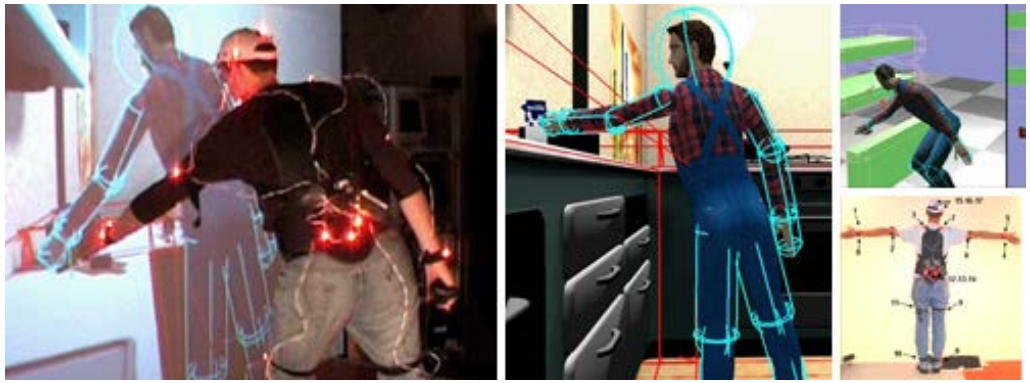

Heidegger
strategy
Spatial
postural
movements
segments
convey
egocentric
algorithm
self-similar
subjects
size
Neuroscience
resources
involvement
avatar
display
mode
interactive
key
design
body
content
environments
character
action
Virtual
cognitively
user
interacting
system
computational
correspondence
performance
conscious
autotelic
cognitive
movement
presence
immersion
Reality
games
semantic
efficiency
avoidance
Action
space
models
virtual
one
real-time
applications
present-at-hand
complex
activity
environment
proactively
perception
humanoids
visual
immersive
task
full-body
sensory
spatial
collision
humans
factors
activities
internal
human
Slater
error
meaning
scaling
proactive
study
animated
control
data
interaction
cortex
form
sensorimotor
game
awareness
Immersive
characters
experience
embodiment

Virtual Reality



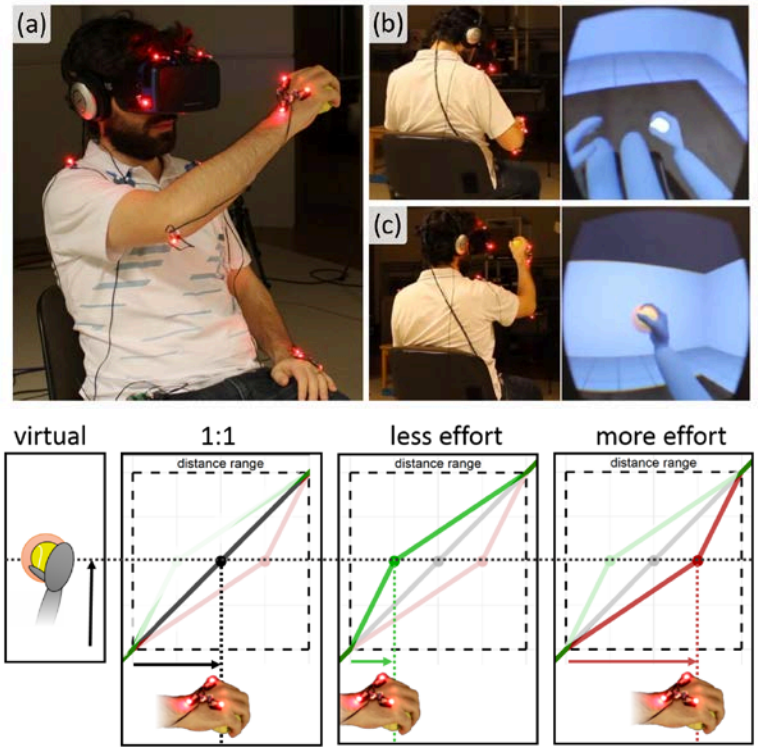
- Lecturers and Teaching Assistants
- Course goals
- Course map
- Grading scheme
- Assignments structure
- Required prior knowledge
- References

Lecturers

Dr Ronan Boulic

Senior scientist / MER

Leader of the Immersive Interaction research group (IIG)

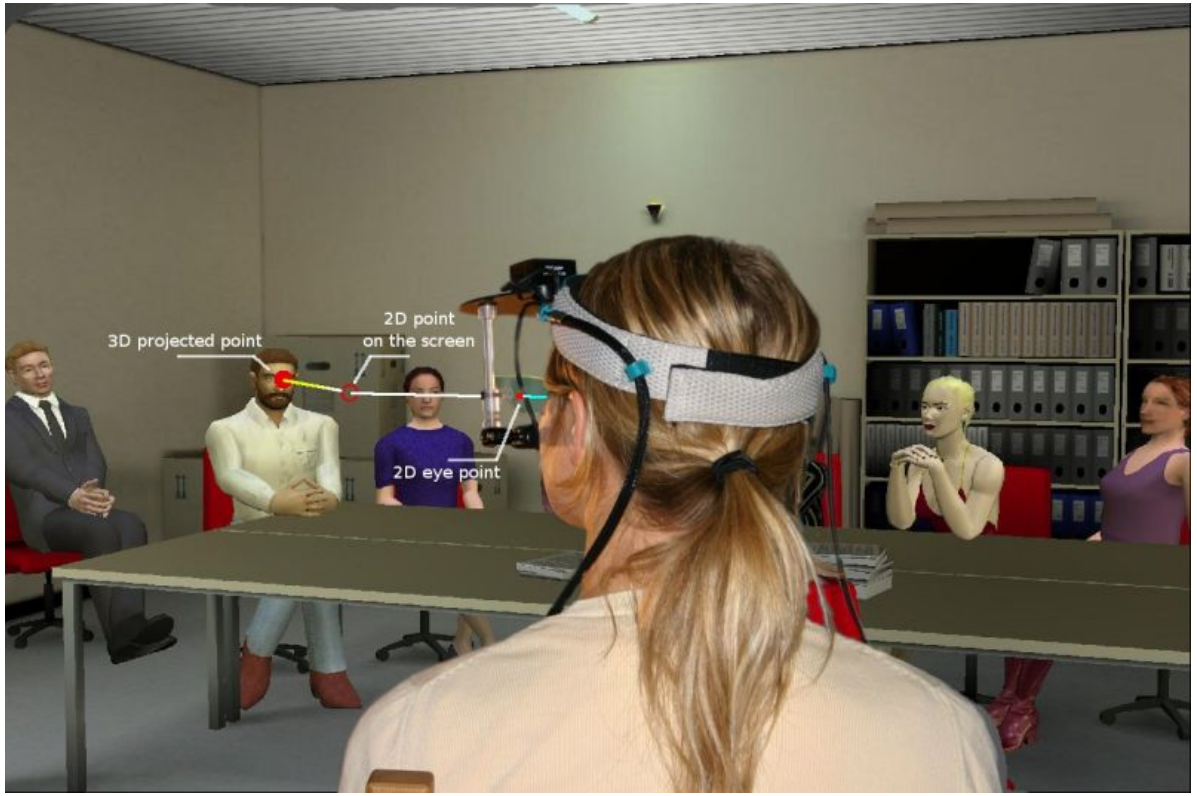


Lecturers

Dr Bruno Herbelin

Deputy Director LNCO

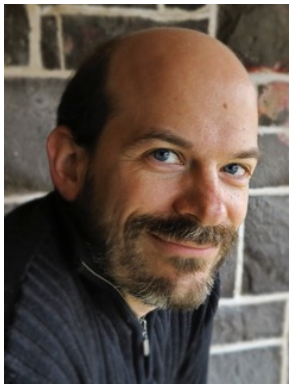
Cognitive Neuroscience Laboratory



Teaching & HW Assistants

Thibault Porssut

PhD student in IIG



Neal Hartman

PhD student in IIG

& 2 students-assistants : Hugo and Joseph

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"

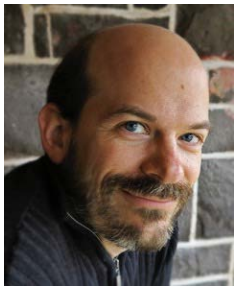
Cover some key interface modalities:

visual, haptic, movement

Present various applications

Course Map

	R. Boulic	B. Herbelin	T. Porssut
1	VR concepts		VR System 1
2	Presence		VR System 2
3	3D Interaction /		Unity
4	display		Unity
5	Action		Hands-on TP
6	Action		Hands-on TP
7	Haptic		Hands-on TP
8	Haptic		Hands-on TP
9	Believability		Hands-on TP
10		VR & NeuroSc.	Hands-on TP
11	Full-body Int.		Hands-on TP
12	*project time*		Project period
13	*project demo*		Project period
14	*final oral*		Project period



Course Map

week	10h15-11h00	11h15-12h	12h15-13h
1	Course presentation	R. Boulic VR concepts	T. Porssut VR System Part 1
2	R. Boulic	R. Boulic Vision & Stereo	T. Porssut VR System Part 2
3	R. Boulic	R. Boulic CAVE Display	T. Porssut Unity
4	R. Boulic	R. Boulic Cybersickness	T. Porssut Unity
5	R. Boulic **Paper Study Deadline**	TP - INJ 118 – INF 213	TP - INJ 118 – INF 213
6	R. Boulic	TP - INJ 118 – INF 213	TP - INJ 118 – INF 213
7	**Quizz1 -** R. Boulic	TP - INJ 118 – INF 213	TP - INJ 118 – INF 213 + project
8	R. Boulic	TP - INJ 118 – INF 213	TP - INJ 118 – INF 213 + project
9	R. Boulic	R. Boulic	project
10	B. Herbelin	B. Herbelin	project
11	R. Boulic	R. Boulic	project
12	project	project	project
13	**Quizz2** – project demos	Project demos	Project demos
14	final oral	final oral	final oral

Grading Scheme

Exam form: during the semester
4 components:

- 16%: 1 article study and citation analysis [weeks **2 – 4**]

- 10%: 2 quizzes on weeks **7** & **13**

- 4% : 4 x 2h VR hands-on [weeks **5 – 8**]

- 40%: 2-persons groups project [weeks **7 – 12/13**]

- 30%: short oral control on the chosen article, one random topic among the 4 TP topics and general VR concepts [week 14]

Assignment structure

16 % Individual article study [weeks 2-4] :

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

VR Hands-on in INJ 118 & INF 213 (4 weeks: 5-8)

Thibault.Porssut@epfl.ch

Neal.Hartman@epfl.ch

Assignment structure

VR Hands-on in INJ 118 & INF 213 (4 weeks: 5-8)

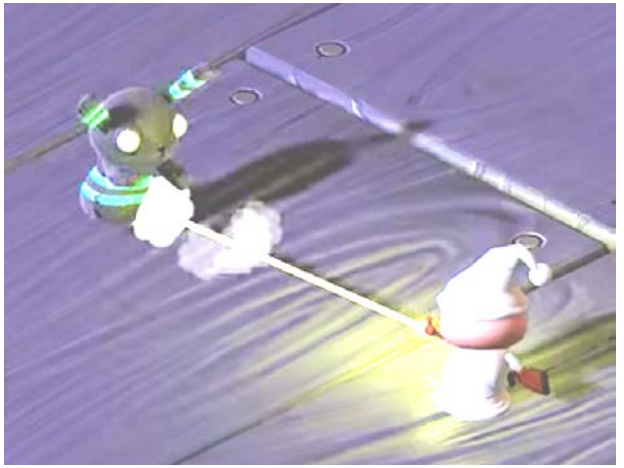
Expected background:

- introduction to Computer Graphics
  - Modeling: hierarchy, transforms, perspective,
  - Rendering: mesh,material, texture, light

Recommended background:

- C#, UNITY 3D, C++, OCV
- introduction to Visual Computing

Topic 1 (2h) : Unity Game Basis



Assignment structure

Overview

2 groups

Laptop with Unity3D platform

Animation/Navigation/Sound

Goals

Discover the main modules of Unity (Sound Mixer, Animator, Particle effect, UI..)

First Scripting Approach (C#)

Organize a full project

Make your first 3D game with Unity

Resources

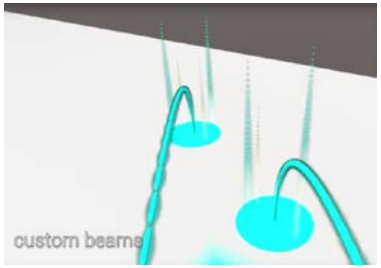
https://unity3d.com/pt/learn/tutorials/s/survival-shooter-tutorial

Topic 2 (2h): Unity Package

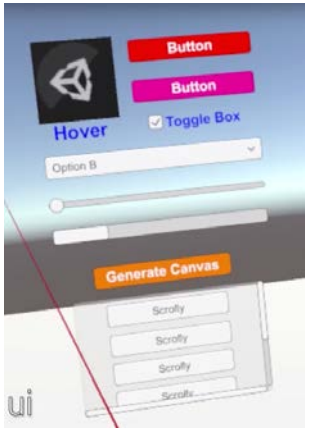
VRTK
virtual reality toolkit

Assignment structure

- Overview
  - 2 groups
  - 4*HMD (HTC-Vive/Oculus Rift) + Desktop
  - Laptop with Unity3D platform
  - Virtual Reality Application
  - Interaction/Locomotion



- Goals
  - First use of VR devices with Unity
  - Discover different types of locomotion and interactions design for Virtual Reality
  - Reuse Assets
  - Fast prototyping
- Resources
  - https://vrtoolkit.readme.io/docs



Topic 3 (2h): Oculus Go

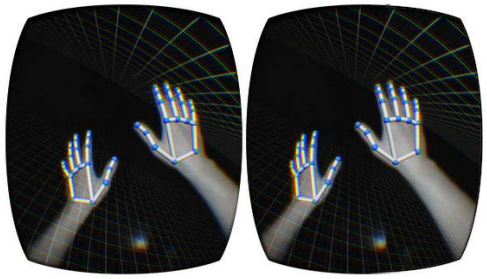
Assignment structure

- Overview
  - 20 groups (2 people per HMD)
  - Laptop with Unity3D platform
  - Android SDK and Debug Bridge
  - Interaction/Controller Settings

- Goals
  - Continue working with different types of locomotion and interaction design
  - Gain experience with controls of Android Based standalone HMDs (Oculus Go)
  - Modify, build, and deploy an APK for Oculus Go
- Resources
  - Build an Oculus Go App from Start to Finish https://bit.ly/2x93LNr

Topic 4 (2h): Discovery of Devices

Assignment structure

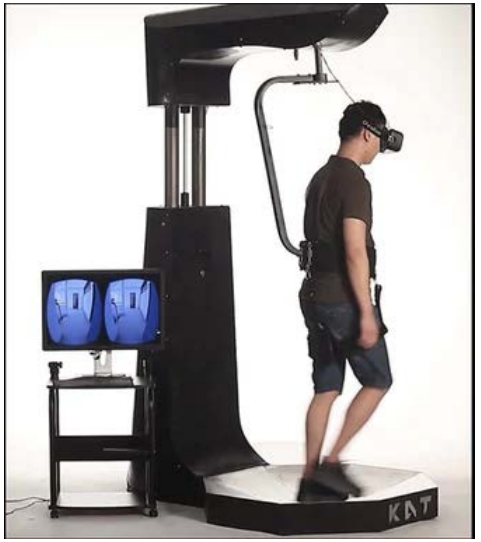


Overview

- 2 groups
- Leap motion sensor
- Kinect
- Katwalk
- Hololens

Goals

- Discovered different technologies (tracking, locomotion, visualization..)
- Give idea for your future project
- Set these new devices in a Unity Project
- Example of Unity integration



Assignment structure

Graded 4%: active participation [weeks 5-8]

- the final TP selection will be based on the final course registration

- group registration on moodle.

- *topics may be adjusted until week 5*

Assignment structure

40%: 2 persons groups project [7-12/13]:

- Specifications: real-time 3D interaction demo with VR devices under UNITY 3D

- Has to run on your own laptop
- Some VR devices can be borrowed from IIG

- 2 persons group registration on moodle, until week 6.
- submit a proposal to the TAs

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++, 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

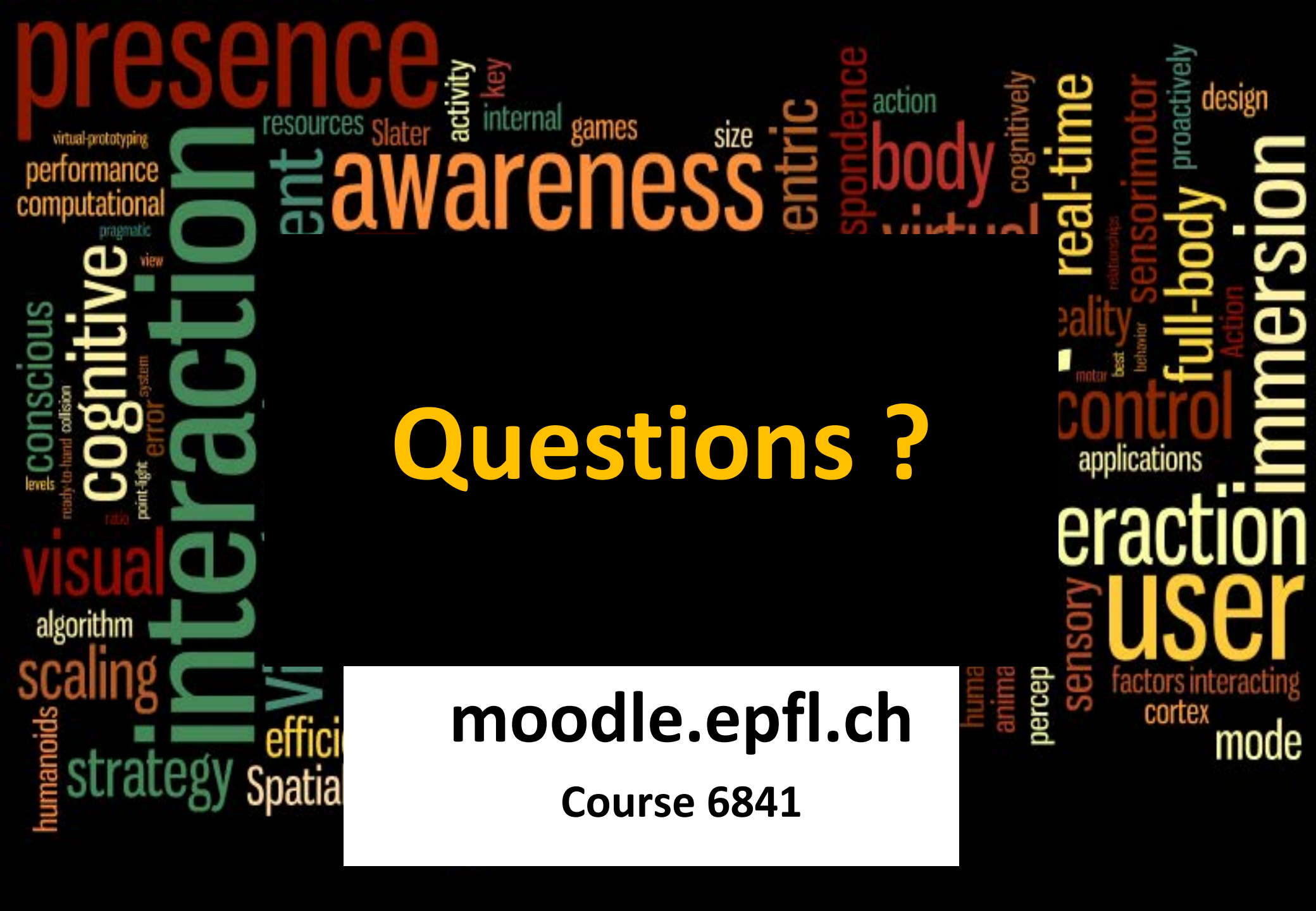
D. Bowman, E. Kruijff, J. Laviola, I. Poupirev, *3D user Interface*, 2nd edition Addison Wesley 2017

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

Course Map

week	10h15-11h00	11h15-12h	12h15-13h
1	Course presentation	R. Boulic VR concepts	T. Porssut VR System Part 1
2	R. Boulic	R. Boulic Vision & Stereo	T. Porssut VR System Part 2
3	R. Boulic	R. Boulic CAVE Display	T. Porssut Unity
4	R. Boulic	R. Boulic Cybersickness	T. Porssut Unity
5	R. Boulic **Paper Study Deadline**	TP - INJ 118 – INF 213	TP - INJ 118 – INF 213
6	R. Boulic	TP - INJ 118 – INF 213	TP - INJ 118 – INF 213
7	**Quizz1 -** R. Boulic	TP - INJ 118 – INF 213	TP - INJ 118 – INF 213 + project
8	R. Boulic	TP - INJ 118 – INF 213	TP - INJ 118 – INF 213 + project
9	R. Boulic	R. Boulic	project
10	B. Herbelin	B. Herbelin	project
11	R. Boulic	R. Boulic	project
12	project	project	project
13	**Quizz2** – project demos	Project demos	Project demos
14	final oral	final oral	final oral


presence
awareness
interaction
cognitive
visual
scaling
strategy
algorithm
humanoids
virtual-prototyping
performance
computational
pragmatic
view
conscious
levels
ready-to-hand
collision
ratio
point-light
error
system
resources
Slater
activity
key
internal
games
size
action
body
cognitively
real-time
proactively
design
sensorimotor
full-body
Action
control
applications
immersion
user
factors interacting
cortex
mode
sensory
Questions ?
moodle.epfl.ch
Course 6841