MASARYK UNIVERSITY

Learning in Virtual 3D Environments: All about immersive virtual 3D interfaces

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Multidisciplinarity

- Faculty of Arts - Psychology
- Faculty of Informatics – Computer Graphics
- Faculty of Science - Cartography

Multidisciplinarity

- Psychologists – Methodology/Ideas

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- IT guys - Technology

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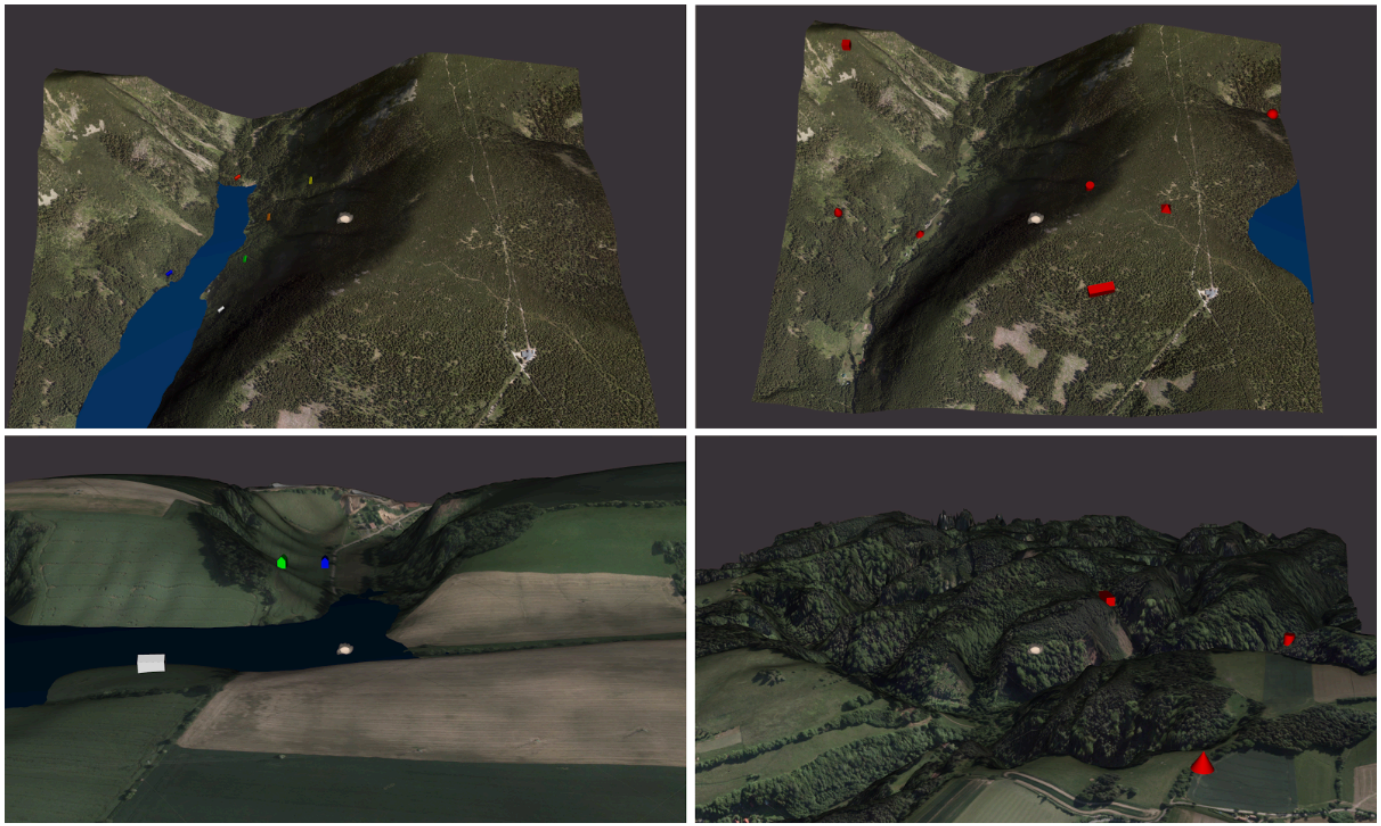
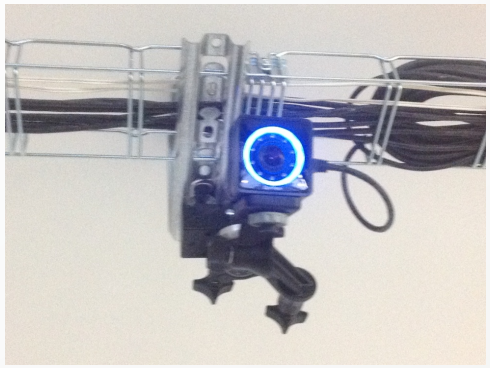
- IT guys - Technology
- Cartographers - Content

We have started with interactive virtual 3D maps...

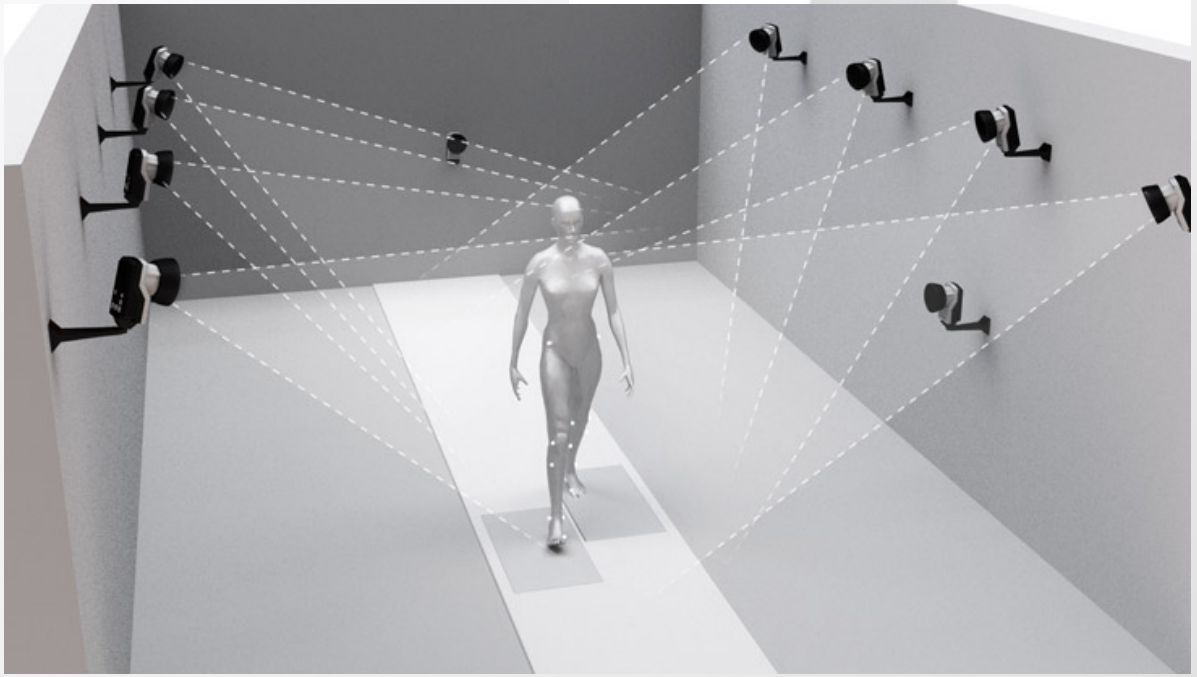


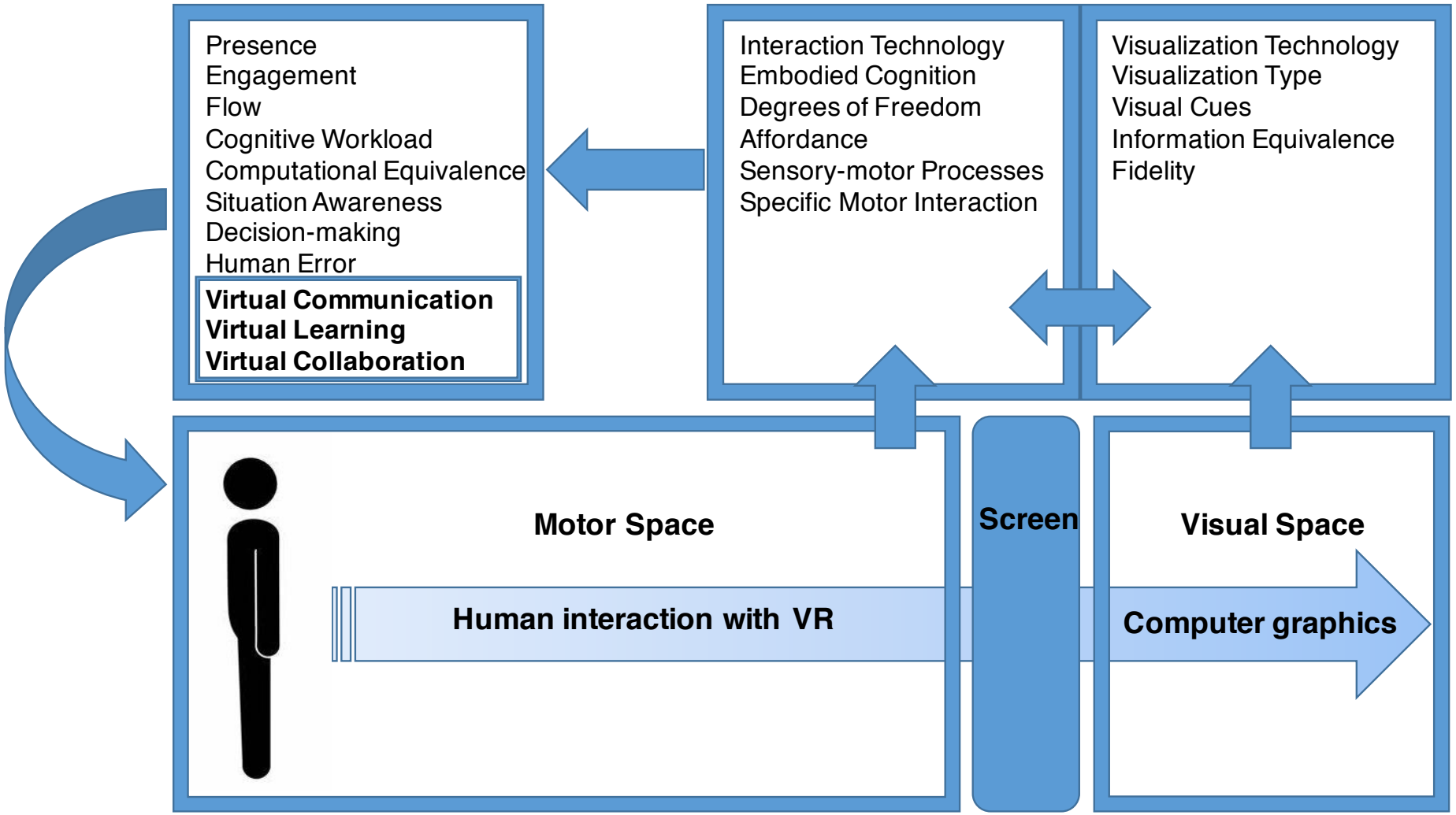
Demonstration

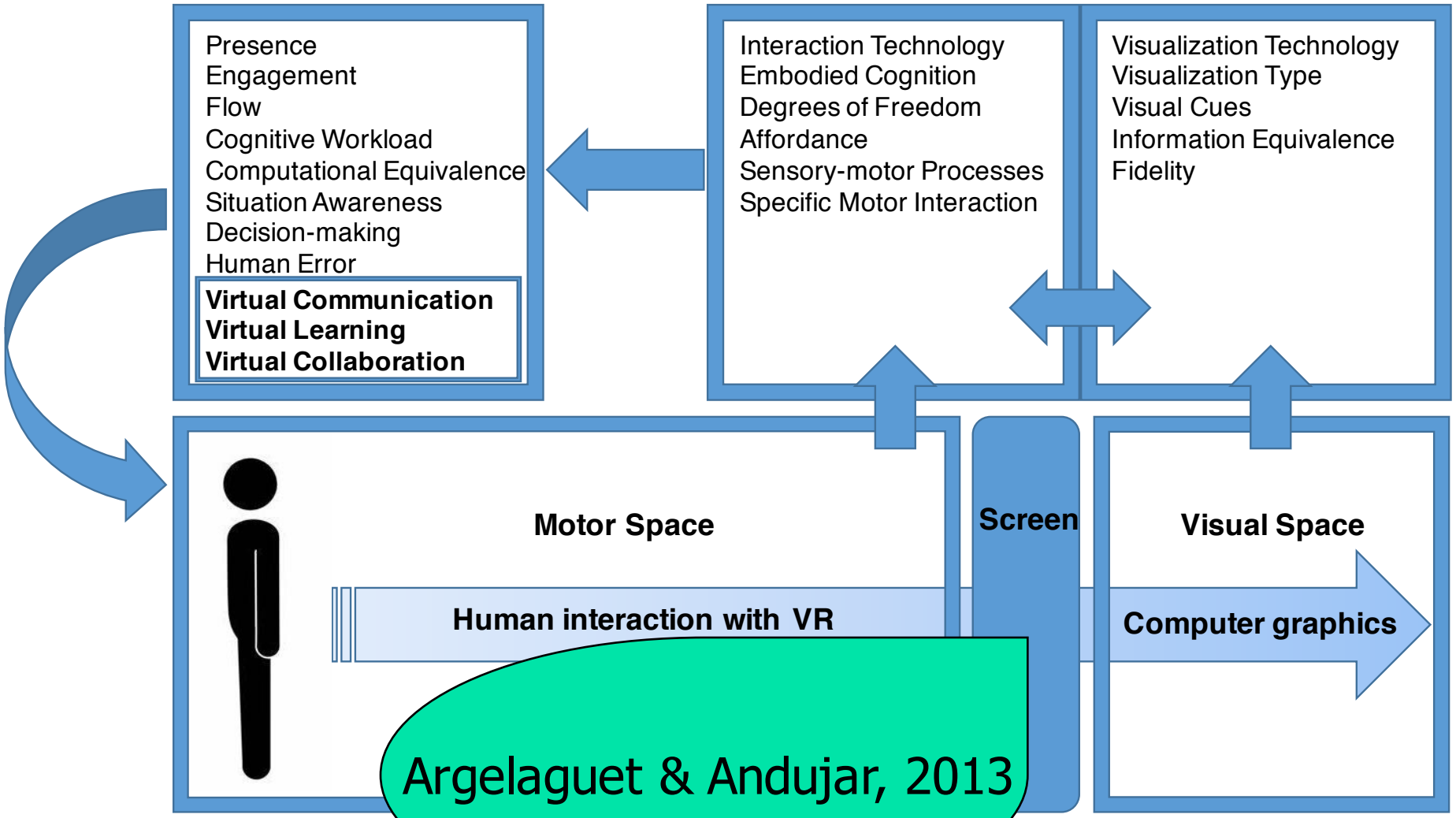
MoCap + Wii RC



- Software:
  - MOTIVE
  - VRECKO




Presence
Engagement
Flow
Cognitive Workload
Computational Equivalence
Situation Awareness
Decision-making
Human Error
Virtual Communication
Virtual Learning
Virtual Collaboration
Interaction Technology
Embodied Cognition
Degrees of Freedom
Affordance
Sensory-motor Processes
Specific Motor Interaction
Visualization Technology
Visualization Type
Visual Cues
Information Equivalence
Fidelity
Motor Space
Screen
Visual Space
Human interaction with VR
Computer graphics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Argelaguet & Andujar, 2013

Basic Question?

Does the Real 3D visualization users differ from Pseudo 3D visualization users when evaluating the features of 3D virtual geographical environments (VGEs)?

- Real 3D visualization – stereoscopic 3D
- Pseudo 3D visualization – 2,5D
- VGEs – 3D Models

Pseudo vs Real 3D Visualization

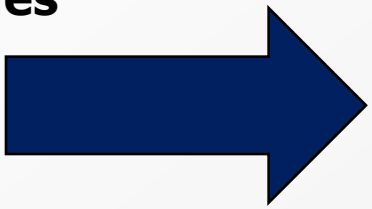
Monocular depth cues

A) Static monocular depth cues

Linear perspective
Aerial perspective
Relative size
Interposition
Texture gradient
Shading and lightening
Elevation

B) Dynamic monocular depth cues

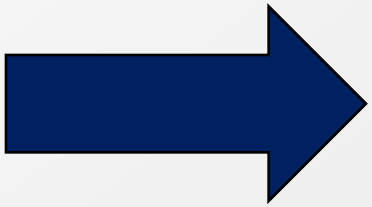
Motion parallax
Kinetic depth effect



Computer graphics

Binocular depth cues

Binocular convergence
Binocular disparity

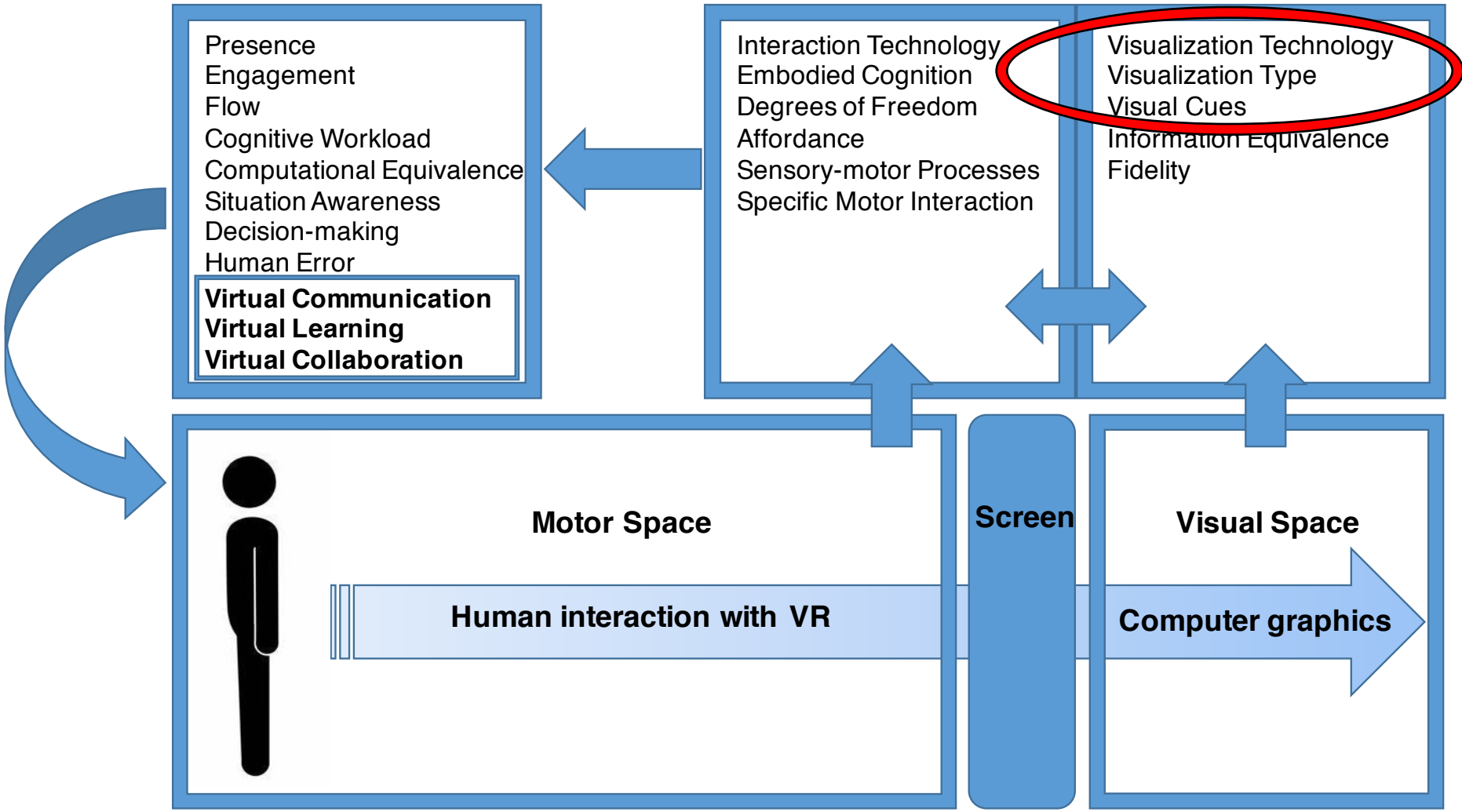


Peripheral Device
= stereoscopy

3D technology

- DOLBY 3D Technology
- Widescreen 3D Projection

- Currently: Active Shutter 3D Glasses - NVIDIA Technology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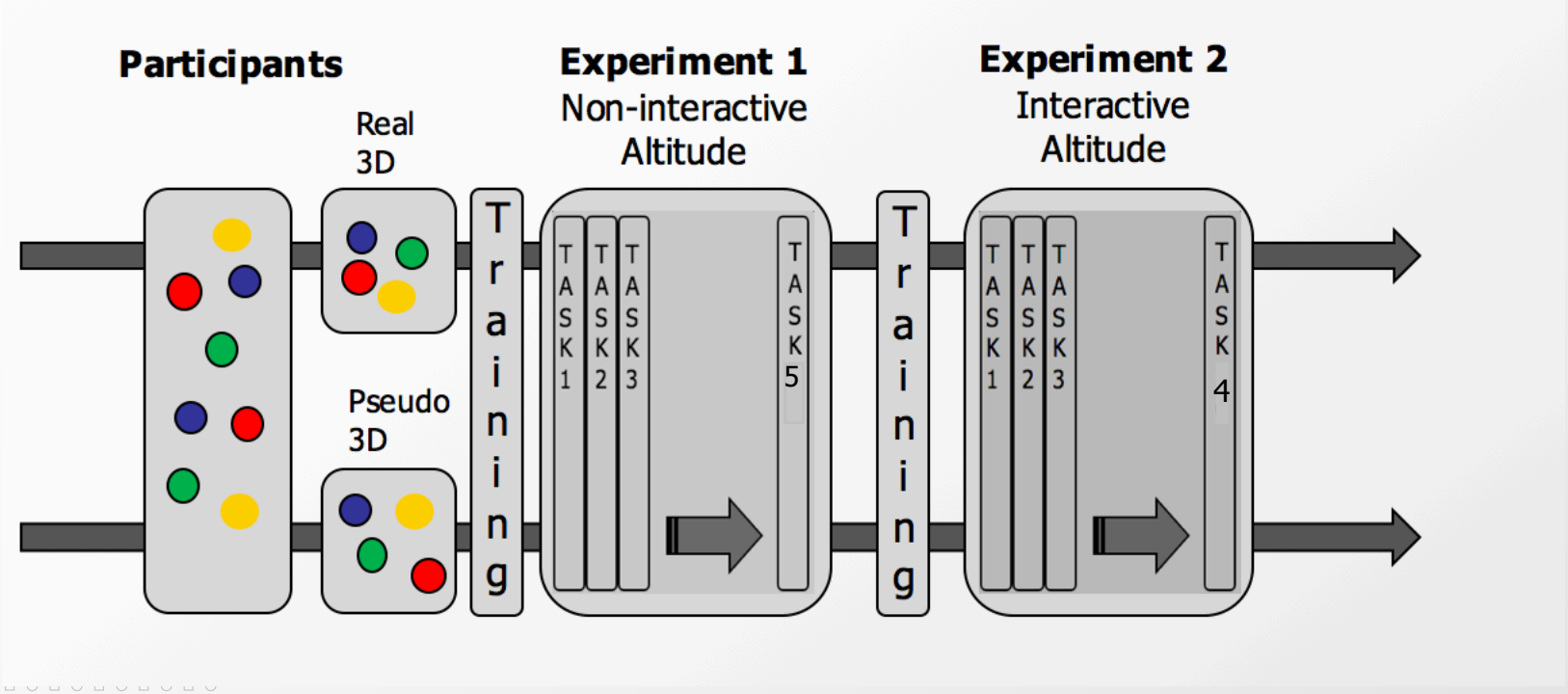
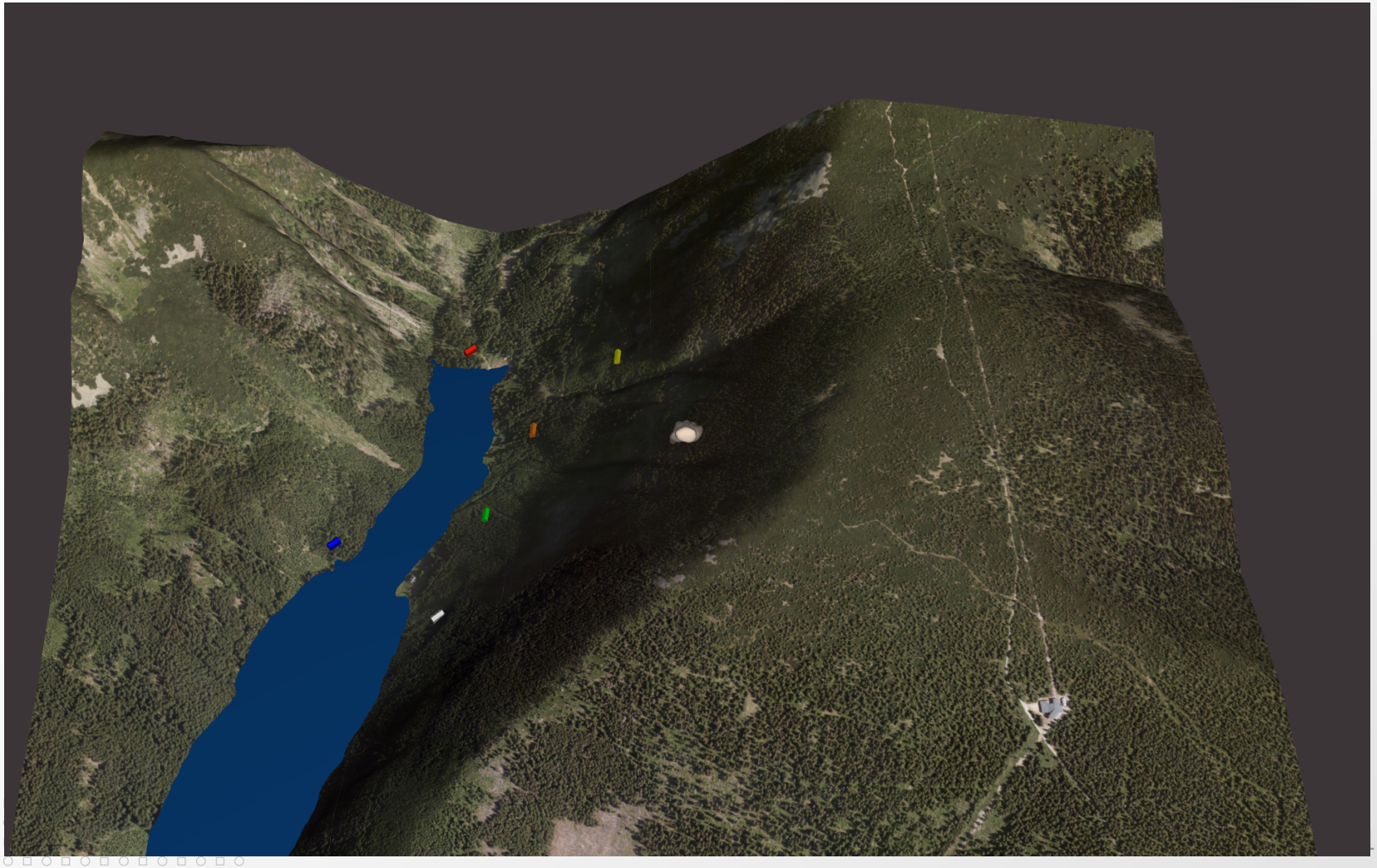
EXPERIMENT

Experimental Scheme

- Altitude Identification
- Memory Recollection



Task Example



Hypotheses

- **Non-interactive Experiment 1** (Participant were not allowed to handle with the VGEs)
  - Real 3D users will be more precise at altitude identification.
  - The Pseudo 3D users will perform better recollection from memory then users in immersive Real 3D.

Hypotheses

- **Interactive Experiment 2** (Participants were allowed to handle with the VGEs)
  - The differences in the accuracy of altitude identification will be flatten.
  - The need for better spatial insight in Pseudo 3D condition will increase elaboration of visualization - motor searching activity.
  - The memory recollection will be better at Pseudo 3D due to better elaboration .

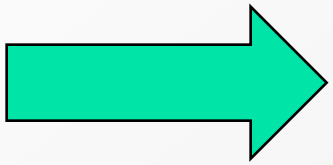
Methods

The specific UI was designed for the experiment

- 3D **VGEs** as a stimuli
- We measured
  - **Response time**
  - **Accuracy of the altitude identification**
  - **Motor activity** when searching for solution (MOTIVE)
    - dragging, orbiting, zooming – total movement of virtual cam

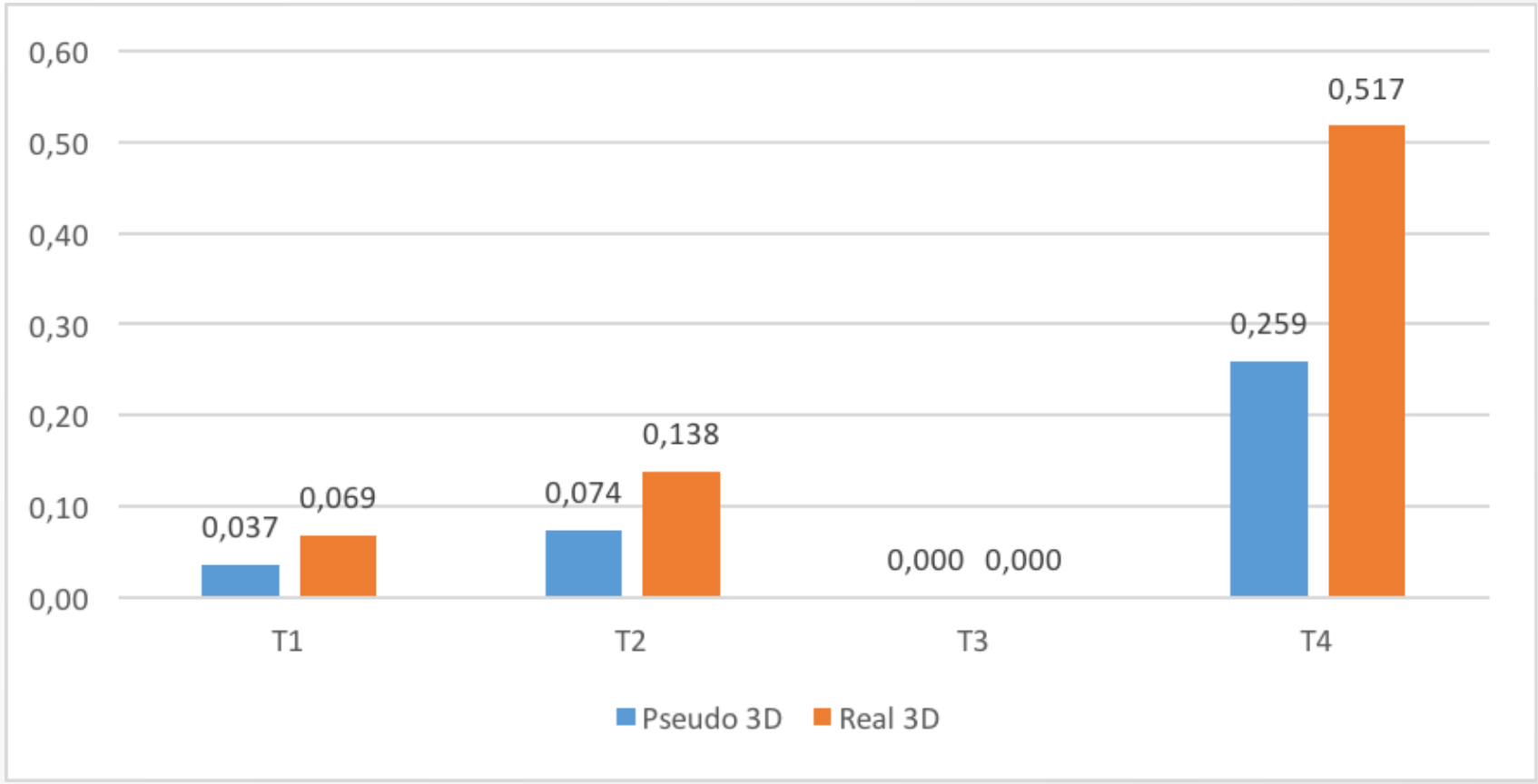
Highlight of the Study – Neglects in Interactive Part

- In Real 3D condition the users neglected to order some bodies in terrain, because they did not notice them at all.



Human Error

Neglects of objects in Interactive Part



Future Research - Discussion

- The tendency to **neglect important objects** in the scene is the suggestion for the future research.
- Better accuracy or presence in VR is necessary to consider with respect to possible human error phenomena.
- **Minority phenomena** – different statistics.

- The searching **motor activity** should be more precisely analyzed with respect to the process of searching.

HOT NEWS

- The Collaborative Virtual Space - Unity engine
- Motion capture – for users' position detection
- Collaboration:
  - a) users share real as well as virtual space
  - b) users can be in different places and share VR
- Data gloves or Wii RC
- Oculus Rift DK2 is currently used
- Features:
  - 3D virtual manipulation with models (objects)
  - GUI interaction – it can be customized

- Exploring the possibilities of virtual collaboration with written texts

Thank you for your attention

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CEPCoS

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References

- Argelaguet, F. and Andujar, C. (2013). A survey of 3D object selection techniques for virtual environments. *Computers & Graphics*, 37(3), pp.121-136.