# D9.4 FINAL SHOWCASE DEMONSTRATION

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## Document History

| Version and date | Reason for Change |
|---|---|
| 1.0 23-08-2022 | Document created by Isjtar Vandebroek |
| 1.1 30.08.2022 | Version with contributions related to FMX included, previous version improved |
| 1.2 31.08.2022 | Revised version by Coordinators, after performing quality control |
| 01.09.2022 | Submission version |

# Table of Contents

# 1  EXECUTIVE SUMMARY

This report serves as documentation for the Final Showcase Demonstration. There were two showcase demonstrations, highlighting different components of the project.

One was an hour long keynote presentation at FMX Germany, Thursday, May 05 2022, involving Framestore, Cubic Motion and the University of Augsburg. FMX is one of the world's most important conferences dedicated to digital entertainment. This showcase consisted of a presentation by Manne Öhrström (FS), Steve Caulkin (CM) and Florian Lingenfelser (UAu). The presentation gave a broad overview of the current state of the digital entertainment industry and the role highly realistic digital humans currently play. It then went on to showcase the technological developments undertaken by Framestore, Cubic Motion and the University of Augsburg within the PRESENT project and how these developments could lead to significant progress within the industry. A live demo of the technology also formed a part of the presentation.

The other showcase was CREW presenting the Experimental Production *Delirious Departures* at SIGGRAPH Vancouver. SIGGRAPH is the premier conference & exhibition on computer graphics & interactive techniques. The PRESENT technical components showcased were locomotion (CM), multi-agent small crowd simulation (Inria) and gaze (CM), integrated in a VR experience by CREW, which approaches the wider applicability of digital humans in different forms and representations. In addition to the experimental production, CREW gave a 15 minute presentation and participated in a panel discussion and an interview.

# 2  BACKGROUND

This document is a concise report of the showcases, presentation slides of both showcases are added in annex.

Evaluation that was performed at these events can be found in deliverables:

- D8.4 Experimental Production Evaluation
- D8.5 Prototype Evaluation Results

CREW's participation in SIGGRAPH is the end result of the work established in WP8T2 Live Embodied & Collaborative Experimental Production. It integrates:
- the scenarios and architecture that were developed in WP2
- animation from WP3
- 1-n interactions in WP4

Specifically, the combination of 1-n simulations animated with the CM implementation of Motion Matching and a gaze system was technically and artistically significant. These developments were captured in the Complex Social Situation Use Case.

At FMX the following Work Packages were demonstrated:
- interaction between components, as established in WP2
- realtime rendering and facial animation in WP3
- social sensing of agent in WP4

# 3   INTRODUCTION

## 3.1   Main objectives and goals

The main objective was to showcase the technology developed within PRESENT to an audience of industry professionals.

## 3.2   Methodology

At FMX the partners Framestore, Cubic Motion and University of Augsburg did a joint presentation.  The three partners collaborated closely ahead of the conference, meeting weekly to put together a presentation with a strong narrative arc, showing the current state of digital humans within their respective industries, the technology developed as part of the PRESENT project and the potential of that technology for transforming workflows, interactions and outputs within those industries.  As part of the presentation a live demo was showcased and feedback questionnaires were filled in and collected.

At SIGGRAPH, CREW presented Delirious Departures, had questionnaires filled in and provided on-site feedback to interested participants. Eric Joris and Isjtar Vandebroeck also gave a small presentation and participated in a panel talk. Isjtar Vandebroeck gave an interview to the SIGGRAPH roving reporter during the online livestream. As for FMX, extensive preparation involving the partners of the project, including meetings every one or two weeks, took place.

# 4   THE TWO KEY SHOWCASES OF THE PROJECT

## 4.1   FMX presentation

The presentation took place at FMX 2022 in Stuttgart, Germany.  It was an hour-long, keynote presentation that formed part of the "Tools of Tomorrow" stream.  The program from FMX introduced the talk as below:

*"The worlds of offline rendered content production and realtime graphics are becoming ever closer. Tools and techniques that were previously computationally prohibitive are increasingly becoming available for a generation of interactive user experiences.  In this talk Framestore will PRESENT a case study of the work they are currently doing on the PRESENT project, where they are utilising machine learning to enable them to bring their high end film character rigs into realtime. PRESENT collaboration partners Epic Games and the University of Augsburg will then show how next generation tools such as these can be used to create emotional engagement with a user.  From these building blocks a vision of the future is emerging that will see ever more commonplace interactions between users and emotionally engaging virtual avatars."*

### 4.1.1 Introduction

The talk started with an introduction to the PRESENT project itself; its goals, approach and the role played by each project partner.
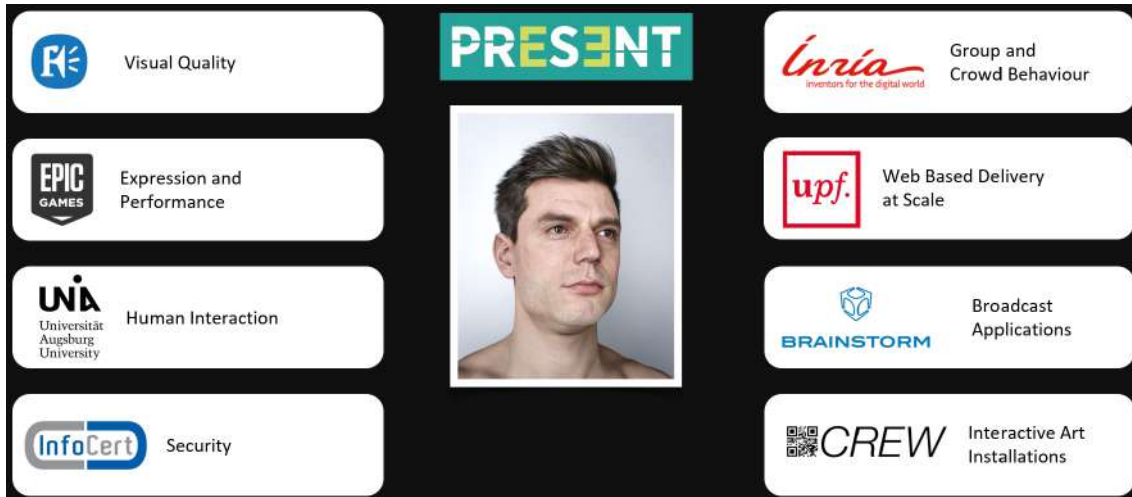


Once the broad context of the project was given to the audience the talk then identified 3 key areas that would be talked about in more detail:

1. Digital humans in visual effects and the techniques developed by Framestore as part of PRESENT project for bringing these cutting edge VFX techniques into the realm of realtime interactions.
2. Cubic Motion's work on automatically generating believable animations, making characters behave and respond in an open-ended fashion and allowing them to not only be real-time but to be able to react to different situations.
3. The University of Augsburg's innovations in detecting the emotional state of a user and utilising this information to modulate the behaviour and response of a digital Avatar.

The speakers for each of these three sections were then introduced.



### 4.1.2 Framestore

In recent years digital humans have become increasingly commonplace in VFX and their size on screen and range of performance is constantly increasing the demands placed on these complex assets. In the presentation Framestore gave a brief overview of the current methodologies for meeting these demands, both in terms of look and motion, and how the vast computational cost involved takes these techniques out of the reach of real-time applications.

As part of the PRESENT project Framestore has developed technology designed to solve these challenges, both in terms of animation deformation and shading.

The first piece of tech presented was a machine learning approach to rig deformation codenamed FIRA. This tech is yielding transformational improvements in the computational

cost of deforming high quality character rigs and bringing them within reach of real-time applications.
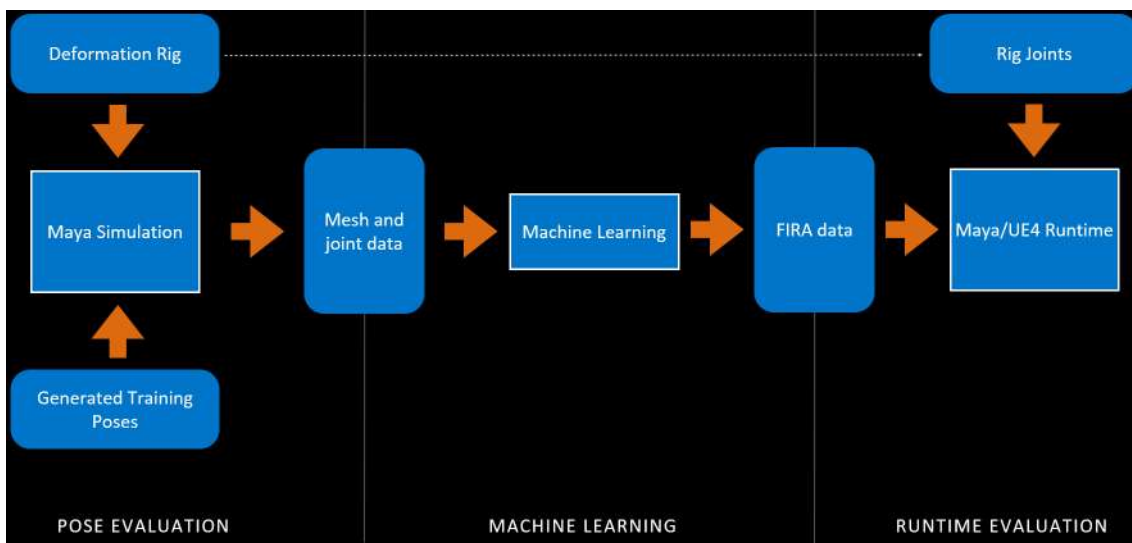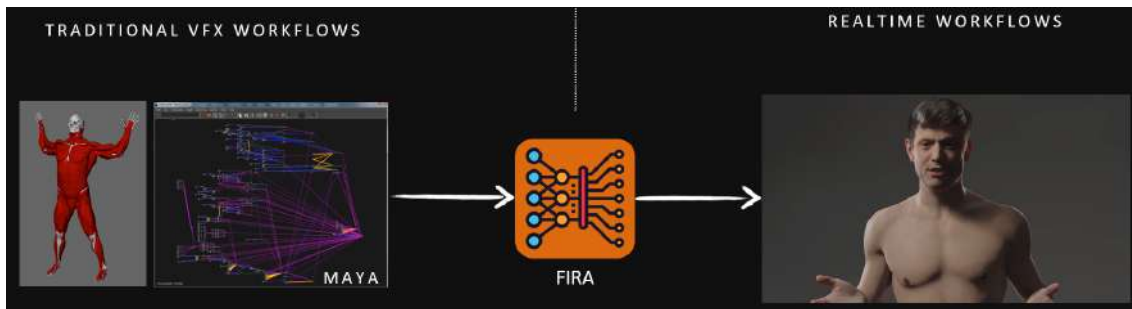




The second piece of tech presented was a pipeline for translation complex offline rendered shading models into more simplified realtime compatible materials.
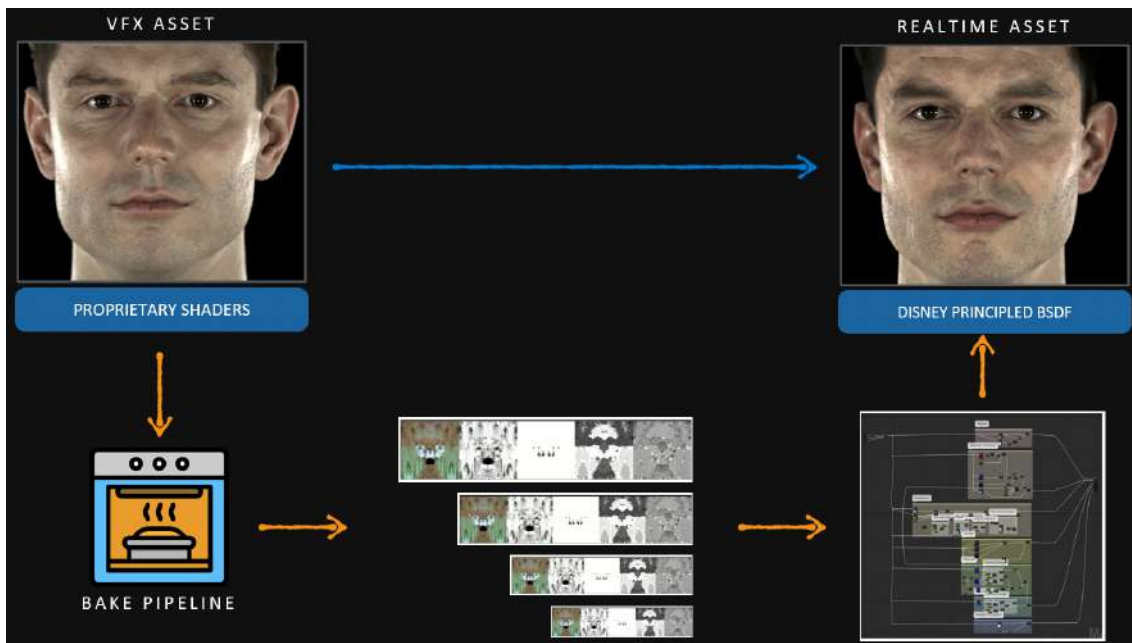
Examples were then given of bringing together both workflows in order to convert a high end VFX character asset into a realtime compatible digital avatar with minimal quality loss and manual intervention.



Both these technologies have recently been deployed on active projects and are being used to solve current production challenges. The feedback from these projects is being used to shape future development and these learnings and development areas were also outlined.

### 4.1.3  Cubic Motion

Cubic Motion presented our work on automatically generating believable animations, making characters behave and respond in an open-ended fashion and allowing them to not only be real-time but to be able to react to different situations.

A full write up of our dissemination is here,  PRESENTat FMX '22 Dissemination.

The first part of the presentation focused on the pipeline developed to produce high quality facial animation from an actor's performance. This technology uses depth information and 2D contour tracking to derive a 4D representation of the actor's geometry. Examples were shown of this process, which aims to faithfully capture the performance of the actor. In order to represent this data in a form which can be used as the basis for more flexible, generative systems, the performance is solved to a MetaHuman digital double of the actor.
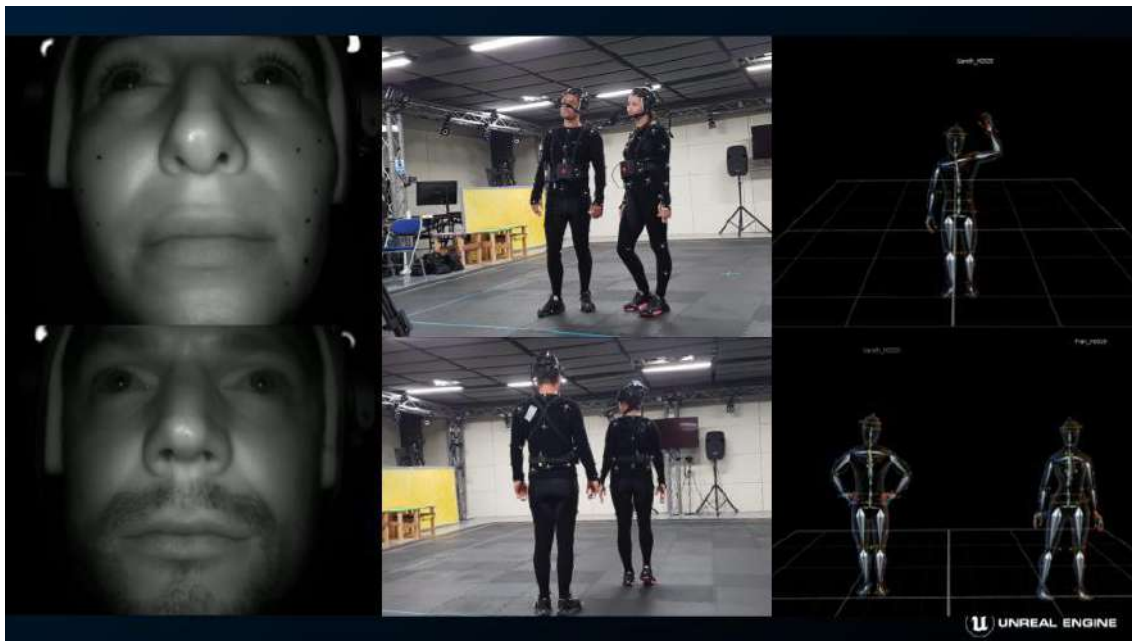
This animation data forms the basis of the motion generation systems explained in the second part of the presentation. These include gaze management, motion matching and the emotional style transfer of animation using generative adversarial networks.



These systems were shown implemented in Unreal Engine. The emotional model is represented as a 2D space connected to a state machine driving the facial animation of the agent. This is integrated with the system which drives the gaze of the agent towards a target.
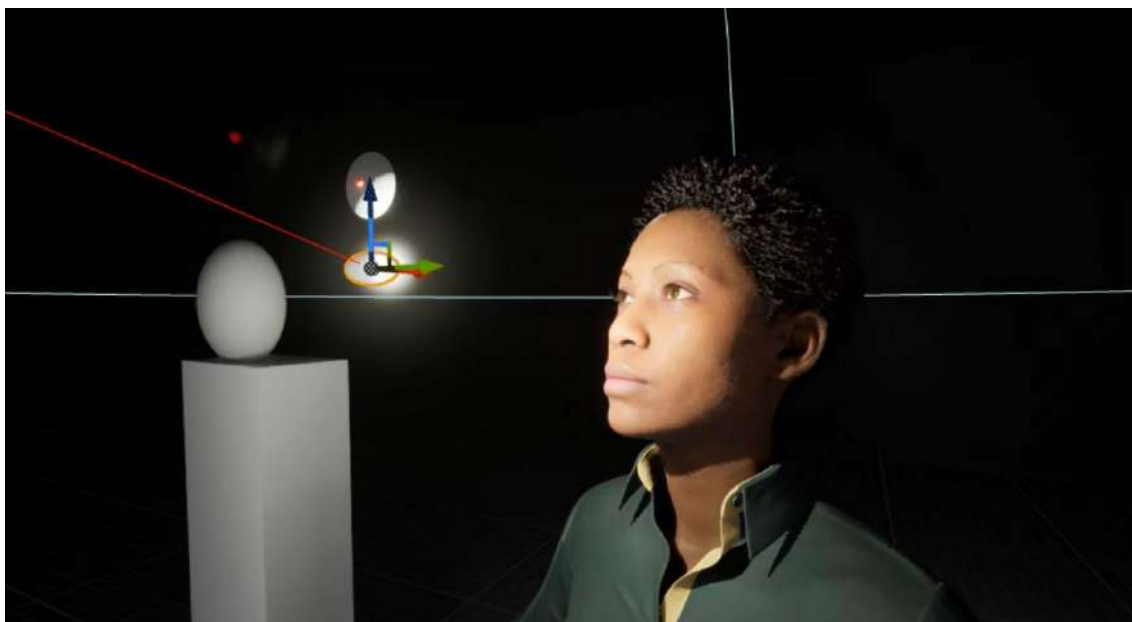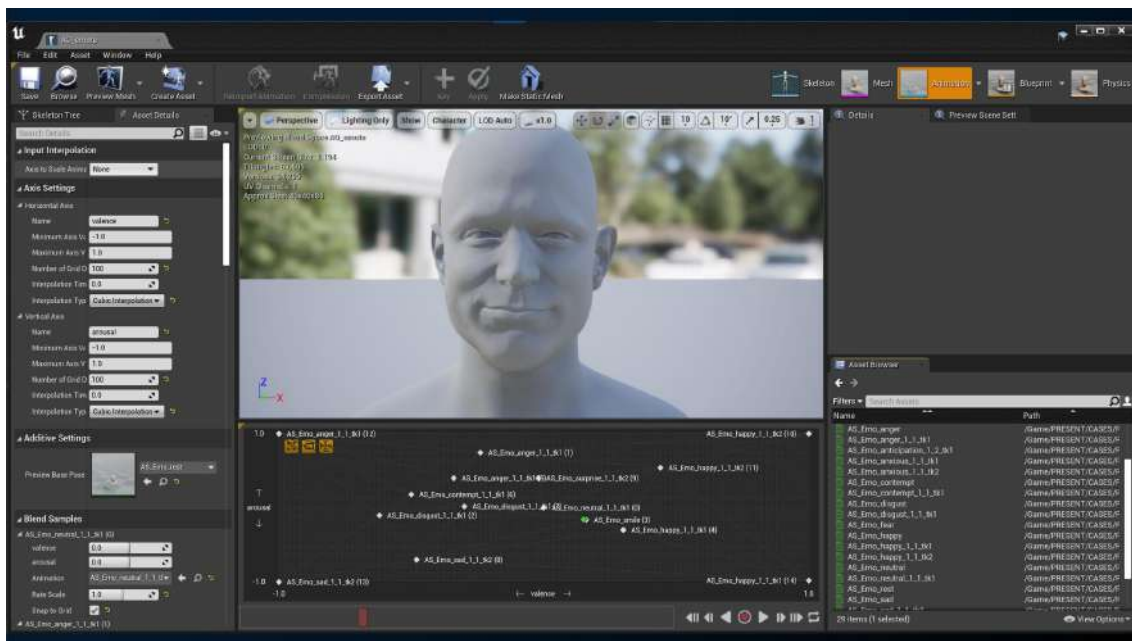
### 4.1.4 Augsburg

University of Augsburg presented the last part of the talk, elaborating opportunities to combine the introduced lifelike Digital Humans and Affective Computing into naturalistic and engaging experiences for the end-user.

To this end, we started with a small introduction to Human-Computer Interaction (HCI) and Affective Computing. As in the PRESENT project itself, the technical basis hereby lies in the real-time recognition of human behaviour (i.e. emotional states) through analysis of facial expressions, vocal characteristics, body language and physiology.
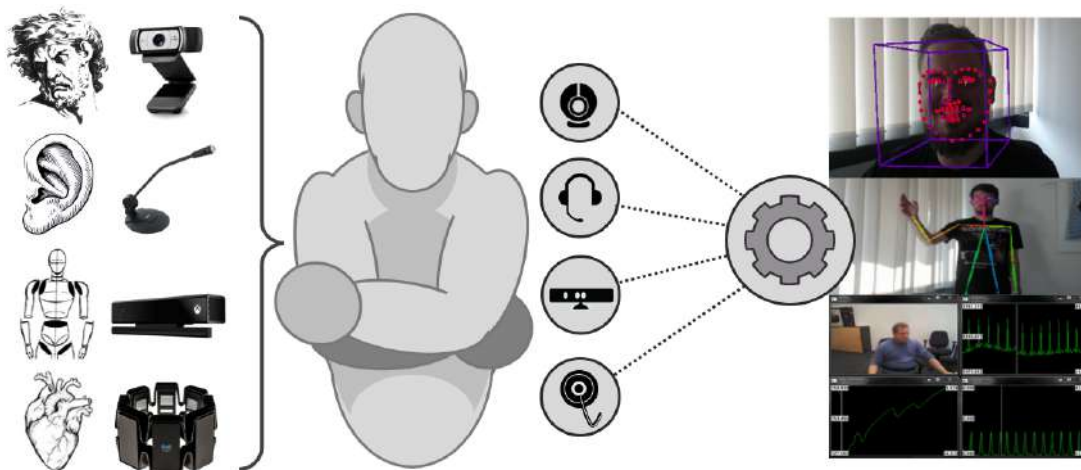
Given an accurate estimation of a user's current affective state, we are able to design applications that are able to react in an interesting way to the user. The corresponding concept we apply in the context of the PRESENT project is the Affective Loop. It describes a back-and-forth between implicit affective feedback that the human provides to the digital agent, which then reacts in a believable way. If the synthesised behaviour in return elicits an affective response in the human user, an immersive loop is established in the presented experience.
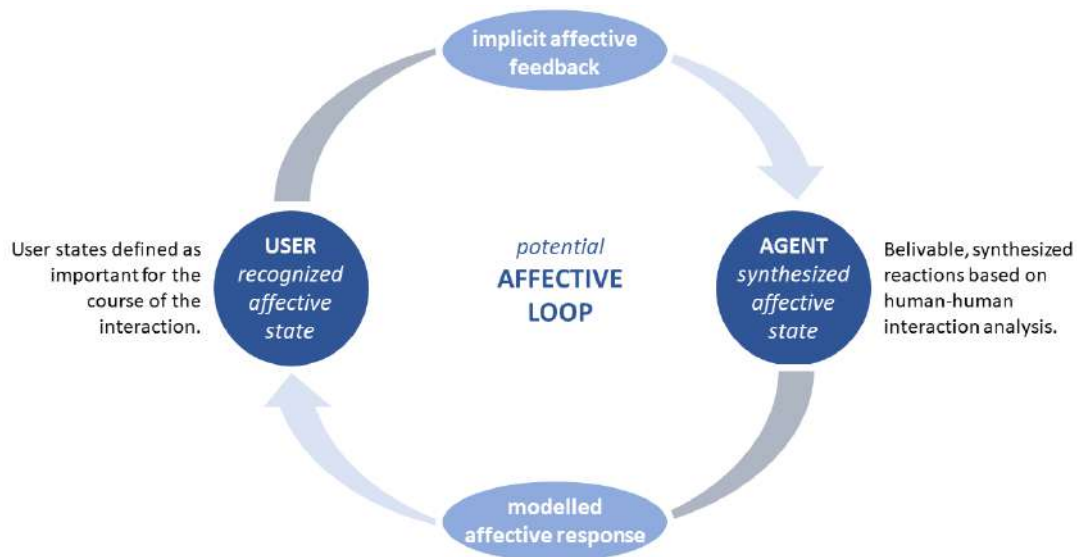


Such sophisticated interaction design is only achievable by a combination of real-time affect recognition with real-time synthesis of digital human behaviour - which is becoming possible by the contributions presented by Framestore and Cubic Motion.
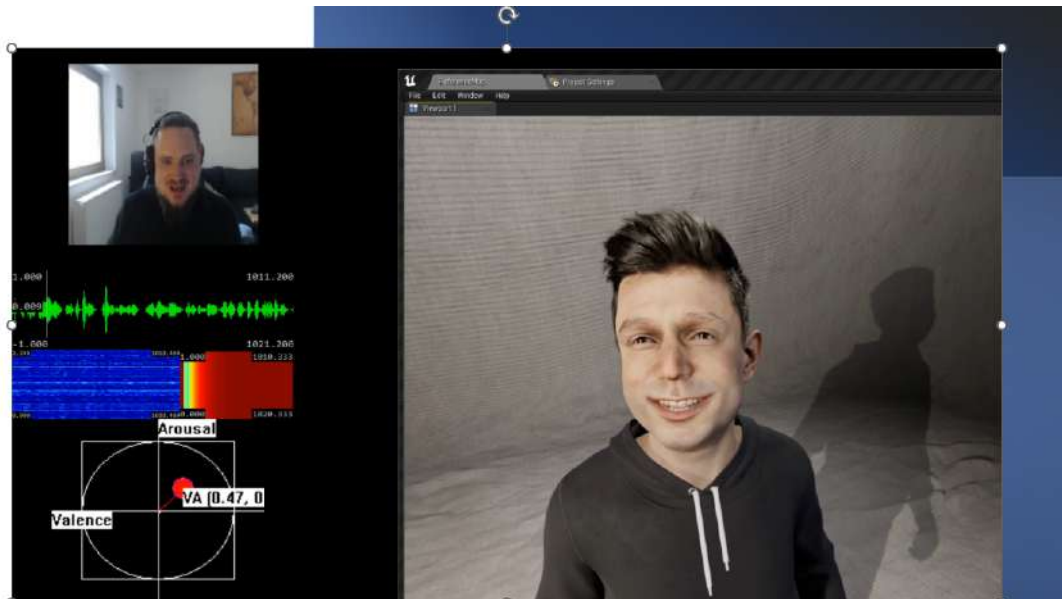
To demonstrate the capabilities of the presented real-time approaches, we concluded the talk with a life demo, in which we analysed the emotion of the speaker and had a first version of the PRESENT agent react to this analysis (i.e. emotional mirroring). The affective loop was successfully established on a broad scale, as the performance of the speaker and the agent did also elicit positive emotional reactions in the audience.

## 4.2 Delirious Departures SIGGRAPH

### 4.2.1 Delirious Departures VR Experience

Delirious Departures was presented at SIGGRAPH 2022 in Vancouver Convention Centre, in the Experience Hall as part of the Immersive Pavilion.

### 4.2.1.1 Set-up
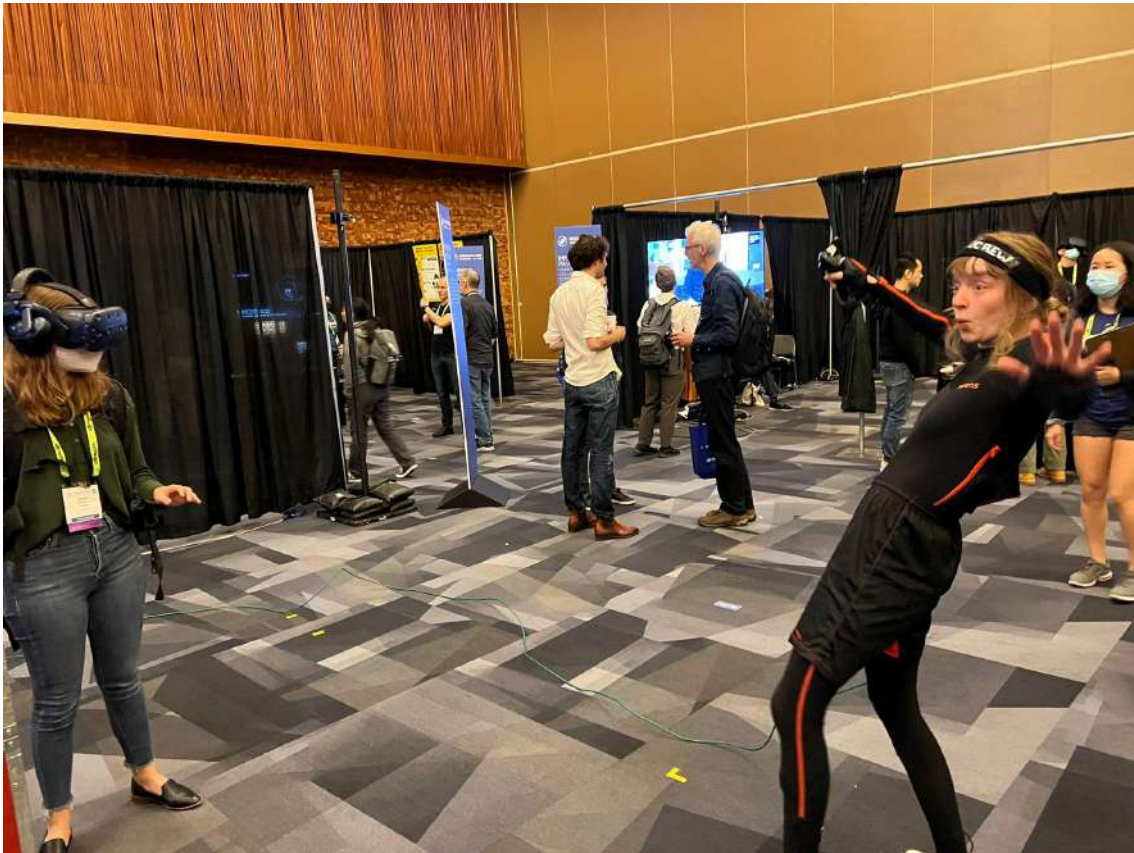


The experience took place in a 6mx7m booth, with a 2m wide display that shows what the person in VR sees. Session time was 8-10 minutes.

The actor wears an Xsens mocap suit. She controls her appearance, switches to different environments and adjusts some mechanics with a controller.

After signing a legal waiver, participants received a small introduction to the project, before being put in immersion. After the immersion they filled in a questionnaire and were free to ask questions regarding the experience.

*4.2.1.2 The Experience*

SCENE 1



The immersant is seated and hears audio. They are in a sparse environment. The actor establishes contact non-verbally and invites the immersant to stand up.

SCENE 2





The immersant is in an eerie corridor of a railway station. A group of agents which take the form of deconstructed figures move through the halfway, look at and evade the immersant. The actor can take the same shape as the agents and play with the confusion that arises.

SCENE 3



The immersant is seated again in a very sparse environment and confronted with the actor, an animated loop and an animated loop with added gaze and a realistic eye. The actor takes a seat themself in front of the immersant, seemingly on a bench across them. The actor then performs an act that interacts with the recorded animated loops, cementing their position and presence in the digital world.

SCENE 4
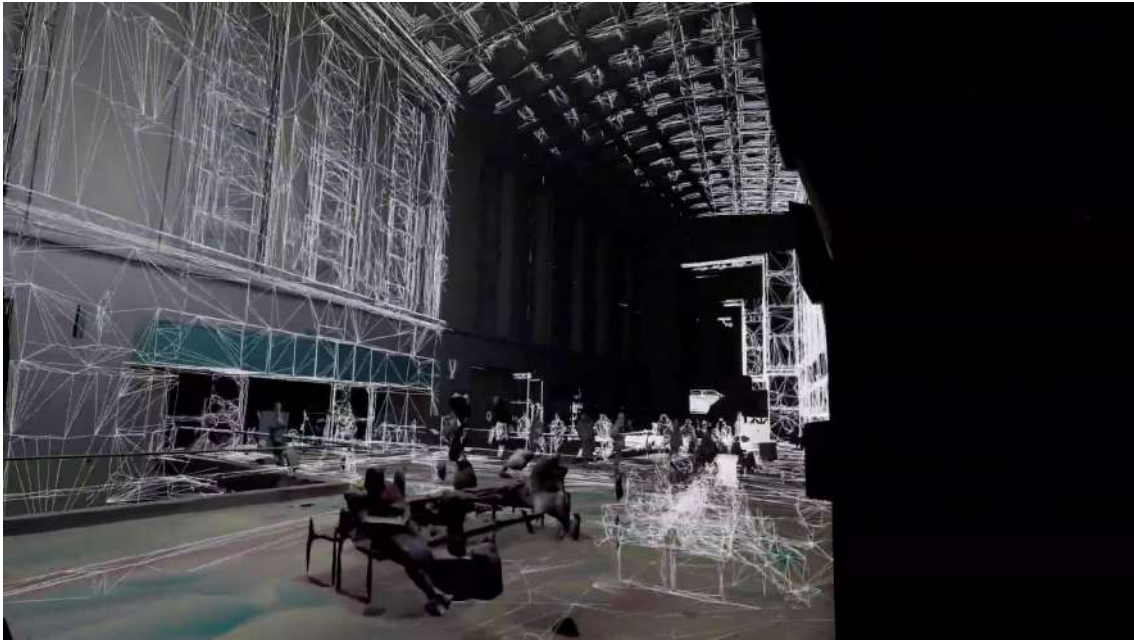




The immersant is in a visually rich and impressive scan of Brussels North Station. The actor touches the immersant, which triggers a mechanic that doubles, translates and rotates the space. The immersant can then walk down a number of stairsteps. The stairs mechanics are simple trigger boxes that translate the world on the vertical axis.

SCENE 5





The immersant is standing on the balcony of Antwerp Central Station and sees an abstract crowd move below. A prop is rolled into place so they feel the railing.
The actor then invites the immersant to step into the void. To allow this, the prop is removed quickly when the immersants lift their hands up.

SCENE 6
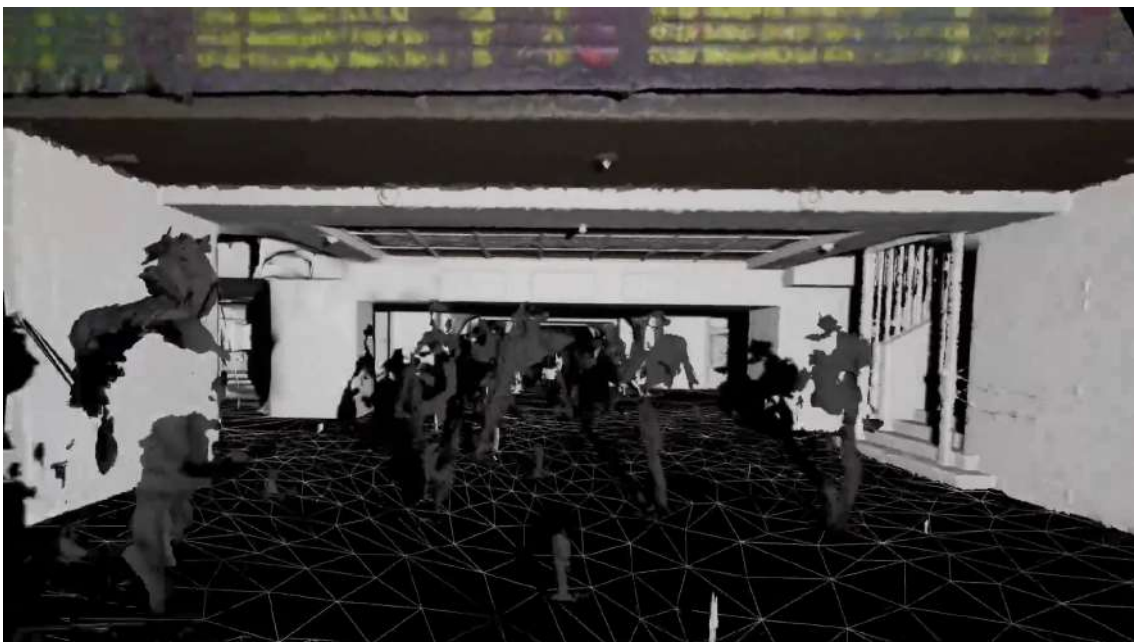


The immersant is in a deconstructed partial scan of Brussels Central Station. Avatars in different shapes and stages of abstraction come from 3 sides, departing through the corridor.


*4.2.1.3 Credits and Additional information*

Live actors: Booi Kluiving and Wieke van Rosmalen
Technical Coordinator: Haryo Sukmawanto
Art Direction: Eric Joris and Isjtar Vandebroeck

SIGGRAPH provided volunteers who handled crowd control.

The schedule was as followed:

Monday, 8 August: 1:30-5:30 pm
Tuesday, 9 August: 10 am-5:30 pm
Wednesday, 10 August: 10 am-5:30 pm
Thursday, 11 August: 10 am-3:30 pm

144 people participated in VR, many more watched the performance live and on the display.

### 4.2.2 Delirious Departures presentation and Panel Talk

CREW was selected to be one of 5 participants of the Experience Hall to give a presentation and to participate in a panel talk. In this presentation, Eric Joris and Isjtar Vandebroeck situated Delirious Departures within the PRESENT project and how Experimental Productions engage with research projects.



In the following panel discussion, the future of VR was discussed as well as the challenges of working with the medium.



### 4.2.3 Delirious Departures on SIGGRAPH Livestream

Delirious Departures was chosen to be featured during the Roving Reporter segments of the conference livestream on the first day of the conference. Reporter Rebecca Strzelec was guided by the Immersive Pavilion Chair Derek Ham through the Experience Hall where they stopped at several booths including Delirious Departures. Isjtar Vandebroeck gave a brief overview of the project while the experience was being performed in the

background of the video.



# 5 CONCLUSION

The PRESENT project was successfully showcased at FMX and SIGGRAPH, two major events involving industry and academia. Different components and developments were demonstrated in a variety of formats.

At FMX the following was showcased:
1. Digital humans in visual effects and the techniques developed by Framestore as part of PRESENT project for bringing these cutting edge VFX techniques into the realm of realtime interactions.
2. Cubic Motion's work on automatically generating believable animations, making characters behave and respond in an open-ended fashion and allowing them to not only be real-time but to be able to react to different situations
3. The University of Augsburg's innovations in detecting the emotional state of a user and utilising this information to modulate the behaviour and response of a digital Avatar.

At SIGGRAPH, locomotion animation (CM) and crowd simulations (Inria) were showcased, as well as the in depth VR work by CREW on the interaction with agents, live actors and different environments and the experimental integration of the learnings of PRESENT in the wider sense.

Together these showcases covered a significant portion of the PRESENT project.

# 6    WEB REFERENCES

https://fmx.de/en/program-2022/detail/event/23380
https://dl.acm.org/doi/10.1145/3532834.3536222
https://dl.acm.org/doi/fullHtml/10.1145/3532834.3536222

## 7    Annex 1 Slides Delirious Departures presentation



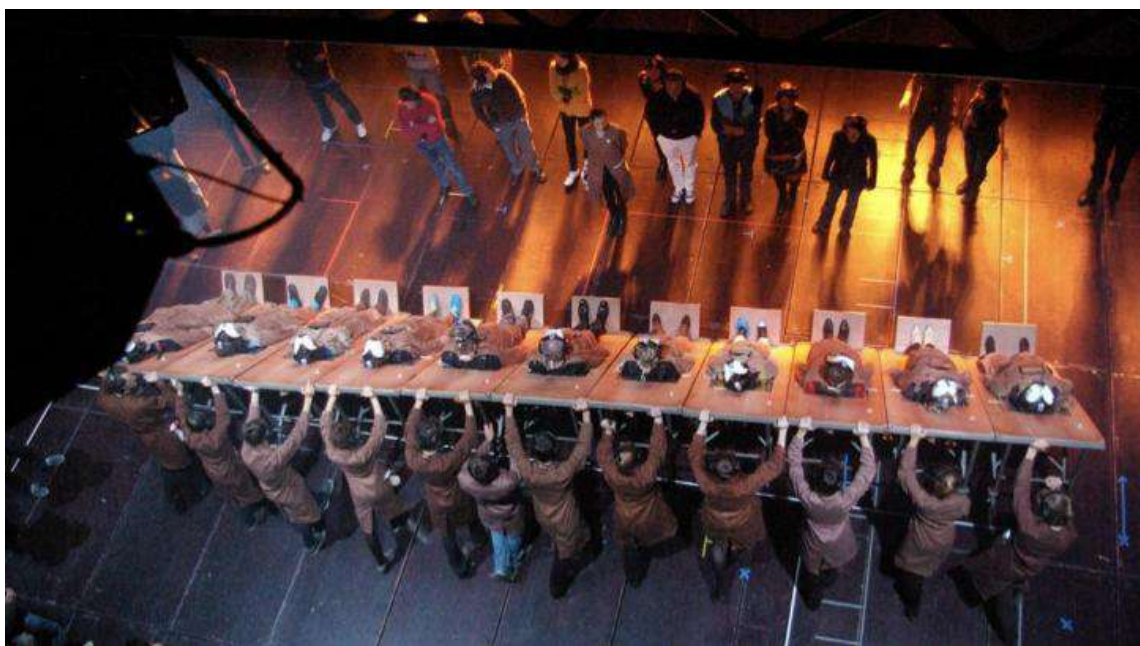## Delirious Departures
### An Experimental Production by CREW



## We are CREW

- Founded by Eric Joris, Brussels Belgium 1996
- Pioneers in the theatrical and new media arts
- How does technology change us?
- First VR on theatre stage (2003)
- Started developing custom 360 video hardware and software
- Isjtar joined in 2019 to develop PRESENT and other immersive applications in 3D

## Main areas of research

- Framestore: ultrarealistic high resolution agent Gareth
- Inria: **crowd behaviour**
- University of Augsburg: affective computing
- Cubic Motion (Epic Games): mid res agent, **animation, gaze**
- UPF: web based agent
- Infocert: security module
- Brainstorm: broadcasting applications

## What is an Experimental Production

- Apply bleeding edge technology experimentally
- Find idiosyncratic Use Cases to push development into areas which are less than obvious and often contrary to needs of the market, but useful to society (or just cool)
- Put it in the real world for real audiences

## Delirious Departures

- One person VR untethered experience with live actor and digital humans
- Created during the pandemic
- Raw scans of Belgian Railway stations
- Avatar research
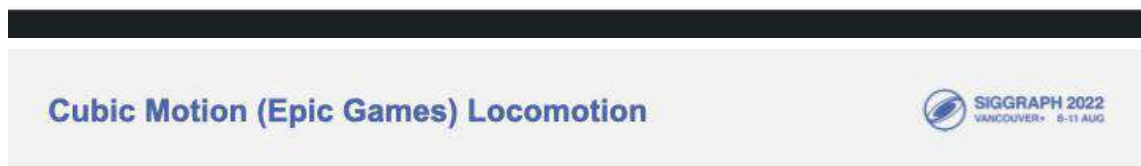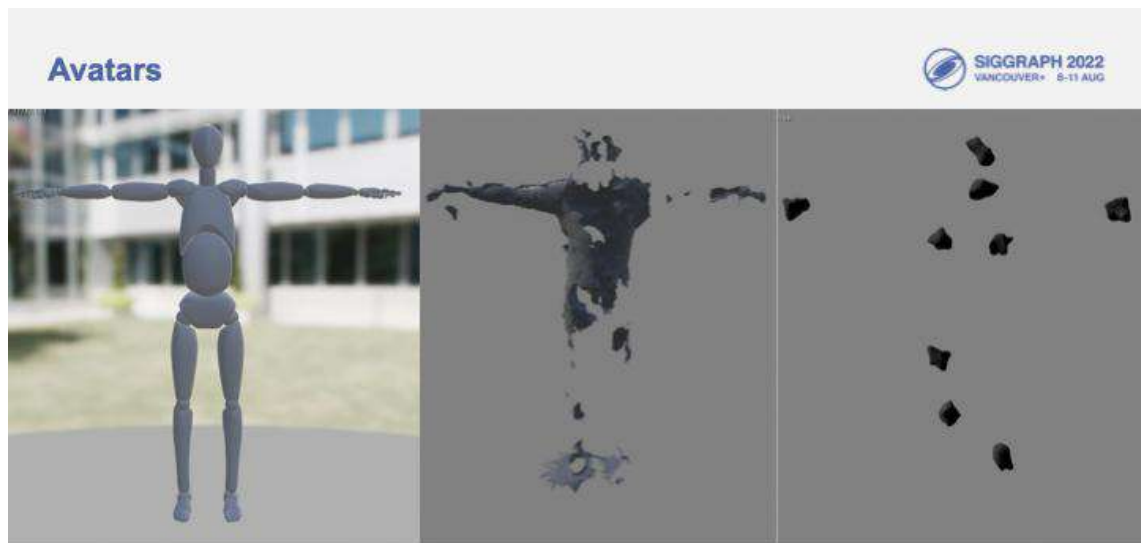- What is the nature of traveling, of leaving, of the other?

**VR principles by CREW**

- We do not believe in photorealism in VR
- We do believe in high quality animation and interaction
- Do not be seated
- Transitional space

## Avatars

## Cubic Motion (Epic Games) Locomotion

- Uses motion matching
- Most implementations are controlled with user input instead of simulations
- Usually focuses on big action game like movement instead of small casual locomotion

## Inria Interaction Fields + UMANS Crowd Simulation
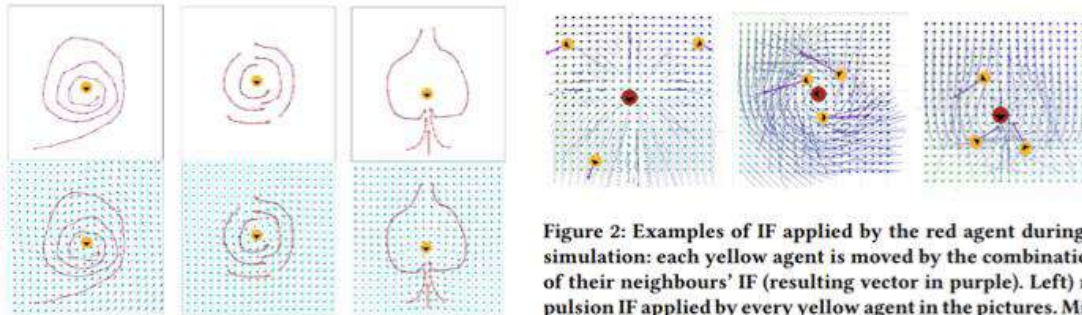
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Figure 1: Examples of IF design. Top: the control vectors drawn around the source agent. Bottom: the IFs resulting from the interpolation. Left) Spiral-shape IF. Middle) Circle-shape IF. Right) IF that directs the agents to move in front of the source agent.

Figure 2: Examples of IF applied by the red agent during a simulation: each yellow agent is moved by the combination of their neighbours' IF (resulting vector in purple). Left) repulsion IF applied by every yellow agent in the pictures. Middle) circle-shape IF designed in Figure 1, middle. Right) the IF applied during simulation designed in Figure 1, right.

https://hal.inria.fr/hal-02969013/file/Interaction_Fields_Poster.pdf

## Scenarizing and prototyping collaboration CREW-Inria

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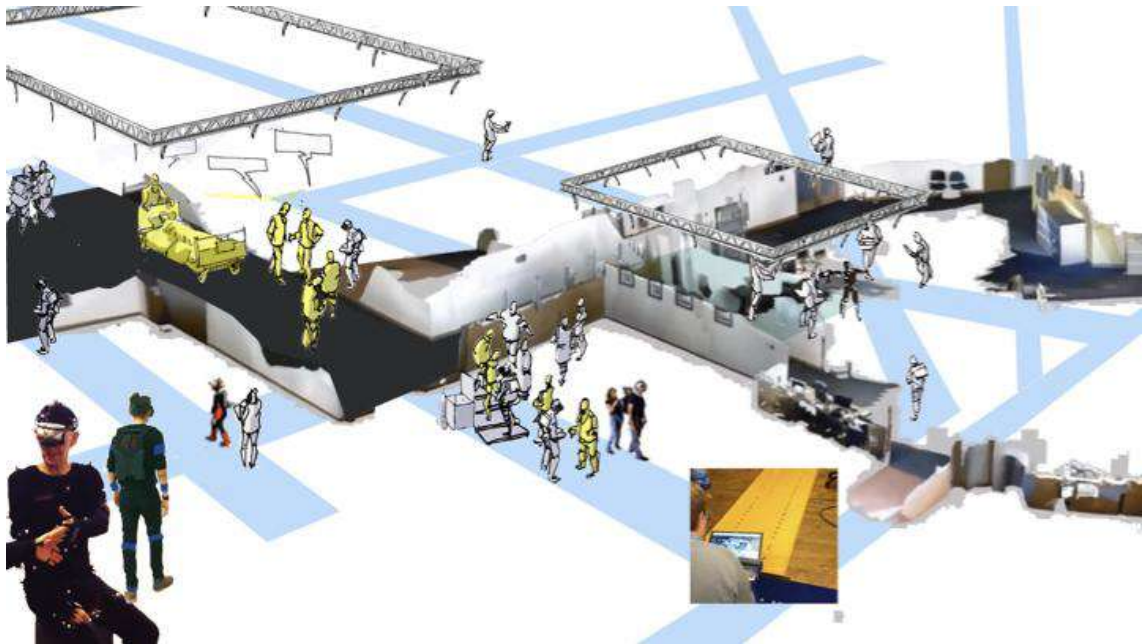
## Live Actor Integration

- Play developed with Booi Kluiving and Jerry Killick
- Xsens mocap + controller
- Actor not only visualized, but uses the experience as a performance instrument, acting as a transitory figure between the real and the virtual

## Future in Horizon Europe Max-R

- Large area tracking (EDM UHasselt)
- Multiple immersants
- Non-linear
- Embodiment and interaction
- Agency
- Multi-modal

CREW information

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www.crew.brussels/en