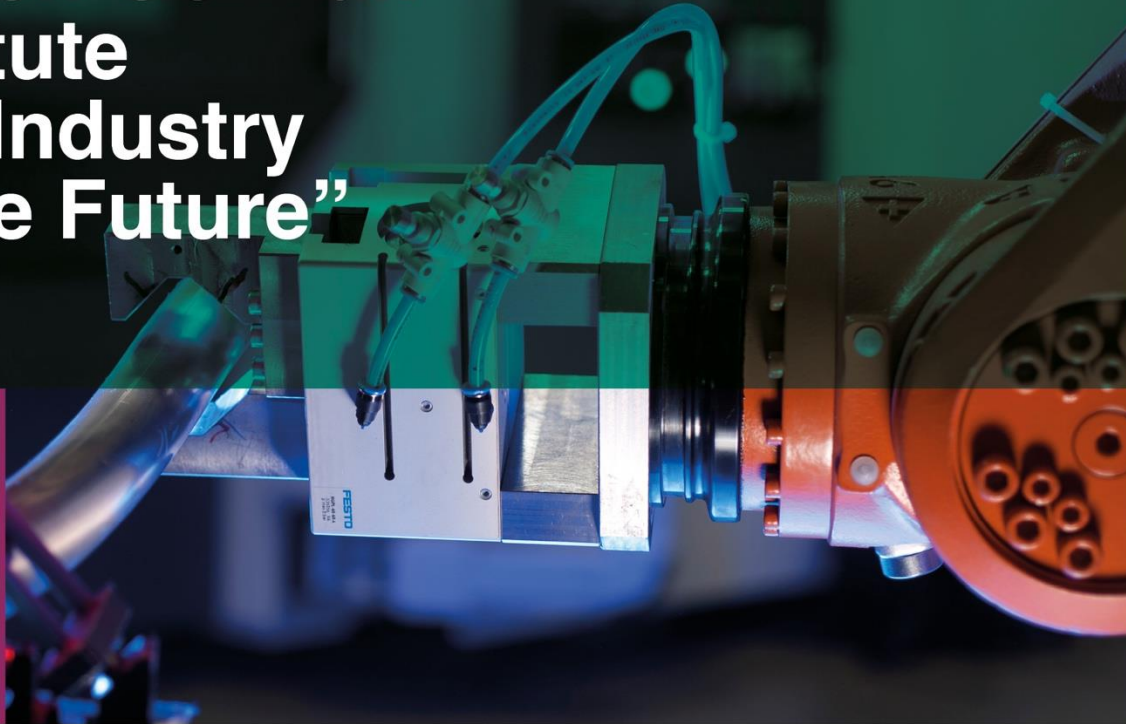


French-German Institute for “Industry of the Future”



Measurement of Immersion in Virtual Environments

Virtual, Augmented and Mixed Reality

Virtual Reality (VR) is:
realistic
immersive
3-dimensional

representation of a real or artificial environment and the interaction with this environment

Source: Prof. Ovtcharova, Lectures in Virtual Engineering



Immersion

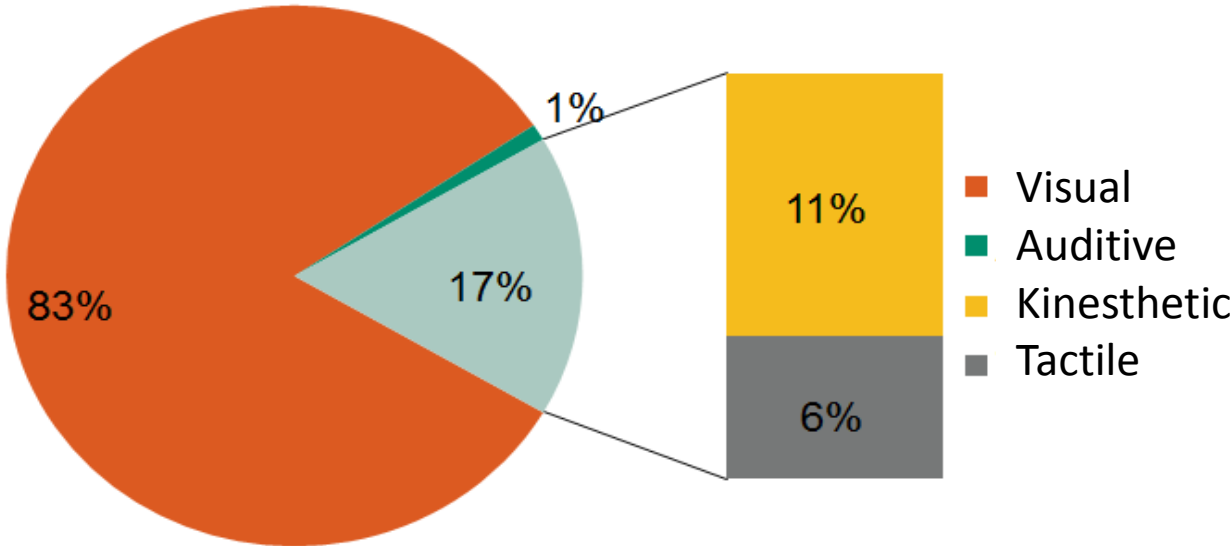
- Immersion refers to the objective level of sensory fidelity a virtual reality system provides
- Immersion is objective and measurable

Presence

- Presence refers to a user's subjective psychological response to a virtual reality system
- Presence is individual and a context-dependent user response



Mel Slater, "A note on presence terminology", 2003



Percentage of different senses in information gathering in driving simulation scenarios

Quelle: Castro (2009)

There is huge variety for VR technology for fake the human senses for the purpose of virtual reality sensation

- How to measure immersion and presence in different virtual reality environments?
- How to define the virtual reality hardware technology for specific applications?

Goal is to

- Create a methodology to help define the virtual reality environment needed for specific application or scenario
- Definition and calculation of **Immersion Index**

Quelle: tobiipro.com

How to achieve objective measurement?



Electromyography

Quelle: delsys.com



Eye-Tracking



Electroencephalography

Quelle: emotiv.com

Physiological Sensors

- Non-invasive
- Wireless data transmission
- No presence brake



Electrodermal activity (skin conductance)

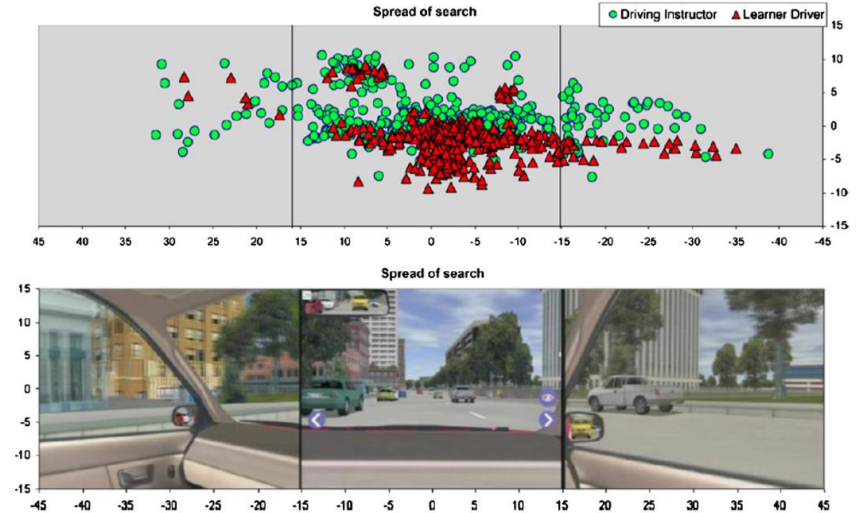
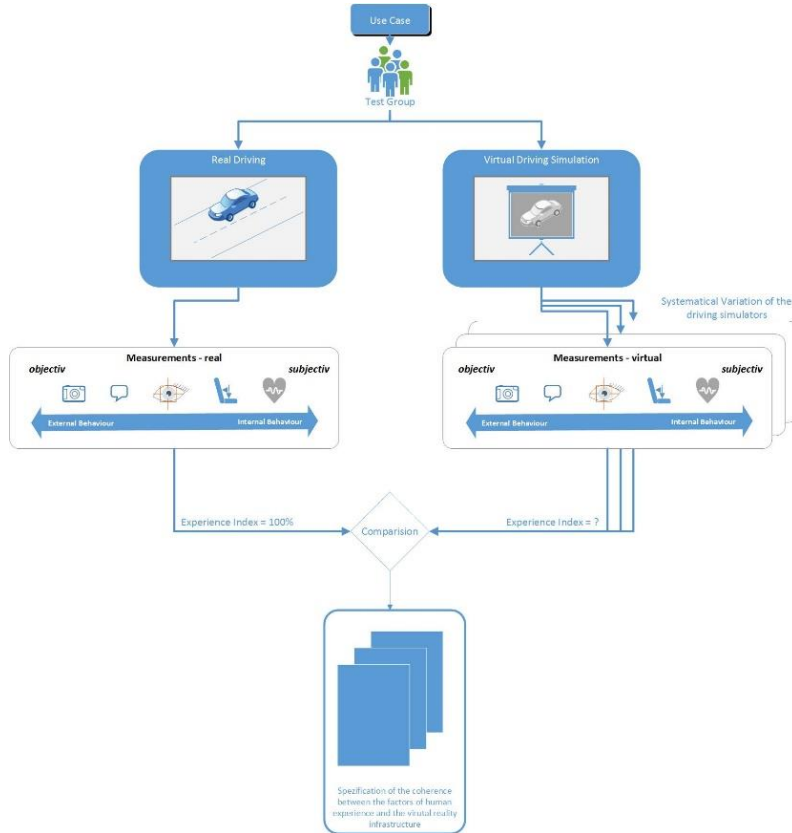
Quelle: empatica.com



Electrocardiography (heart rate)

Quelle: shimmersensing.com

Use Case – Virtual Reality Driving Simulator



Eye Tracking results in driving simulator

Quelle: Underwood et al.

Expected Project Results

- Experience Index
- Measurements methods
- Hardware sets for the measurement

Proposed Time Plan

- Phase I: Concept experience index definition, use cases, study design, hypothesis, measurement sets, VE infrastructure
- Phase II: Study (2 levels, 1st Pilot: experience with infrastructure and measurement in VE, 2nd level Main Study real /virtual)
- Phase III: Analysis and Validation (studies evaluation, theory and praxis validation)

Potential Project Partners

- ENSAM Institute Image, KIT IMI, FZI and Renault