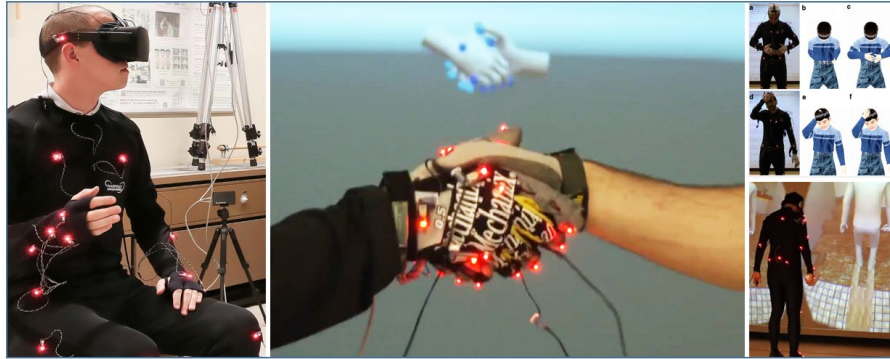


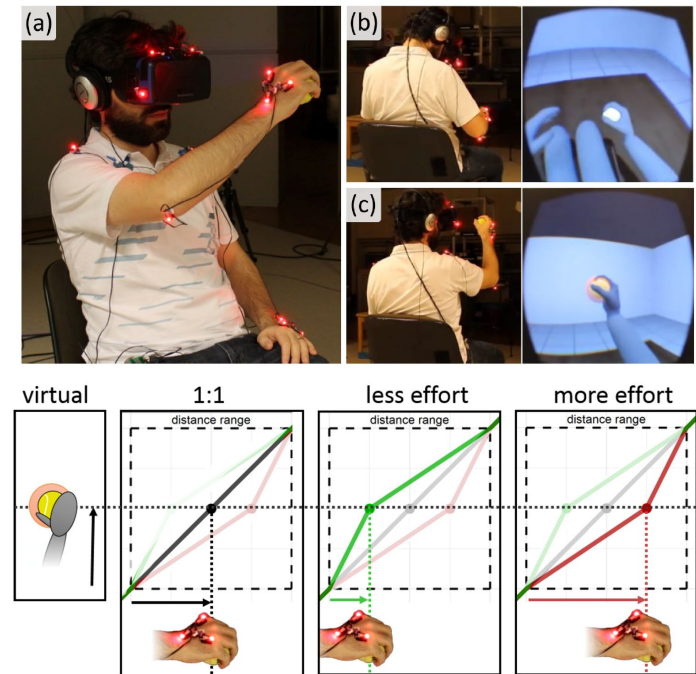
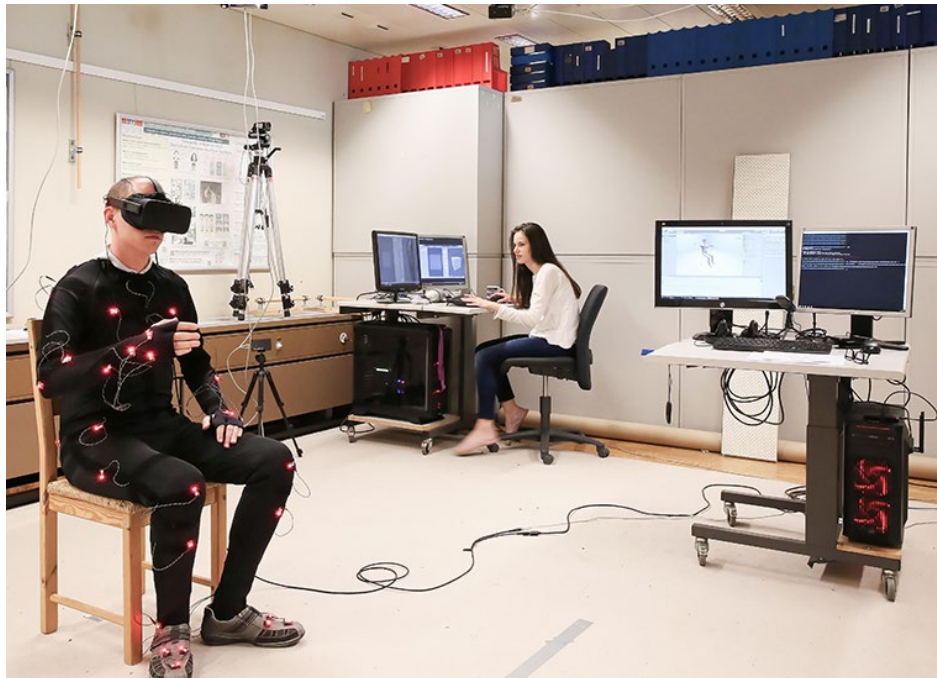
Virtual Reality



- Lecturers and Teaching Assistants
- Course goals
- Course map
- Grading scheme
- Assignments structure
- Required prior knowledge
- References

Lecturers

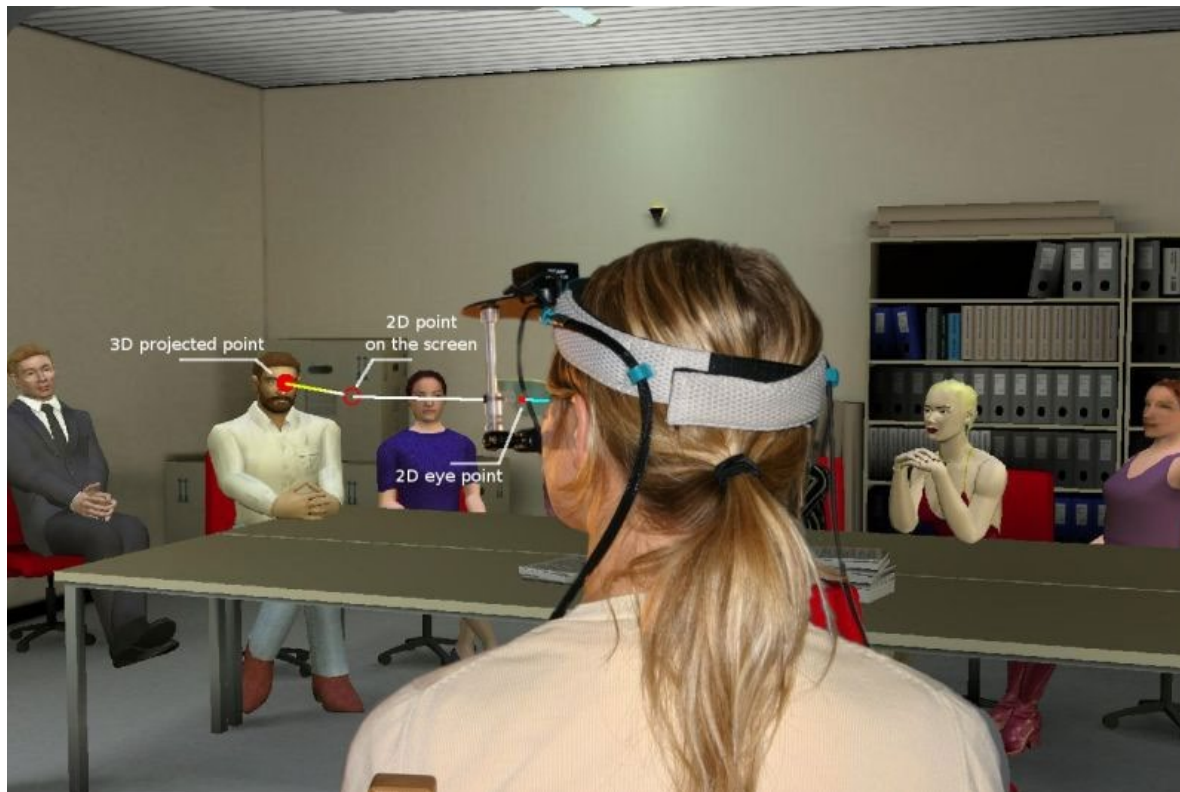
Dr Ronan Boulic
 Senior scientist / MER
 Leader of the Immersive Interaction
 research group (IIG)



Dr Bruno Herbelin

Senior Researcher

Cognitive Neuroscience Laboratory



Teaching & HW Assistants

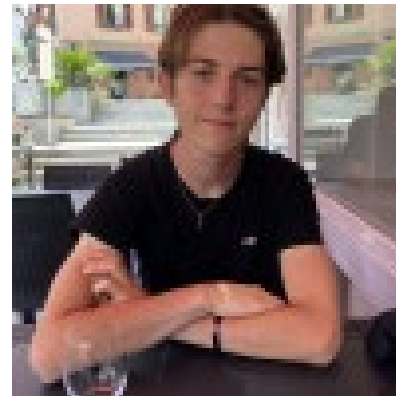
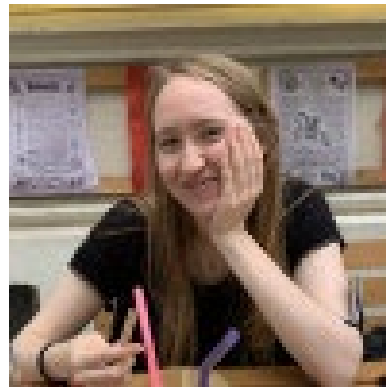


Fatma-Betül Güres

PhD student in ML4ED

& 2 student-assistants :

Elif Kurtay and Dylan Vairoli



Course Goals

Introduction to the field of Virtual Reality (VR)

concepts & technologies of immersive real-time interaction

Background in human perception-action

ensure the users are able to react as if the virtual environment were real, even if it is not “realistic”

Cover some key interface modalities:

visual, haptic, movement

Present various applications

Disclaimer: given its limited number of hours the VR course does not cover these topics:

- Augmented Reality : is traditionnally a Computer-Vision Topic
- Shared Virtual Environment (aka Metaverse): network, multi-users
- buzz words often associated to VR: AI, ML, Blockchain, Security...

Course Map



R. Boulic

1 VR concepts & Immersive Perception

2 Game Topics Betül Güres



3 Presence

4 Hands-on TP

5 3D Interaction

6 3D Interaction

7 3D Interaction

8 Haptic

9 Haptic/Action

10 Action

11 Believability

12 VR & NeuroSc.

13

14 *final oral exams*



B. Herbelin

2 VR Systems

3

4

5

6

7

8

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12

13

14



Course Map

week	10h15-11h00	11h15-12h	12h15-13h
1	Course presentation R. Boulic Embodied VR	R. Boulic Perception & Immersion	R. Boulic Depth perception
2	Betül Güres Intro to Game design	Betül Güres Play Testing	Betül Güres + Dylan Vairoli VR System + setup (HO1-a)
3	R. Boulic Immersion, presence, flow	R. Boulic Cybersickness	HO1-b: Intro to UNITY (laptop) + Project groups
4	HO2: Intro to XR in Unity (Quest)	Intro to XR in Unity (Quest)	Intro to XR in Unity (Quest) + Project topic choice
5	R. Boulic	Project pitch	Project pitch
6	R. Boulic Paper Study Deadline	HO3: Explore the XR Interaction Toolkit	Explore the XR Interaction Toolkit
7	R. Boulic	HO4: Build your first XR game	Build your first XR game
8	R. Boulic	project baseline peer assessment	project baseline peer assessment
9	R. Boulic	HO5: Hand tracking and advanced Unity concepts	Hand tracking and advanced Unity concepts
10	R. Boulic	project	project
11	R. Boulic	project	project
12	B. Herbelin	B. Herbelin	project
13	project play testing	project play testing	project play testing
14	project & theoretical oral exams	project & theoretical oral exams	project & theoretical oral exams

Grading Scheme

Exam form: during the semester

4 components:

- **15%**: 1 article study and citation analysis [weeks **2 – 6**]
- **50%**: 1 project (group of 3-4 persons) [weeks **2-13**]
- **35%**: closed book theoretical oral control on the chosen article (as starting point) followed by more general VR concepts [week 14]

Assignment structure

Week2: select one paper from the proposed list
Week6: upload a short structured report ...

- highlighting the key contributions of the paper.
-> **one page including paper title & your name**
- presenting how that topic is still evolving through a short survey of the articles who cited it (use **google scholars** citation list): **one page**
- list of key references & citing articles: **one page**
- **One page = [2'400-3'000] char including spaces**

VR Hands-on

(~5 hands-on tutorials over week3 to 9)

all material on :

<https://github.com/cs444-epfl/cs444>

Week 2 : Setup of the environment (HO1-a)



you will need to **install Unity 3D** on your own computer.

In order to upload your game to your headset, install
Meta Quest Developer Hub

Set up (and learn) Git

Resources

<https://github.com/cs444-epfl/cs444/blob/main/hands-on/ho1.md>



Week 3 HO1-b : Introduction to Unity 3D (Without VR headset)

Assignment structure

Master (non-XR) basics of **Unity 3D (Like: Getting familiar with the editor, c#, components, etc)** with your own computer.

This hands-on mainly includes tutorials from **Unity Learn**.

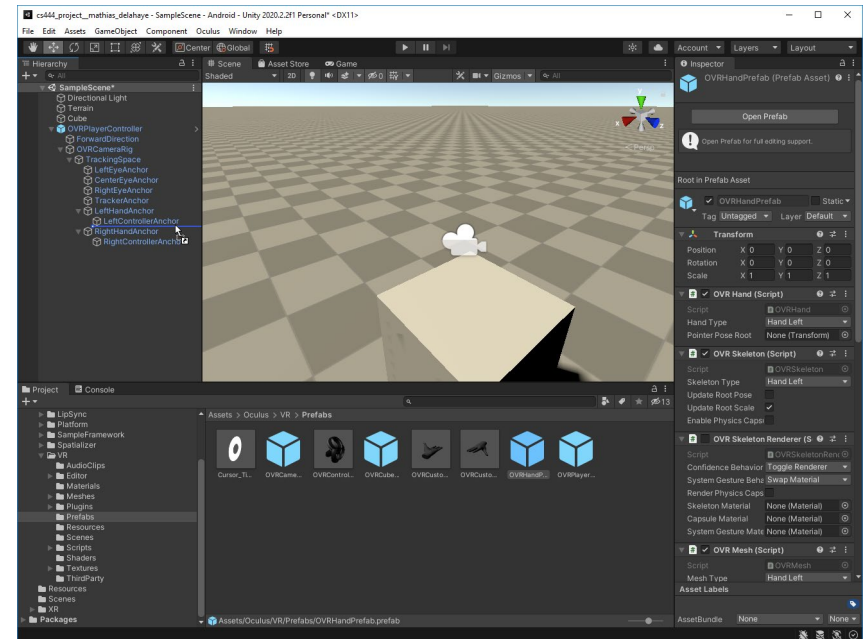


Illustration of the Unity3D layout

Resources

<https://github.com/cs444-epfl/cs444/blob/main/hands-on/ho1.md>

50%: project (group of 3 persons) [3-13]:

- Topic: **Build a 3D VR Game** using **Unity 3D** and the **Oculus Quest**.
 - **Project Guidelines:** Details on Moodle.
 - **Please Read Them!**
 - **Week2-3:** Project Group Registration on Moodle
 - > **Until March 3rd:** free choice of group
 - > **After March 3rd,** for those without group:
 - > automatic constitution of groups
 - > groups of 2 persons are completed to 3
- > borrow 1 Oculus Quest per group of 3-4 persons
between March 4th and 7th

Week 4 H02: Introduction to XR in Unity



(laptop and headset)



- Set up a Unity project for VR
- Test your game on your laptop using a device simulator (because only 1 headset per team)
- Set up your headset
- Build your game and play it on a headset

Resources

<https://github.com/cs444-epfl/cs444/blob/main/hands-on/ho2.md>

Assignment structure

50%: 3 person group projects [3-13]:

- Topic: Build a 3D VR Game using Unity 3D and the Oculus Quest.
- Project Guidelines: Details on Moodle.
 - Please Read Them!
- Project Group Registration on Moodle: March 4th
- **Week5 Public Project Elevator Pitch** -> March 17th
 - Upload a 2 pages summary latest on March 16th
 - Public oral pitch (3 min) followed by 5min Q&A

Pitch Feedback provided through the Q&A

Week 6 HO3: Explore the XR Interaction toolkit

The XR Interaction Toolkit (XRIT) is the framework proposed by Unity to help developers creating XR games.

This hands-on will help you getting familiar with the basic features of the XRIT, which are all required to appear in your project.

Full specification in [VR project Guidelines - 2025](#):

Resources

<https://github.com/cs444-epfl/cs444/blob/main/hands-on/ho3.md>

Week7 HO4 : Build your first XR game

Step-by-step tutorial demonstrating some of the XRIT features to help you getting started building your first XR game.

Resources

<https://github.com/cs444-epfl/cs444/blob/main/hands-on/ho4.md>

Assignment structure

50%: 3 person group projects [3-13]:

- Topic: Build a 3D VR Game using Unity 3D and the Oculus Quest.
- Project Guidelines: Details on Moodle.
 - Please Read Them!
- Project Group Registration on Moodle: March 4th
- Project Pitch & feedback -> March 18th
- **Week8: basic game interactions peer assessment on Monday March 31st**

Week9 H05 : hand tracking and advanced Unity concepts

Assignment structure



You will learn to take advantage of the **finger tracking features** of Oculus Quest

What are the best design and programming practices to keep your Unity project maintainable and to help your collaborate as a team?



Resources

<https://github.com/cs444-epfl/cs444/blob/main/hands-on/ho5.md>

Assignment structure

50%: 3 person group projects [3-13]:

Topic: **Build a 3D VR Game** using **Unity 3D** and the **Oculus Quest**.

Project Guidelines: Details on Moodle.

Please Read Them!

Project Group Registration on Moodle: March 4th

Project Pitch & feedback -> March 18th

Basic game interactions peer assessment -> April 8th

Week 13: Playtesting on May 19th

Week 13: Project Deadline Wednesday May 21th

(@23:55)

Fully Playable Build, Report and Code.

Week14: Individual oral exams on the project code

Required prior knowledge

Requested background in programming:

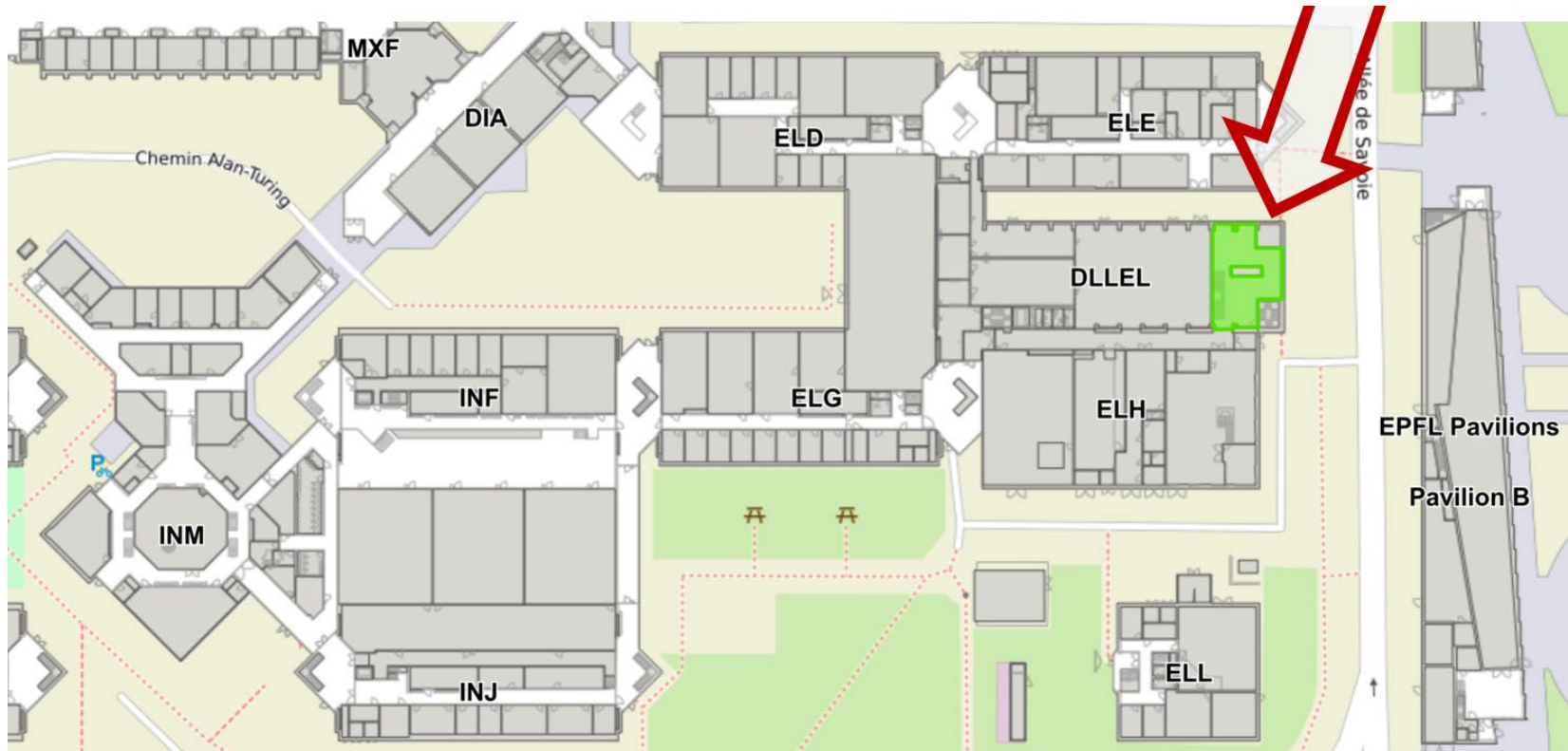
- Object Oriented Programming:
=> C# is the language used for VR with UNITY 3D

Recommended EPFL course in Graphics:

- Introduction to Visual Computing
elements of Computer graphics, Computer Vision, Human-Computer Interaction, game design, interaction project
- Introduction to Computer Graphics
perspective transf., modelling hierarchy, orientation coordinate system transformations, rigid body movt.
Rendering: mesh, material, texture, light

From week 3: once the project groups are formed and the list is provided to the SPOT manager, **12 Oculus Quest 2** can be borrowed in the **SPOT** (DLLEL 0 21) *for local use only*. ask to the student-assistant at the welcome desk (monday-friday 14-20h), or to a SPOT coach (monday-friday 9h-12h). First-come first-served.

extra-hardware



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<https://moodle.epfl.ch/course/view.php?id=6841>

References

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T. Parisi, *Learning Virtual Reality*, O'Reilly 2015

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