Summary
The goal of VR is to embed the users in a potentially complex virtual environment while ensuring that they are able to react as if this environment were real. The course provides a human perception-action background and describes the key techniques for achieving efficient VR applications.

Content
The first lectures focus more on the technical means (hw & sw) for achieving the hands-on sessions:

- Visual display (CAVE and stereoscopy)
- Interaction devices and sensors
- Software environment

The proportion of more theoretical VR and Neuroscience background increases over the semester:

- Key Human perception abilities, Cybersickness, Immersion, presence and flow
- Basic 3D interaction techniques: Magic vs Naturalism
- The perception of action
- Haptic interaction
- What makes a virtual human looking alive ?
- Motion capture for full-body interaction
- VR, cognitive science and true experimental design

Keywords
3D interaction, display, sensors, immersion, presence

Learning Prerequisites

Required courses
(CS 341) Introduction to Computer Graphics

Recommended courses
(CS 211) Introduction to Visual Computing

Important concepts to start the course
from Computer Graphics:
- perspective transformations
- representation of orientation
- 3D modelling hierarchy
- matrix algebra: translation, orientation, composition

Learning Outcomes
By the end of the course, the student must be able to:
• Describe how the human perception-action system is exploited in VR
• Apply the concepts of immersions, presence and flow
• Give an example of applications of VR in different industrial sectors
• Choose a method of immersion suited for a given 3D interaction context
• Explain the possible causes of cybersickness in a given VR system configuration
• Design a VR system involving 3D interactions

Transversal skills
• Set objectives and design an action plan to reach those objectives.
• Assess one’s own level of skill acquisition, and plan their on-going learning goals.

Teaching methods
Ex cathedra + Hands-on sessions on VR devices in the first half of the semester, a mini-project in groups on personal laptops will have to integrate various components of 3D real-time interaction. the group will negotiate their project proposal with the course responsible TA who will assess whether it meets the key specifications and is original enough. The proposal can include the use of some VR devices that the IIG research group will lend on a first-come/first-served basis.

Expected student activities
exploit citation analysis tools to evaluate a scientific paper
combine libraries to produce an original 3D interaction
experiment the hands-on practical work in the lab
synthesize the knowledge acquired in course and hands-on in the quizzes and final oral

Assessment methods
Throughout semester: 4 Hand-on sessions (4%), 2 Quizzes (10%), 1 paper citation study (16%), 1 mini-project (40%), 1 oral (30%)

Supervision
Office hours No
Assistants Yes
Forum Yes

Resources
Virtual desktop infrastructure (VDI)
No

Bibliography
- Course notes will be updated and made available after each course, with links to key sites and on-line documents
- Parisi, Learning Virtual Reality, O’Reilly 2015
student upon registration.

**Ressources en bibliothèque**
- 3D User Interfaces: Theory and Practice / Bowman
- Learning Virtual Reality / Parisi
- The VR Book / Jerald
- Le Traité de Réalité Virtuelle / Fuchs

**Notes/Handbook**
pdf of slides are made visible after the ex-cathedra courses

**Websites**
- http://www.thevrbook.net/