Running immersive media projects at TU Ilmenau

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Immersive Media Projects at AVT (1)

DFG SPP2236 AUDICTIVE (see http://www.spp2236-audictive.de/)

- APlausE-MR - Audiovisual Plausibility and Experience in Multi-Party Mixed Reality
  - Partners: TU Ilmenau, Electronic Media Technology Group
    Bauhaus-Universität Weimar, Virtual Reality and Visualization Research Group
- ECoClass-VR - Evaluating cognitive performance in classroom scenarios using audiovisual VR
  - Partners: RWTH Aachen University, Chair of Hearing Technology and Acoustics
    TU Kaiserslautern, Department of Cognitive and Developmental Psychology
- QoEvaVE - QoE Evaluation of Interactive Virtual Environments with Audiovisual Scenes
  - Partners: Friedrich-Alexander-Universität Erlangen-Nürnberg, Spatial Audio Research Group

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German Research Foundation

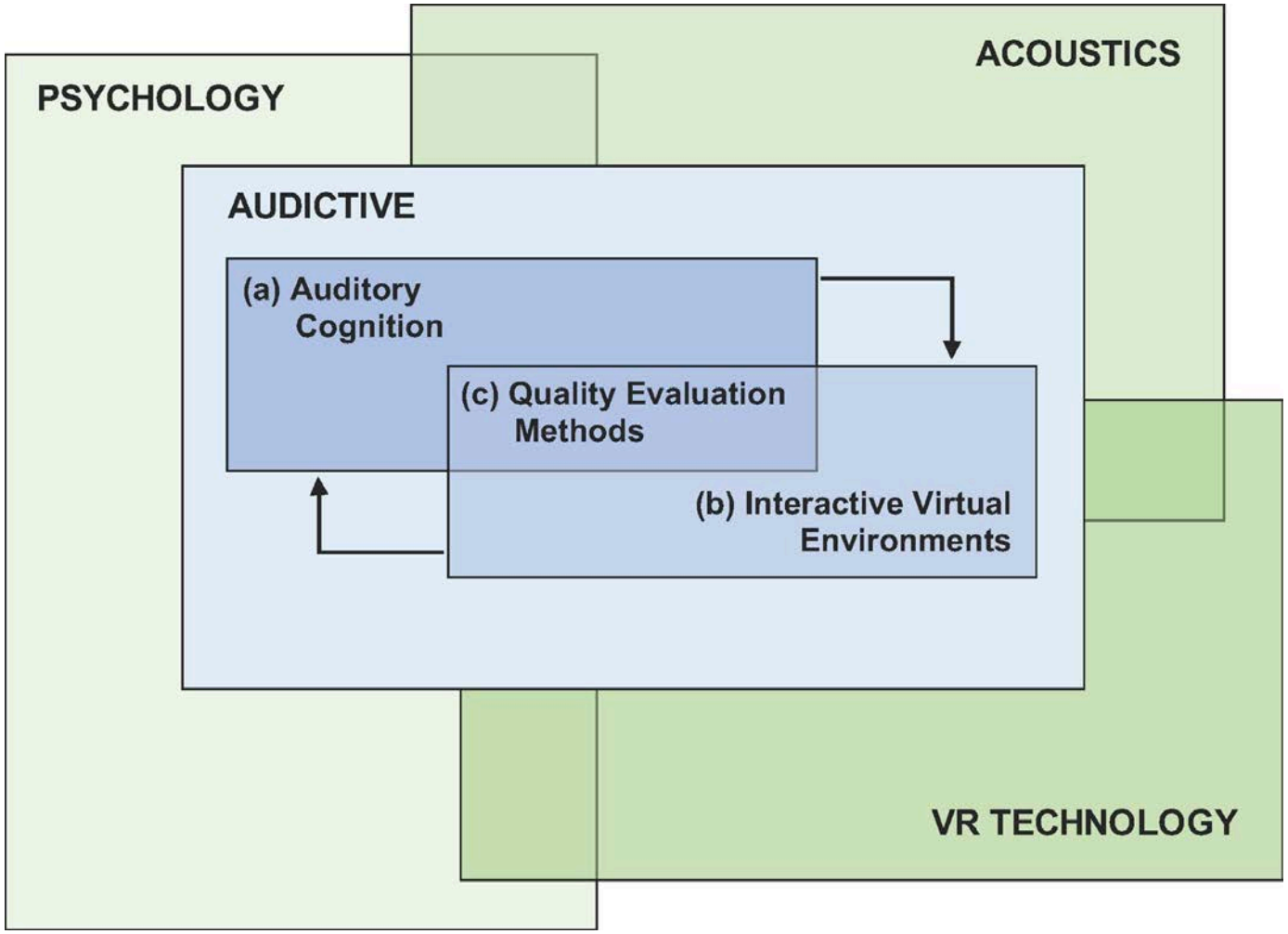
Immersive Media Projects at AVT (2)

CO-HUMANICS - Co-Presence of Humans and Interactive Companions for Seniors
(www.co-humanics.de)

- 5 Research Groups of TU Ilmenau
  - Audiovisual Technology, Prof. Alexander Raake (speaker) + team
  - Electronic Media Technology, Prof. Karlheinz Brandenburg, Dr. Stephan Werner + team
  - Virtual Worlds and Digital Games, Prof. Wolfgang Broll, Dr. Florian Weidner + team
  - Media Psychology and Media Design, Prof. Nicola Döring + team
  - Neuroinformatics and Cognitive Robotics Lab, Prof. Horst-Michael Groß, Dr. Andrea Scheidig + team
- Project funded by Carl-Zeiss-Stiftung within program "Durchbrüche 2020" (https://www.carl-zeiss-stiftung.de/german/programme/durchbrueche-2020.html) for 5 years

Carl Zeiss Stiftung

SPP2236 AUDICTIVE: Auditory Cognition in Interactive Virtual Environments



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Audiovisual Technology Group

The SPIRIT of science

TECHNISCHE UNIVERSITÄT ILMENAU

AUDICTIVE
APlausE-MR - Audiovisual Plausibility and Experience in Multi-Party Mixed Reality

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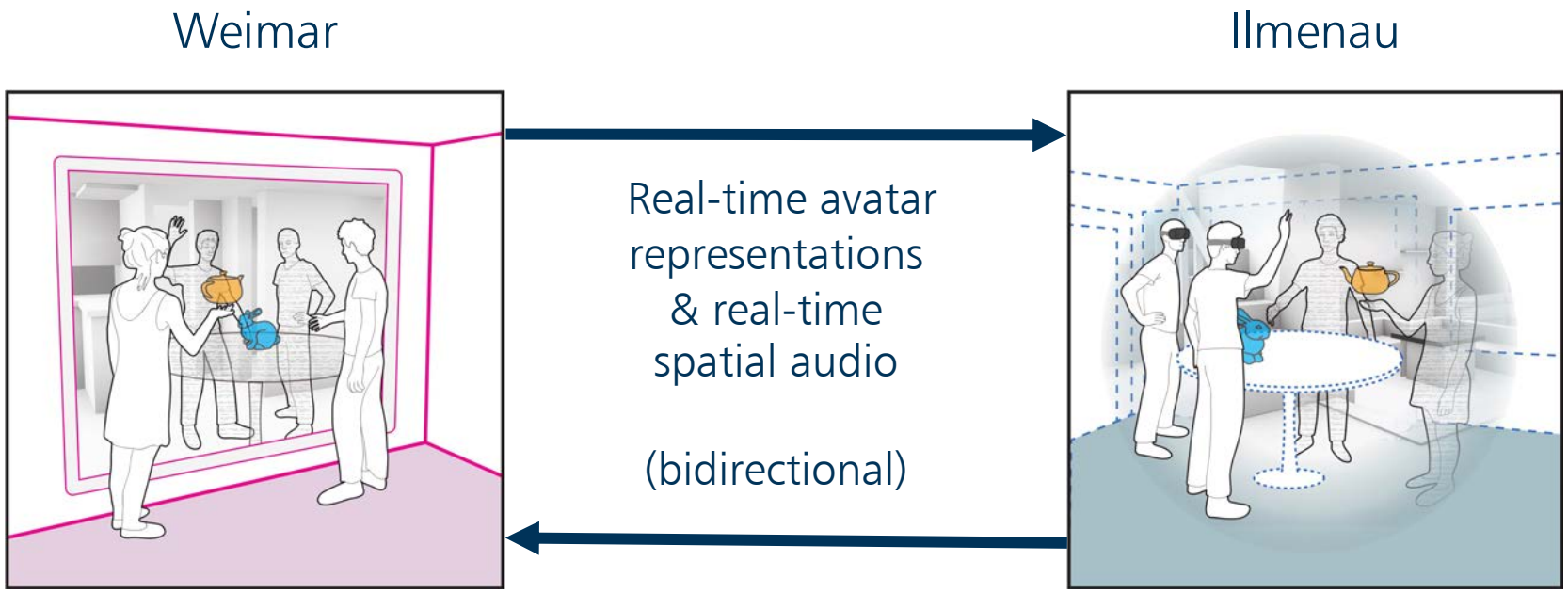
APlausE-MR – Audiovisual Plausibility in Multi-Party MR



Multi-party communication in a realistic shared virtual environment (SVE)

Project Goal: Gain an understanding of factors influencing plausibility and quality of audio-visual experiences in multi-party SVEs

APlausE-MR – Audiovisual Plausibility in Multi-Party MR

Research Questions

- Which factors influence plausibility of audiovisual experiences in multi-party SVEs?
- How can the effect of those factors on plausibility be best evaluated?
- Do plausibility factors reinforce and compensate for each other?

Development of Tools

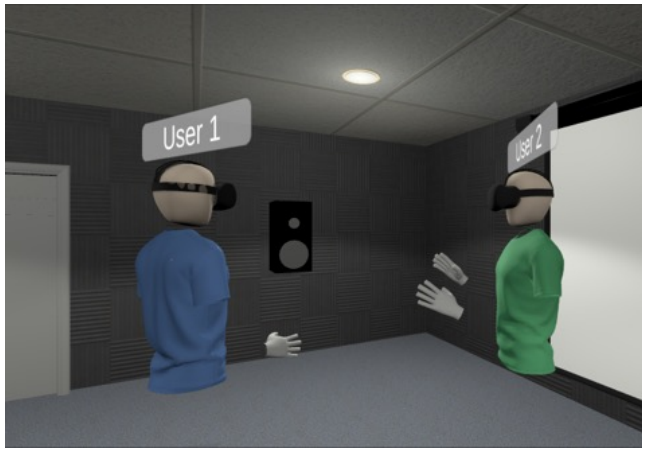
- Develop audiovisual technologies for plausible group-to-group communication
- Enable immersive performance re-exploration to support offline analysis of Quality Metrics

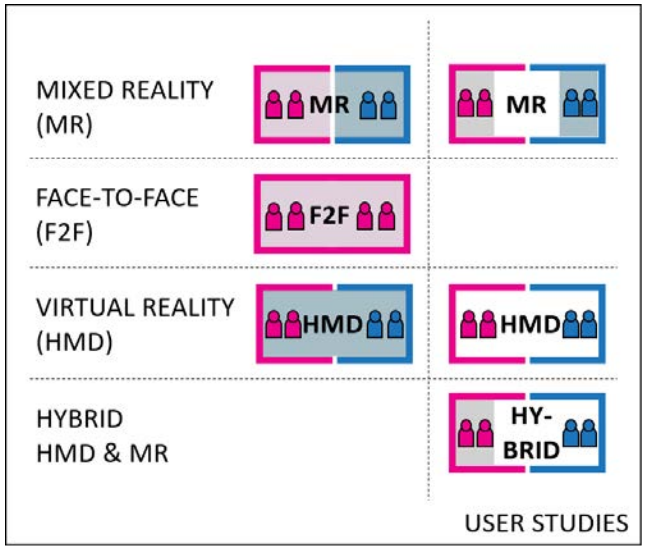
APlausE-MR – Audiovisual Plausibility in Multi-Party MR

- Quality and Quality of Experience (QoE) evaluation in audio-visual communication and telemeetings
- Evaluation methods for interactive Mixed Reality (MR) systems
- Assessment of media quality and perception

Contribution of AVT to the project:

- Designing, implementing and conducting user studies
- Audiovisual integration
- Assessment and evaluation of media quality, perception, plausibility, presence and QoE
  - **Direct assessment:** questionnaire-based
  - **Indirect assessment:** conversation and behavioral analysis





AUDICTIVE
ECoClass-VR - Evaluating cognitive performance in classroom scenarios using audiovisual VR

Funded as part of DFG SPP 2236 “AUDICTIVE”

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Motivation & Research Objectives

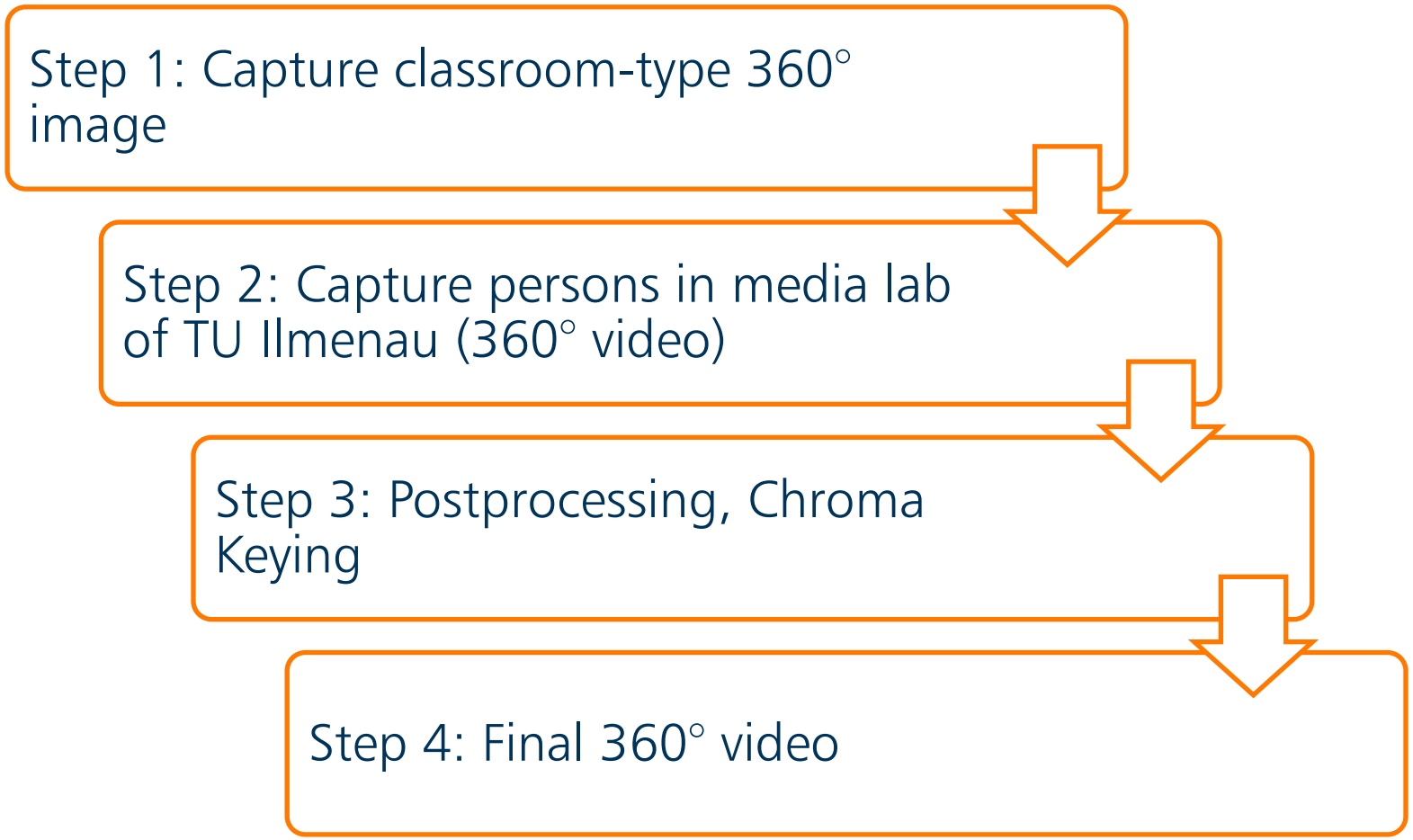
- Focus ECoClass-VR project: Cognitive performance evaluation in classroom-type settings for adults and children
- Increase realism of experimental procedures in terms of
  - Cognitive tasks used
  - Audiovisual representation

- Research objectives
  - Transfer experimental conditions of three auditory paradigms to audiovisual IVEs
  - Test transferred paradigms in terms of cognitive performance in classroom-like settings
  - Create cognition-based Quality of Experience (QoE) measures,
  - Relation between technical aspects of audiovisual IVEs and cognitive performance

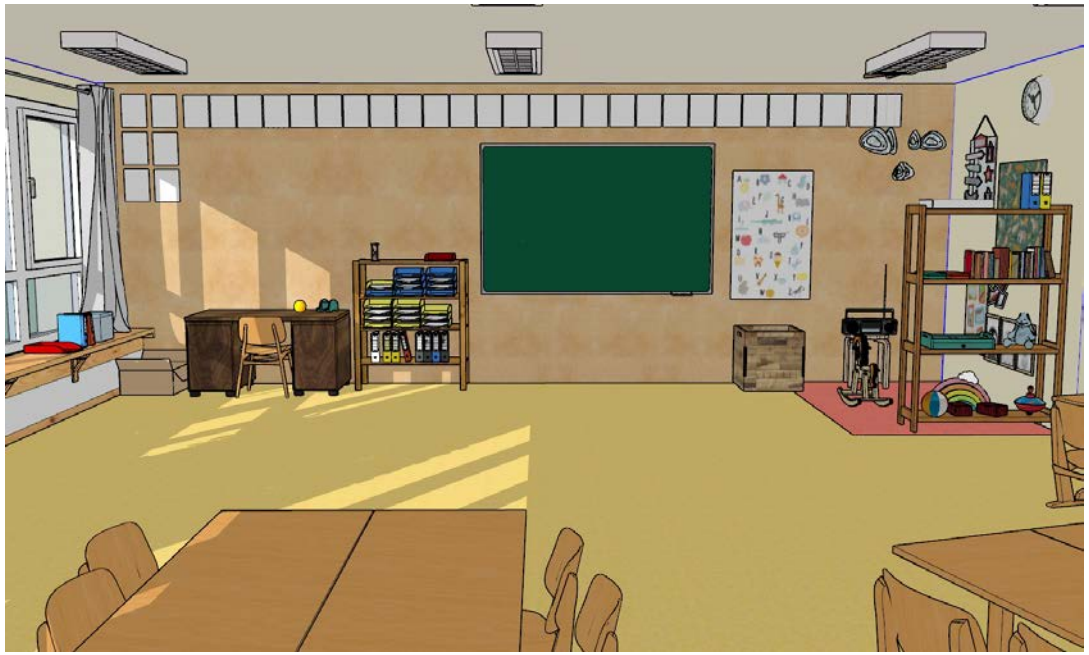
Requirements for Scene Generation

- Two visual representations of a classroom-type scene
  - Immersive 360° captured video scene
    - » Captured with Insta360 Pro 2
  - CGI-based scenes
    - » Modelling with SketchUp
- Goals:
  - Target close-to-photorealism and natural audiovisual scene complexity
  - Enable flexibility required to conduct targeted cognitive performance tests

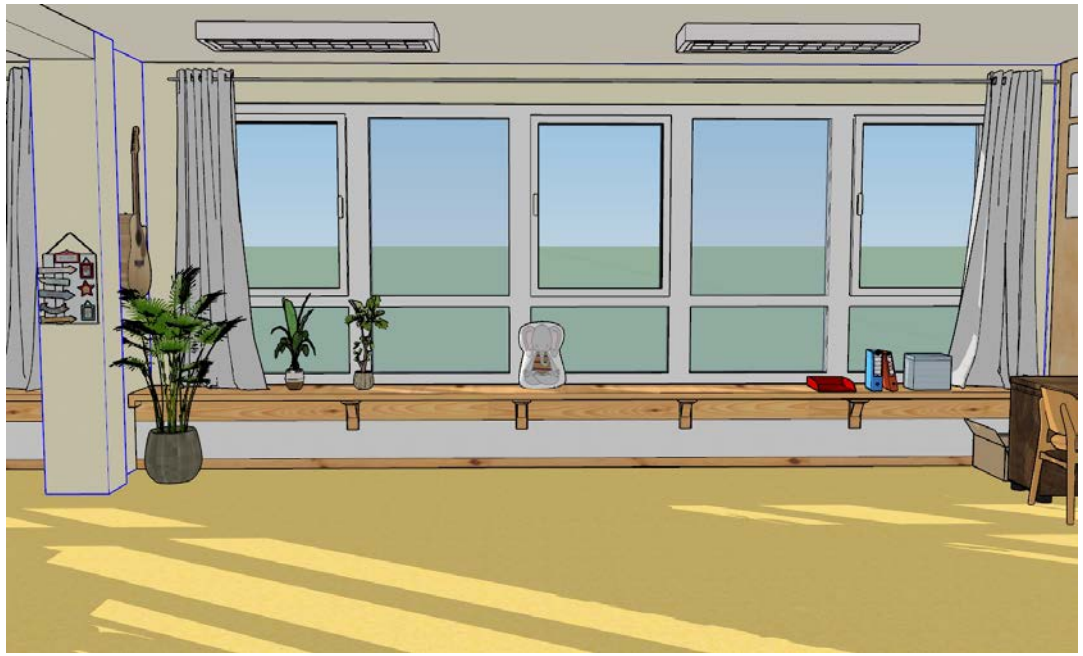
Generation of 360° Scenes (1)



Classroom – Front View



Classroom – Left View



Classroom – Back View

Classroom – Right View

AUDICTIVE
QoEvaVE - QoE Evaluation of Interactive Virtual Environments with Audiovisual Scenes

Funded as part of DFG SPP 2236 “AUDICTIVE”

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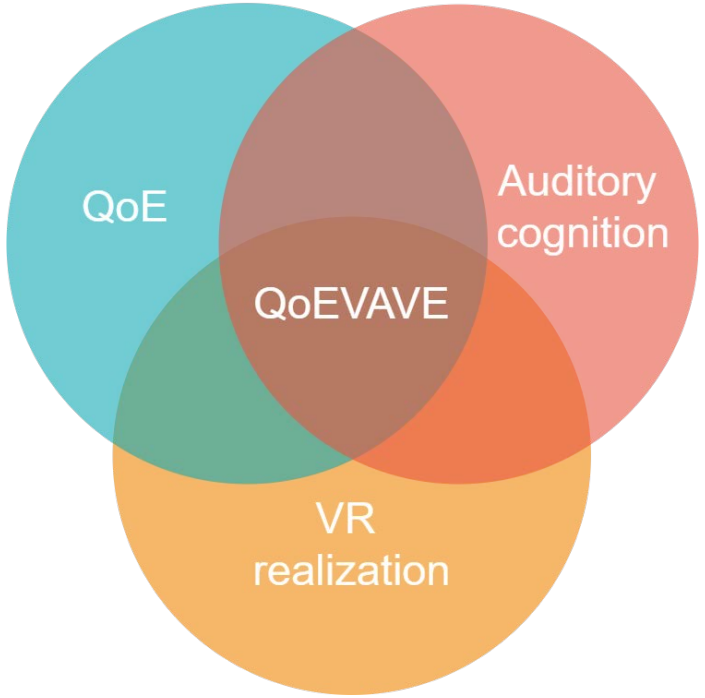
QoEVAVE Project Aims: Towards a Holistic Evaluation of Interactive Virtual Environments (IVEs)

- Develop a methodological framework for QoE evaluation in Interactive Virtual Environments (IVEs)
- Explore and refine Quality of Experience constructs and definitions
- Assess auditory cognitive performances and audio-visual sensory integration
- Realize IVEs with auditory rendering and engagement with interactive setting and/or task specific aspects



(Raake, Rummukainen, Habets, Robotham, Singla, DAGA 2021)

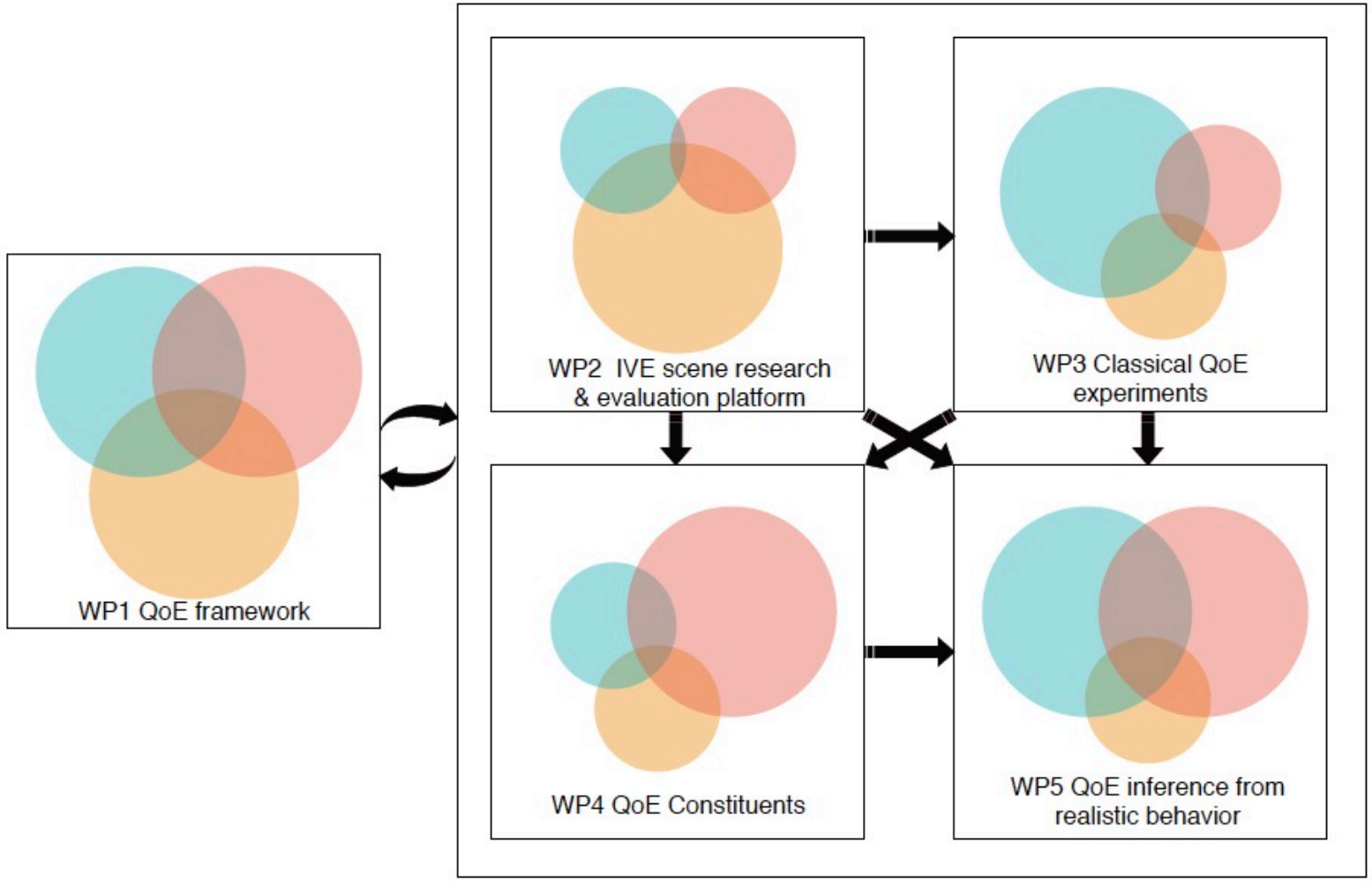
Background

- IVEs aim to replace real-world sensory input
- Key criterion for IVE evaluation: how close do experiences replicate those of real life?
- Presence through immersion

Challenge	IVEs: high degree of complexity, of sensory information. IVEs tend to be multimodal.	Divergence between Quality and VR / HCI communities.	Direct methods mean subjects are focusing on quality judgement.
QoEvaVE	Enable appropriate cross-modal interactions, interactions with the scene evoking appropriate internal references.	Employ an integrated view of quality perception using QoE.	Include indirect methods to assess immersion, presence, cybersickness, attention, cognitive load, etc.

Approach

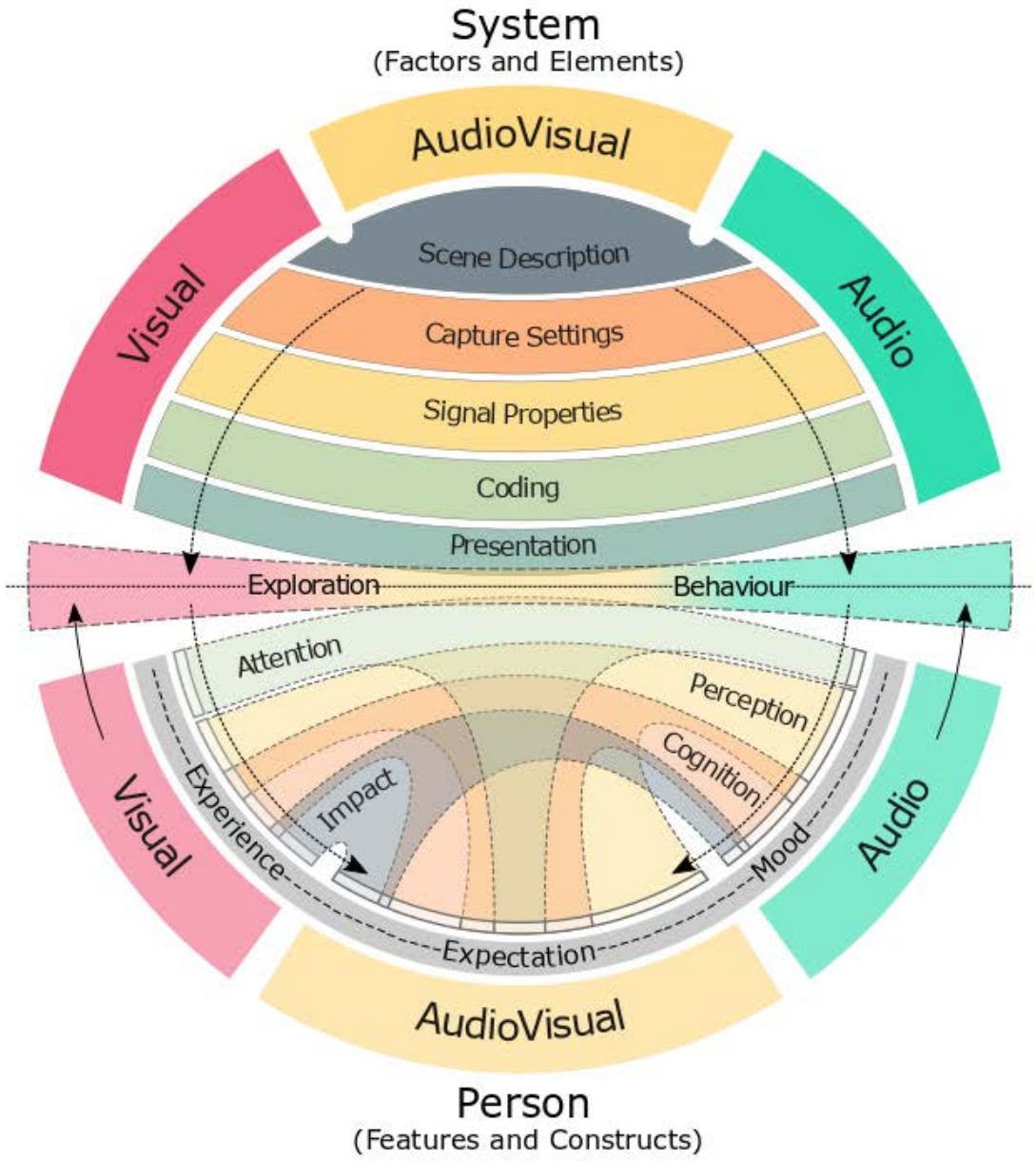
- Work packages considering auditory, visual and audiovisual contributions to QoE
- Iterative development of IVE-QoE definitions, taxonomy, evaluation framework
- Create scenes for QoE evaluation
- Understand cross-modal quality formation
- Use higher-order quality cognitive performances as quality indicators
- Develop and investigate indirect approaches to distinguish quality



(Raake, Rummukainen, Habets, Robotham, Singla, DAGA 2021)

Taxonomy

- First version of audiovisual IVE QoE taxonomy
- Integrates technology factors up to perceptual attributes and cognitive constructs inside a person's mind
- Linked with mind map and spreadsheet
  - Technology, scenes, expected user behavior and perceptual / cognitive attributes
- Expert-based taxonomy-label elicitation and sensory evaluation study in preparation



(Raake, Rummukainen, Habets, Robotham, Singla, DAGA 2021)

CO-HUMANICS - Co-Presence of Humans and Interactive Companions for Seniors

Funded by Carl-Zeiss-Foundation

CO-HUMANICS

Augmented Reality (AR)

Robotics

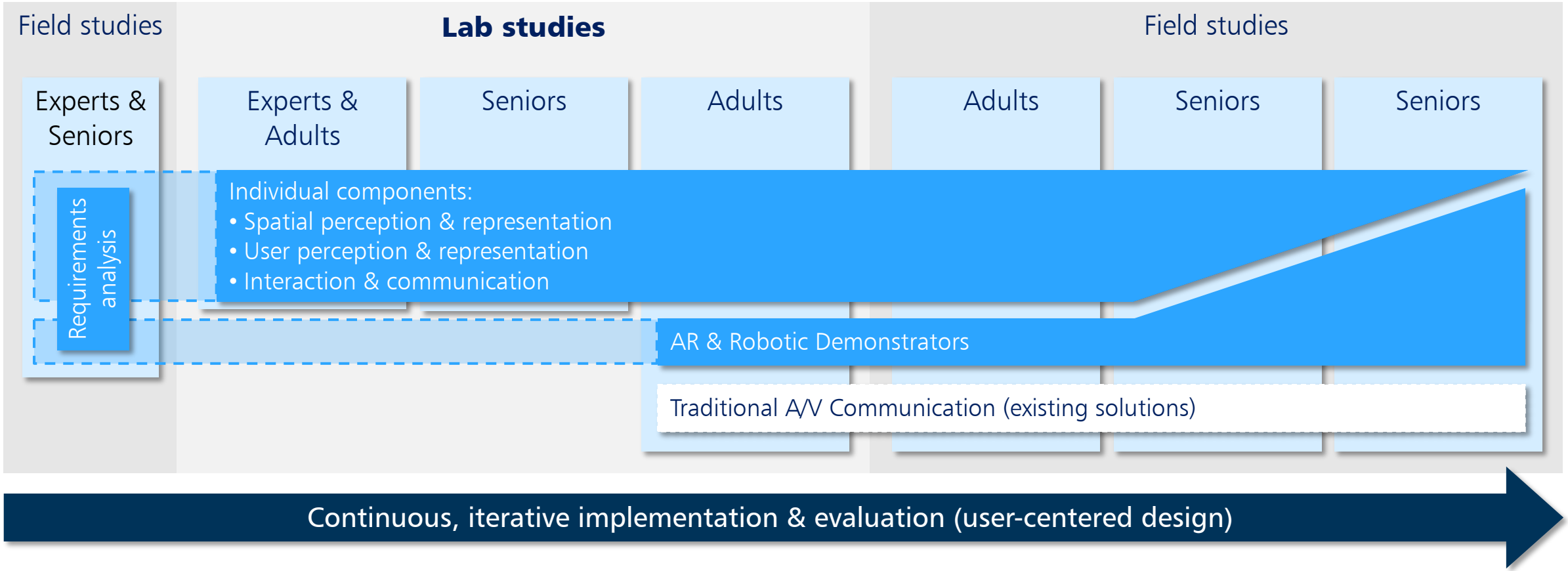
CO-HUMANICS
Research questions

- How can avatars in AR and/or assistance robots be used to realize interaction and communication between distributed users that is as natural as possible?
- How can the environment be captured for AR representation and for the control of assistance robots without influencing user behavior?
- How can information from users (pose, speech, facial expressions, ..) be captured and reconstructed so that a realistic AR representation can be generated?
- How can the quality of user experience and the co-presence of Augmented Reality (AR) and robotics representation be measured and improved?

Schematic development and evaluation process

Selected evaluation criteria:
- Technical: autonomy, QoS, plausibility, ...
- Psychosocial: Proximity/co-presence, familiarity, uncanniness, ...
- Holistic: QoE, usability, acceptance, ...

Other factors include:
- Modalities (auditory, visual, tactile).
- Degree and type of interactivity



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