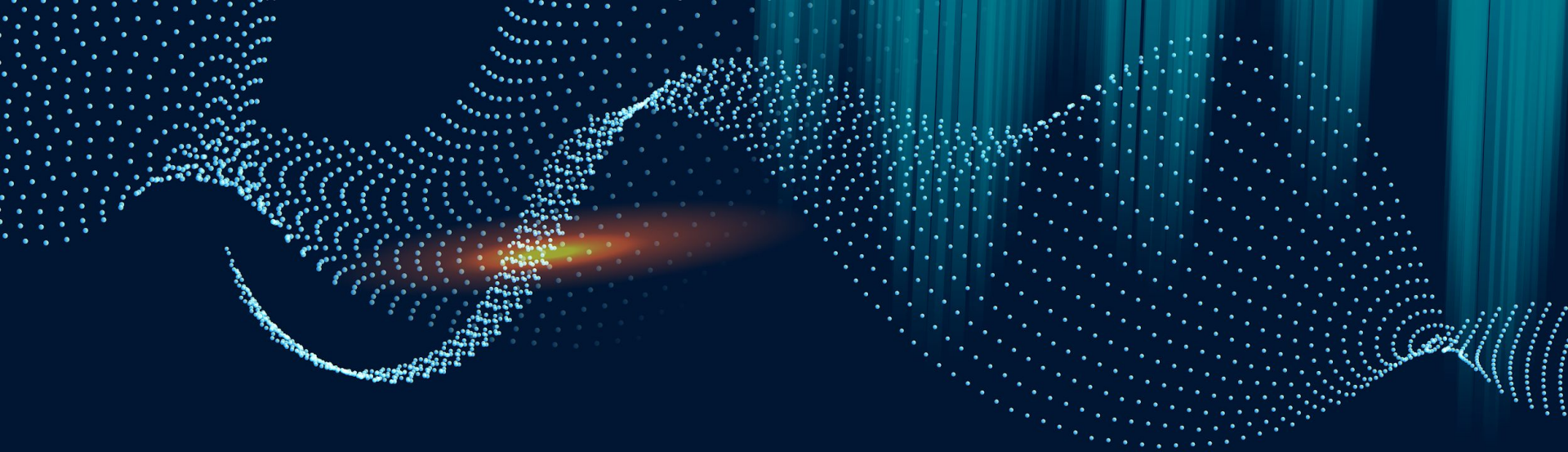
- Store a map from things we might want (“commodities”) to interactions which satisfy that commodity.
  - Eg: Energy: {Nap, Drink}

- When the protagonist reaches a venue, there should already be *spawned sims* and existing suitable and situation specific behaviour.

Simulating a larger world

- Every agent has motives
  - Venues have them too!
    - Hierarchical

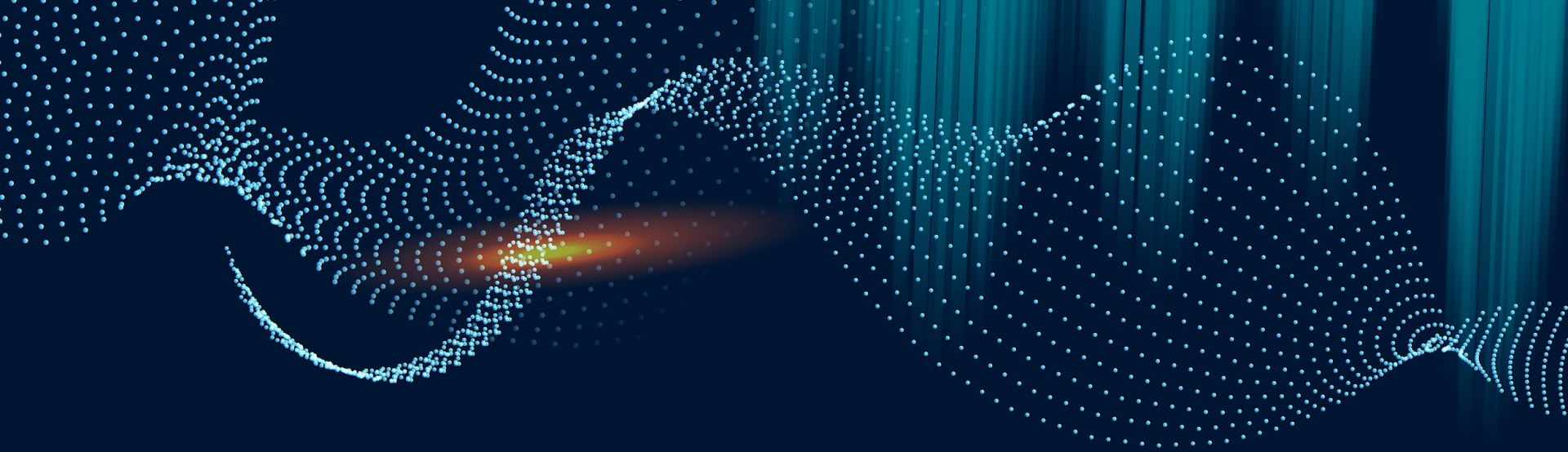
- Optimisation
  - Foreground sims
  - Background sims



Story progression

P: Update the motives when the sim comes to the foreground.

Does P leave something out?



Story progression: Long-term goals

Other sims need to make progress even if they're not being fully simulated - marriage, college, etc.

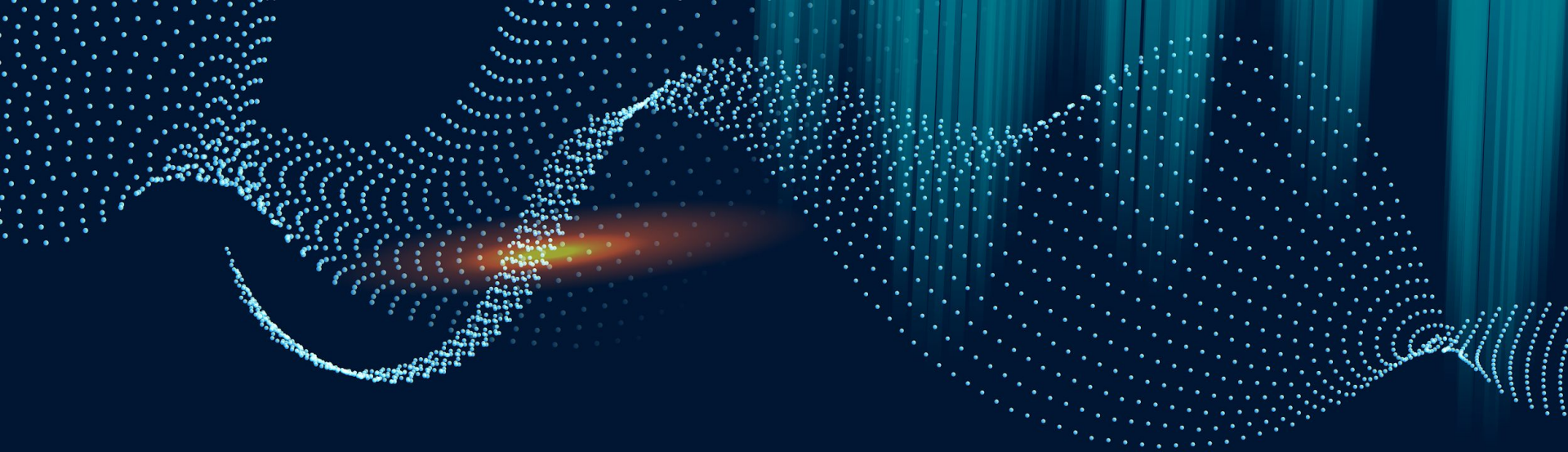
Town has *meta-level desires*.

Variability

There should be many unique sims to complement the varied and large world.

Traits and Motives

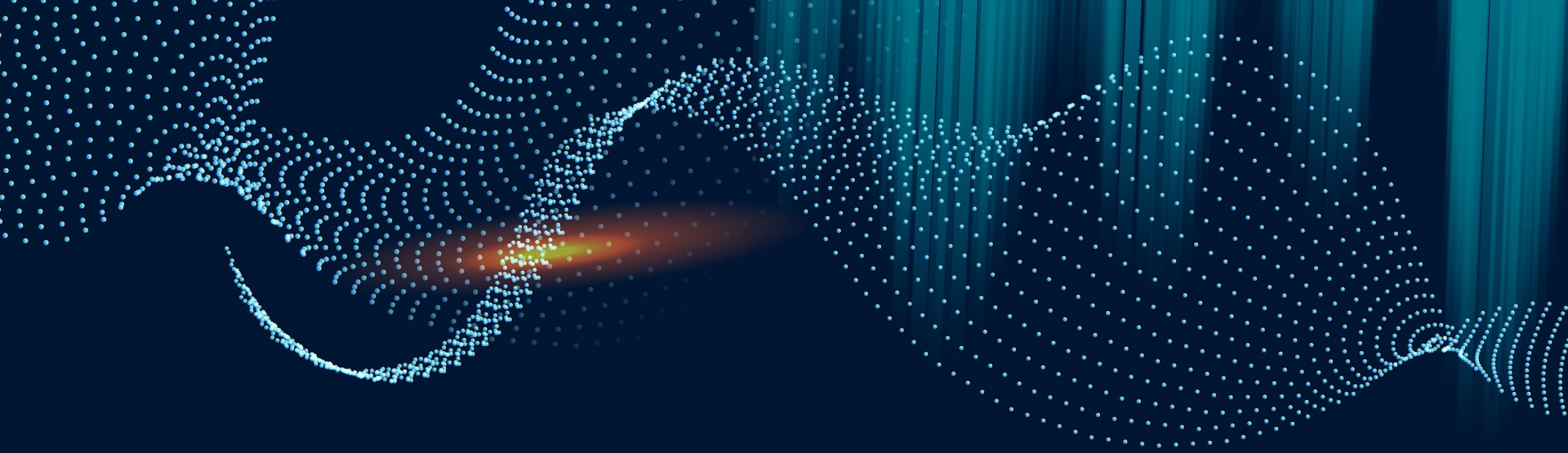
- A personality is a bag of traits
- There is a new motive for each trait
- Different sims have different motives
- Motives vary between individuals *and time*
- By satisfying their unique wants, the agents are manifesting their individual personality autonomously



Randomness

Q: Each action has a score; always choose the highest scoring action?

Would you enjoy a game with Q?



Preventing robotic behaviour

Choose randomly from one of the top *k* scored actions

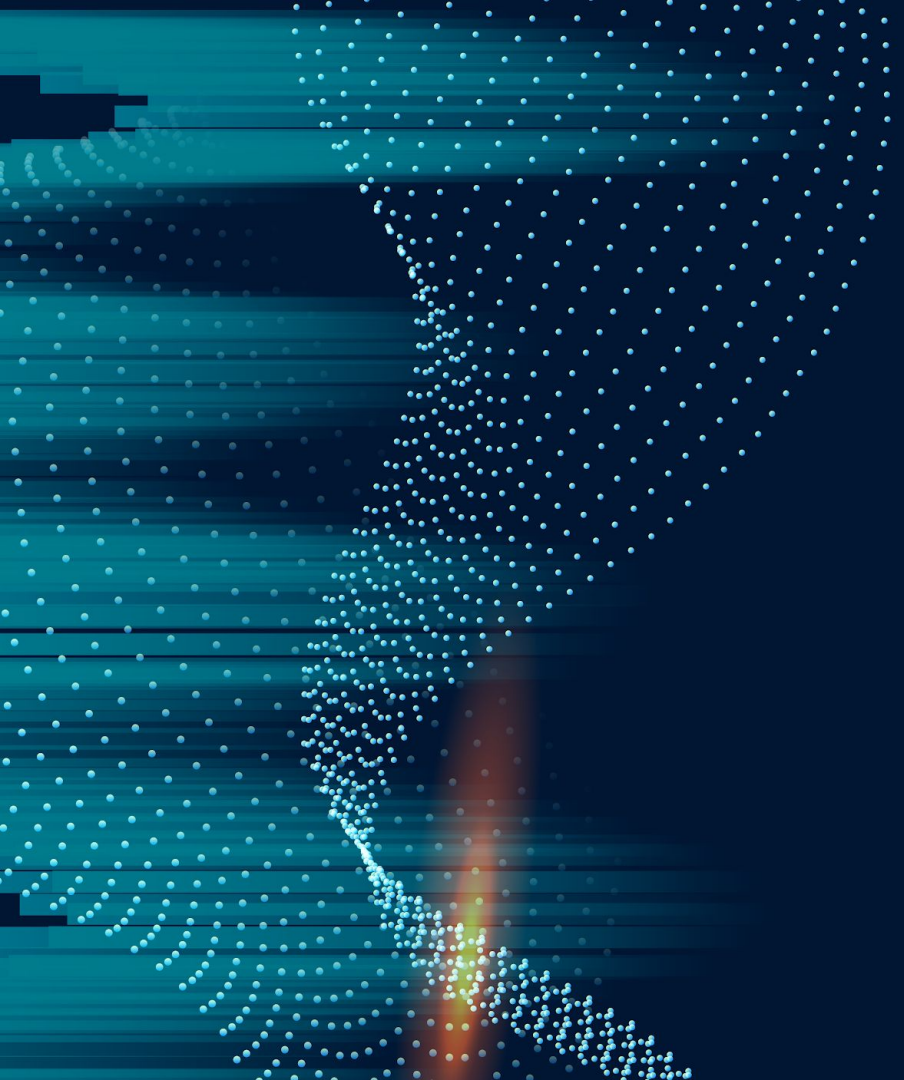
Also, sample from Maslow's hierarchy of needs

Personalities

- They should be immediately obvious to the player
  - Yet, at the same time, there should be something left to learn
- If we are going to have much finer grained personalities, we are going to need much more finer grained social interactions to support them
- Trait learning is contextual

Trait conflict

Same action creates very different stories when the sims have different traits



Family activities

Various archetypes of sims

Society bonds and feuds

We looked at a lot of emergence among the agents

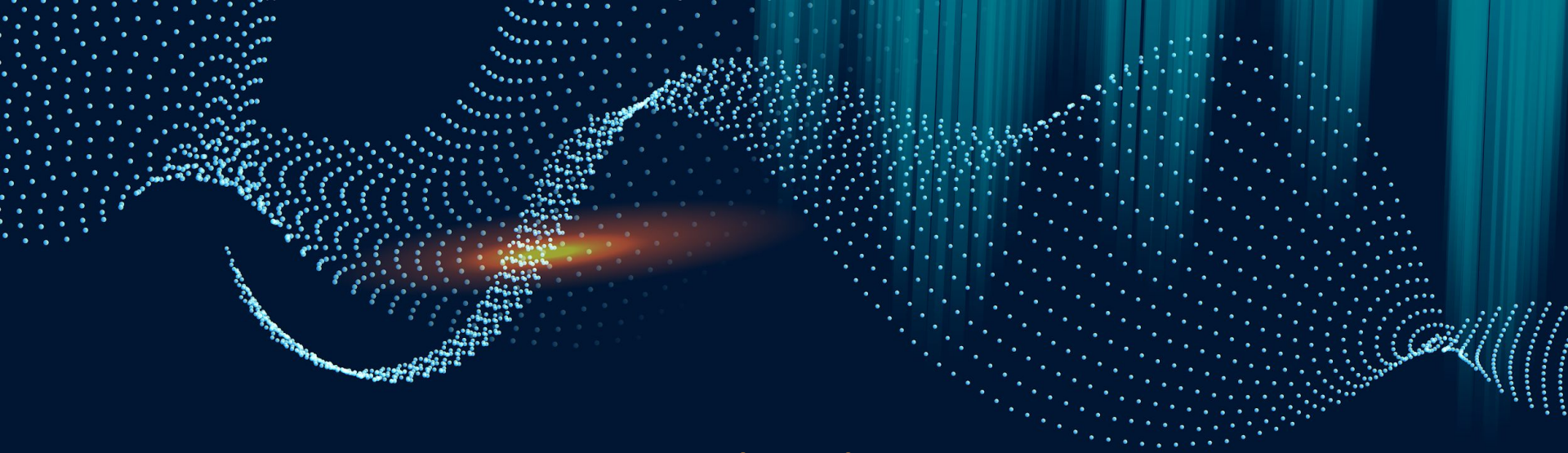
What about the players?

Players are active agents negotiating both the game's version of real life, and their own real-world experiences.

Two-way!

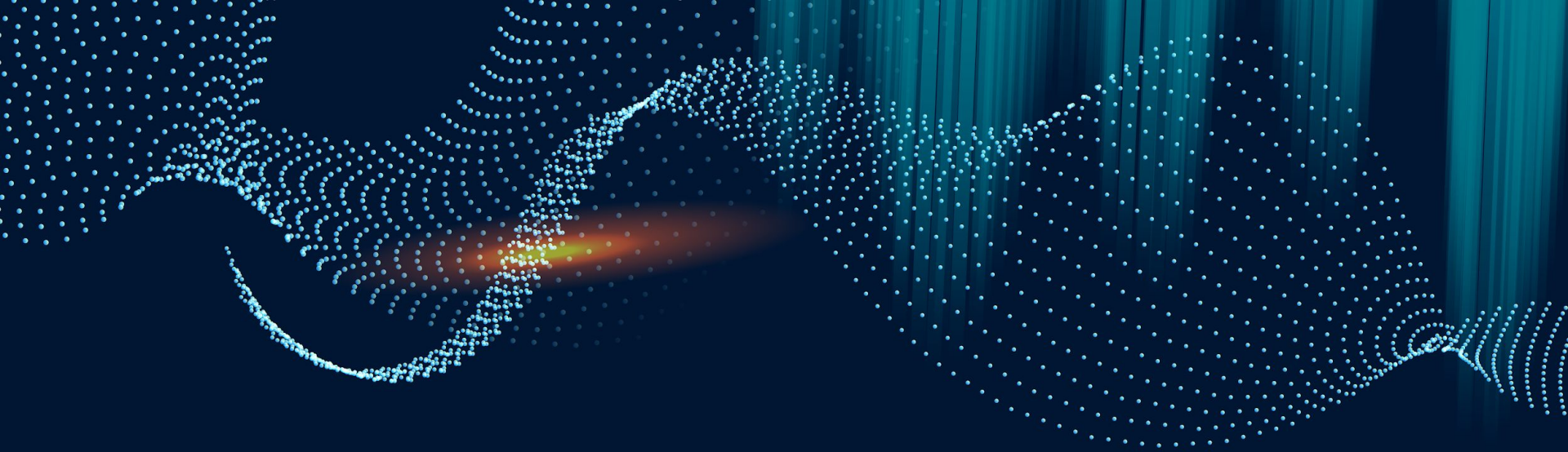
Some common play styles

How would you play the game yourself?



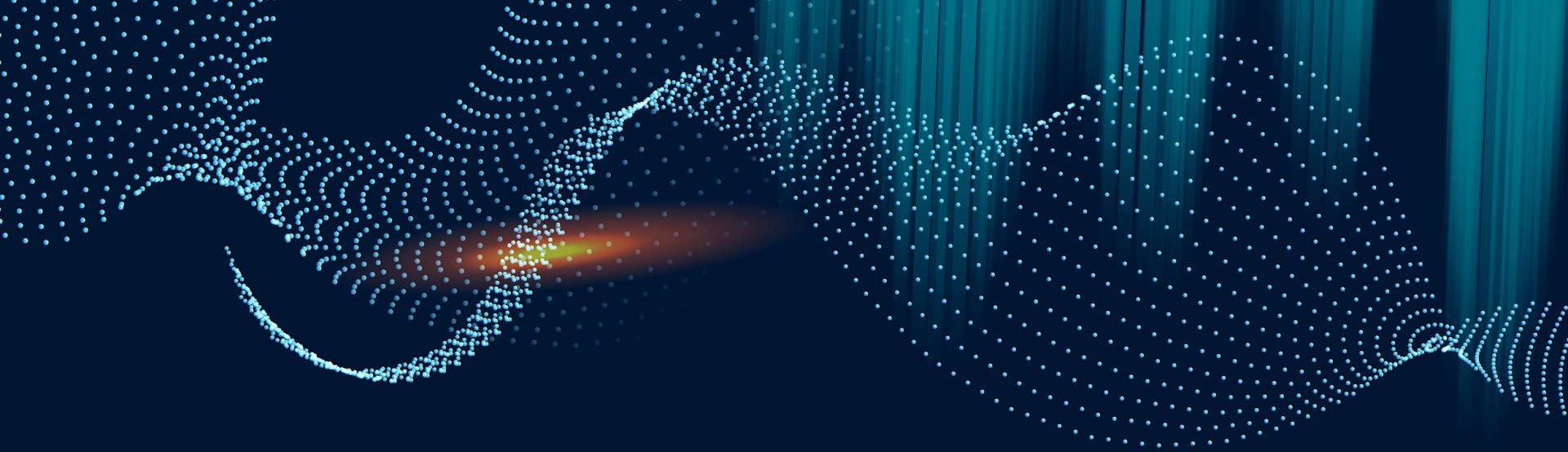
projection

emulating aspects (or wishful aspects) of real life in the game



cacoethes

def:
the-one-and-only-thing-you-shall-not-ever-do



schadenfreude

def:
pleasure derived from someone else's pain

What design would you give your player (if you had to impulsively pick one)?

Expertly designed RPG games are seen as viable tools to evaluate ABM models and frameworks

References

- https://www.tandfonline.com/doi/abs/10.1080/1369118032000163268 - Emergent human behaviour in games
- https://www.sciencedirect.com/science/article/pii/S2352146517309572?via%3Dihub - RPGs as validations for ABMs
- https://link.springer.com/article/10.1057/jos.2016.7 - More about ABMs
- https://arrow.tudublin.ie/cgi/viewcontent.cgi?article=1000&context=scschcombk - ABM in CG and Games
- https://www.youtube.com/watch?v=YjuOSgPdtS0 - Emergent Storytelling in the Sims
- https://aliceandkev.wordpress.com/2009/06/09/alice-and-kev/ - Emergent Narrative Example
- https://www.youtube.com/watch?v=DVMs5_B611E&t=2779s - Modelling individual personalities in the Sims 3
- https://drive.google.com/file/d/1Xx8W2iKCDkJddiQnIOEze_1YxXd7e4Tq/view - MAS Slides
- https://www.cs.ox.ac.uk/people/michael.wooldridge/pubs/ker95.pdf - Definition of Intelligent Agent
- http://www.red3d.com/cwr/boids/ - Boids simulation

Thank you!

CREDITS: This presentation template was created by Slidesgo, including icons by Flaticon, and infographics & images by Freepik.