Virtual Reality
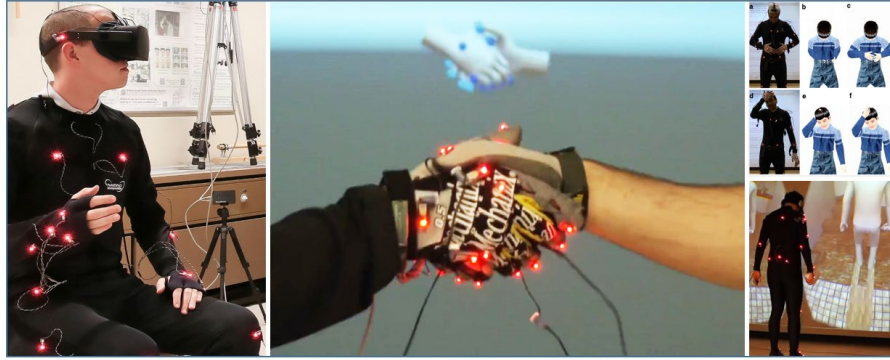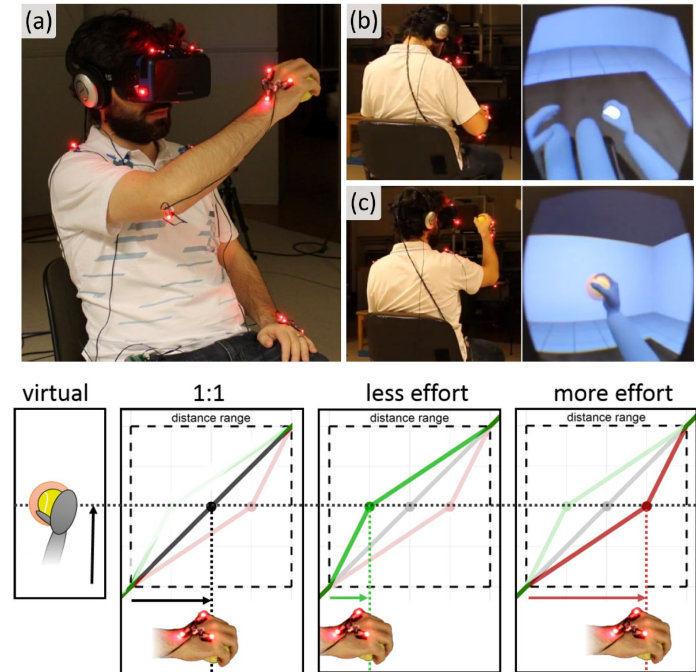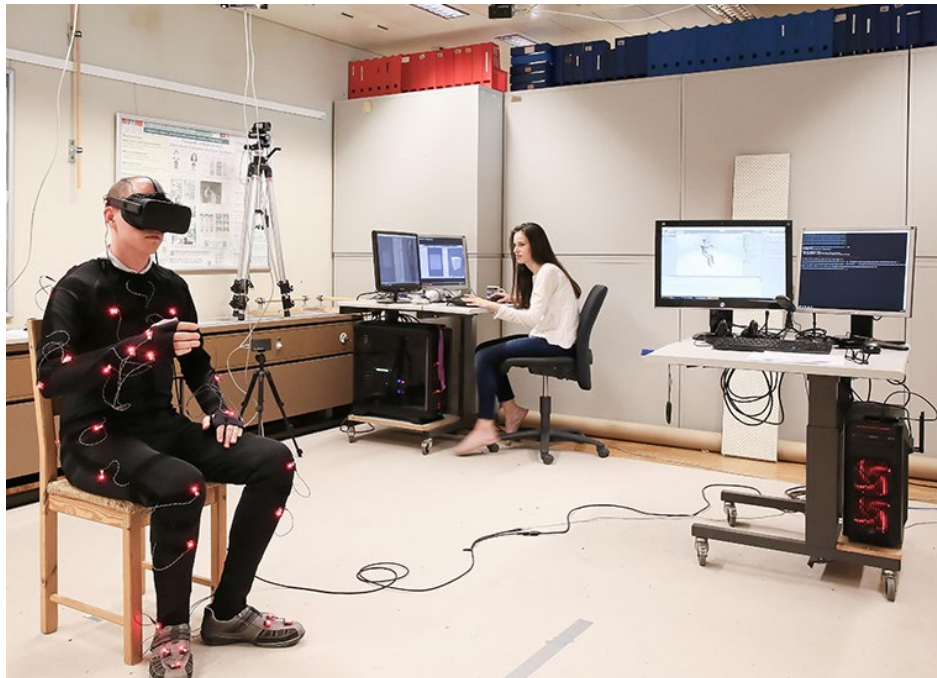

- Lecturers and Teaching Assistants

- Course goals

- Course map

- Grading scheme

- Assignments structure

- Required prior knowledge

- References

Dr Ronan Boulic

Senior scientist / MER

Leader of the Immersive Interaction research group (IIG)

virtual   1:1   less effort   more effort

Dr Bruno Herbelin

Deputy Director LNCO
Cognitive Neuroscience Laboratory
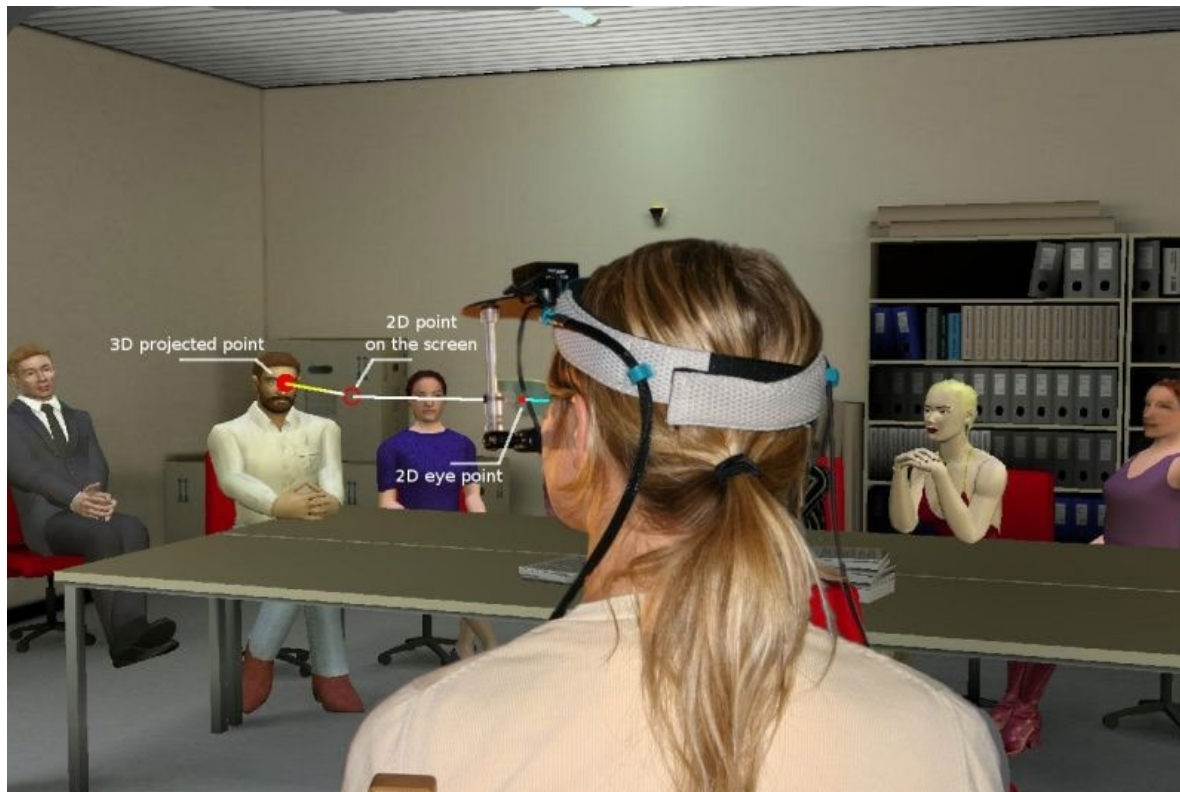
Teaching & HW Assistants

Mathias Delahaye
PhD student in IIG

Nana Tian
PhD student in IIG

& one student-assistant : Hugo Hueber

Course Goals

Introduction to the field of 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

Course Map

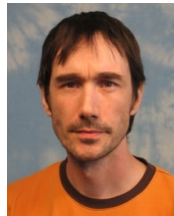**R. Boulic**

1 VR concepts
2 Immersion
3 Presence
4 3D Interaction
5 3D Interaction
6 Action
7 Haptic
8 Haptic
9 Believability
10 Full-body Int.
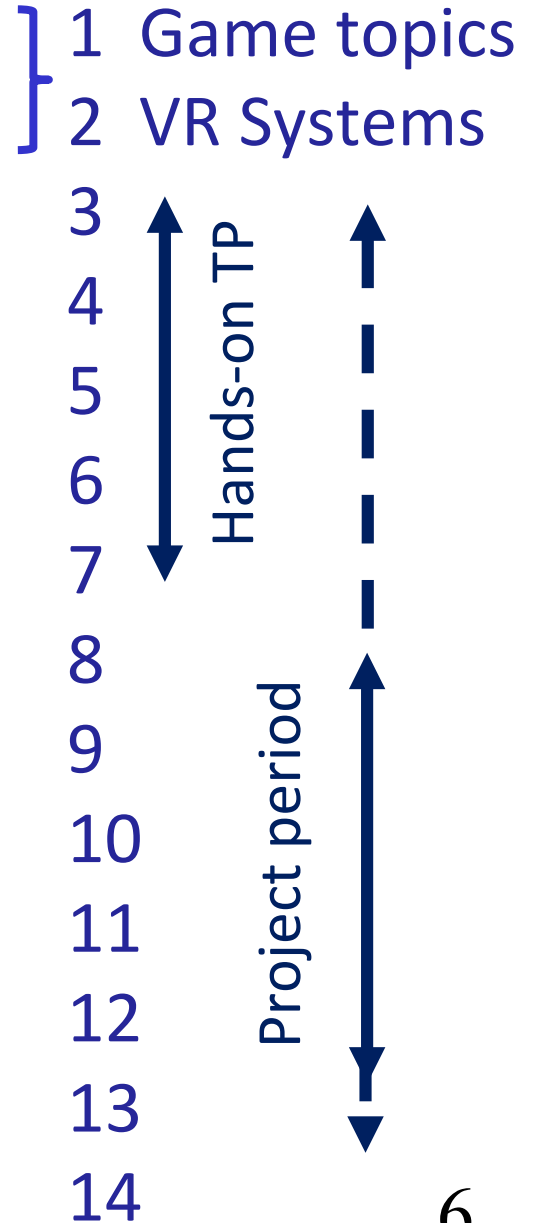11
12 *project time*
13 *project demo*
14 *final oral*

Mathias Delahaye
Nana Tian

B. Herbelin

11 VR & NeuroSc.

} 1 Game topics
  2 VR Systems

3
4   Hands-on TP
5
6
7

8
9   Project period
10
11
12
13
14

6

Course Map

week	10h15-11h00	11h15-12h	12h15-13h
1	Course presentation R. Boulic Embodied VR	intro to Game design Nana Tian	Play Testing Mathias Delahaye
2	R. Boulic Perception & Immersion	R. Boulic Depth perception	Mathias/Nana VR System + setup (HO0)
3	R. Boulic Immersion, presence, flow	R. Boulic Cybersickness	HO1:INTRO UNITY laptop + Project groups
4	R. Boulic	HO2: Intro Oculus Quest	Intro Oculus Quest
5	R. Boulic **Paper Study Deadline**	HO3: Basic interaction with controllers	Basic interaction with controllers
6	R. Boulic	HO4: Structuring interaction behavior & Callbacks	Structuring interaction behavior & Callbacks
7	R. Boulic	HO5: Advanced Interaction: Finger tracking, locomotion	Advanced Interaction: Finger tracking, locomotion
8	R. Boulic	Project pitch	Project pitch
9	R. Boulic	R. Boulic	project
10	R. Boulic	R. Boulic	project
11	B. Herbelin	B. Herbelin	project
12	Project	Project	project
13	project demos / tbd	Project demos / tbd	Project demos / tbd
14	final oral(s)	final oral(s)	final oral(s)

7

Grading Scheme

Exam form: during the semester
4 components:

- 20%: 1 article study and citation analysis [weeks **2 – 5**]

- 50%: 3 persons groups project [weeks **3-8-12,+13**]

- 30%: short theoretical online oral control on the chosen article and general VR concepts [week 14]

20 % **Individual** article study [weeks 2-5] :

Provide a short report on week 5 (the chosen article is the starting point of the final oral exam):

- highligthing 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

Assignment structure

9

VR Hands-on
(5 weeks: 3/4-8)

https://cs444-practice.epfl.ch

Nana Tian and Mathias Delahaye

https://cs444-practice.epfl.ch

https://cs444-practice.epfl.ch ··· ✪ ☆ | Q Search | ☆ ||\ 🔲 ◉ » ≡

🗄 LIST OF HANDS-ON

Forum documentation (Discourse)
Documentation on how to use the dedicated forum for this course

Weeks 1 and 2 : Setup of the environment
Installation of Unity3D, `adb` and configuration of the `$PATH`

Week 3 : Introduction to Unity 3D
Discovery of Unity3D mechanics

Week 4 : Setup of a basic scene for the Oculus Quest
Creating a simple scene for the Oculus Quest, compile, debug, push the build to the HMD and record videos

Week 5 : Design of an interaction
Design a simple interaction using the Oculus Quest's Touch Controllers

Week 6 : Structuring collection behavior and callbacks
Design of a structure to collect items, derviate those items with upgrades allowing new features and callbacks

Week 7 : Finger tracking and locomotion
Setup a scene with the finger tracking and design a locomotion method

EPFL

IIG

🌐 http://cs444-discourse.epfl.ch

Link to the Q&A tool Discourse

Weeks 1 & 2 : Setup of the environment

Assignment structure

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

In order to push and debug your game on Oculus Quest, you will also need to install the Android Debug Bridge: **adb.**

Last but not least duty: configuring the PATH

Resources

https://cs444-practice.epfl.ch/setup/environment/

Weeks 3 : Introduction to Unity 3D (Without VR headset)

Master basics of **Unity 3D (Like: Getting familiar with Unity 3D, c sharp programming etc)** with your own computer.
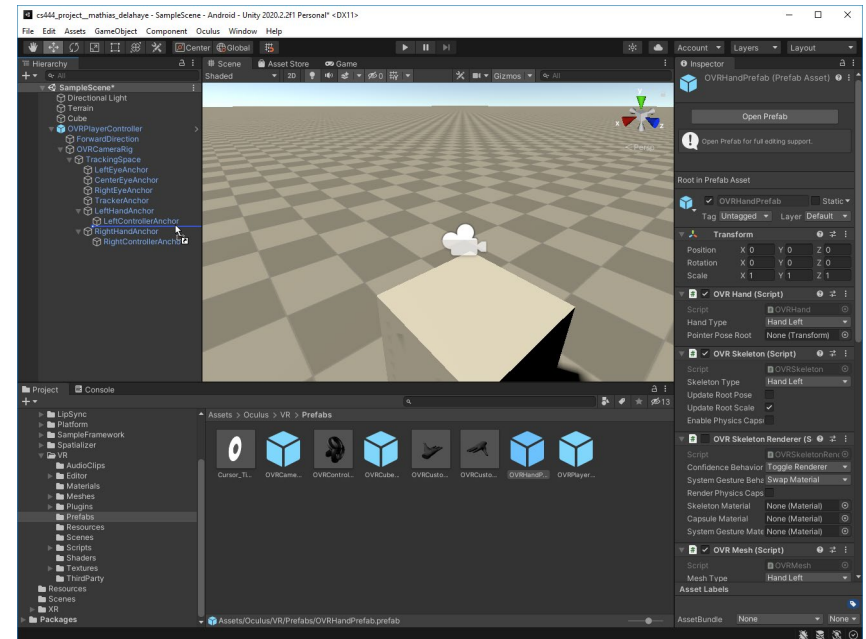
This hands-on mainly includes tutorials from **Unity Learn**.

Illustration of the Unity3D layout

Resources

https://cs444-practice.epfl.ch/tp/tp1/

Weeks 4 : Setup of a basic scene for the Oculus Quest.

With this tutorial, you will learn how to create a simple VR project, and finally, build and run the game to the **Oculus Quest** so that you can enjoy your first VR application.

 Additionally, you will learn some extra skills like *versioning with GitLab, debugging, and recording videos in VR headset.*

Resources

https://cs444-practice.epfl.ch/tp/tp2/

Weeks 5 : Design of an interaction

This hands-on focuses on **implementing a basic interaction (Grasping objects)** in the VR scene.

 Goals include handling inputs from the Oculus Touch controllers, implementing anchors to graps objects and integrate modules to the scene.

Resources

https://cs444-practice.epfl.ch/tp/tp3/

Weeks 6 : Structuring collection behavior and callbacks

Upgrade the previous tutorials on basic interaction and dive a bit more into programming skills (Note: It will be useful to follow the C# basics in **Unity Learn** first.)

Focus on Event driven scenarios and callbacks

Resources

https://cs444-practice.epfl.ch/tp/tp4/

Weeks 7 : Finger tracking and locomotion

You will learn to take advantage of the **finger tracking features** of Oculus Quest and **implement a teleportation locomotion behavior with finger gestures recognition.**

Resources

https://cs444-practice.epfl.ch/tp/tp5/

Assignment structure

40%: 3 person group projects [3-8-12, +13]:

- Topic: **Build a 3D VR Game** using **Unity 3D** and the **Oculus Quest**.
- **Project Guidelines**: Details on Moodle.
  - **Please Read Them!**
- Group Registration on Moodle (latest week2)
- **Project Pitch** -> week8 : April 19th
- **Pitch Feedback** -> week9 : latest April 26th
- Deadline: week12 **May 26th** (@23:55)
  - **Fully Playable Build**, Report and Code.
- Project Presentation: **upon appointment week13-14**
- Individual Code check : **week14**

Required prior knowledge

Requested background in Computer Graphics:

- Introduction to Computer Graphics

   perspective transf., modelling hierarchy, orientation

   coordinate system transformations, rigid body movt.
   Rendering: mesh, material, texture, light

- Programming: C# (UNITY 3D)

Recommended EPFL course
- Introduction to Visual Computing

   elements of Computer graphics, Computer Vision, Human-Computer

   Interaction, game design, interaction project

References

J. Jerald, The VR Book, ACM Press 2016

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

D. Bowman, E. Kruijff, J. Laviola, I. Poupirev, *3D user Interface*, 2nd edition Addison Wesley 2017

Philippe Fuchs, Guillaume Moreau, Pascal Guitton, *Virtual Reality: Concepts and Technologies*, July 27, 2011 by CRC Press, 432 Pages
ISBN 9780415684712 - CAT# K13701

Bruno Arnaldi, Pascal Guitton and Guillaume Moreau, Réalité virtuelle et réalité augmentée, Mythes et réalités, ISTE 2018
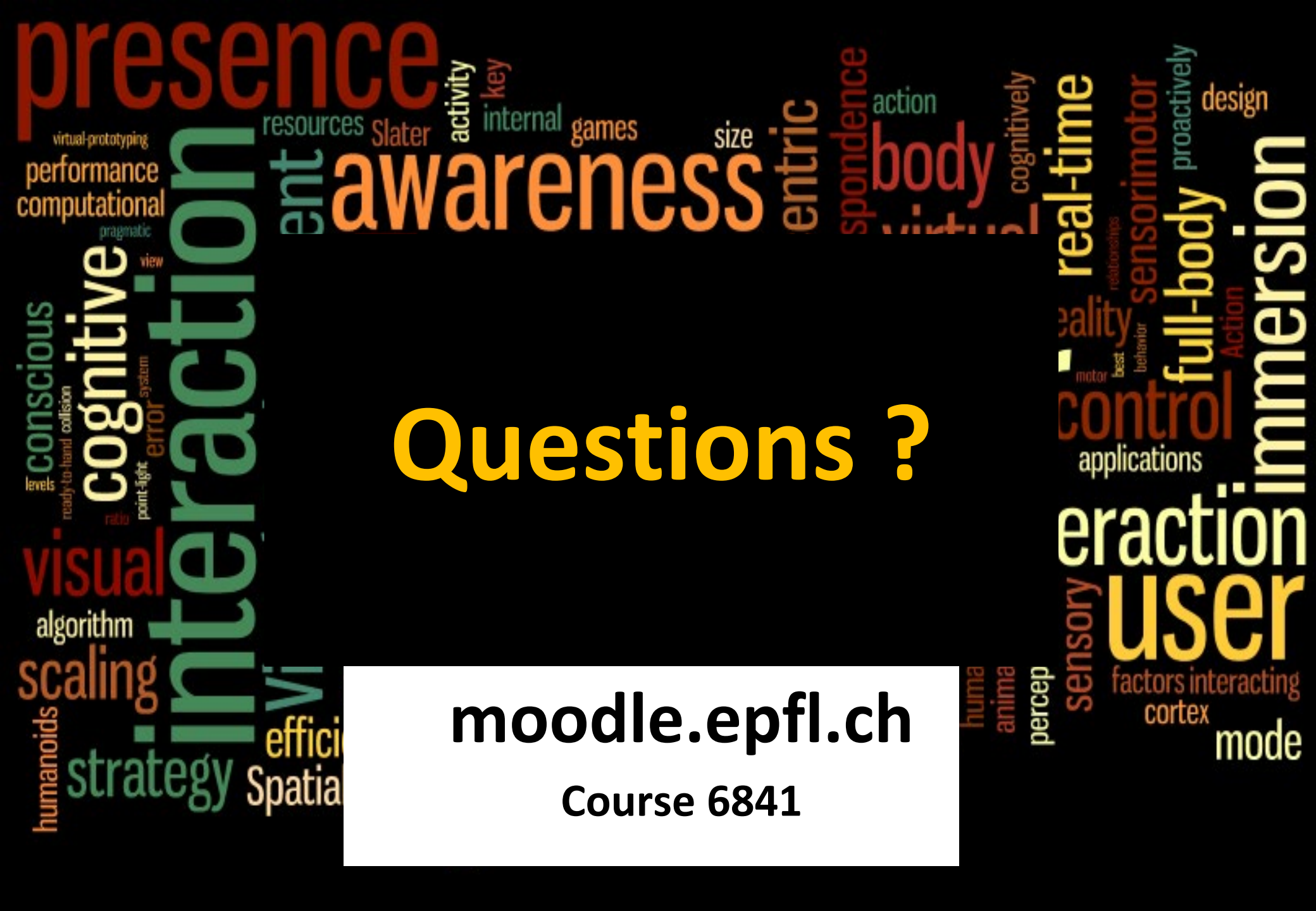
Questions ?

moodle.epfl.ch
Course 6841