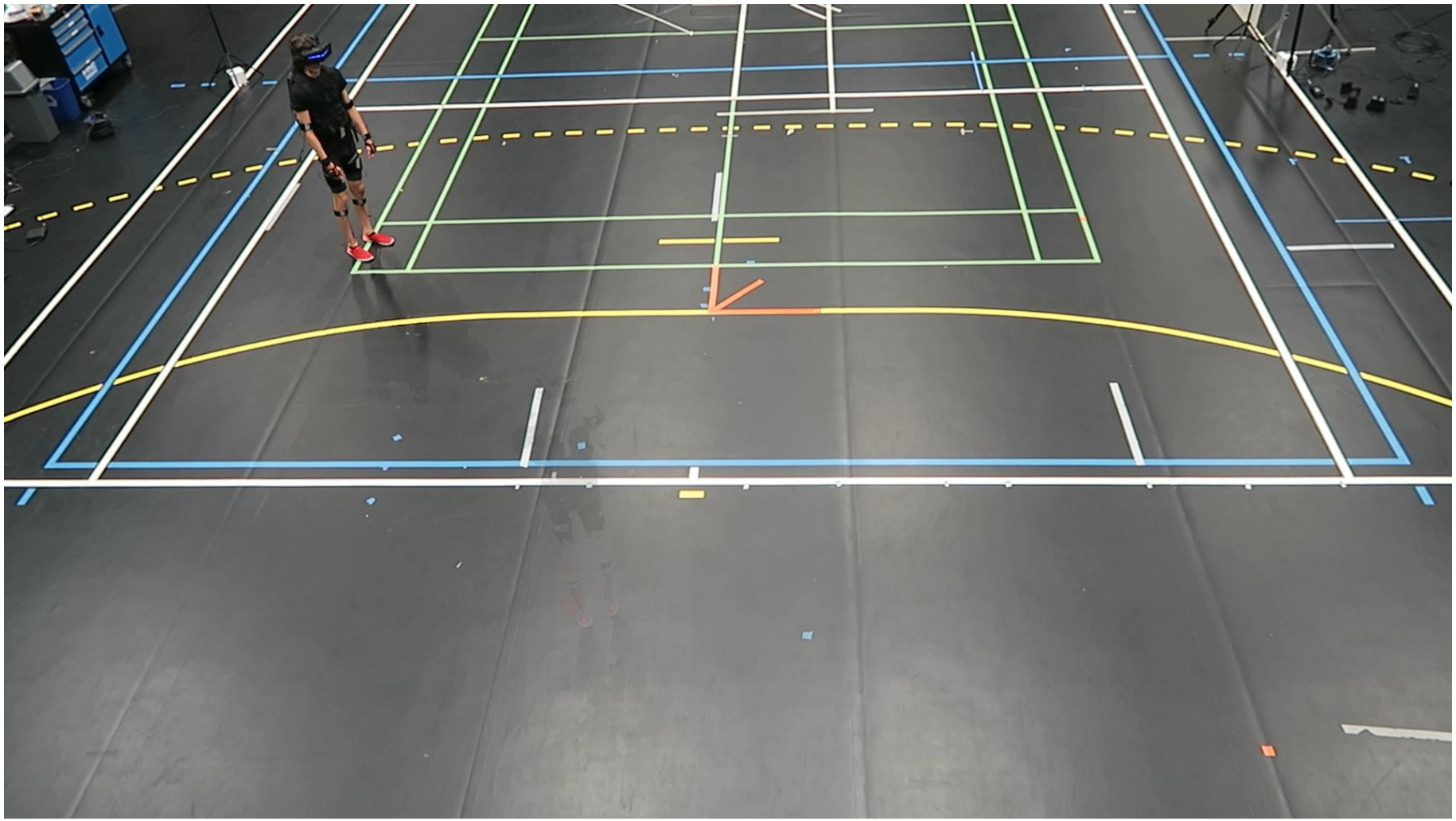
The One-Man-Crowd:

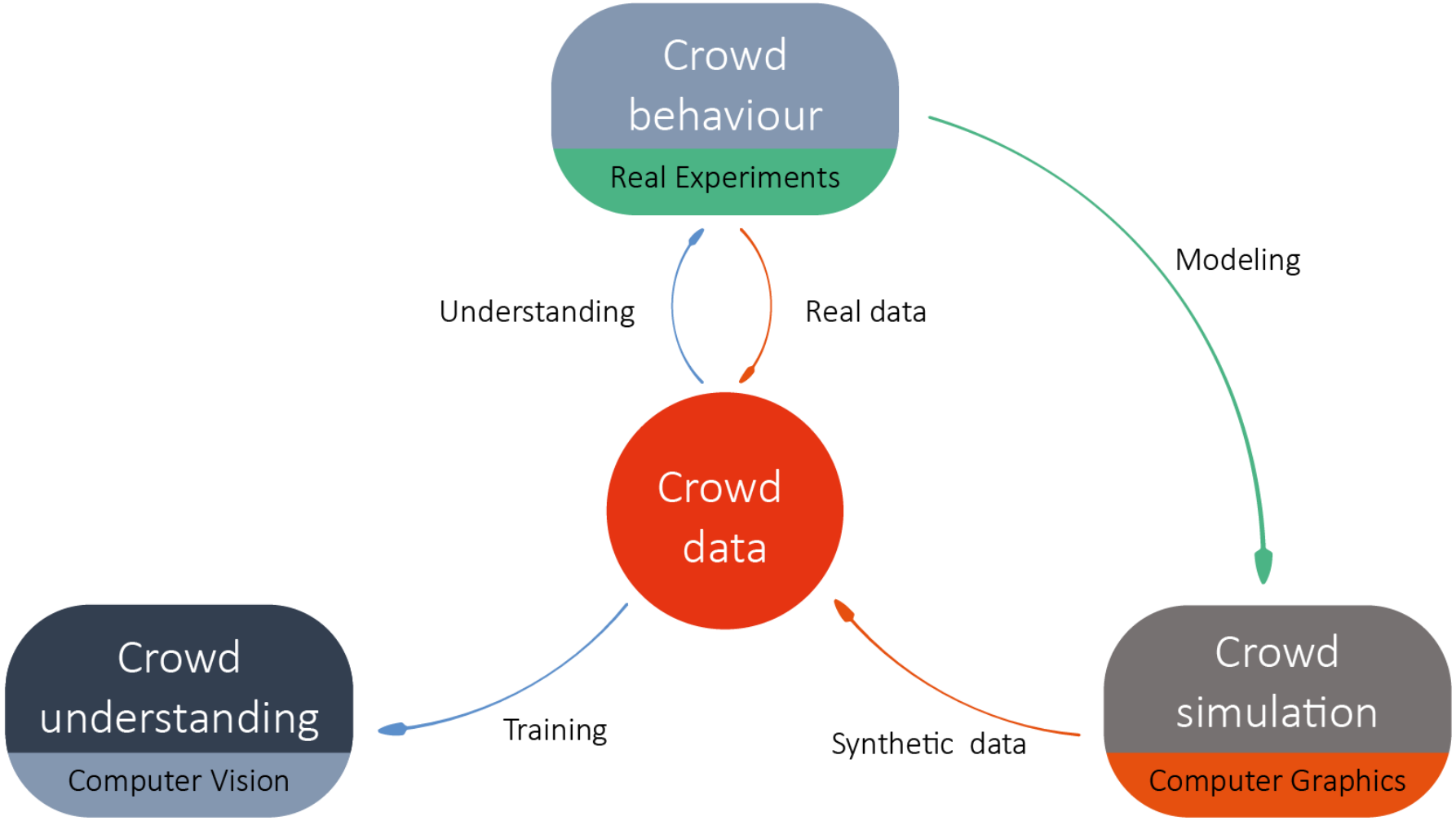
Single User Generation of Crowd Motions Using Virtual Reality

Tairan Yin, Ludovic Hoyet, Marc Christie, Marie-Paule Cani, and Julien Pettré

One man to create a crowd would be like ...

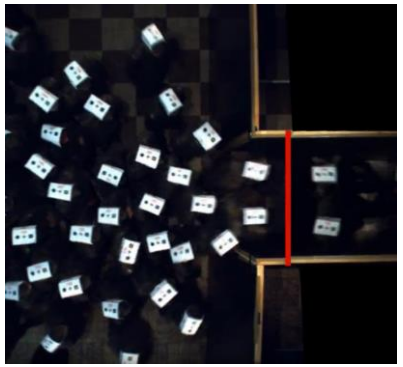


The making and the use of crowd data



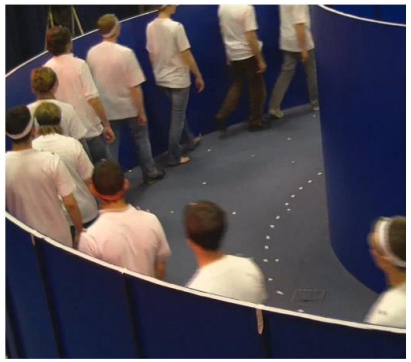
Real data from real experiments

Collection through controlled experiments



Seyfried et al. 2008

Cao et al. 2017



Lemercier et al. 2012

Such data is scare due to …

- Logistical difficulty
- Ethical concerns
- Tracking difficulty – occlusion
- Time cost
- etc.

Synthetic data from simulation

Emergent patterns:

- Each person makes local decision
- The collective motions present patterns

Emergent patterns of flocking birds

Simulation with autonomous agents

- Unrealistic local behaviors
- Unrealistic emergent patterns

Unrealistic behaviors in video game

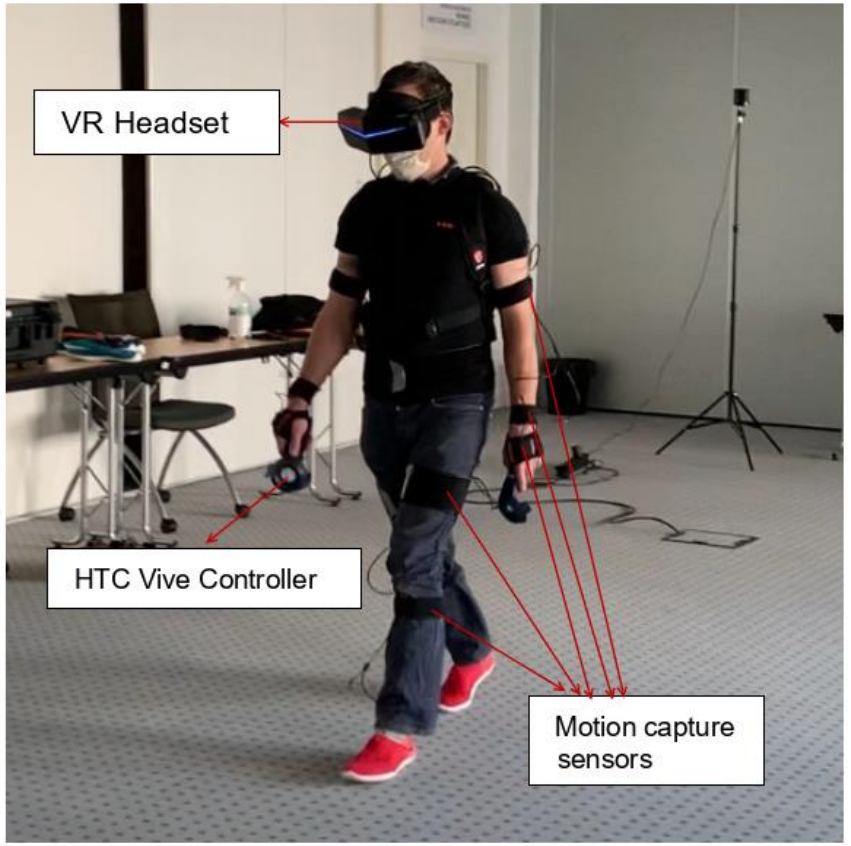
The One-Man-Crowd (OMC)

General Goal:

- Explore a novel way to generate crowd dataset
- Avoid the difficulties of organizing real crowd experiments
- Avoid the use of autonomous agents
- Take advantage of VR's controllability

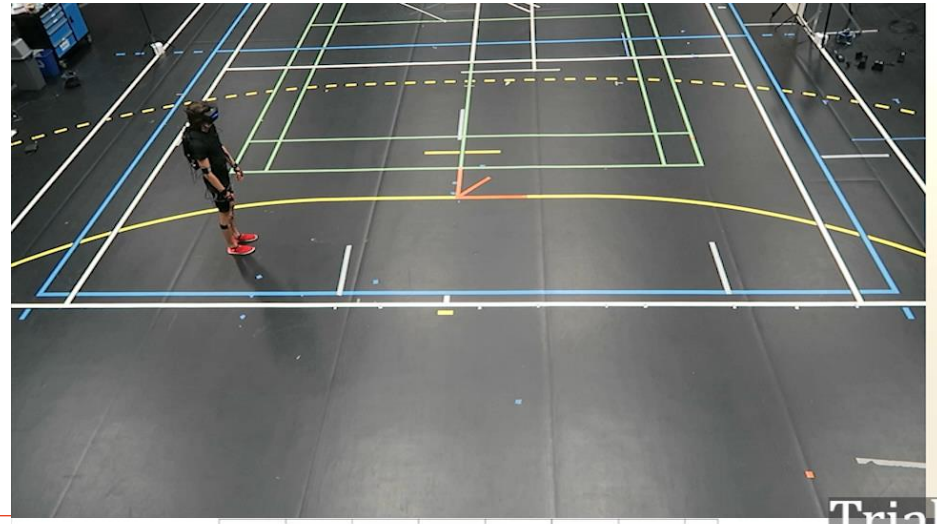
Solution:

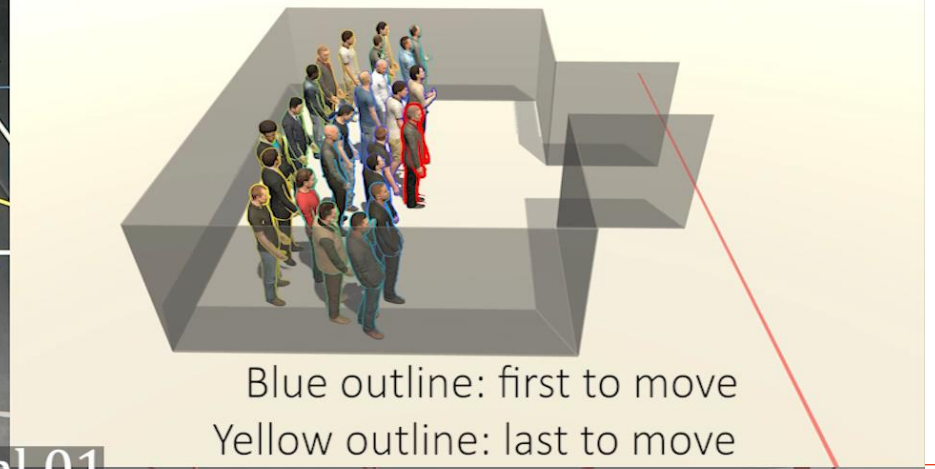
- Immerse one user in VR and generate a crowd by himself/herself



The One-Man-Crowd

Real-world situation

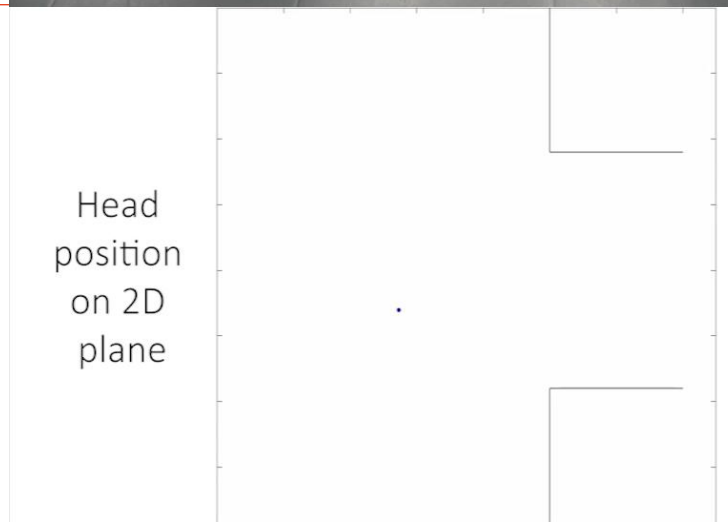


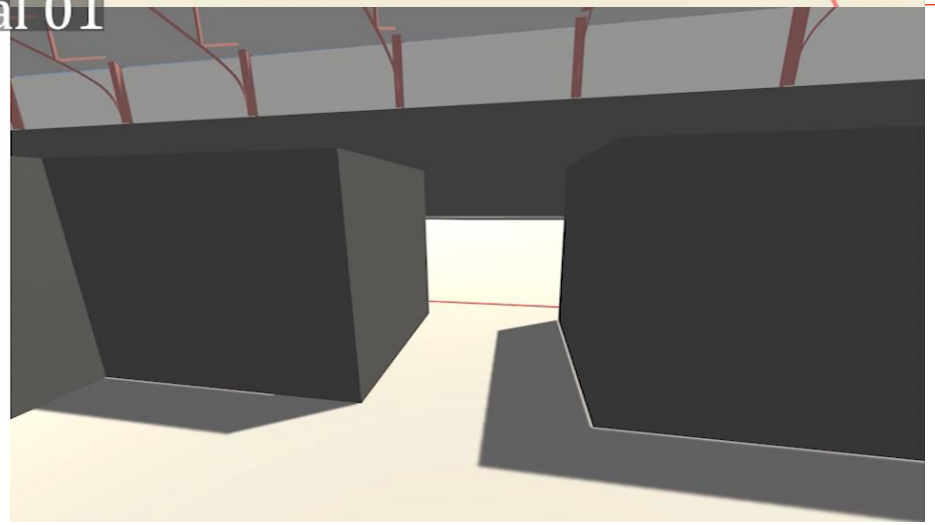


VR situation

Trial 01

Trajectories





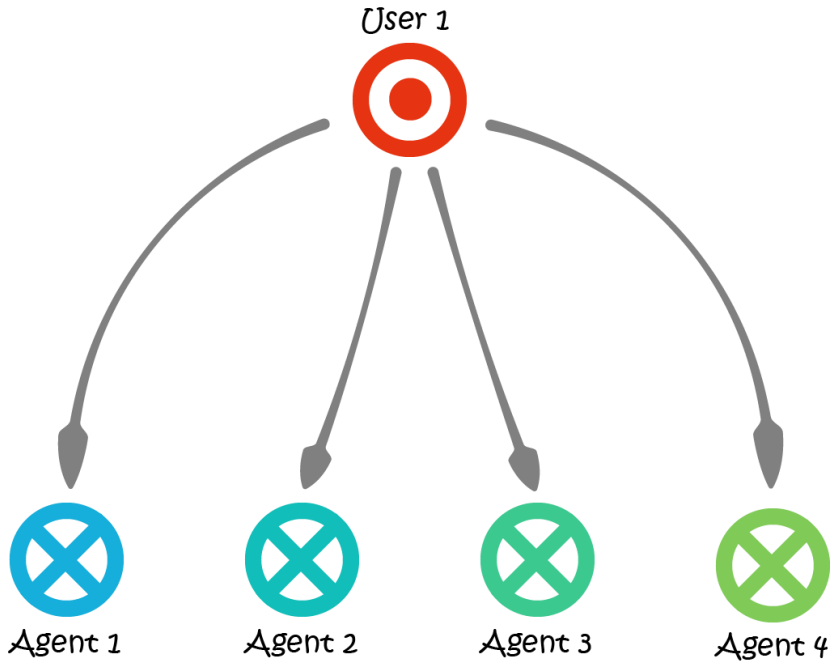
First-person view

What is OMC's performance?

S2N:

Single-user-to-N-characters

→ a single user needs to play N trials



Hypotheses:

- Individual behaviors:

  Qualitatively similar, quantitatively different

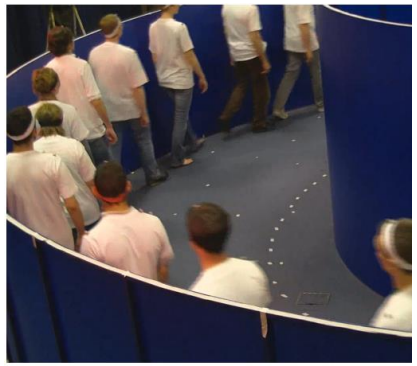
- Emergent patterns:

  Realistic emergent pattern can be produced

What is OMC's performance?

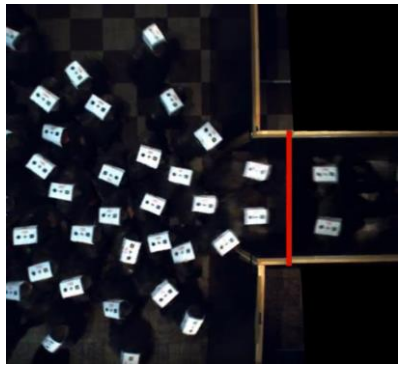
Verification:

1. We replicated 3 classical experiments in VR
2. We replicated the data analysis of these experiments
   - Reaction time
   - Personal space
   - Density-speed relation
   - Etc.
3. We evaluated the emergent patterns



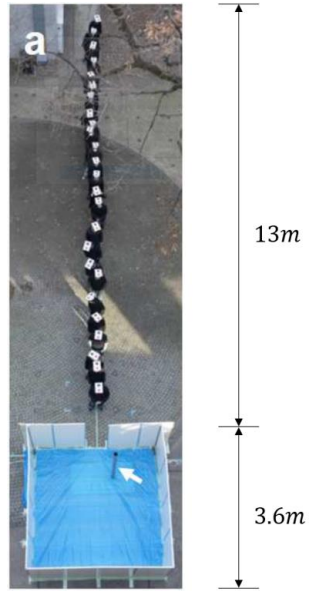
Unidirectional flow

Lemercier et al. 2012



Bottleneck

Seyfried et al. 2008

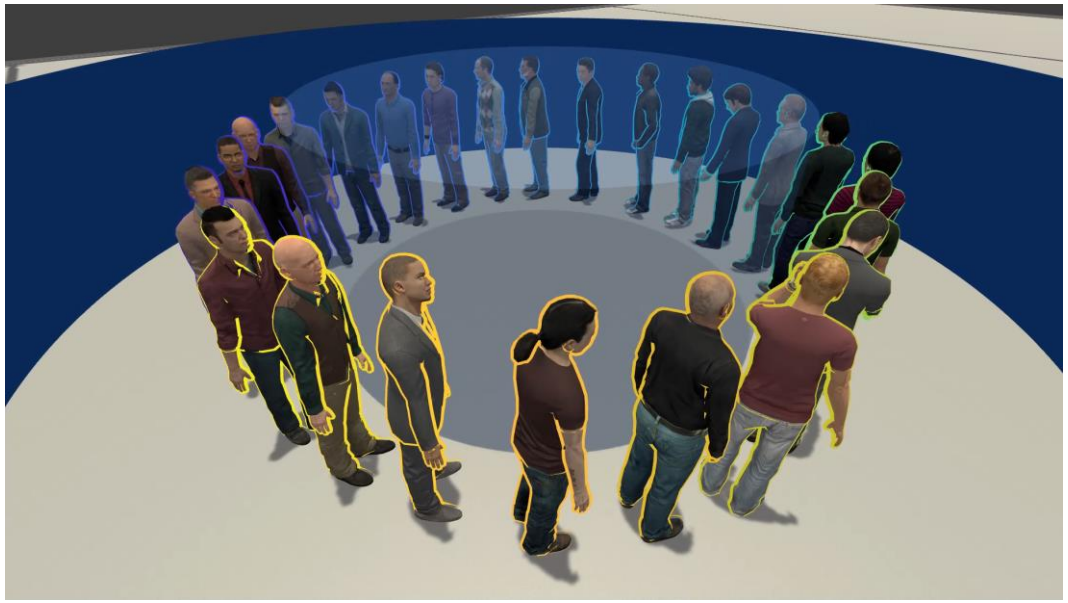


Inflow

Ezaki et al. 2015

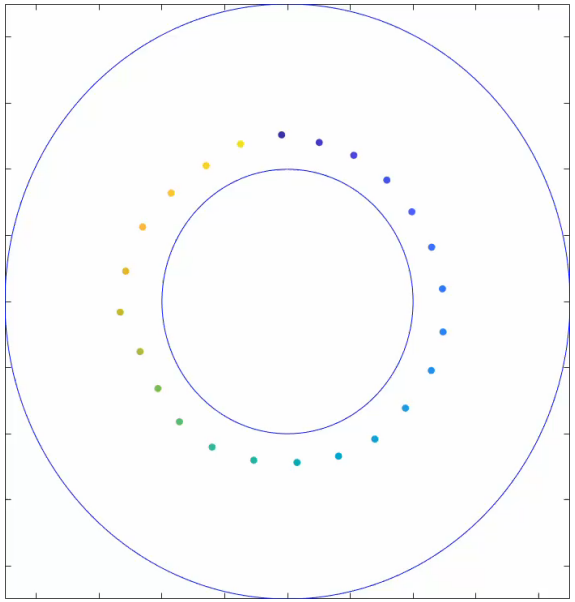
Unidirectional Flow

Animation (One S2N result)

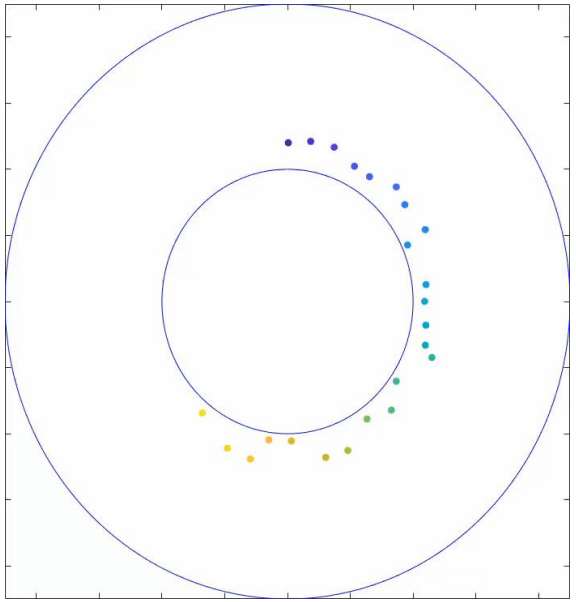


Blue: first to be generated
Yellow: last to be generated

Head Position



S2N Result



Real Result

Emergent pattern: stop-and-go wave

Bottleneck

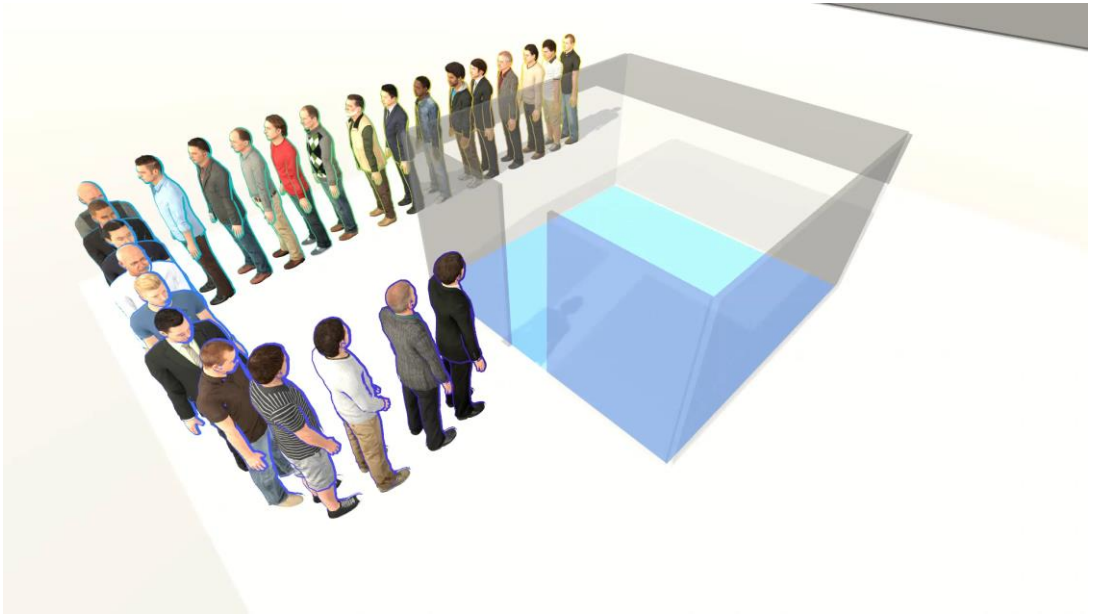
One S2N result

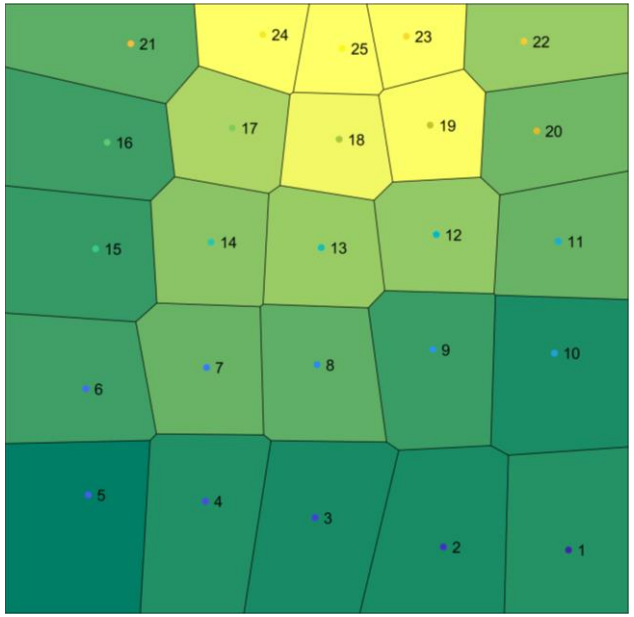
Emergent pattern: lane formation

Another S2N result

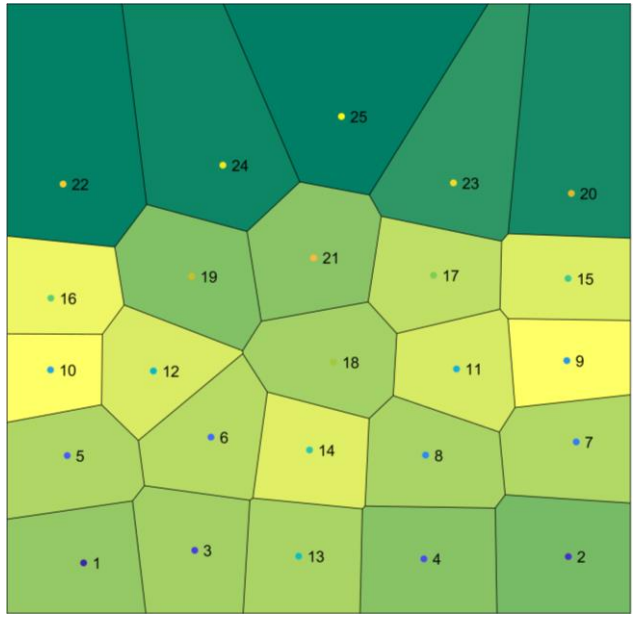
Specific pattern: single lane
resulted from low behavioral variety

Inflow





S2N result



Another S2N result

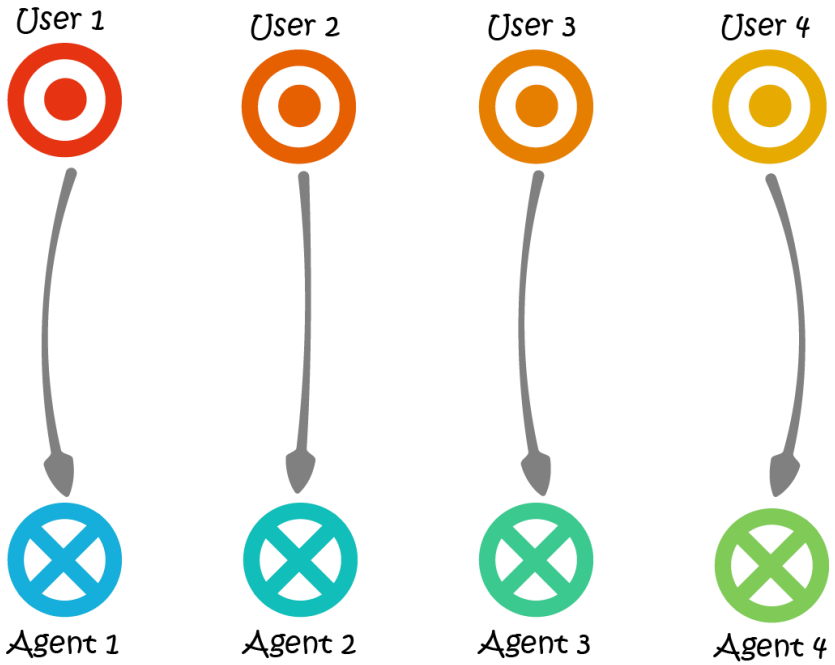
Each point represents one character's final position

A different procedure

N2N:

N-user-to-N-characters

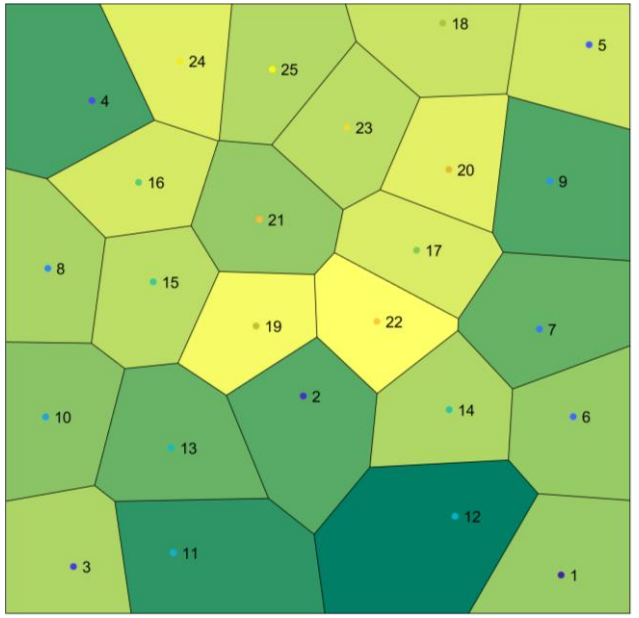
→ N user, each plays only 1 trial



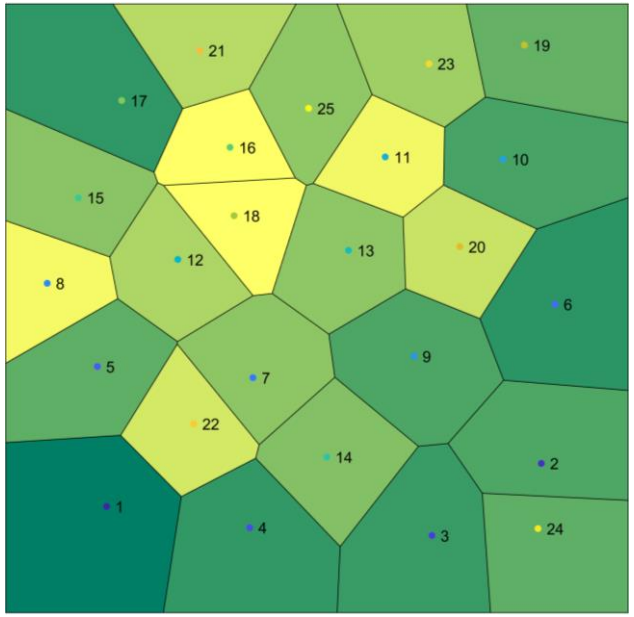
Hypotheses:

- Collective behaviors:

  S2N & N2N differ on behavioral diversity



Real result

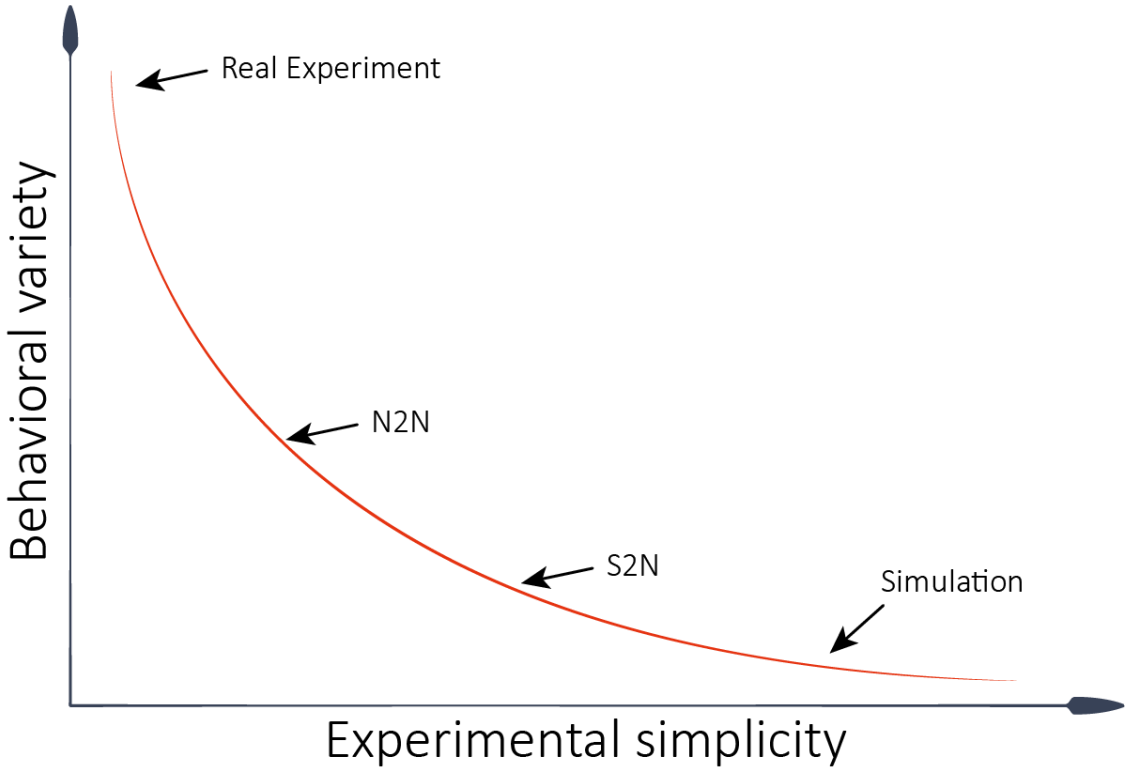


N2N result

The One-Man-Crowd paradigm …

- Is able to create crowd dataset with full body animation
- Has successfully replicated well known emergent patterns
- Has 2 different procedure (S2N & N2N)

  S2N introduces bias from the lack of behavioral variety, N2N is able to compensate



Thank you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Can OMC Handle Multi-directional Flow?