

# Toward directable autonomous crowds



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# Populate virtual environments



- ❖ Mainstream in animation/vfx
- ❖ Trend in video games
- **Crowds must be believable & directable**

# Autonomous entities



- ❖ Manual authoring
  - ❖ Long (read expensive)
  - ❖ Difficult
- ❖ What is autonomy ?
  - ❖ Handle high level orders
  - ❖ React to events
- **How tools can direct autonomous entities?**

❖ Software company

❖ INRIA's spin-off

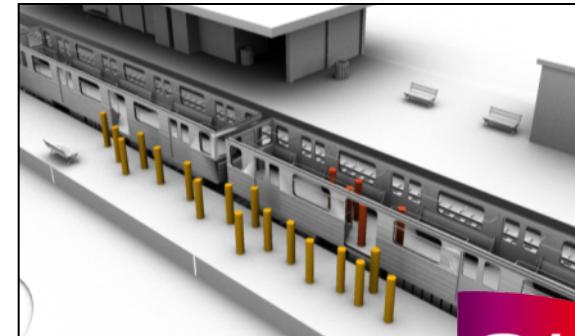
❖ Founded in 2009

❖ Virtual humans in 3D worlds

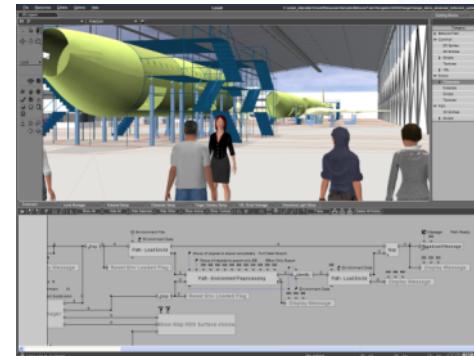
❖ Animation

❖ Navigation

❖ Behaviors



**SNCF**

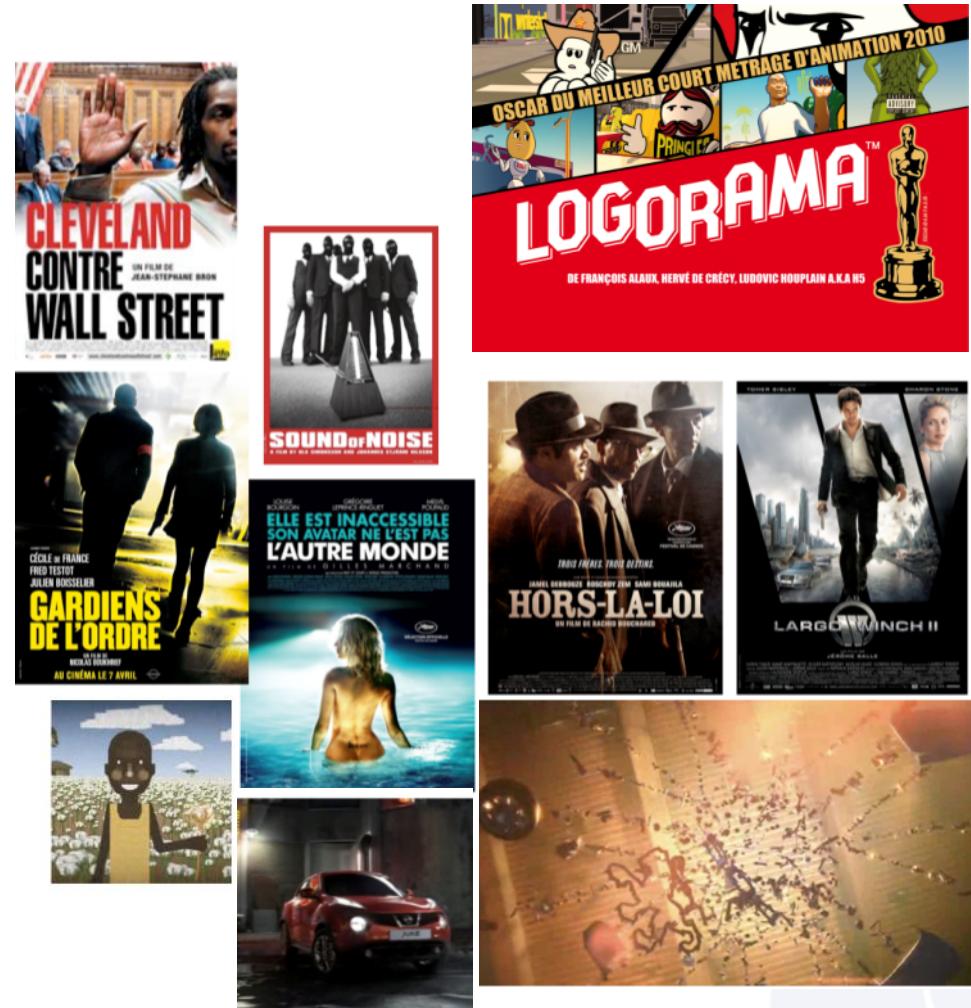


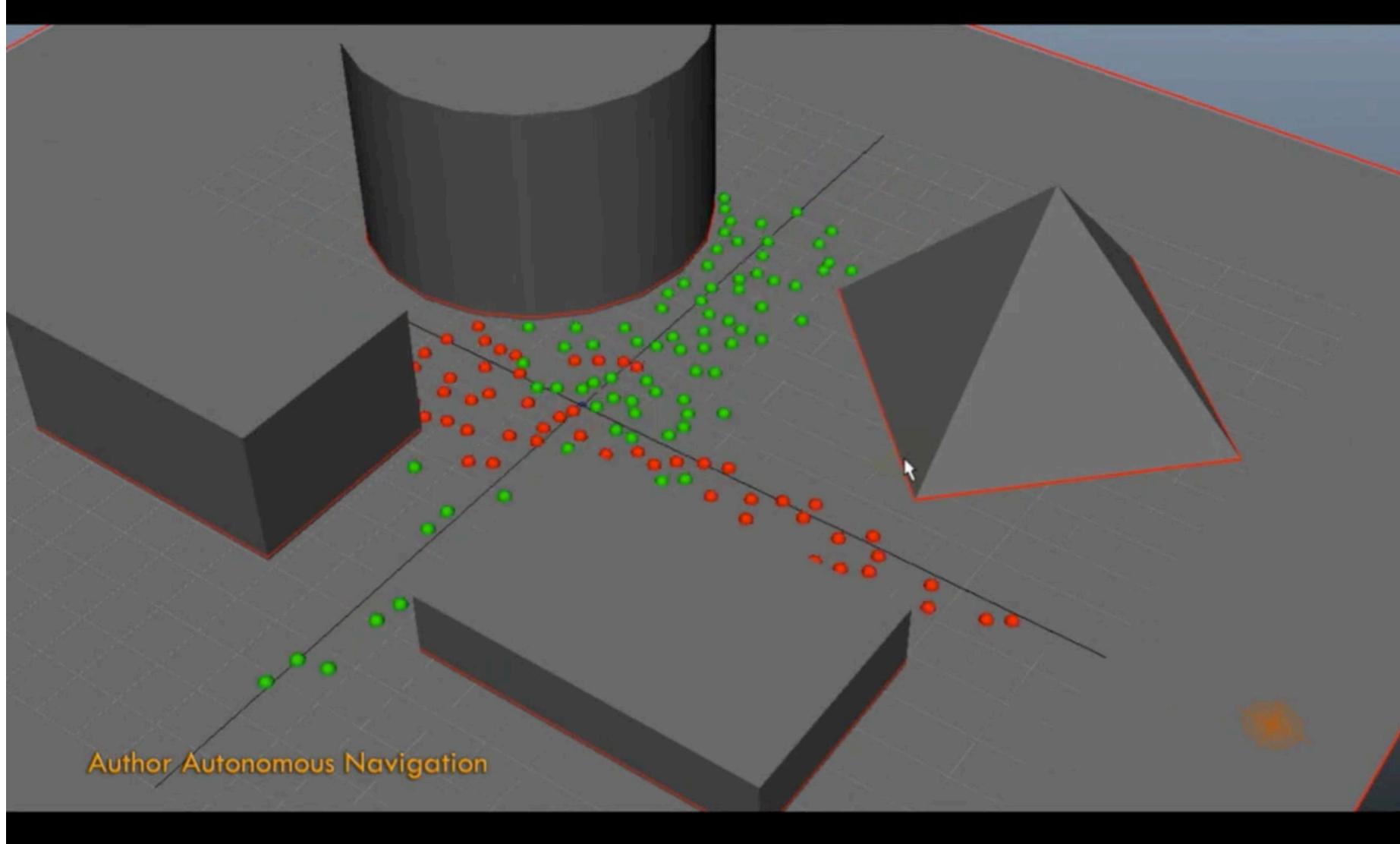
**D2DS**



**MICROS**  
IMAGINE

- ❖ Post-production studio
- ❖ France, Belgium & Luxembourg
- ❖ Special effects for commercials and features films





Author Autonomous Navigation

# Key ideas

## ❖ Known host tool

- Plugin for Autodesk Maya®

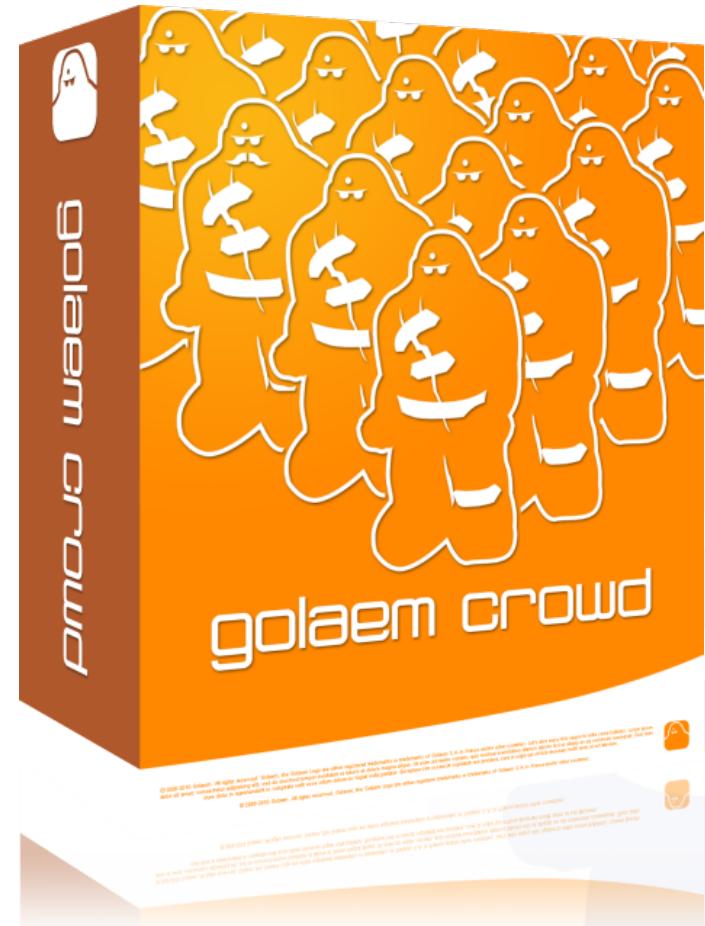
## ❖ Respect existing production workflow

- Designed with professionals

## ❖ Rely on Golaem SDK

## ❖ Focus on users needs

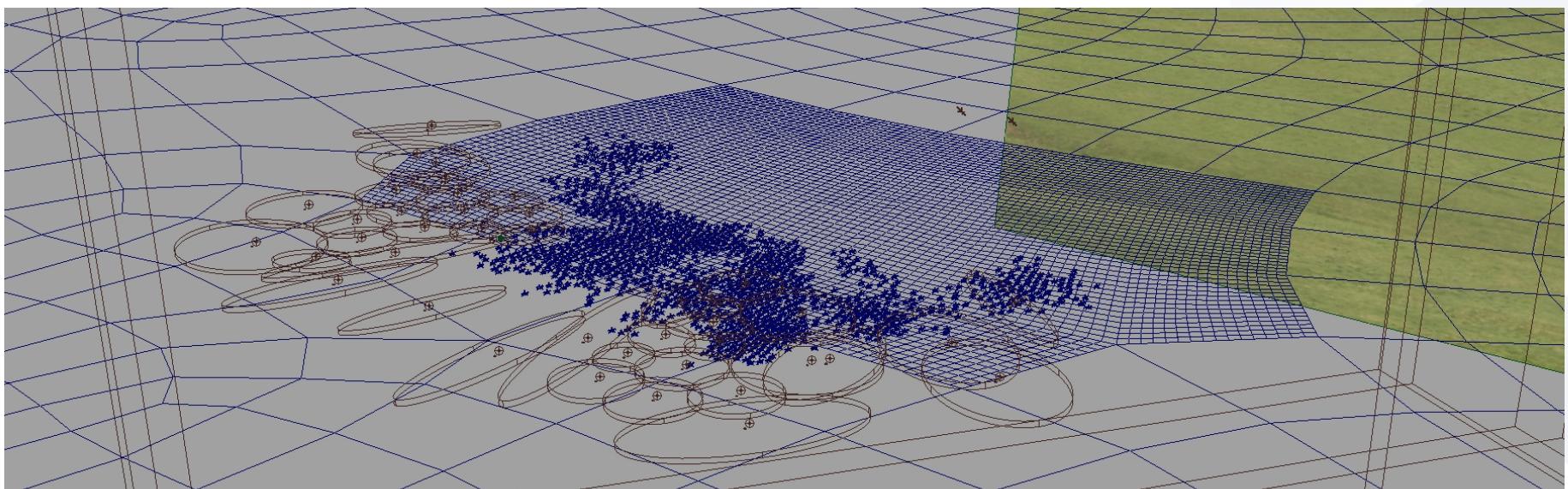
- Limit exposed features



- ❖ How the entities move in the environment
    - ❖ As a whole
    - ❖ At the entity level
  - ❖ Usually created using particles and fields
- **How to introduce autonomy?**

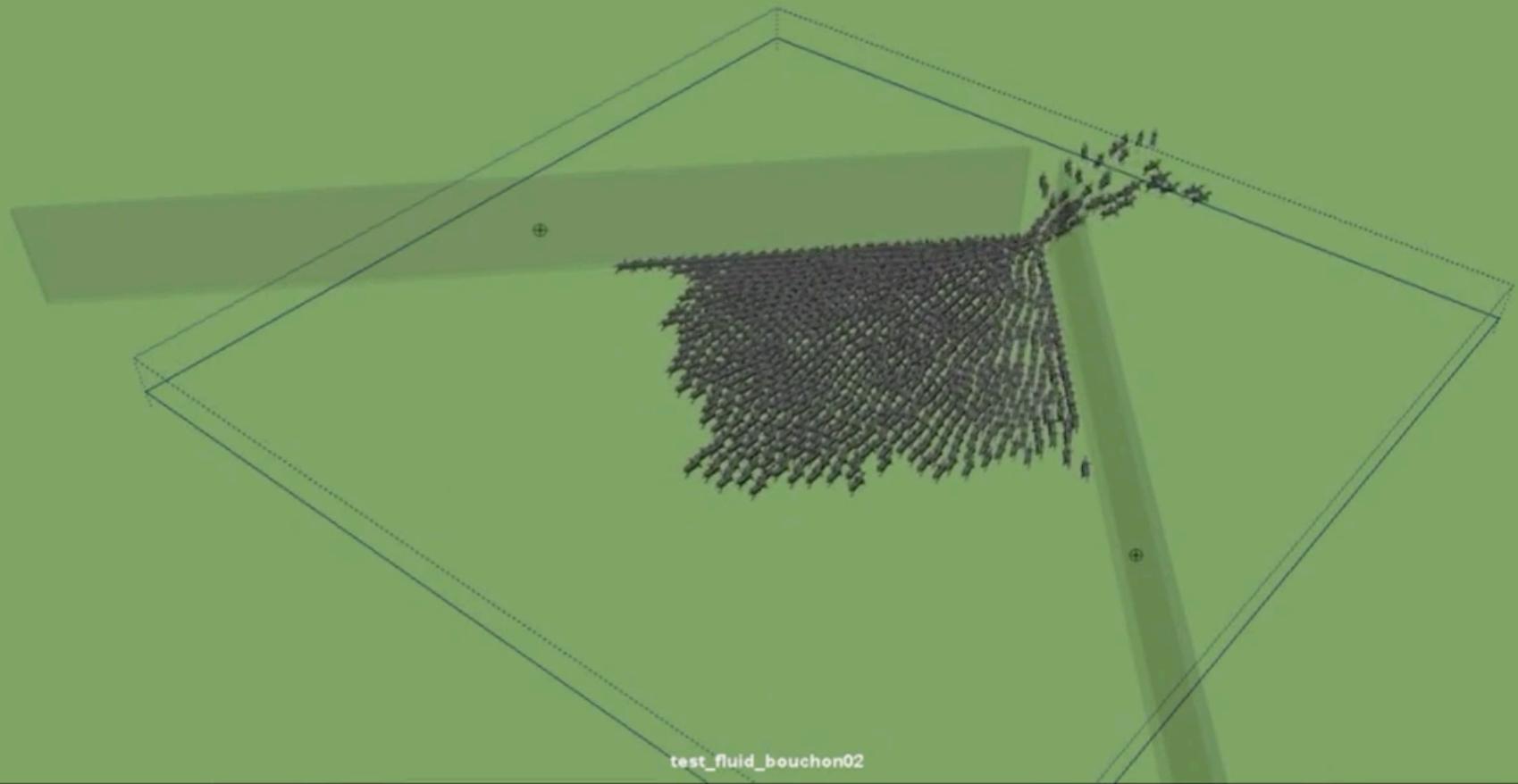


- ❖ Explicit setup
  - ❖ Localized fields
  - ❖ Keyframed forces
  - ❖ Separation forces
- ❖ Difficult to tune
- ❖ Impossible to reuse

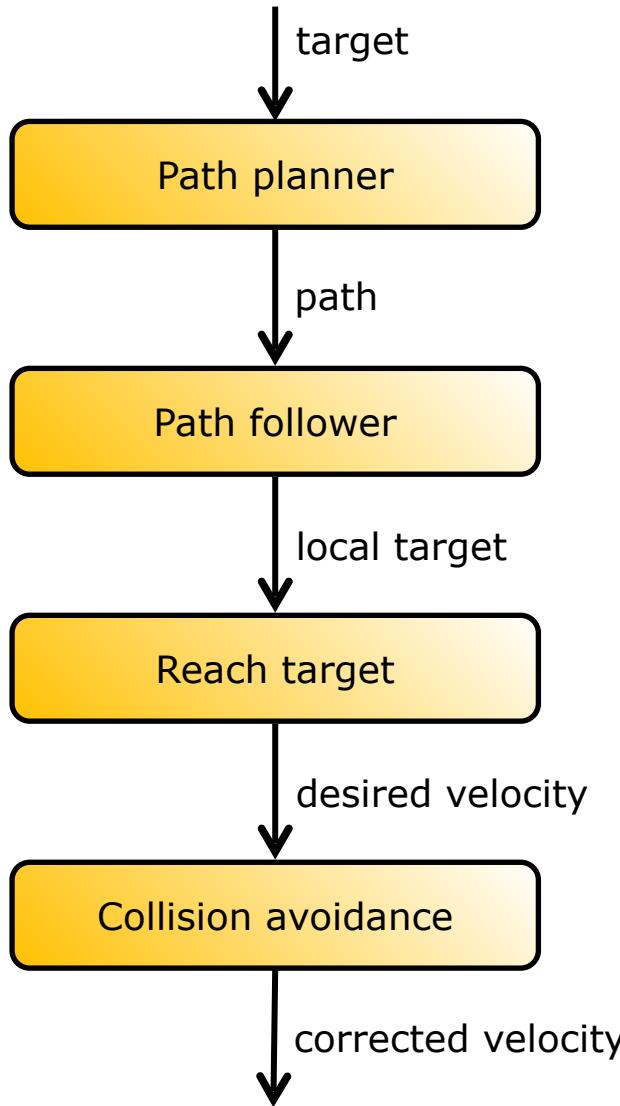


# Force fields

MikroImage  
wiu



# Autonomous navigation



➤ Rely on Golaem SDK

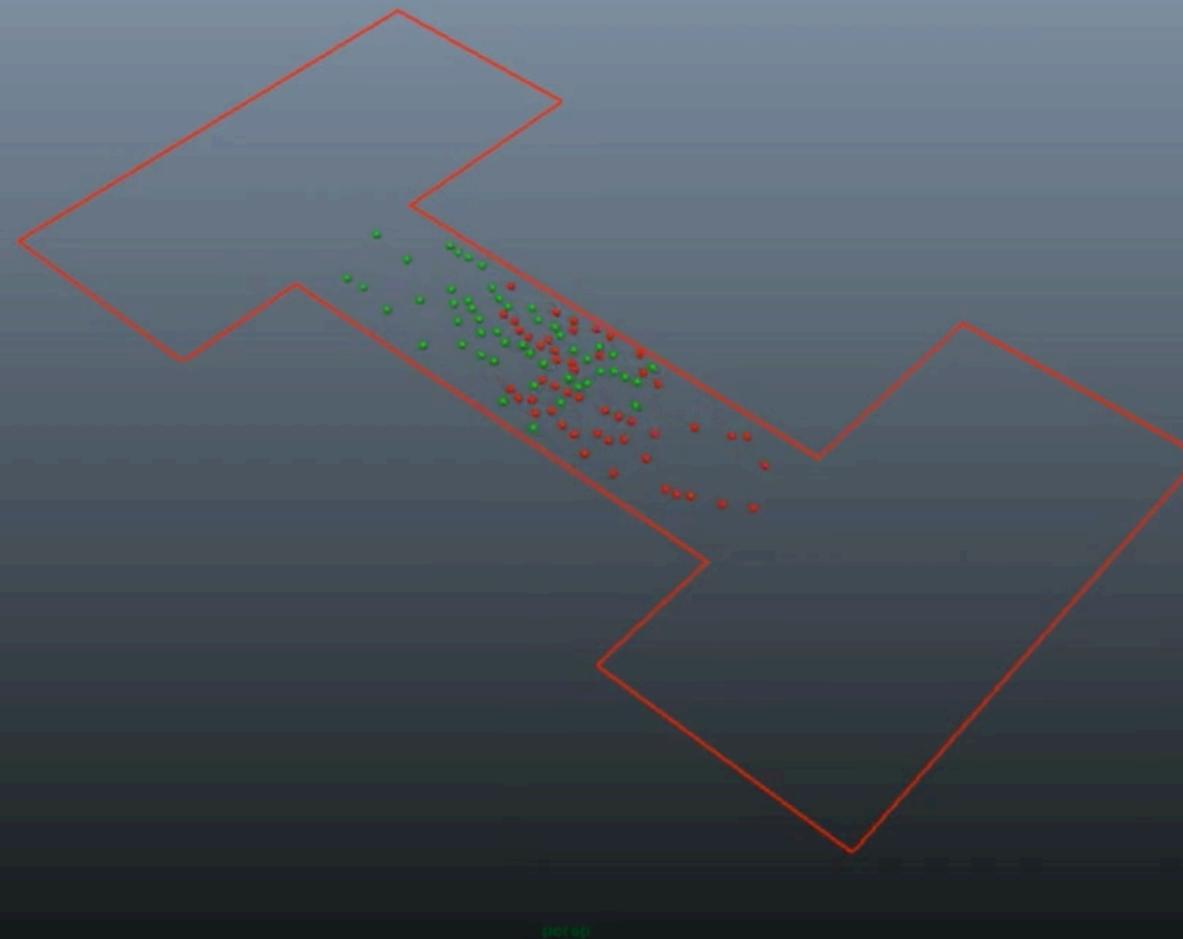
➤ Navigation mesh & roadmap

➤ Configurable navigation  
pipeline

➤ Algorithms handle complexity

➤ What tools to direct ?

# Provide « goto » targets



## Force fields as input

Theory: best of both worlds

Practice: so-so

Manual control of some entities

Forces from Maya

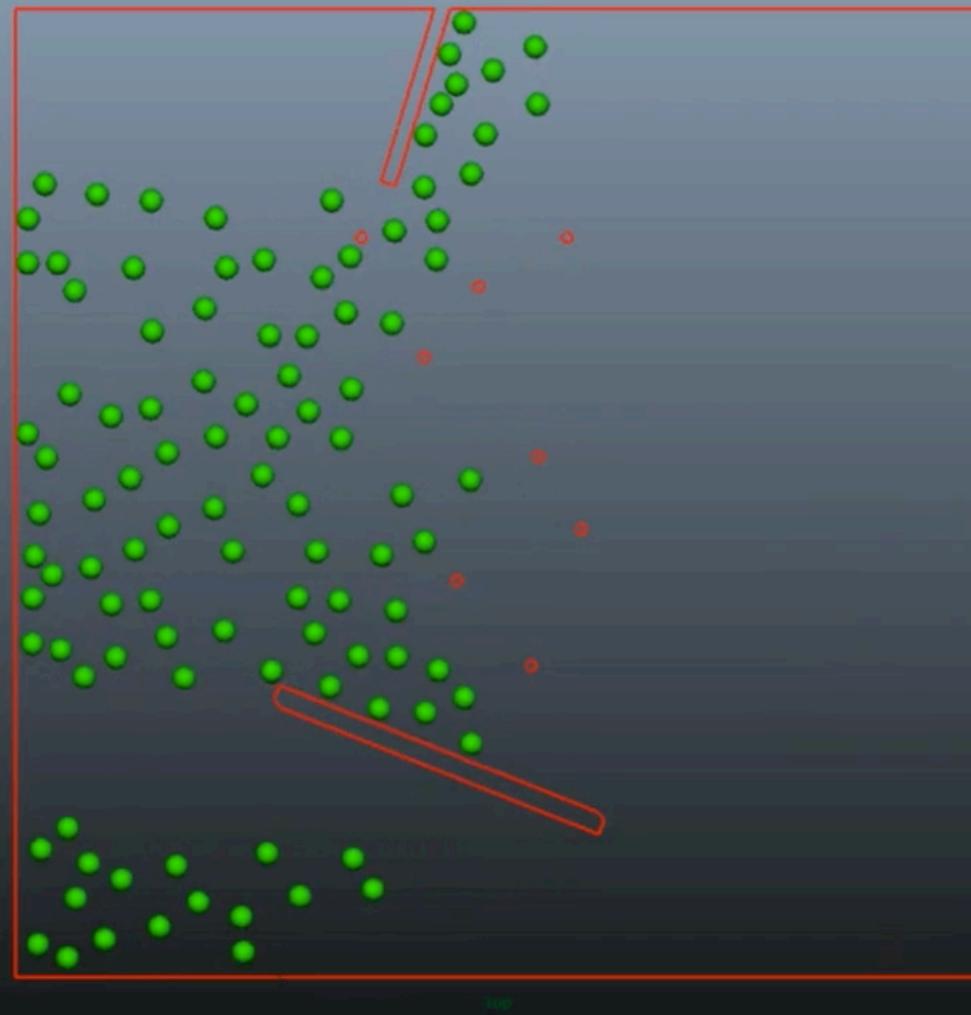
Force to velocity

desired velocity

Collision avoidance

corrected velocity

# Mix with manual



28.1 fps

# Expose parameters

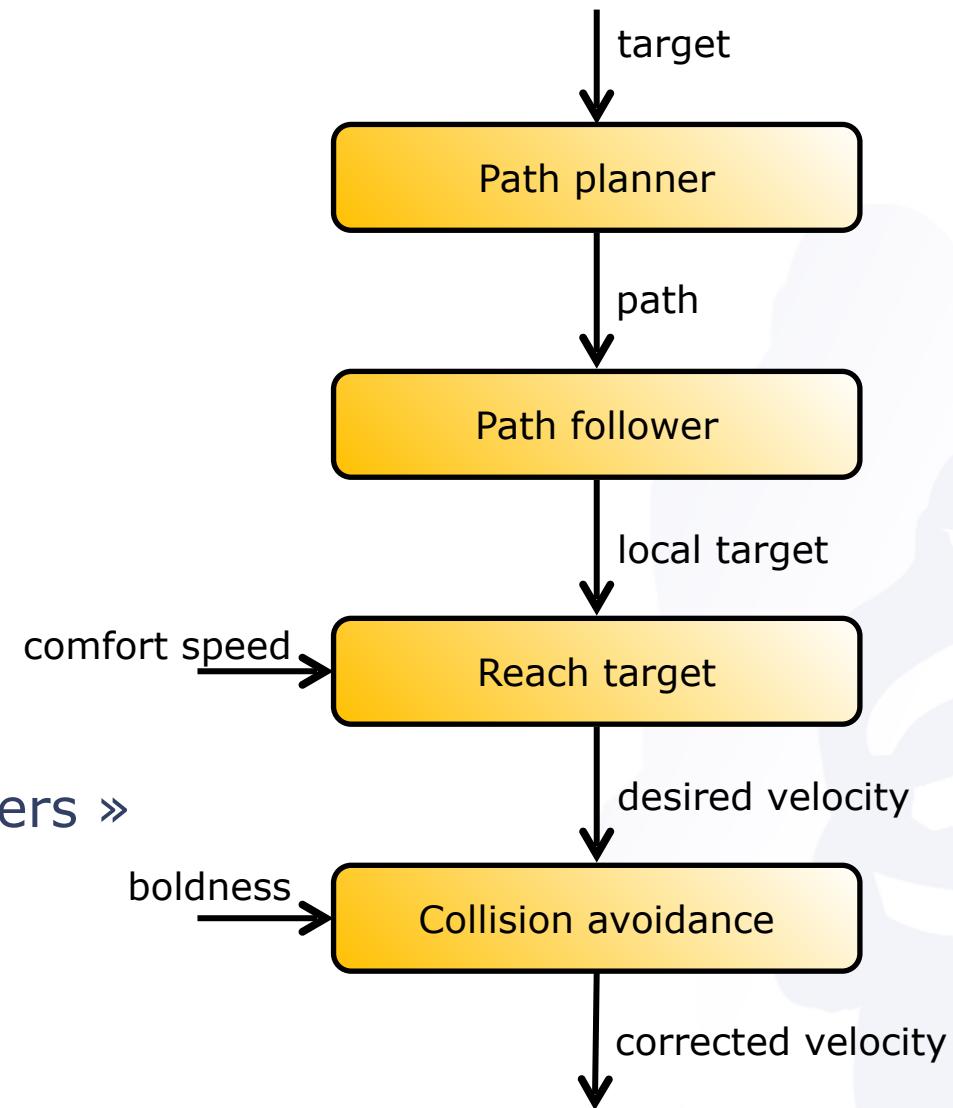
## Parameters must

- ❖ Understandable
- ❖ Visible influence
- ❖ No « wrong » value

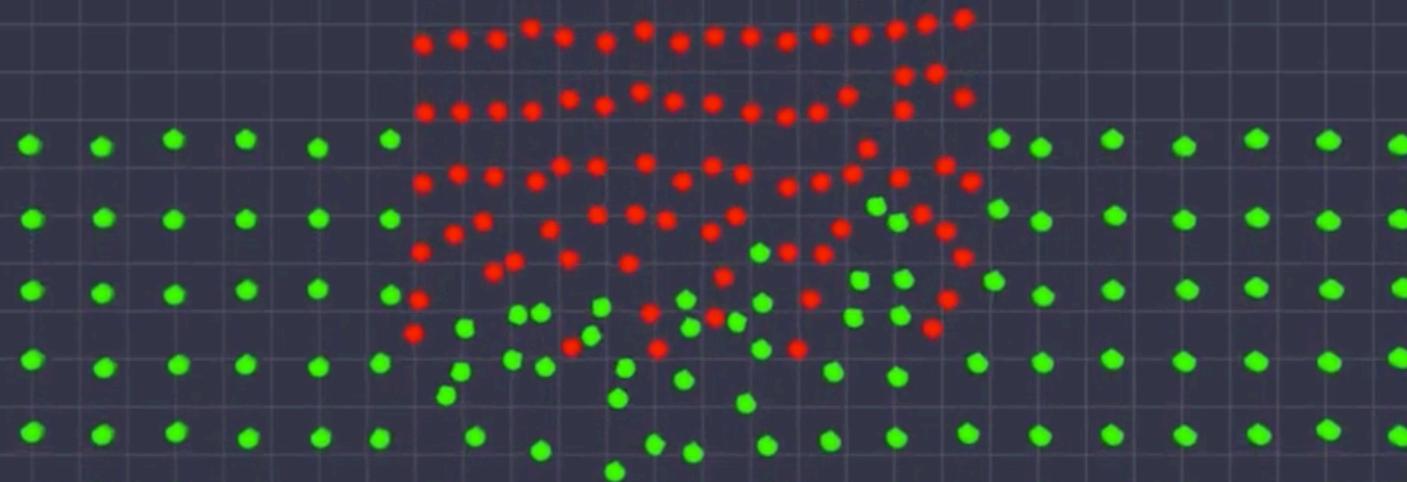
## Comfort speed

## Boldness

- ❖ « I don't care about others » factor



# Expose parameters



## ❖ Groups

- ❖ Cohesive flocks and formations

- ❖ Sketching

## ❖ Navigation fields

- ❖ Allow to navigate around obstacles toward a goal

- ❖ Easy to mix with authored fields

- ❖ *« Directing Crowd Simulations Using Navigation Fields » - Sachin Patil et al.*

# Conclusion



- ❖ Innovative tool
- ❖ Change of habit
- ❖ New direction possibilities
- ❖ Convince animators to use it
  - ❖ Useful and simple
  - ❖ Lack of real production feedbacks
- ❖ Applicable for game designer tools ?

# It's question time !



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Rendered pictures extracted from:  
« Alesia, le rêve d'un roi nu »  
Production : Agat Films et Cie  
Scenario & direction : Christian et Gilles BOUSTANI