Hannes
Kaufmann

Virtual and Augmented Reality VO, UE – Vorbesprechung Introduction

Hannes Kaufmann

Khrystyna Vasylevska

Iana Podkosova

Interactive Media Systems Group (IMS)

Institute of Visual Computing & Human-Centered Technology

Interactive Media Systems Group

**Head:
Prof. Dr. Christian Breiteneder**

Virtual & Augmented Reality

Hannes Kaufmann

- Collaborative Shared Environments
- Large Optical 6DOF Localization
- 3D HCI, incl. Haptics and Locomotion,
- High Quality Rendering for Mixed Reality

Media Processing
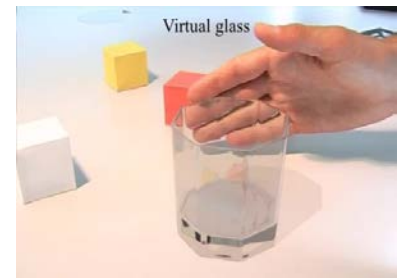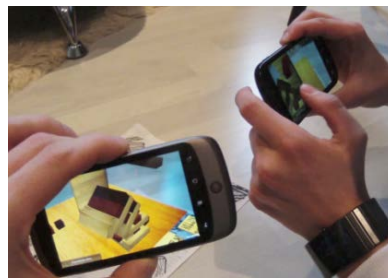
Christian Breiteneder   Horst Eidenberger

- Human-like understanding of multimedia content
- Pattern recognition (audio, images, text, video, bio-signals)
- Intelligent categorization

Image and Video Analysis & Synthesis

Margrit Gelauz

- Image and video analysis & synthesis
- Stereo processing, image matting, high dynamic range imaging
- 3D scene reconstruction
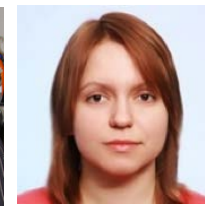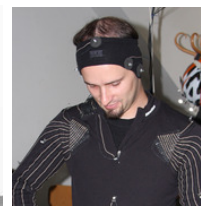
VIRTUAL & AUGMENTED REALITY

Key Researcher:

PD. Mag. Dr. techn. Hannes Kaufmann

INTERACTIVE MEDIA SYSTEMS
Vienna University of Technology

GCD
Center for Geometry and Computational Design
Doctoral College DC:{CD}

Research Staff

Postdocs: Peter Kán, Min Kyung Lee, Annette Mossel, Christian Schönauer

PhDs: Georg Gerstweiler, Emanuel Vonach, Khrystyna Vasylevska, Iana Podkosova, Mohammad Mirzaei, Soroosh Mortezapoor
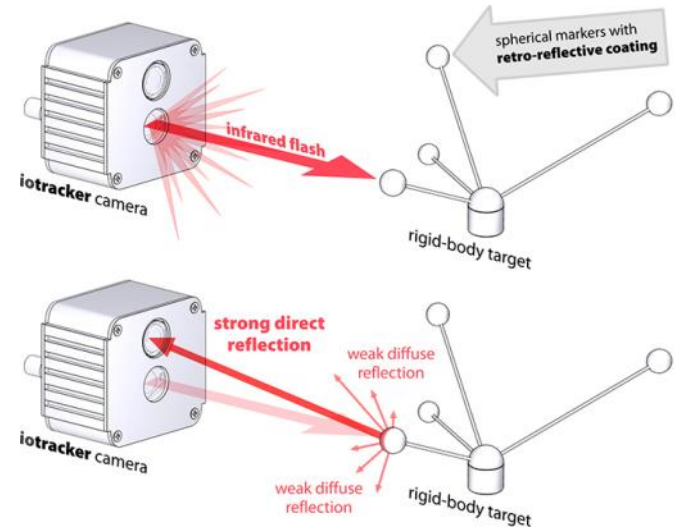
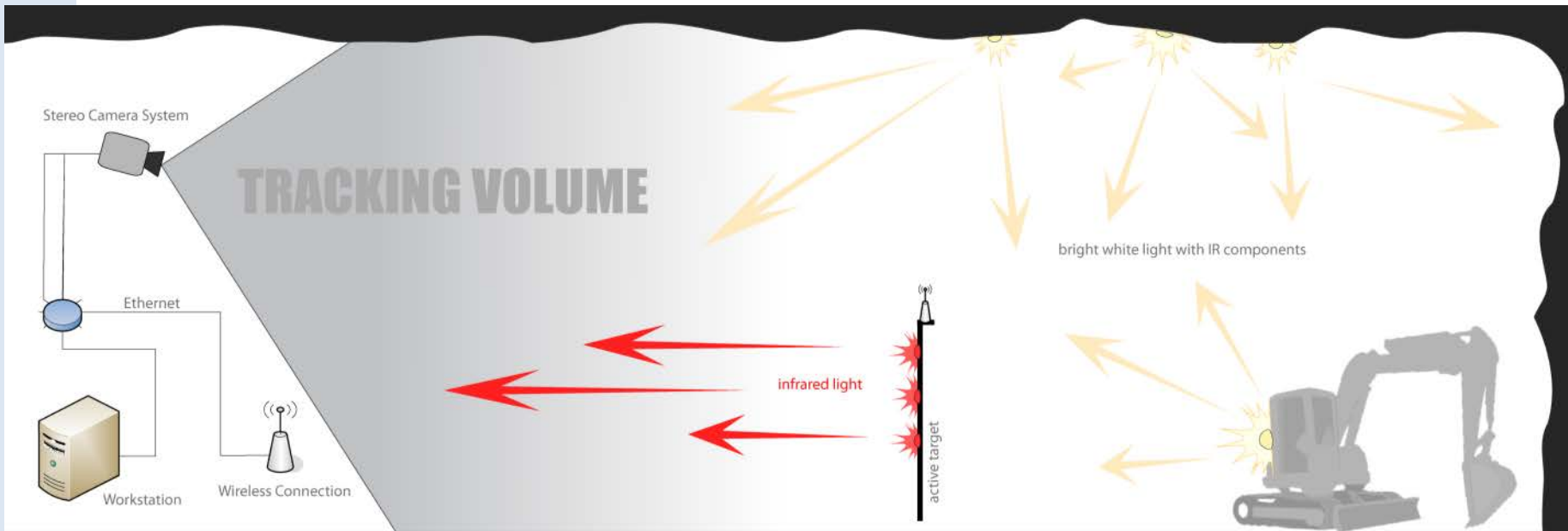**Students:** 25 graduate and undergraduate students involved in research

Tracking Technologies

- ## iotracker

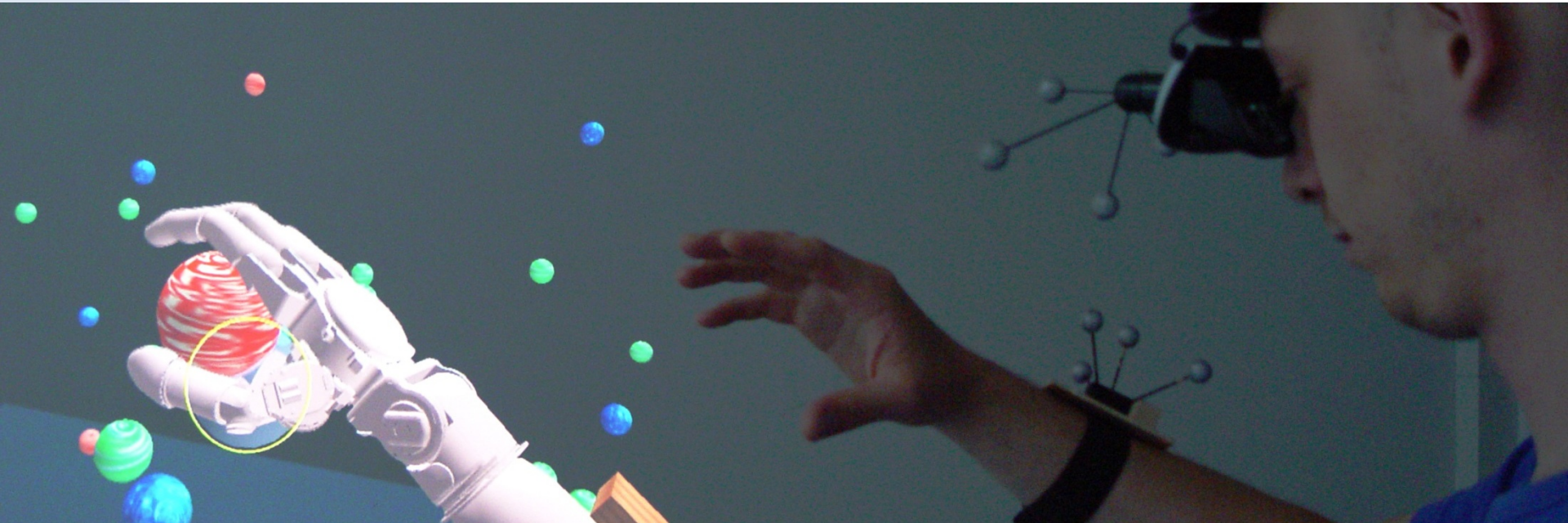 Low-cost infrared optical tracker for room-sized VR environments

- ## Tunnel Measurement (RTMIOT)

Medical & Biosensor Applications

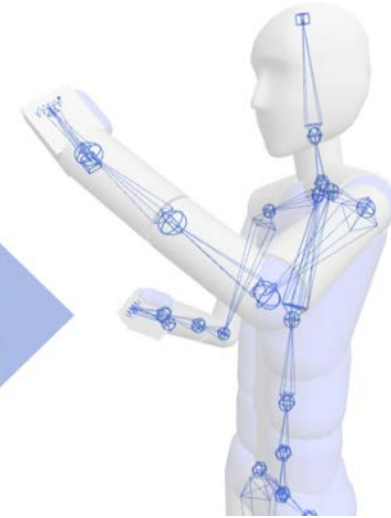- ## Virtual Reality Training for Upper Limb Prosthesis Patients

  Training for amputees with EMG sensors
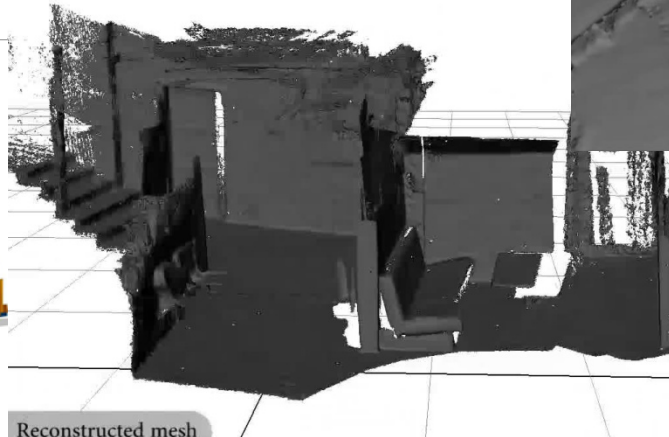
Medical & Biosensor Applications

- ## PLAYMANCER

  3D-Serious Game Environment with real-time motion capturing and bio-signal feedback for physical rehabilitation

- ## ProFiTex

  Support fire fighters with mission-relevant information based on various sensor data

Inertial Sensor (localisation)

Integrated visualisation device

Infrared Camera (connected via docking station)

Chips or tags to store information („door", „victim",...)

Wireless communication between lifeline and firefighter´s suit

Example interface for data input

Smart Lifeline transmits data and stores information

Reconstructed mesh
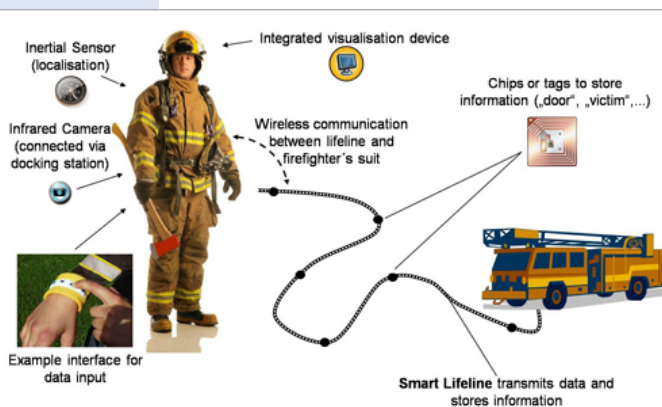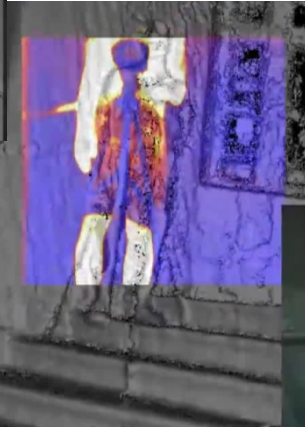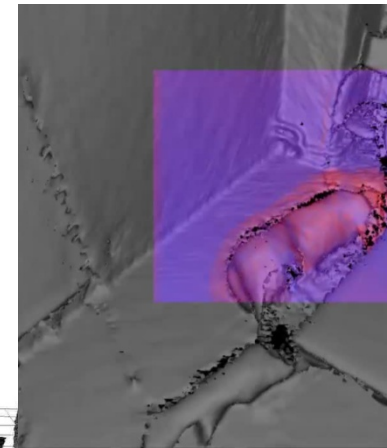
Real Walking through Large Virtual Environments

ImmersiveDeck

Spatial Perception in Virtual Reality

- Self-overlapping rooms
  - *Simple layouts prevent spatial compression*
  - *Less virtual space fits in the real room*

- How people perceive the space?
  - *Where is the room you came from?*

- What parameters/layouts are more efficient?
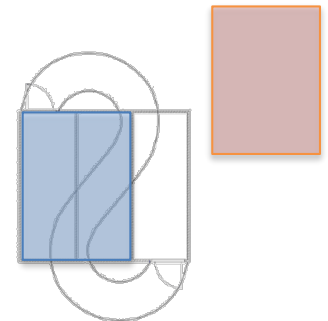 - *Same arrangement of rooms*
  - *Different corridors*
  - *Multiple parameters: corners, distances, curvature, walking direction…*
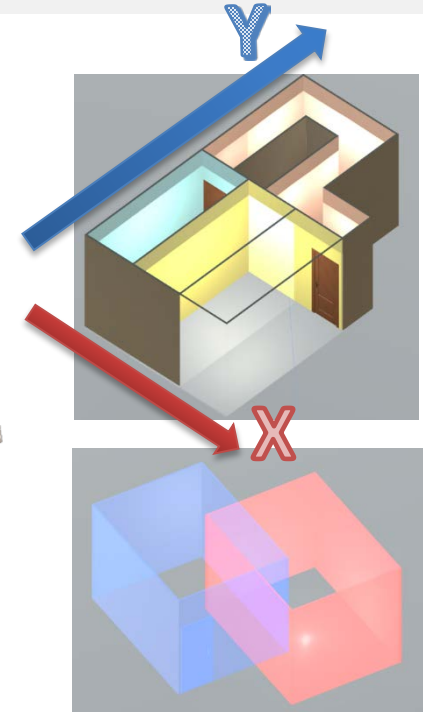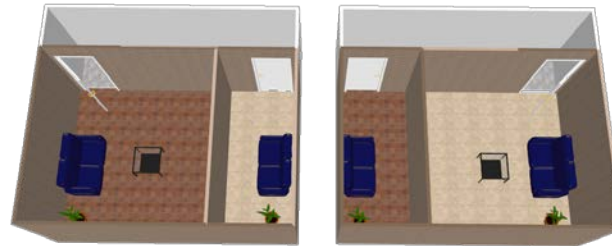
K. Vasylevska, H. Kaufmann, *Towards Efficient Spatial Compression in Self-Overlapping Virtual Environments, IEEE Symposium on 3D User Interfaces (3DUI), March 2017, Los Angeles, CA, USA,* **Best Paper Award**

S-shaped

Real-time Ray Tracing in AR
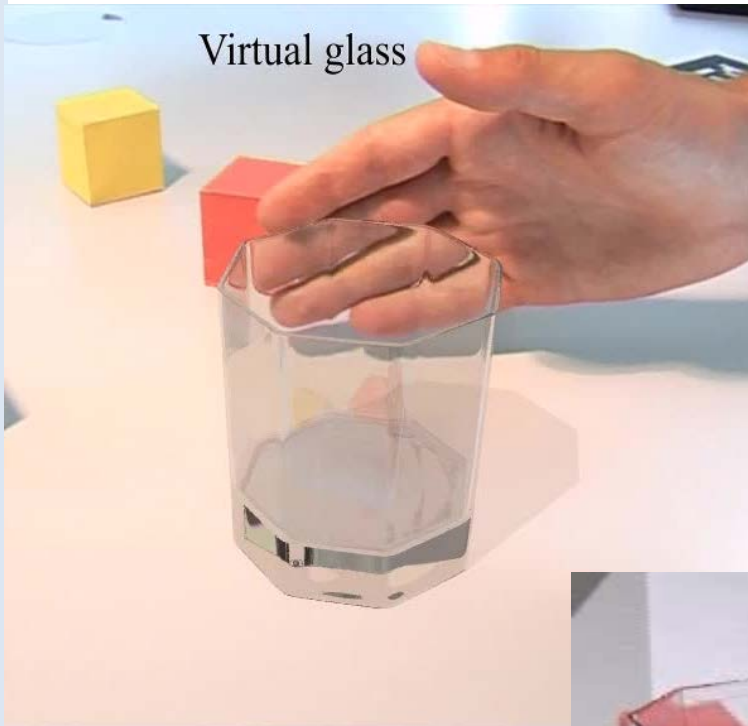
Virtual Architect

Automated Architectural 3D Model Generation and Interaction
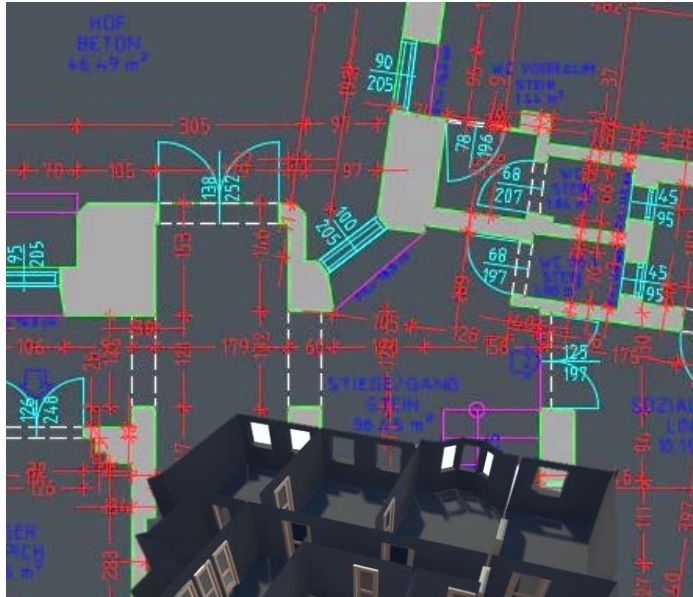
Aim: Visualize apartments in VR

- Automatic generation of geometry out of 2D floor plans
- Generation of interior design

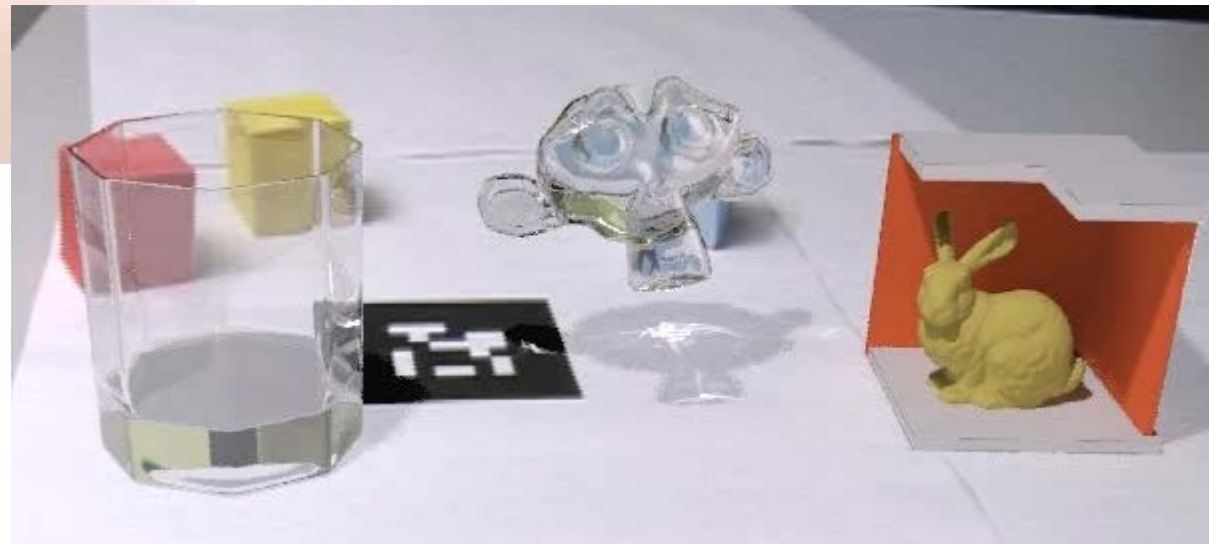Peter Kán & Hannes Kaufmann (2017), Automated interior design using a genetic algorithm. *23rd ACM Symposium on Virtual Reality Software and Technology (VRST '17)*, pp. 1-10, ACM, New York, NY, USA

Peter Kán & Hannes Kaufmann (2018), Automatic Furniture Arrangement Using Greedy Cost Minimization, *accepted for IEEE Virtual Reality*, March 2018, Tübingen, Germany

Virtual Architect

Automated Architectural 3D Model Generation and Interaction

- Automatic model generation
  - 2D floor plan conversion to BIM Format
  - 3D Visualization (Unreal)

- Automatic furnishing
  - Automatic furniture placement
  - Furniture cost functions
  - Material optimization

- Interaction in VR
  - Interaction with furniture
  - Moving
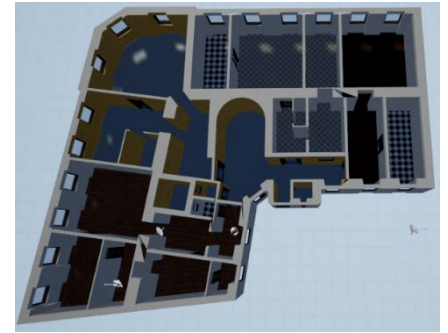
Virtual Architect

Automated Architectural 3D Model Generation and Interaction

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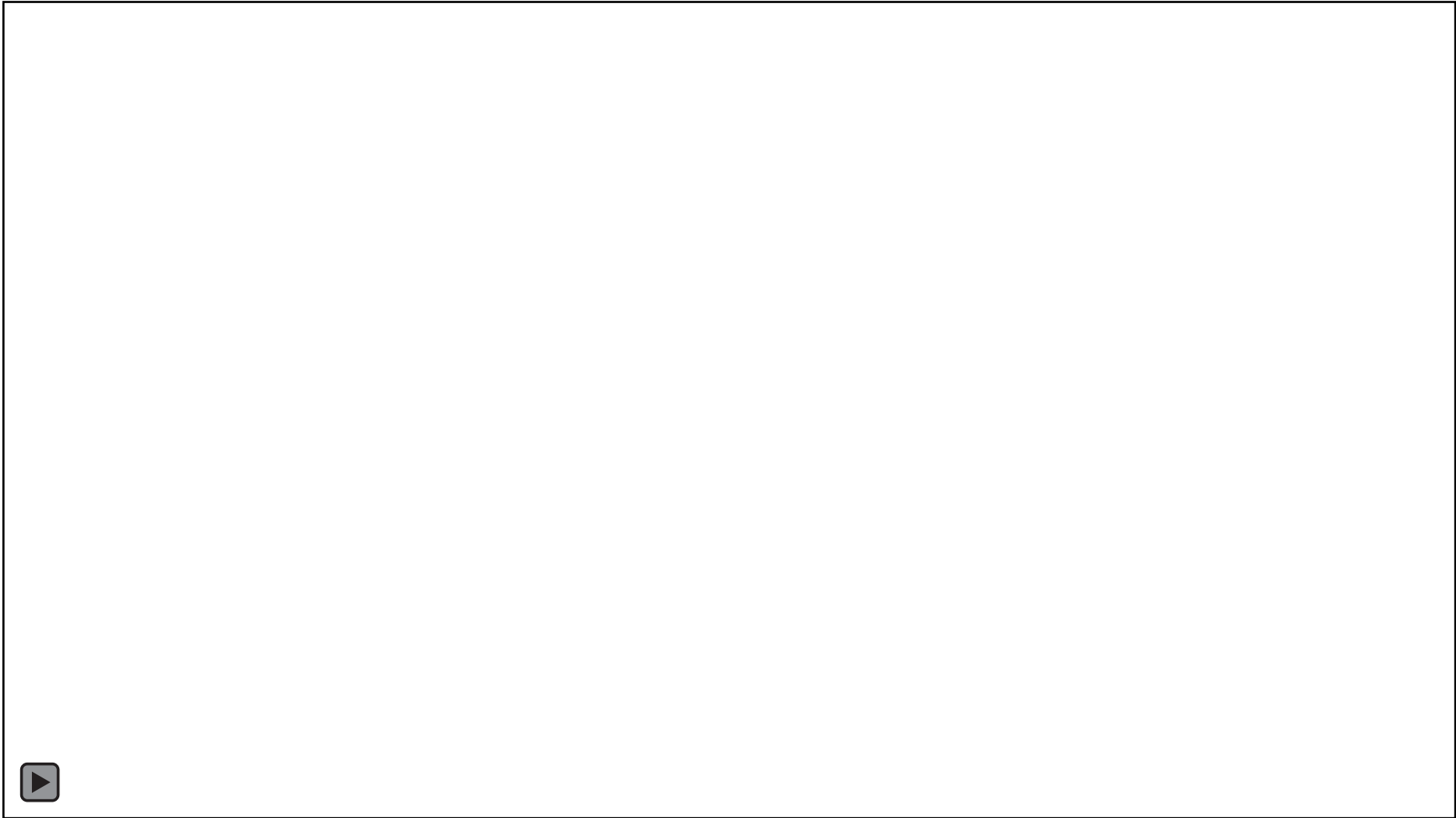
VROnSite

Virtual Simulation and On-Site Training for First Responders

- Mobile immersive virtual reality training platform
  - On-site squad leaders of disaster relief units
  - Train *Plan-Do-Act-Check* command cycle
- Save cost and time, increase training time

DO

Perspective

Locomotion

PLAN

CHECK

Time Pressure

Stress/Exhaustion

ACT

Scenario

Processing Unit

Stereoscopic Rendering

SAMSUNG Gear VR

Navigation Input

Setups

Physical State + Scene Viewing + Navigation

Physical State + Scene Viewing + Navigation
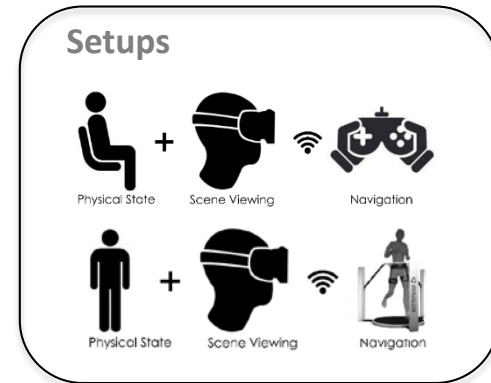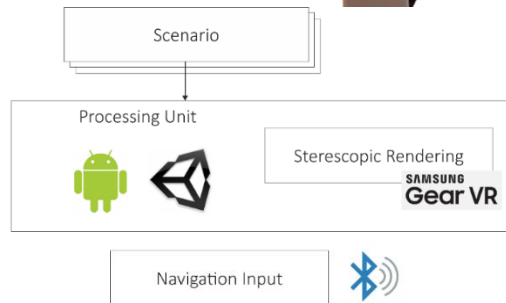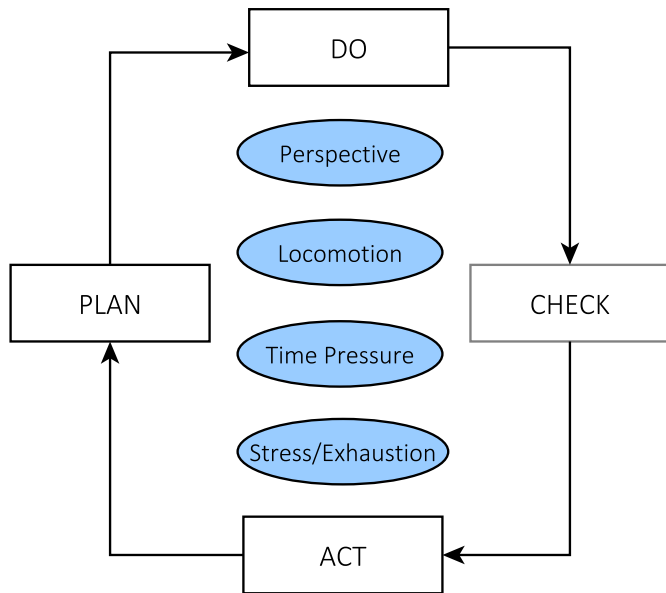
A. Mossel, M. Froeschl, C. Schoenauer, A. Peer, J. Goellner, H. Kaufmann (2017), VROnSite: Towards Immersive Training of First Responder Squad Leaders in Untethered Virtual Reality, *IEEE Virtual Reality, March 2017, Los Angeles, USA*

MasterMind Development GmbH

FFG

TU WIEN

INTERACTIVE MEDIA SYSTEMS
Vienna University of Technology

Exchangeable Haptic Feedback in VR

- Robot actuated physical props for haptic feedback

- Infinite virtual environments with close-to-natural walking

- Research tool for studying haptics in VR

E. Vonach, C. Gatterer, H. Kaufmann (2017) VRRobot: Robot Actuated Props in an Infinite Virtual Environment, *in Proceedings of IEEE Virtual Reality, March 2017, Los Angeles,USA*

Exchangeable Haptic Feedback in VR

▶
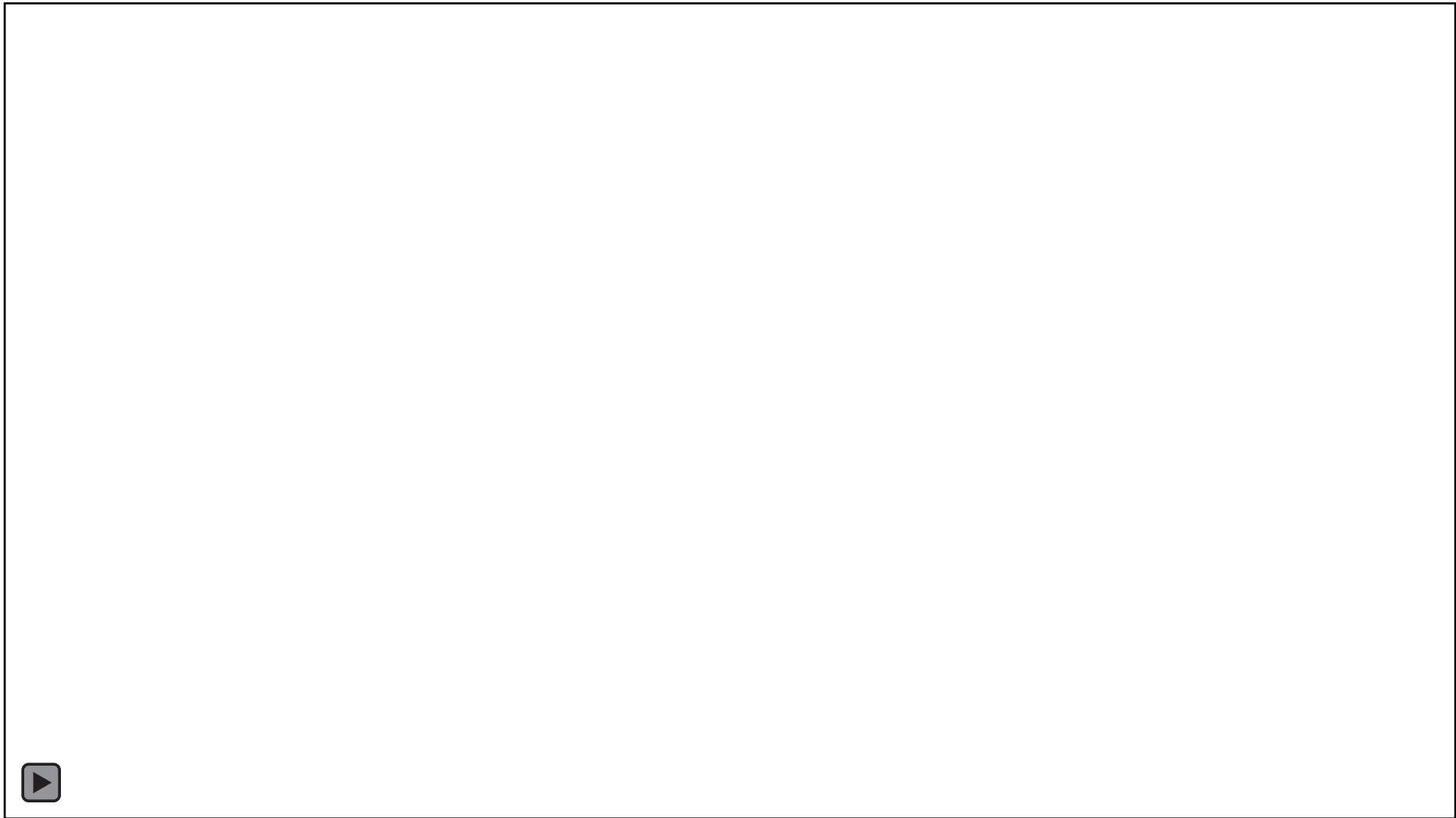
Virtual Reality VO – Dates

- VO 2.0 SwS, 2.0 ECTS, LVA 188.369
- Location: Zemanek
- blocked

- MO 1.10.   11:00 - 13:00   Zemanek
- DI 2.10.   13:00 – 16:00   Zemanek
- MI 3.10.   10:00 – 13:00   Zemanek
- DO 4.10.   13:00 – 16:00   Zemanek
- FR 5.10.   10:00 – 13:00   Zemanek
- MO 8.10.   13:00 - 16:00   Zemanek

Exam

- ## Written Exam (next 3 Dates)
  - MI 17.10.2018, 14:00 - 16:00, EI 9 Hlawka HS
  - DI 30.10.2018, 14:00 – 16:00, EI 9 Hlawka HS
  - DO 21.2.2019, 14:00 – 16:00, HS 7 Schütte-Lihotzky

- ## Contact:
  - Tel.: 01/58801 18860
  - Email: Hannes.kaufmann@tuwien.ac.at
  - Favoritenstr. 9-11; 4. Stock; Stiege 3; HD 04 05

Content

- Introduction, Applications

- Input Devices & Tracking

- Output Devices – Displays, Haptics,…

- 3D Graphics Hardware

- AR/VR Framework & Scene Graphs

- 3D Interaction

- Usability, Evaluations

- Current Research

Hannes
Kaufmann

Questions?

VO – Website with all materials (slides) in TISS!

Hannes
Kaufmann

Virtual Reality Übung 2018
VRUE'18

LVA-LeiterInnen:

Khrystyna Vasylevska

Iana Podkosova

TutorInnen:

Philip Krachler,

Wassily Bratuska

Hannes
Kaufmann

VRUE 2018 (188.913)

- Value: 3.0 h, 4.0 ECTS
- Duration: 05.10.2018 – 19.12.2018

- Calendar (VRUE)
  - https://calendar.google.com/calendar/embed?src=hfbkjq0e5gdtcac9ibgoveoi8s%40group.calendar.google.com&ctz=Europe/Vienna

- Materials (TUWEL)
  - https://tuwel.tuwien.ac.at/course/view.php?id=12052

- Help & Communication
  - Course leaders: vrue@list.tuwien.ac.at
  - Tutors: TUWEL Forum

Anmeldung

- **In TISS untill Thursday, 05.10.17 23:59**
  - 188.913: Virtual and Augmented Reality
  - De-registration 10.10.17 23:59!

- **Prerequisites**
  - Masterstudium
  - Basic knowledge in Programming (C#, C++)

Goals & Contents

Device Tracking

3D Virtual Scene

VR View

Physics

TRACKING

VISUALIZATION (Rendering)

INTERACTION (HCI)

DISTRIBUTION

Virtual Hand

Networking

3D Interaction Metaphors

Collaboration

Multi User
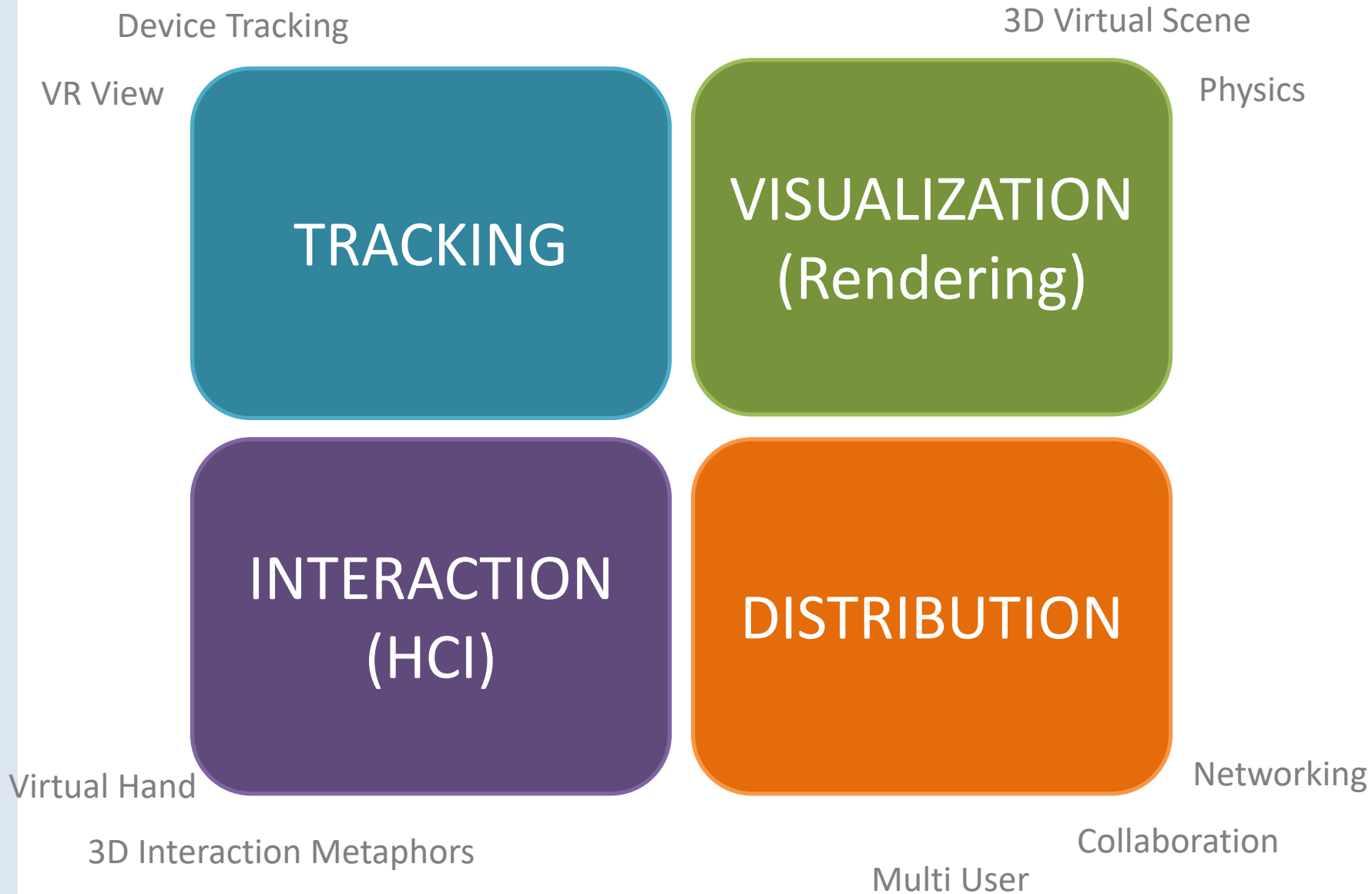
VRUE Dev Environment

- Game Engines
  - Unity
  - Unreal

- 3D Tracking and Input
  - HTC Vive
  - Leap Motion

optionally

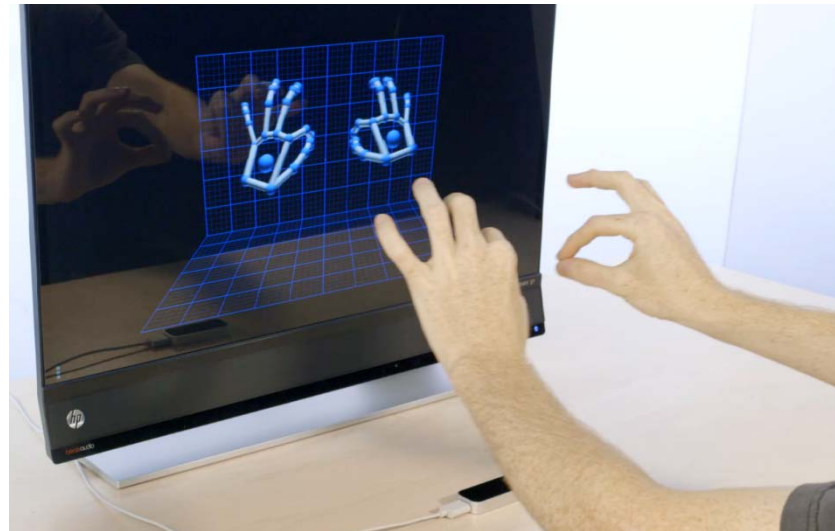# VRUE Software

- Unity3D (optionally Unreal)
- Installation: apply for free license

- HTC Vive SDK
  - Steam
  - Steam VR

- Leap Motion SDK
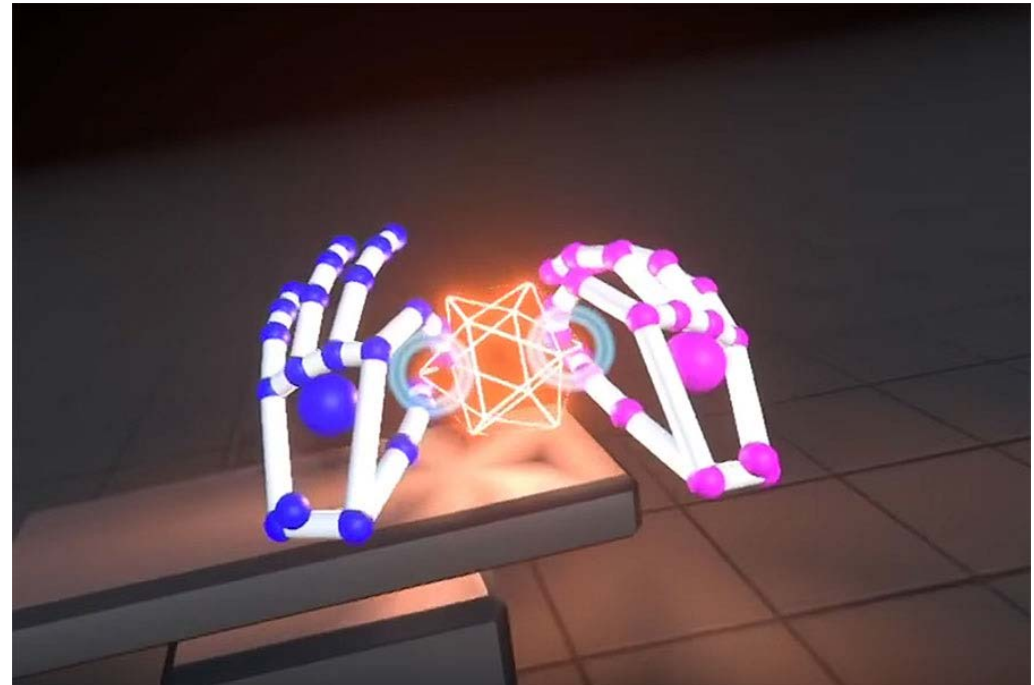
Preparation & Assignments

- Preparation before 5.10.18
  - Form groups of two!
  - Prepare your hardware contracts & scan your Student ID
    - If you would like to use Unreal Game Engine – let us know!

- Assignments
  - Assignment 1   Basics: Unity, Physics, Hand gestures
  - Assignment 2   3D Interaction, advanced Physics
  - Assignment 3   Networking, Collaboration, Distribution
  - Project phase   **make your own game with prerequisites**

  - timing #1 - 12d, #2 - 12d, #3 - 18d, #4 - 1month

Tutorials & Abgaben

- Four Tutorials
  - Days & time (auch im Google Calendar and TISS):
    Tutorial 1   5.10.18   @14:00
    Tutorial 2   16.10.18   @12:30
    Tutorial 3   30.10.18   @12:30
    Tutorial 4   13.11.17   @12:30
  - Location: Zemanek Hörsaal

- Submissions: Data upload in TUWEL
  - Abgabe 1   17.10.18
  - Abgabe 2   30.10.18
  - Abgabe 3   18.11.18
  - Project phase   16.12.18

VRUE Hardware Requirements

- You need 2 PCs per Group of two

- At least 1 HTC Vive compatible PC

  – **GPU**: GeForce GTX 970 / AMD Radeon R9 290

  – **CPU**: Intel i5-4590 / AMD FX 8350

  – **RAM**: >= 4 GB

  – **Video Output**: HDMI 1.4

If your group does not have an HTC Vive compatible PC

– Try to find another group partner

– otherwise, contact us vrue@lists.tuwien.ac.at

Work in the lab space is possible only for max. 2 groups

VRUE Hardware Hand-Out

Only for the groups **registered** in TUWEL!

Every Group gets:
- 1 HTC Vive
- 1 Leap Motion

- **Each person** brings:
  - Student ID + its photocopy (NO passports, please!)
  - Two copies of contract for the **chosen** hardware
  - No substitute signatures allowed
  - 1 person = 1 piece of hadware (Leap OR Vive)

- Location: HG 04 06 (Favoritenstr. 9-11, 4. Stock)
- Hand-out after Tutorial #1 on 05.10.18
- Contracts are in TUWEL

Los geht's ..

- Preparation tasks **till 05.10.18**
  - Finding a Partner and Group registration in TUWEL
  - Confirm at least one HTC Vive compatible PC
 - Prepare and fill in the documents for the hardware

- 1. Tutorial:
  - **Fri, 05.10.18**, 14:00 – 15:00 - Zemanek Hörsaal
  - Afterwards Hardware hand-out
    - **Only for the registered Groups of two!**
    - Bring your Student ID + its copy, two contracts for the piece of hardware that you will take

- 2. Tutorial
  - **Tue, 16.10.18**, 12:30 – 13:30 - Zemanek Hörsaal

- 1. Assignment submission
  - Assignment : Wed, 17.10.18 (in TUWEL)

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Multimedia Interfaces LU

- **Task:** Extending of the project task of the lecture **(UE) Virtual and Augmented Reality** with a custom Hardware interface
- Hardware
  – Arduino WiFi, multiple Sensors
- Schedule
  - Preliminary Discussion: 2.Oct.2018 – 16:15 – Sem 188-2
  - Tutorial: 24.Oct 2018 – 16:00-17:00 – Sem 188-2
  - Concept hand-in 20.November
  - Final Hand-In: 25.Jan.2018
  – Registration in Tiss
    - (1.10.2018 – 24.10.2018)
- Contact
  – mmilu@list.tuwien.ac.at

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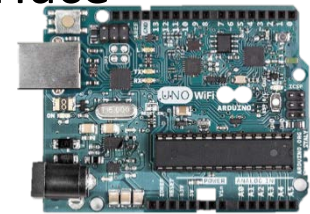
Topics in the Area

- Multimedia Interfaces; 188.461; 1.5 ECTS
  - Incl. Praktikum topics
  - 2.Oct.2018 – 16:15 – Sem 188-2

- Virtual Reality Advanced Topics; 188.456; 3 ECTS
- Praktikum
  - Praktikum aus Visual Computing; 188.938; 9 ECTS
  - From Design to Software 1; 188.934; 6 ECTS
  - From Design to Software 2; 184.743; 6 ECTS
- Diplomarbeiten

Betreuer direkt kontaktieren
Themen: https://www.ims.tuwien.ac.at/topics