Réalité virtuelle pour l'entrainement sportif : enjeux et défis

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Overview

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02 - Motivations & Expectations in using VR for human performance

03 - VR training projects

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01

Context

Human performance analysis, understanding and training

Human performance?

Force, velocity, flexibility…

Perception, decision making, strategy

Locomotor coordination

Physical status, fatigue

Multifactorial

VR as a mean to isolate subskills?

Promise of Virtual Reality

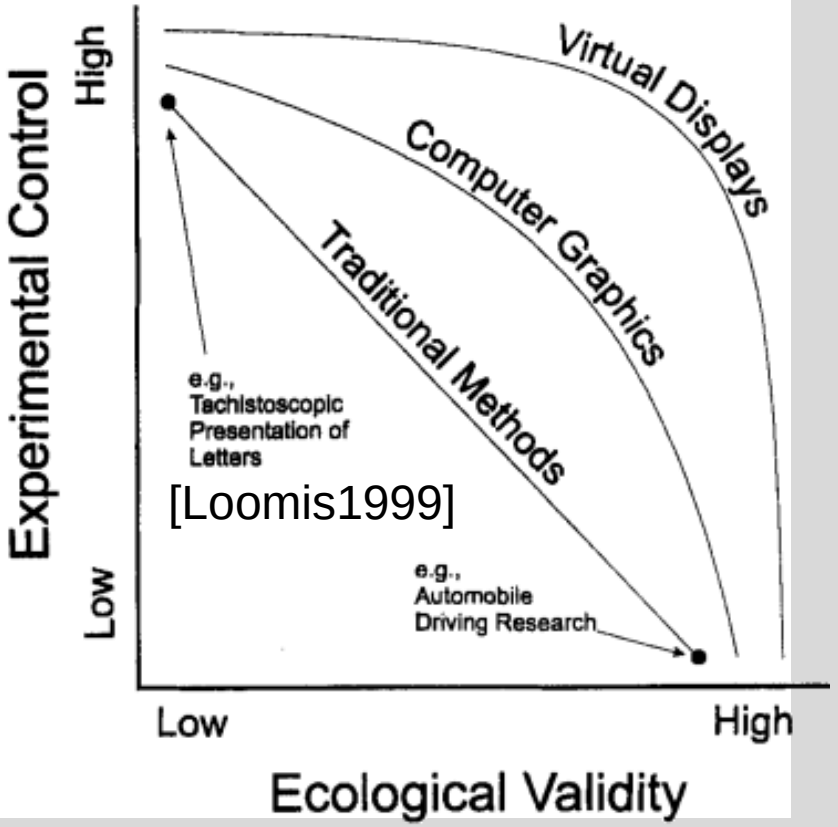
Controlled/ecological trade-off

Standardisation

Control of multisensorial feedback

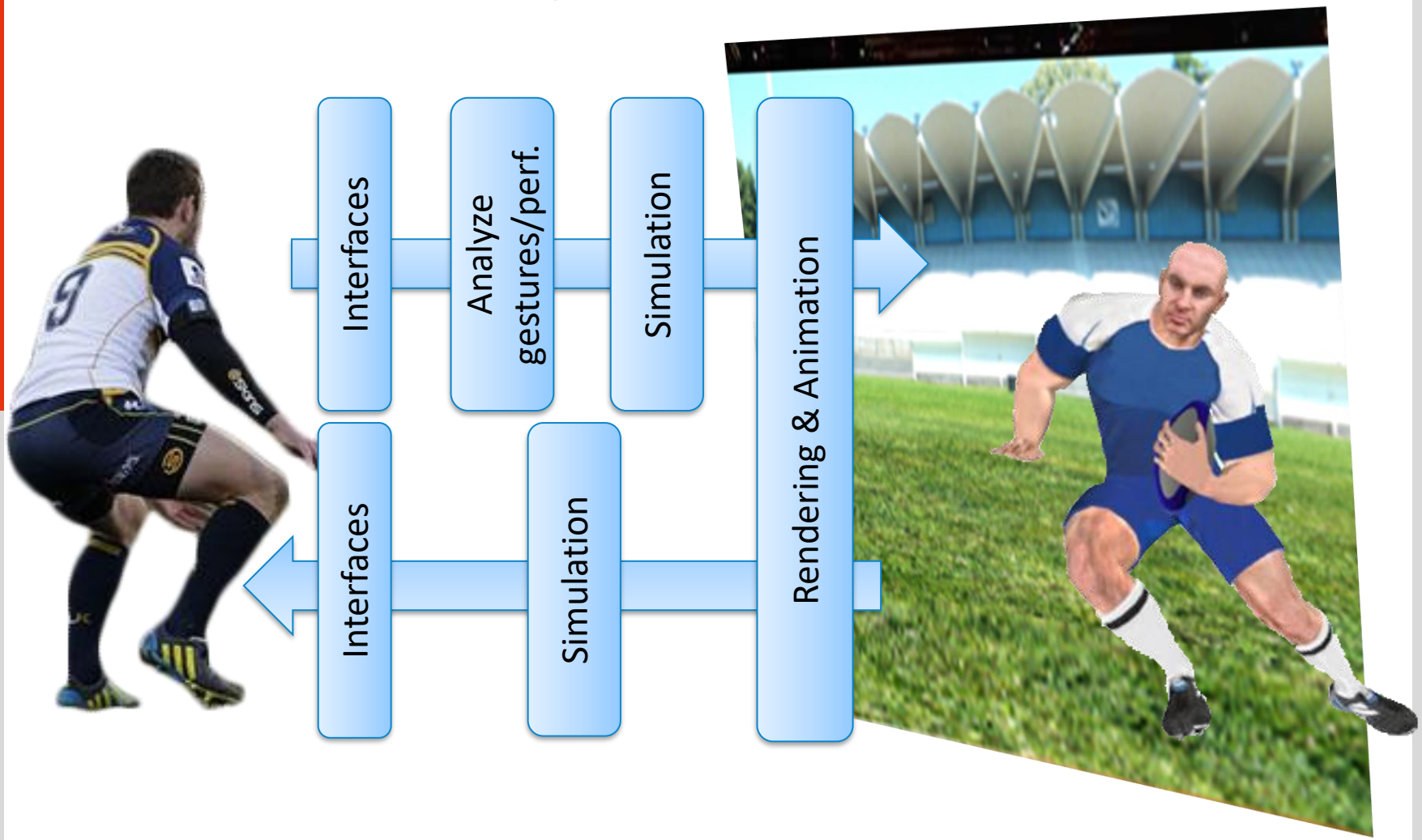
Secured environment

Motivation/gamification



Introduce technological challenges

VR Interaction loop



02

Motivations & Expectations in using VR for human performance

Context

Dissemination of VR in the wide public audience

Various

- **Applications**
- **Motivations**
- **VR experiences**
- **Requirements**

Dance battle in VR-Chat (RoadToVR)

Better understand how and why VR is used

➔ Survey on the Dance VR community

1. **Motivations for using VR for dancing?**
2. **Features do users like and dislike?**
3. **Guidelines for designing user-centered dance VR applications?**

[TheVisualComputer 2023]

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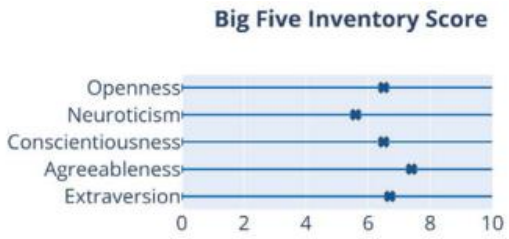
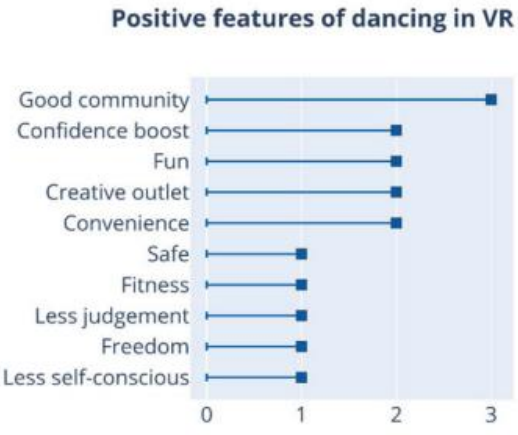
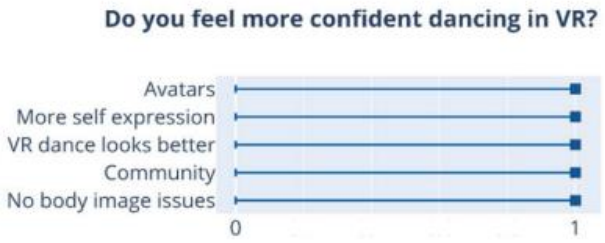
Results – « professionals » (n = 11)





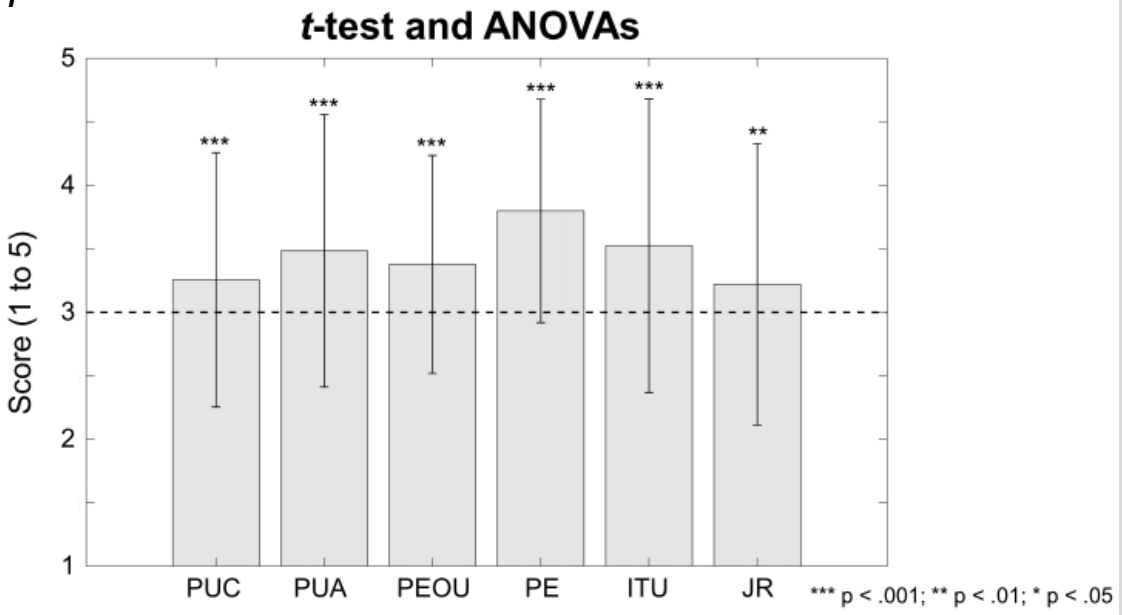


Prefer their avatars to be a different from themselves
Feel more confident when dancing in VR compared to the real world
Technical limitations: headset, latency, body tracking

Acceptance by coaches of immersive virtual reality for improving sport performance

[Devrièse-Sence 2023]

239 coaches from various sports
Perceived Usefulness for Coaching (PUC)
Perceived Usefulness for Athletes (PUA)
Perceived Ease Of Use (PEOU)
Perceived Enjoyment (PE)
Intention To Use (ITU)
Job Relevance (JR)



Conclusion

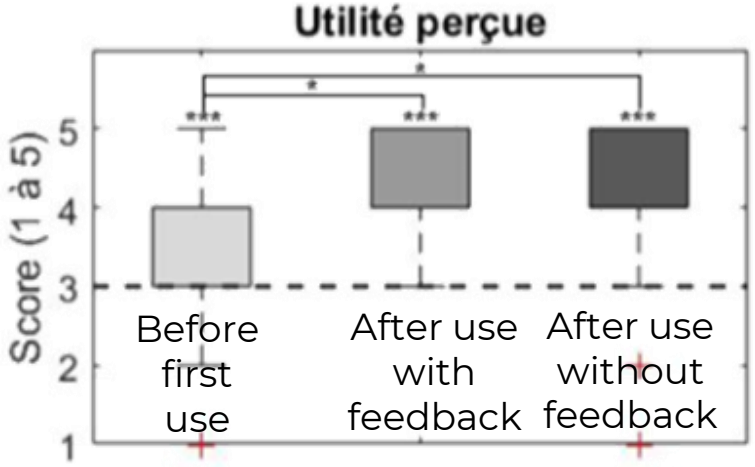
Motivation in VR ++, reported as “Fun”

Reported as equally exhausted

Limitations of VR headset and other technological devices

Considered as useful by professional coaches

[Devrièse-Sence 2023]



Open questions for “serious” training applications: Transfer of skills?

03

VR training projects

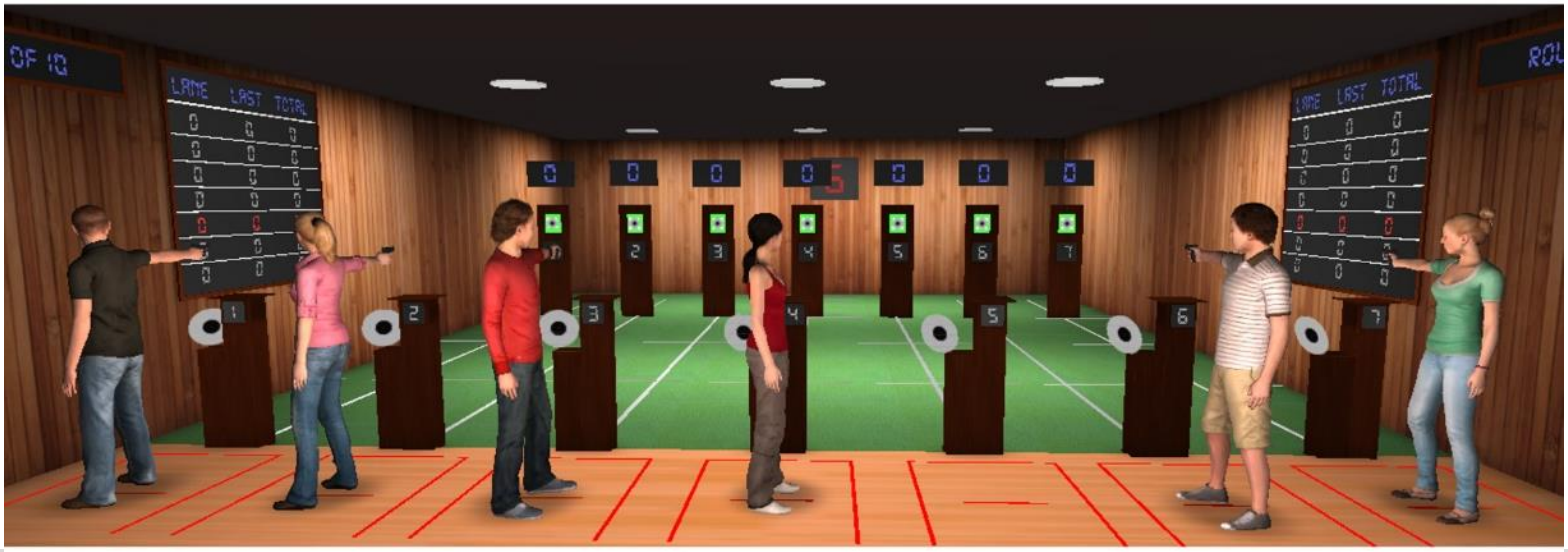
Preparing athletes to future anxious conditions

A methodology for introducing competitive anxiety and pressure in VR sports training, application to shooting

Coll. with Hybrid team

ECG analysis

Variable	Baseline $(\overline{x}, \sigma)$	Experiment $(\overline{x}, \sigma)$	*F*-statistic
Mean RR (ms)	(648, 97)	(664, 104)	$F_{(1,16)} = 8.21^{*}$
Std RR (ms)	(37.7, 16.08)	(46.13, 20.9)	$F_{(1,16)} = 15.64^{**}$
HRV index	(8.4, 2.84)	(10.8, 4.12)	$F_{(1,16)} = 82.04^{**}$
LF normalized	(84.5, 8.27)	(90.2, 4.16)	$F_{(1,16)} = 16.84^{**}$
HF normalized	(15.47, 8.25)	(9.73, 4.16)	$F_{(1,16)} = 16.85^{**}$



[Frontiers in Robotics and AI, 2015]

Develop new sensors and signal processing

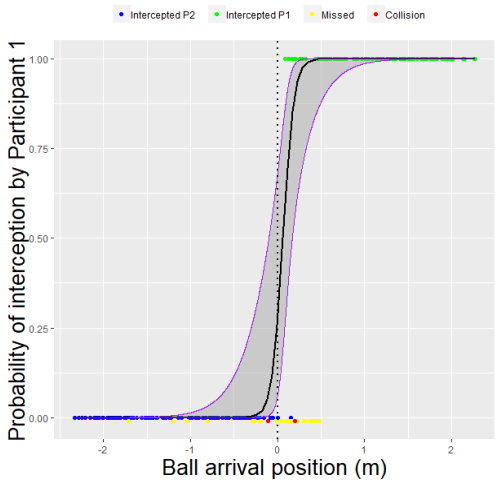
Training to collaborative complex tasks

Subskill in volley-ball: intercept a ball serve in-between players

Study the decision-making process ➔ standard situations

- Design an egocentric uncertainty area

Propose training system to enhance the cooperation ➔ simulate situations



[ECSS2018; IEEEVR19]

Training to collaborative complex tasks

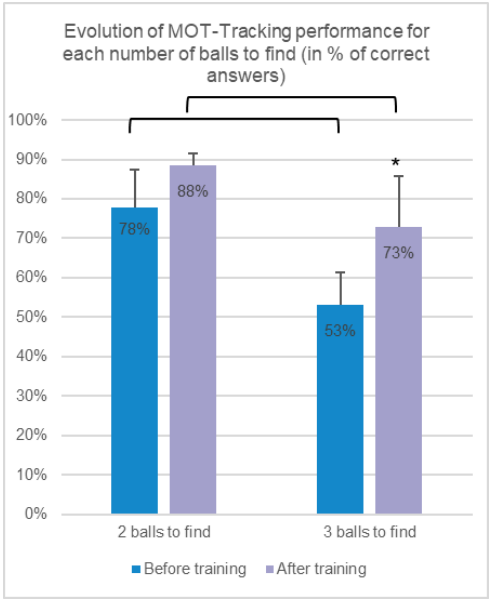
Distant collaboration + avatar simulation/rendering

Training to player tracking tasks for goalkeepers

subskill: track several targets and use peripheral information

Adaptation of standard MOT protocol (perception only)

4 months training



Training to player tracking tasks for goalkeepers

Design of new cheap large field of view XR systems

Detect fine visual cues

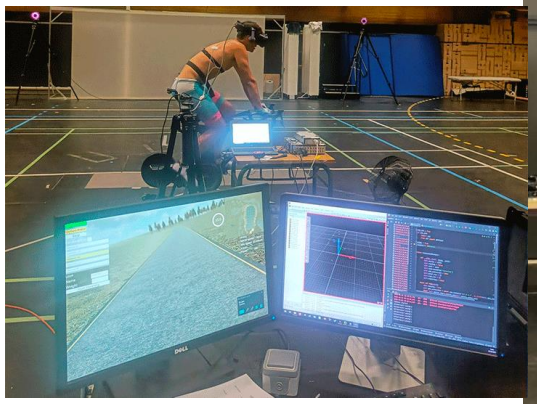
ShareSpace project: Embodied Social Experiences in Hybrid Shared Spaces

Aim: propose innovative AI-based amplifiers to support coordination between people

- AI-driven humans creating change in coordination
- AI-driven amplifiers to enhance fine visual cues

Scientific questions:

- Information Encoding
- Information Readout
- Does VR/AR enable to train these skills?



Avatar simulation with sparse signals, physics-based simulation

Context: develop VR-training for Olympic French boxers

REVEA project: serious VR training in boxing

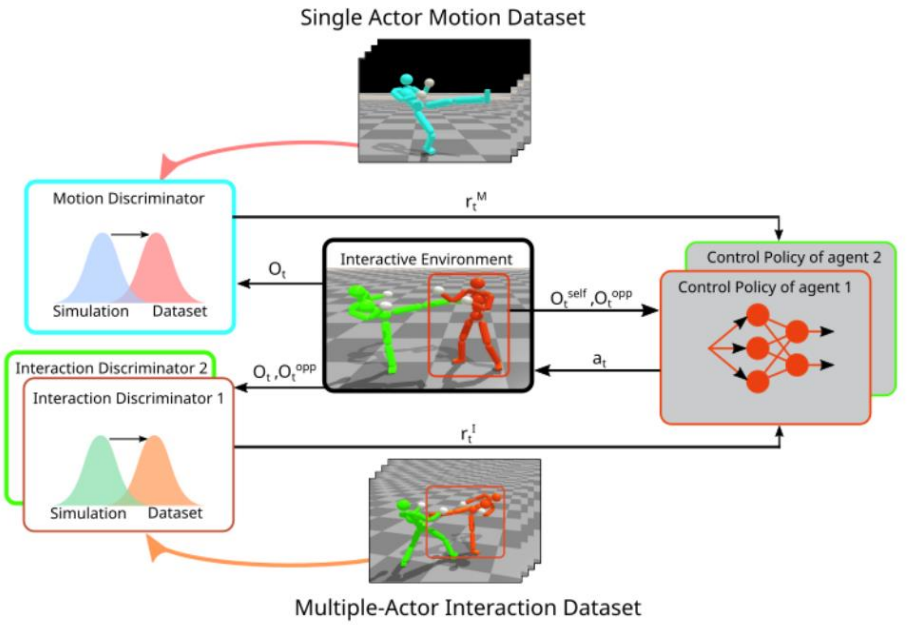
Anticipation of attacks
Biofidele experience
Transfer of skills

But unrealistic static behavior
➔ Simulation by imitation

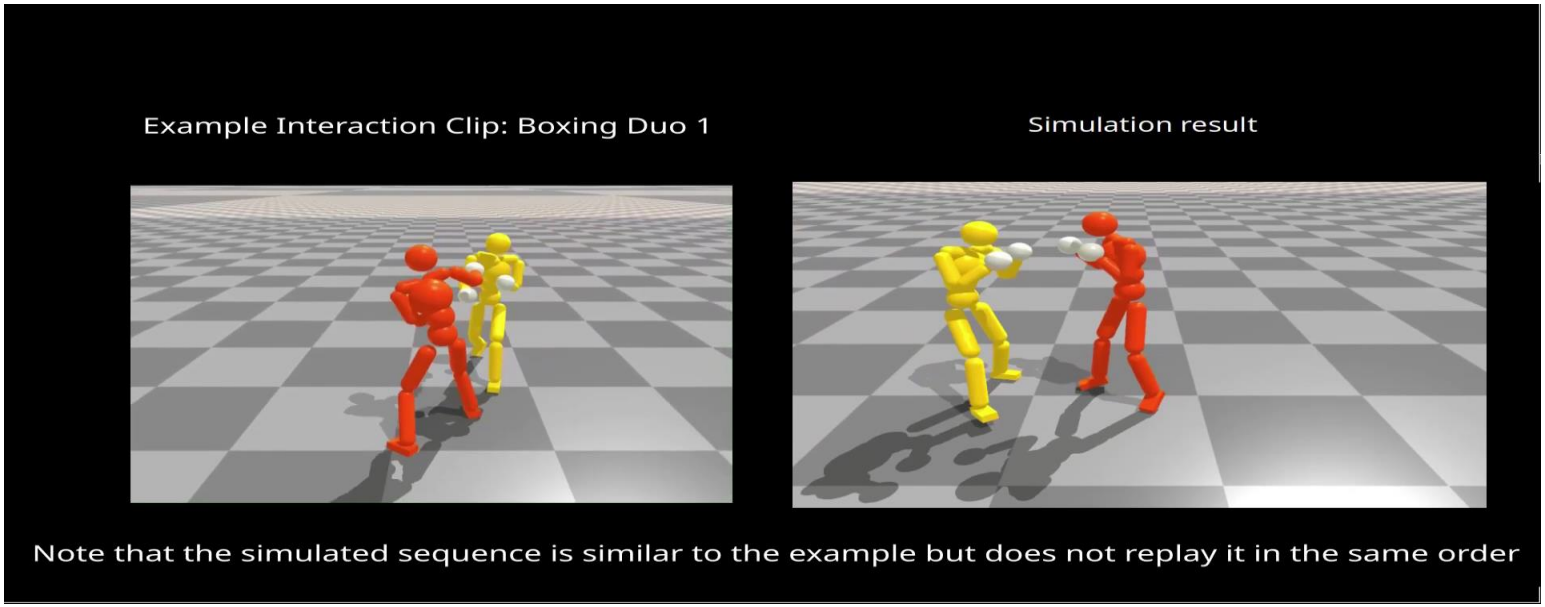
Imitation based learning for physics-based simulation of opponents

Extension of the imitation learning approach to interactions

- Single fighter clip => discriminator => similarity reward.
- Two fighters clip => each agent's interaction discriminator => interaction reward.
- Combined to train each agent imitate the interactive behavior depicted in the datasets.



Experiments and results: Imitation



- Generative AI for long term strategy simulation
- Video-based motion imitation

Conclusion

Human performance still difficult to capture, model & train

Many applications in sports, ergonomics, rehabilitation

Metaverse: multiple interactions, network

Challenges

- **Headset and interfaces**
- **Presence, embodiment, transfer…?**
- **Performance estimation and prediction with sparse or low-quality signals➔ cheap and on-site devices?**
- **Protocols to embed technology in training sessions**
- **Ethical issues?**

Contributors & Questions?

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Hybrid

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