

Social Virtual Reality

A Natural User Interface for Learning

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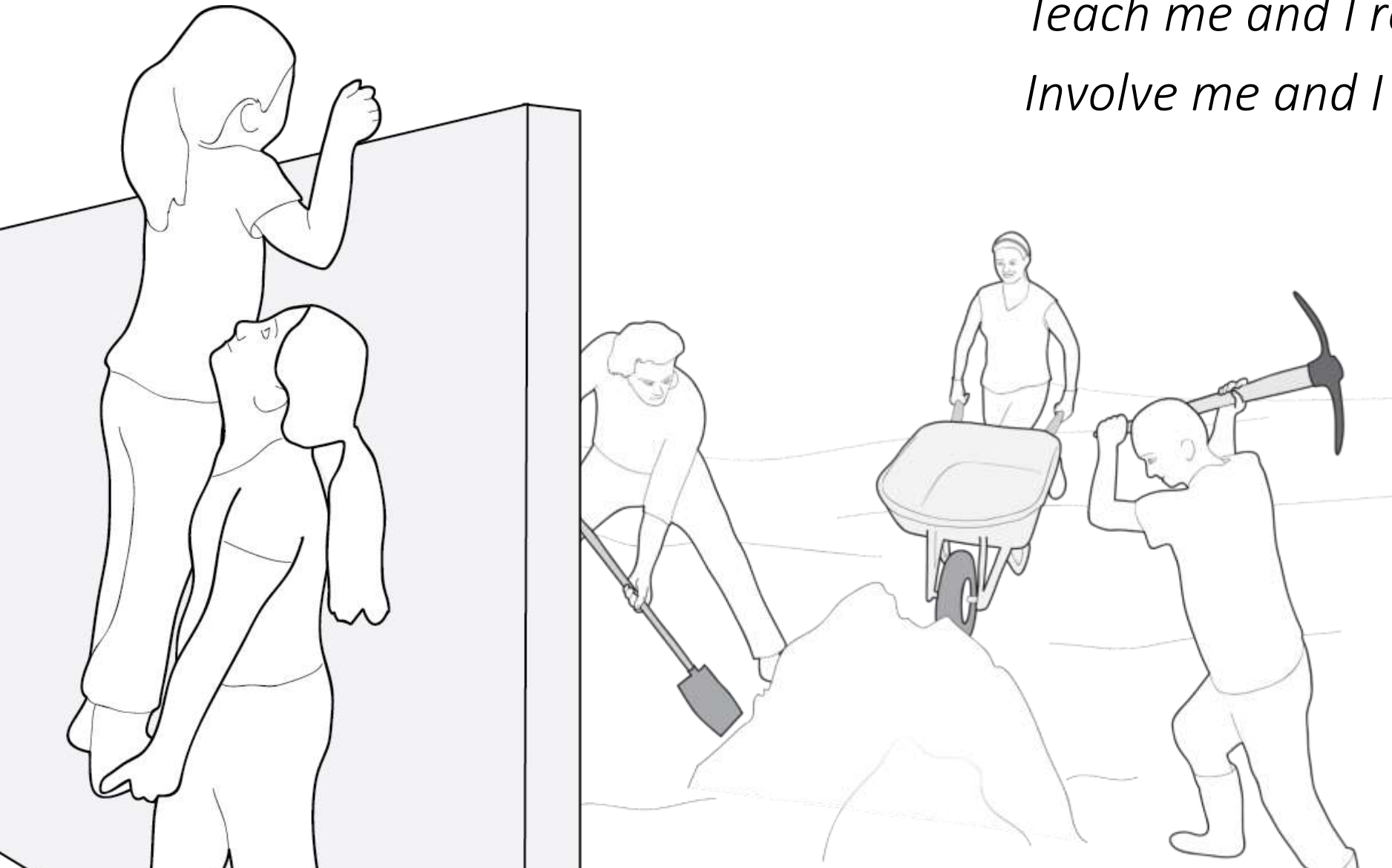
Virtual Reality and Visualization Research Group



Learning by Doing Together

*“Tell me and I forget.
Teach me and I remember.
Involve me and I learn.”*

-- Benjamin Franklin



Multi-User Virtual Reality



Joint Perception

- Co-experienced stimuli are more salient
- Focus of attention is shifted in joint perception tasks
- Distributed perception tasks are represented holistically
- Collaborative visual search can be significantly more effective

Shteynberg, Garriv. 2010
A silent emergence of culture: the social tuning effect.
Journal of personality and social psychology 99.4 (2010): 683.

Richardson, Daniel C., et al. 2012
Joint perception: gaze and social context."
Frontiers in human neuroscience 6 (2012).

Sebanz, Natalie, Günther Knoblich, and Wolfgang Prinz. 2003
Representing others' actions: just like one's own?.
Cognition 88.3 (2003): B11-B21.



Joint Perception – Mutual Confirmation



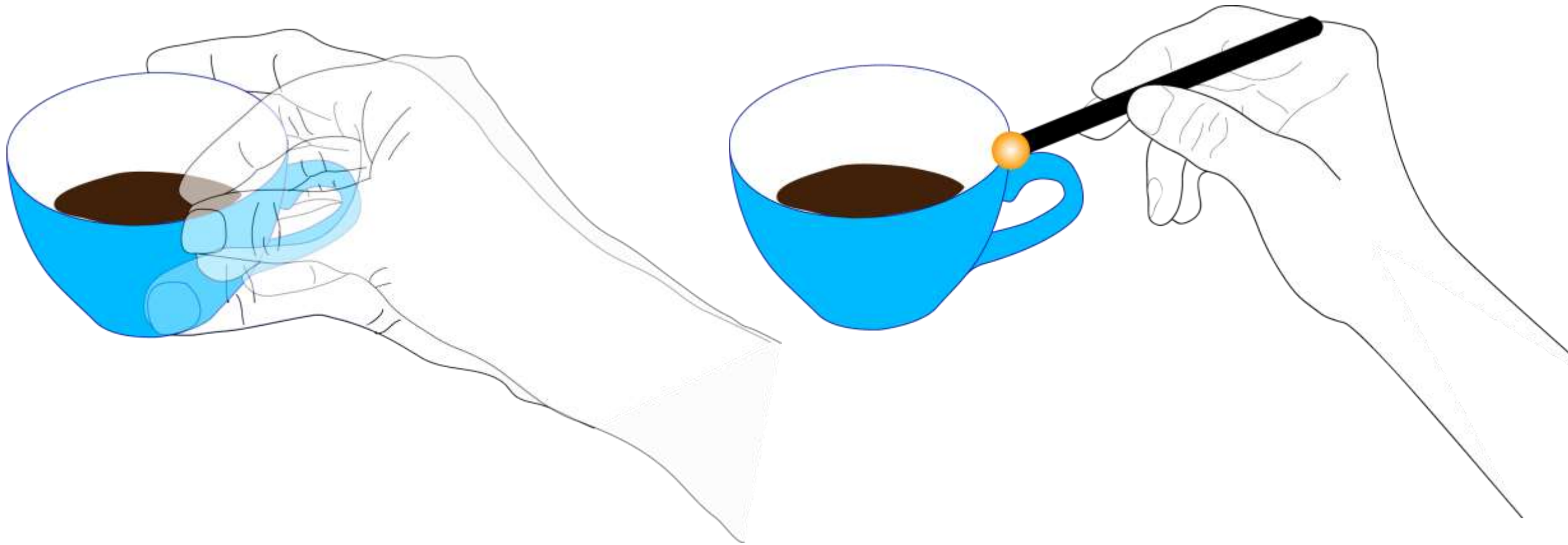
Not Quite Real – Perceptual Issues of Virtual Reality

- Technically Solveable Problems
 - Latency and Framerate
 - Image Resolution and Dynamics
 - Tracking Accuracy
 - Calibration, Calibration, Calibration
- Conceptual Issues
 - Missing Perceptual Modalities
 - Simulator Sickness
 - Spatial Perception



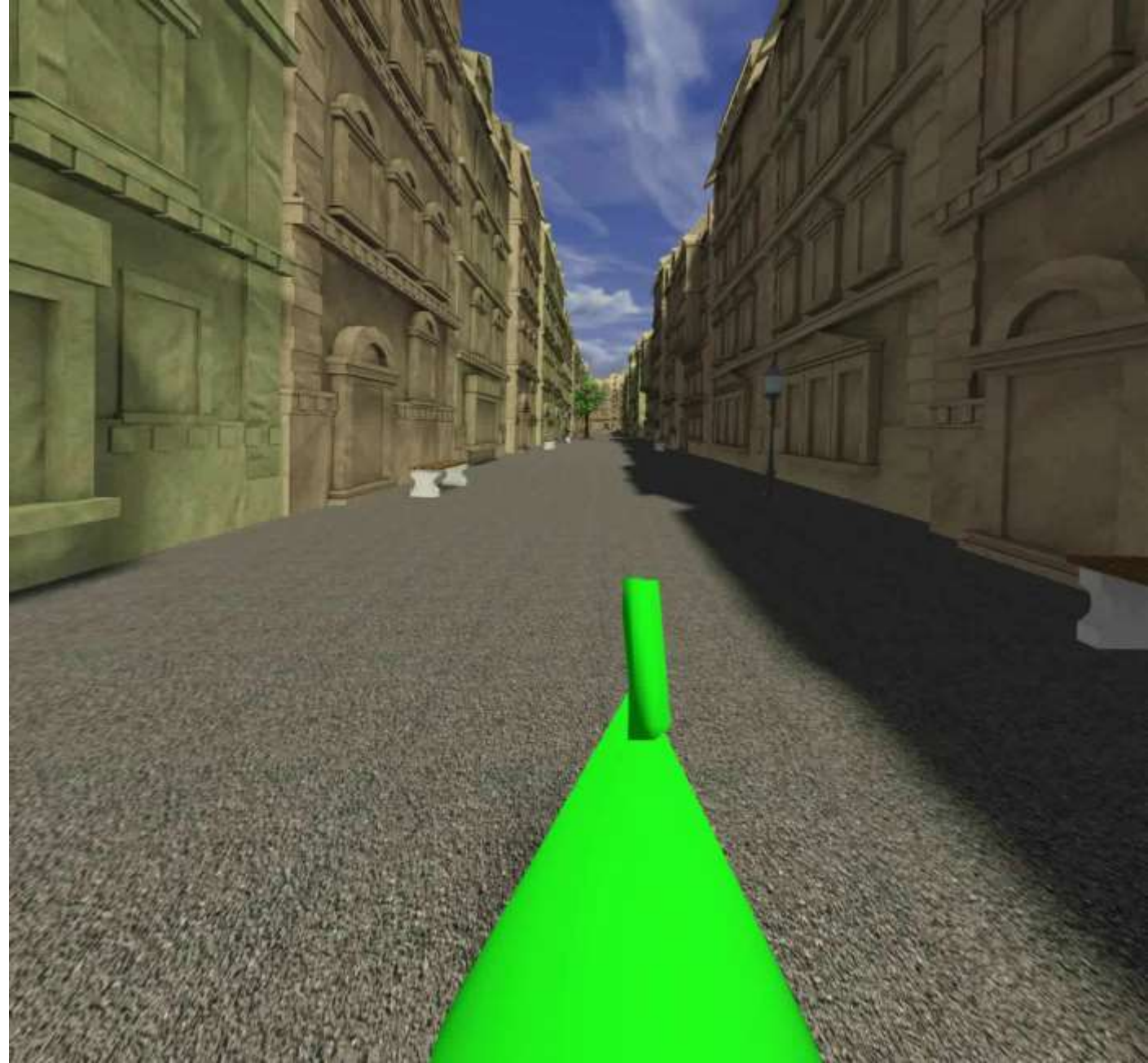
Missing Haptics

- Use Tools



Simulator Sickness through Virtual Locomotion

- Conflict of Visual and Vestibular Perceptual System



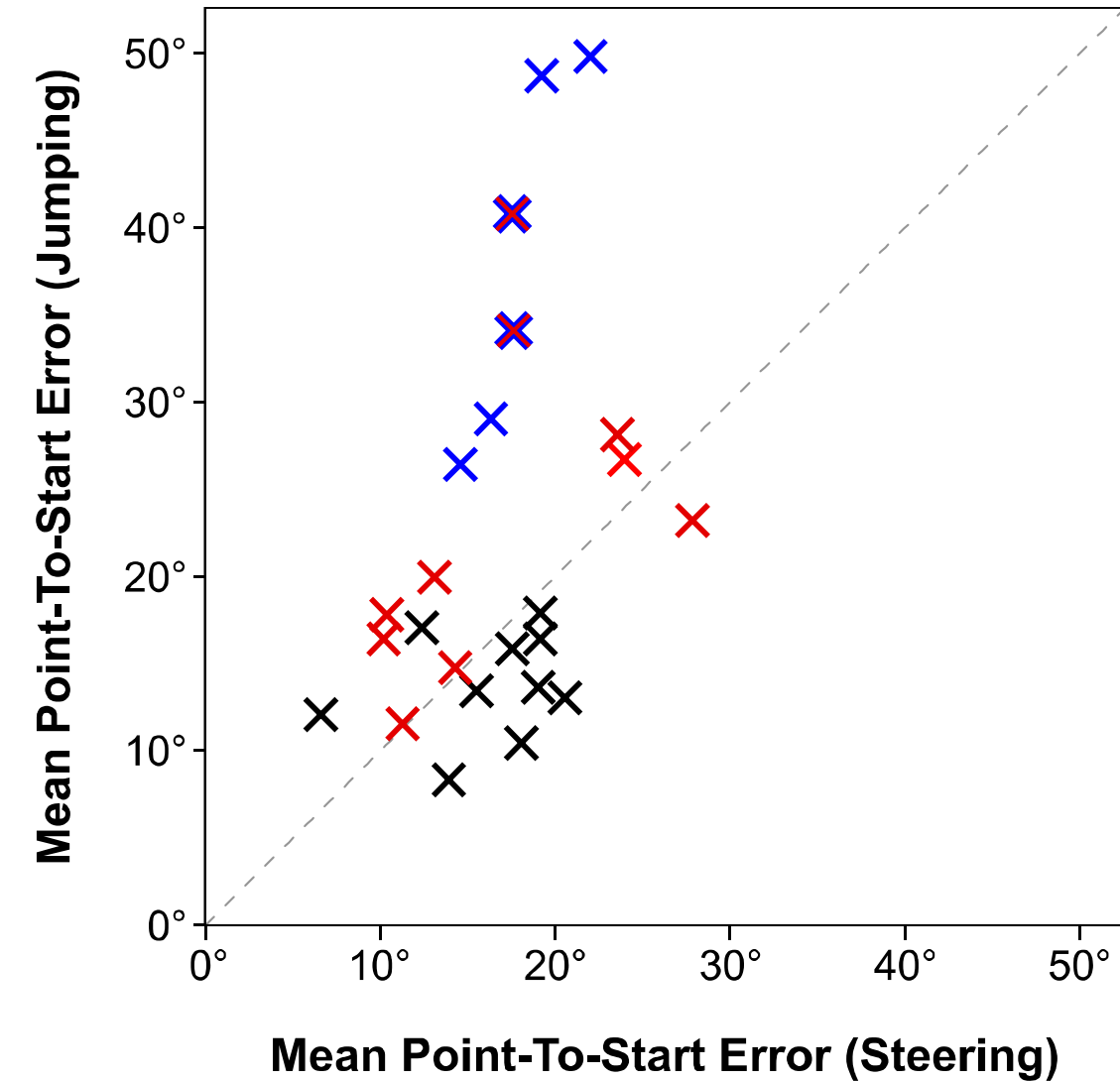
Simulator Sickness through Virtual Locomotion

- Minimize Virtual Locomotion
 - Spatial Perception and Awareness?

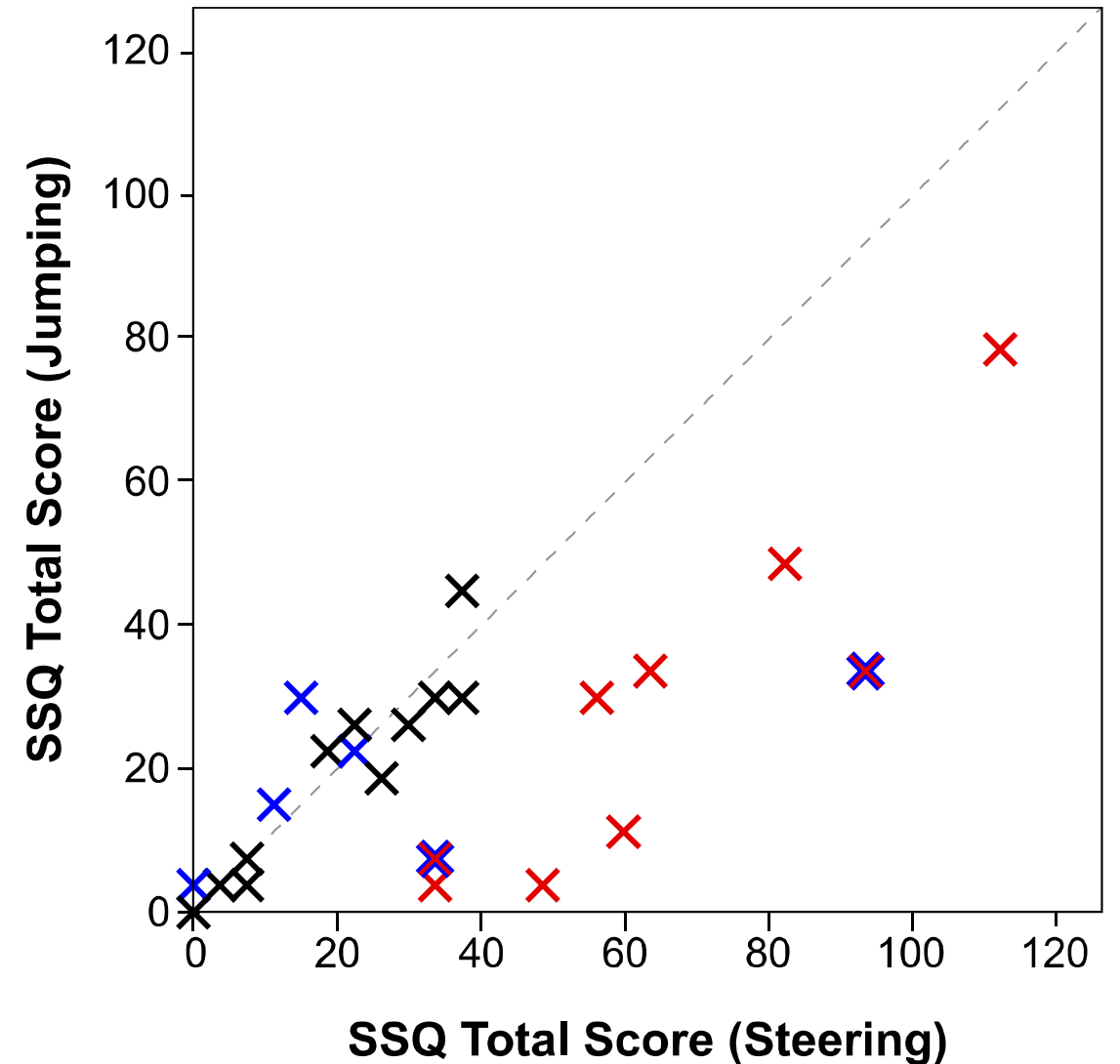


Simulator Sickness vs. Spatial Updating Accuracy

Spatial Updating Performance



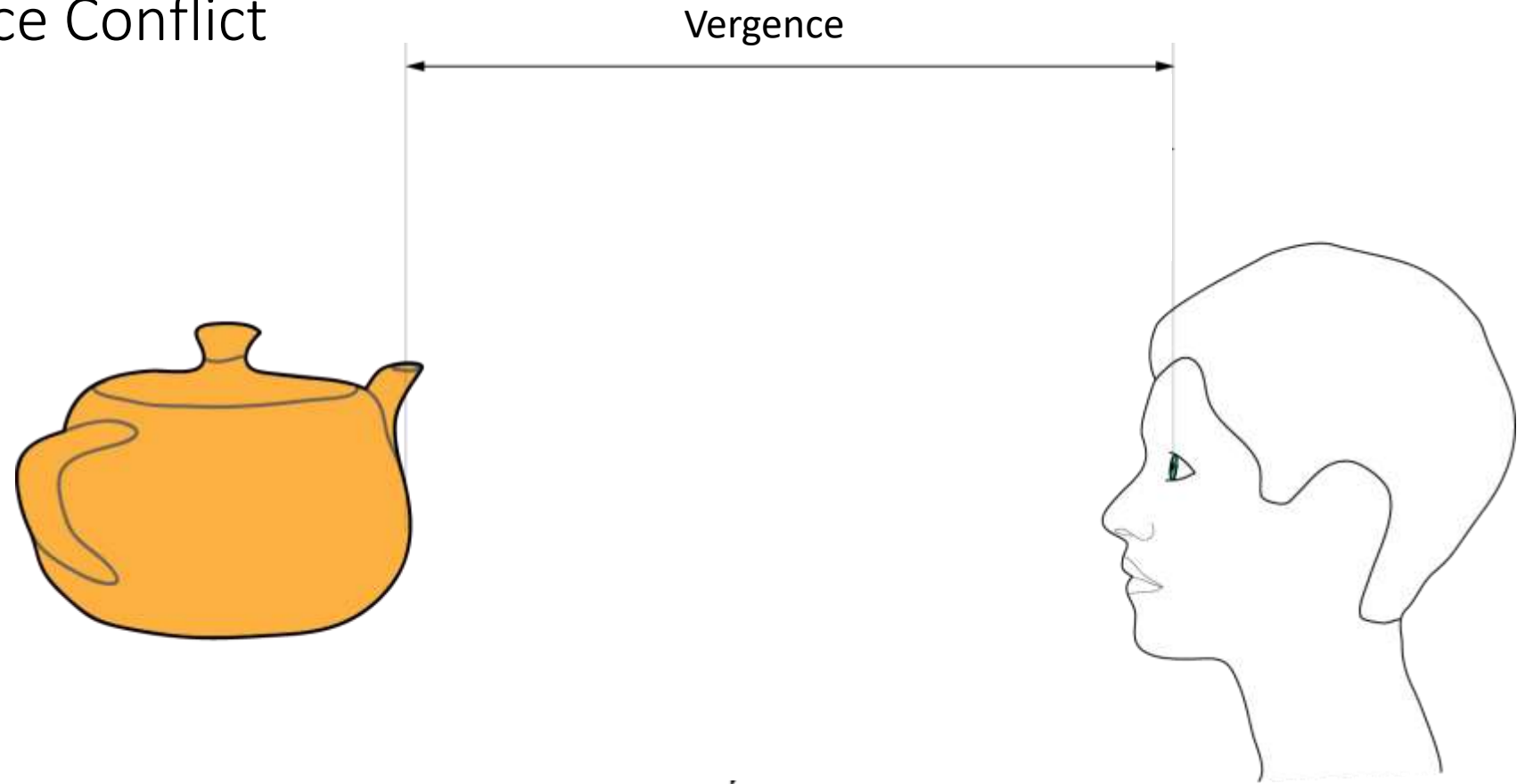
Simulator Sickness Symptoms



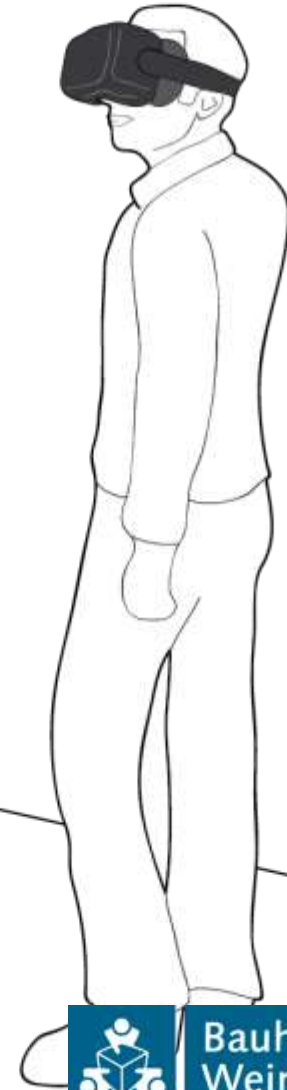
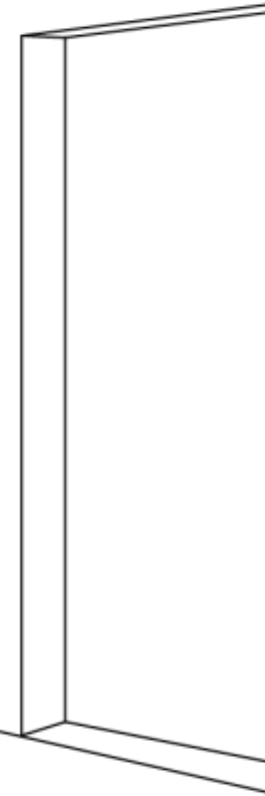
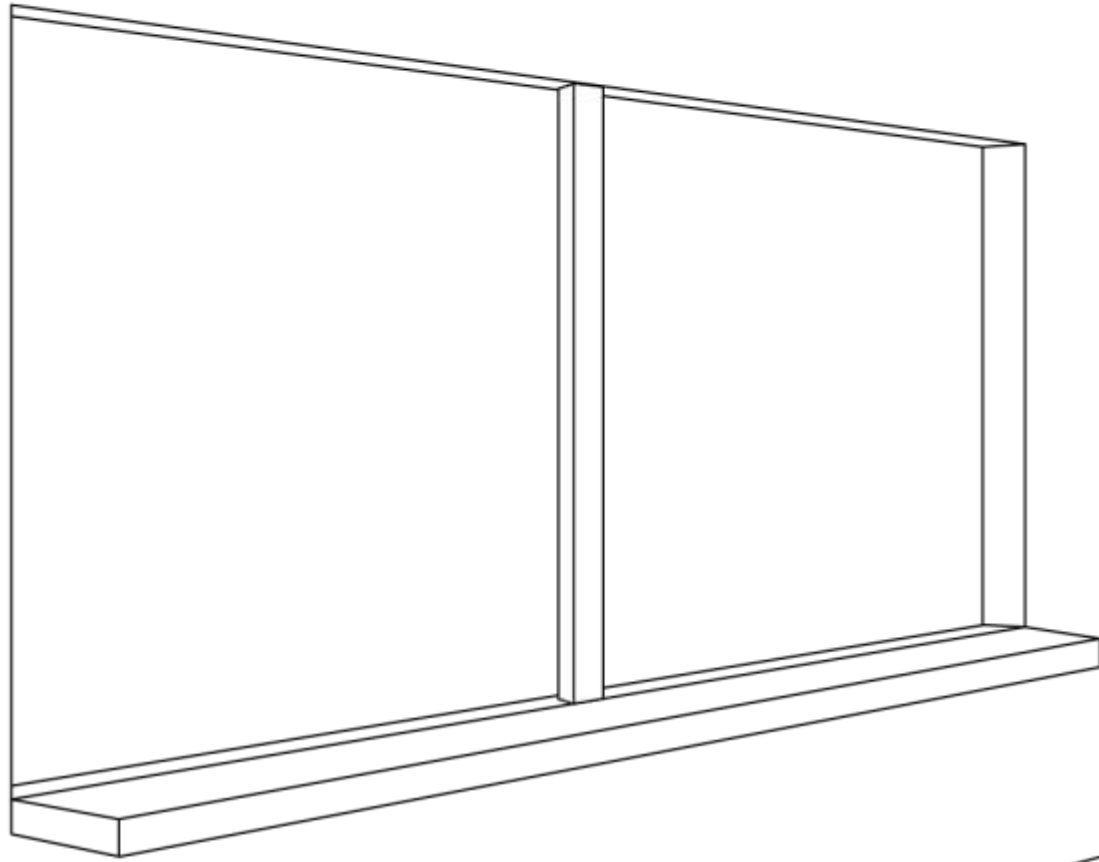
Multitouch 3D View Manipulation

Impaired Depth Perception

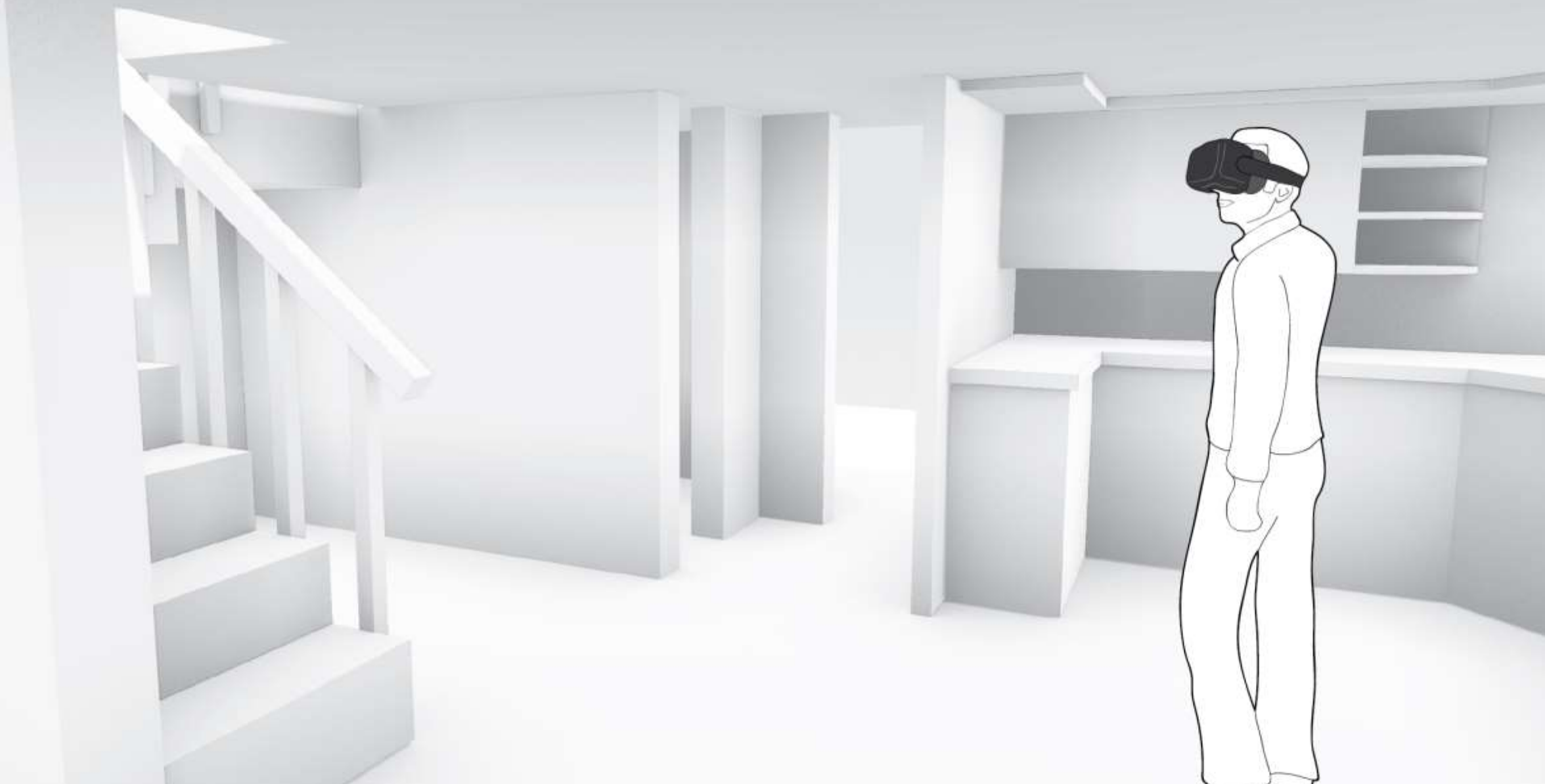
- Accomodation-Vergence Conflict



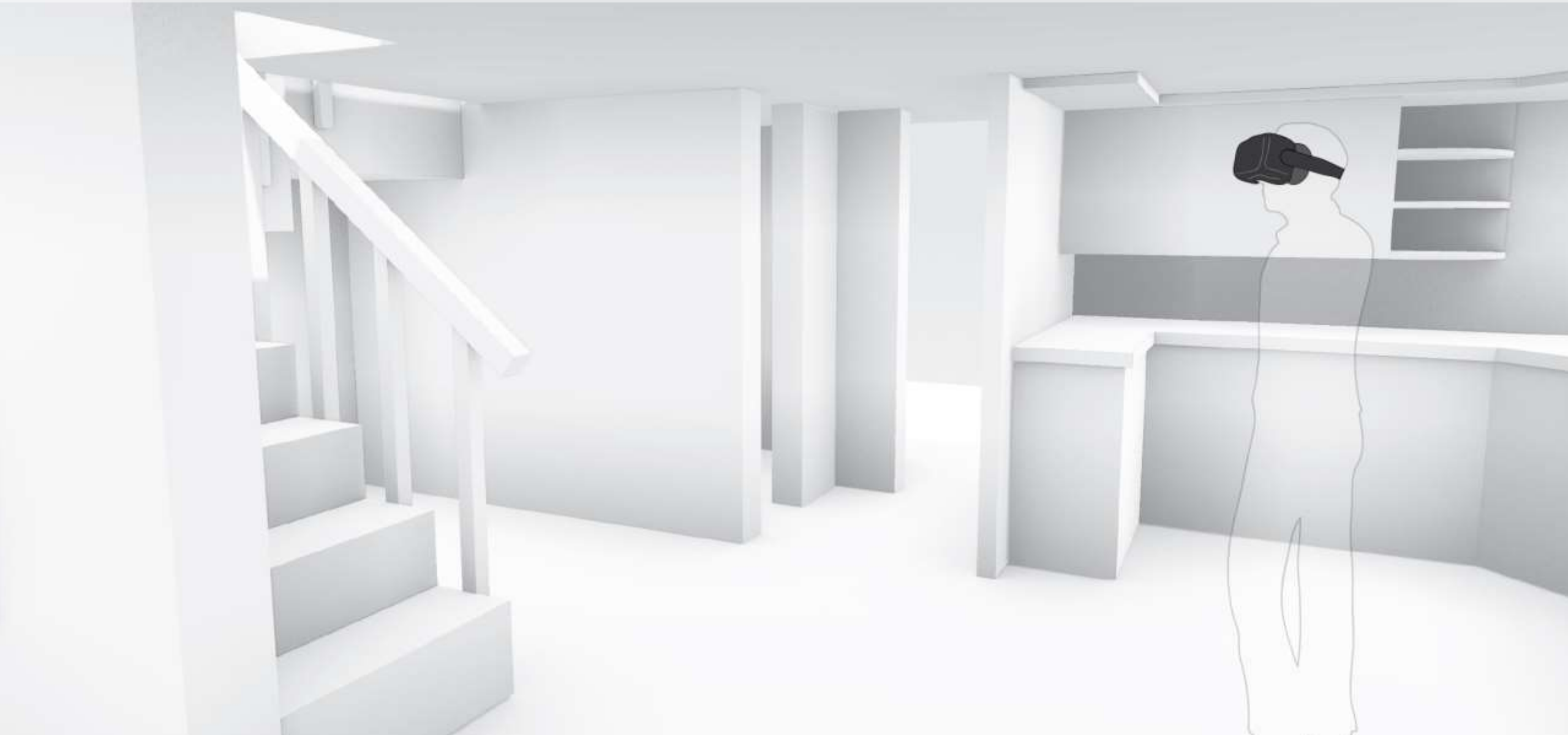
Spatial Perception in HMD-based Virtual Reality



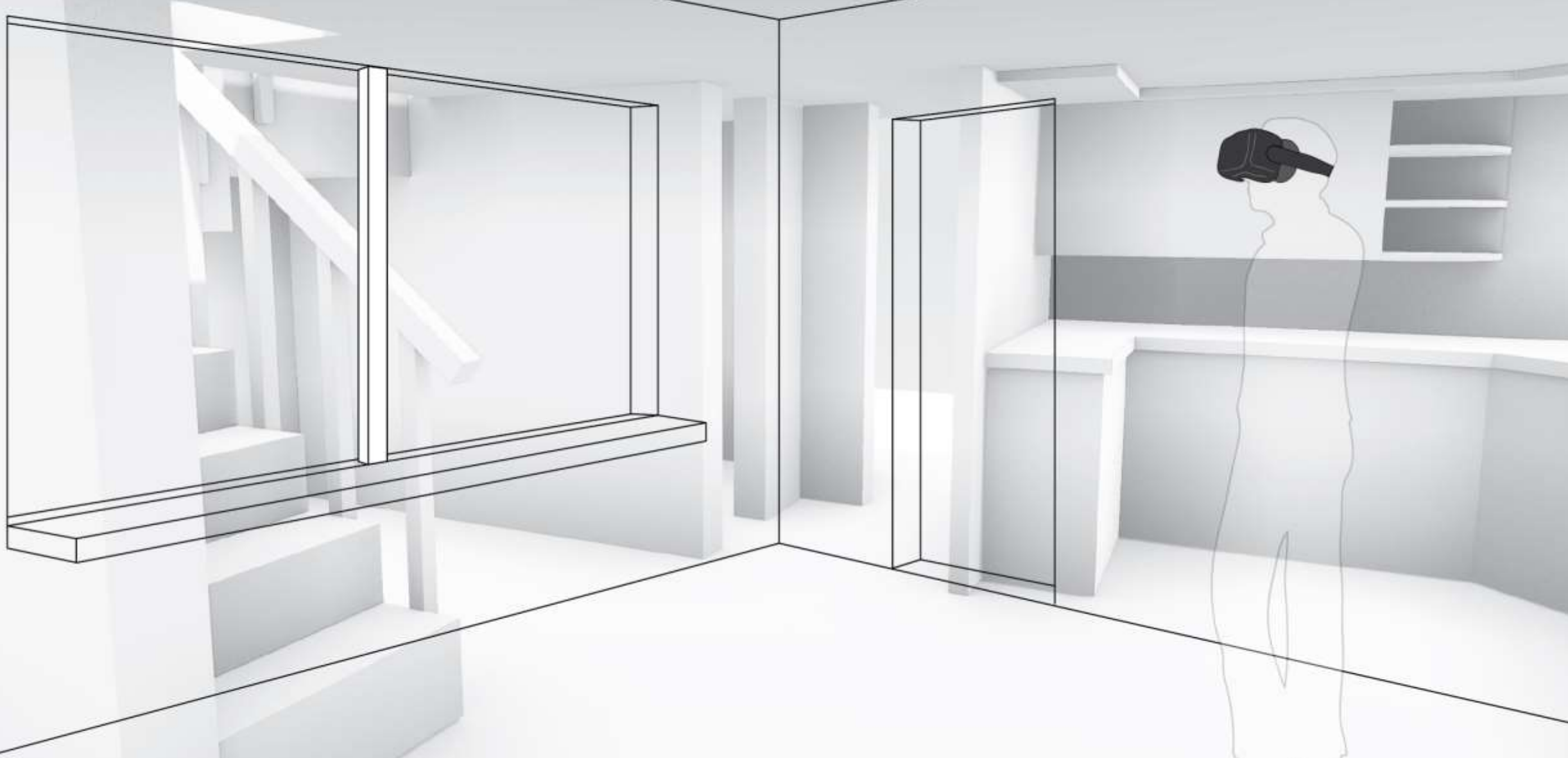
Spatial Perception in HMD-based Virtual Reality



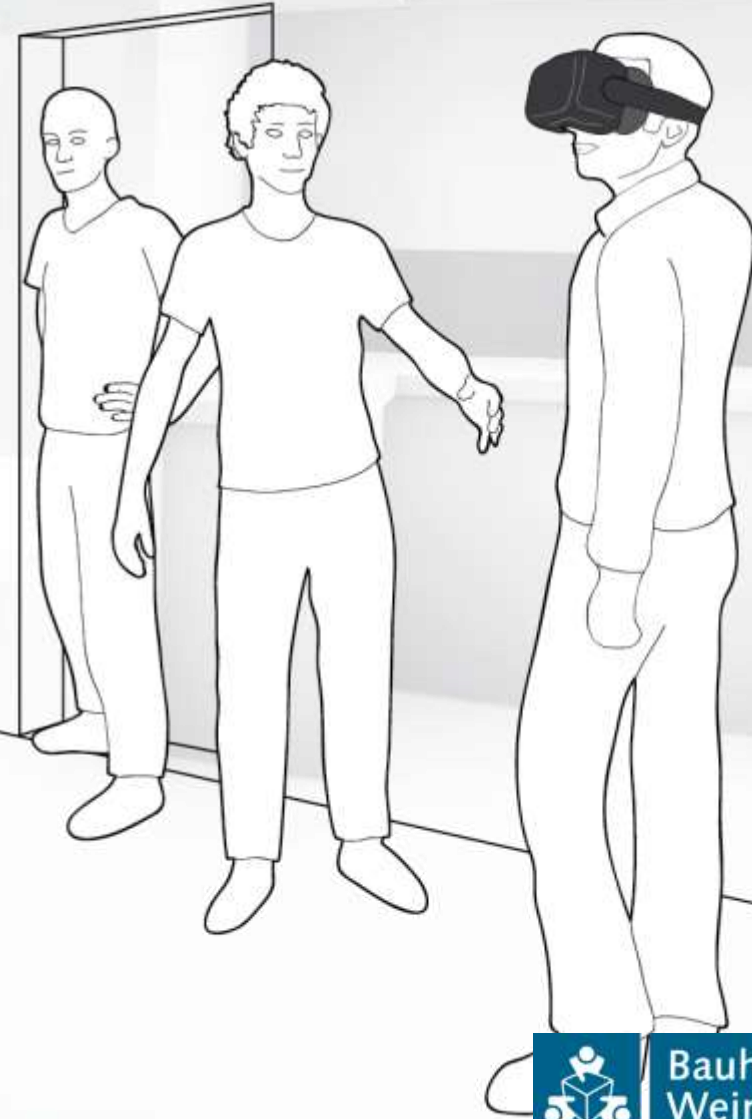
Effects of Self Perception



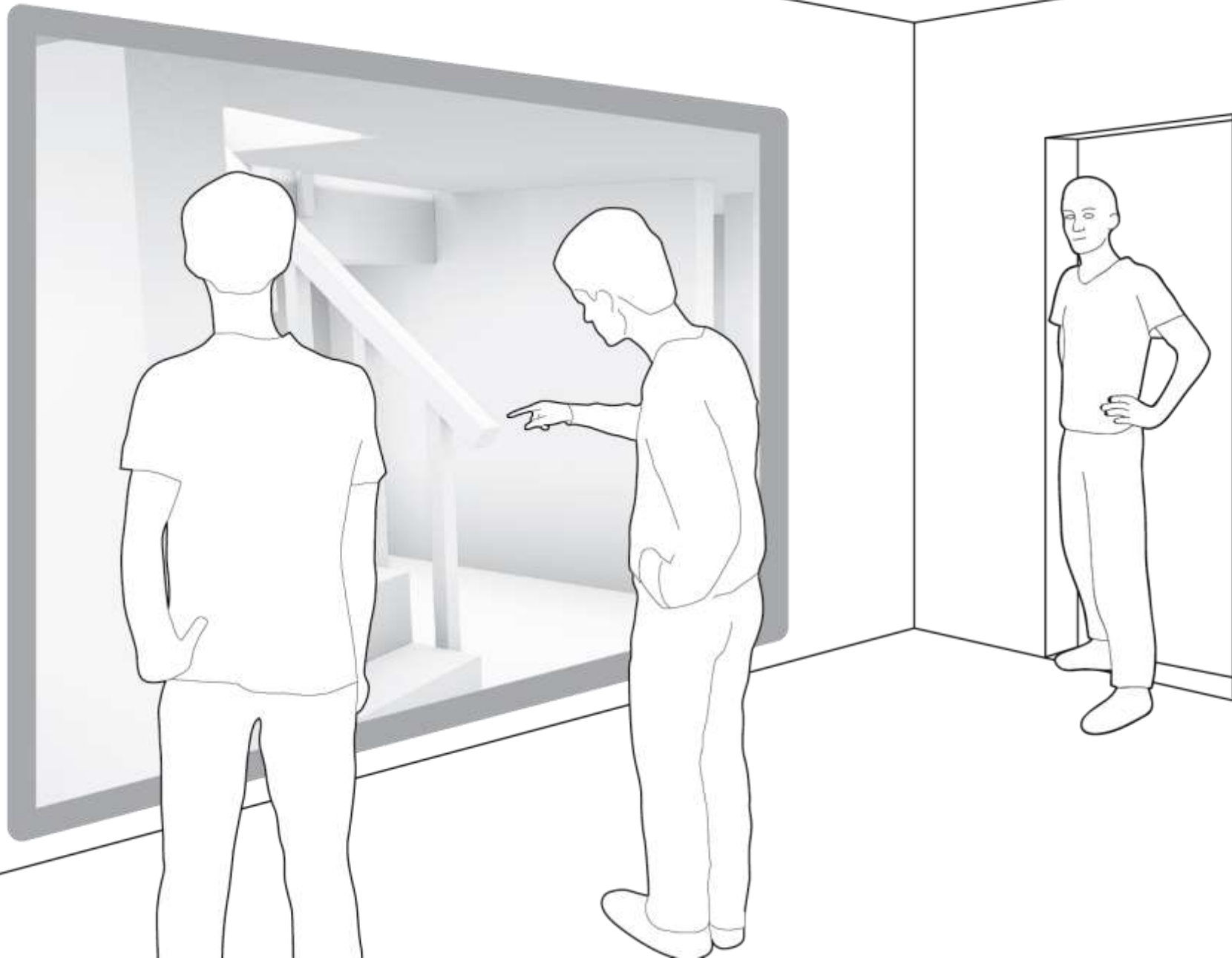
Effects of the Physical Surrounding



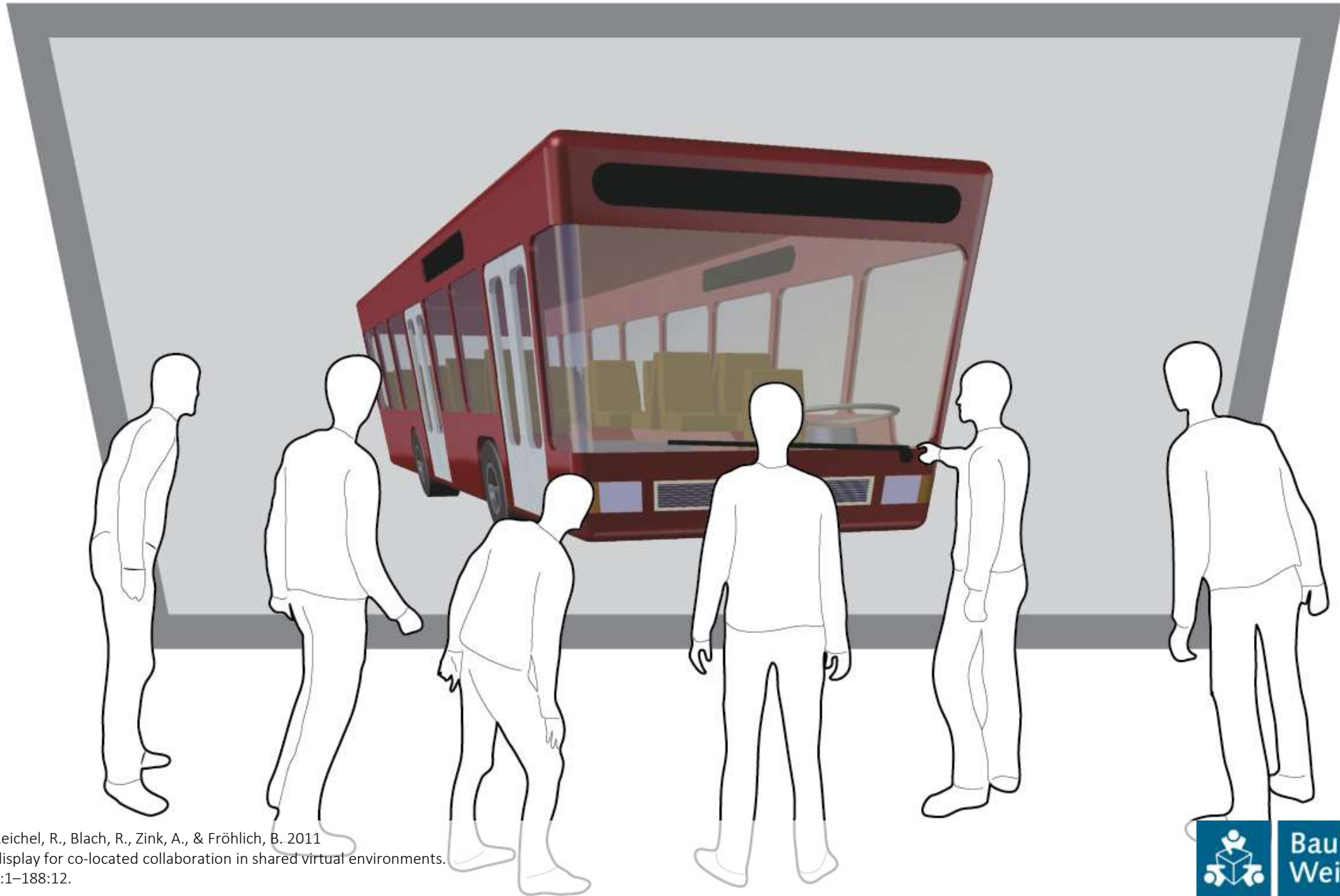
Effects of the Social Situation?



Projection-based Multi-User Virtual Reality



A 3D Display for up to Six Users



The Leftmost Perspective



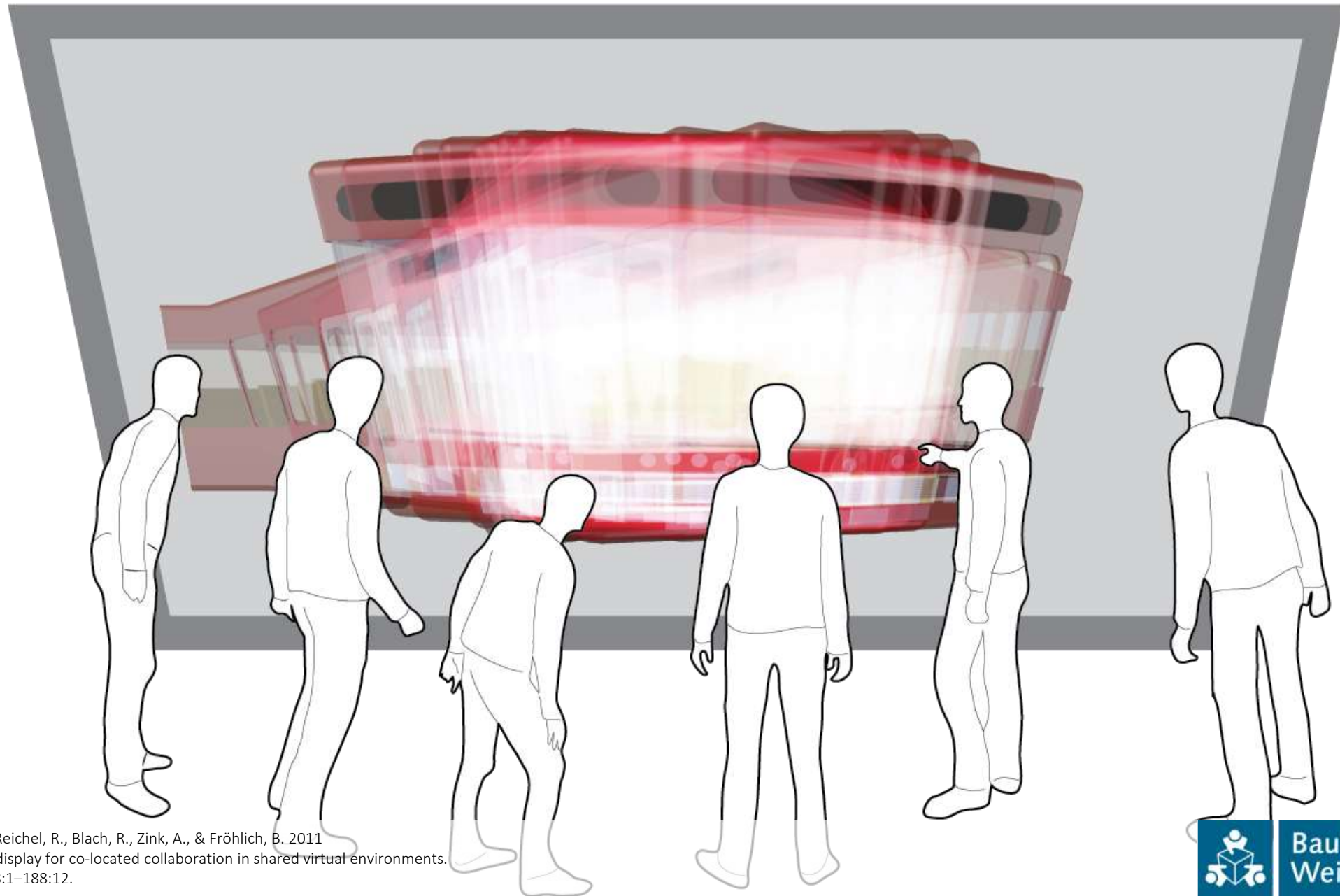
The Center Perspective



The Rightmost Perspective



Six Stereo Views on One Screen



Mixed-Reality Headsets



Mixed-Reality Headsets



Nicht ganz...

<https://www.ethz.ch/de/news-und-veranstaltungen/eth-news/news/2018/02/hololens.html>

<https://youtu.be/bA3MaQ6GImU>

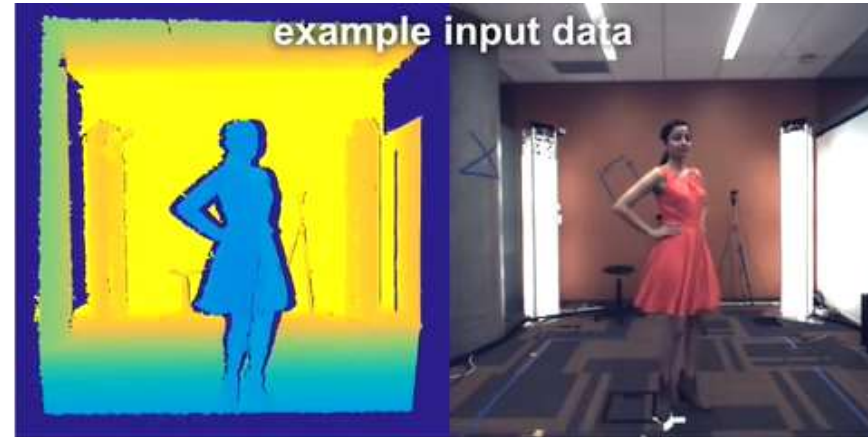
User 1 View



www.artanim.ch/RealVirtuality

Sylvain Chagué. 2015.
Real virtuality: immersive explorers.
In *ACM SIGGRAPH 2015 Computer Animation Festival (SIGGRAPH '15)*. ACM, New York, NY, USA, 195-195.

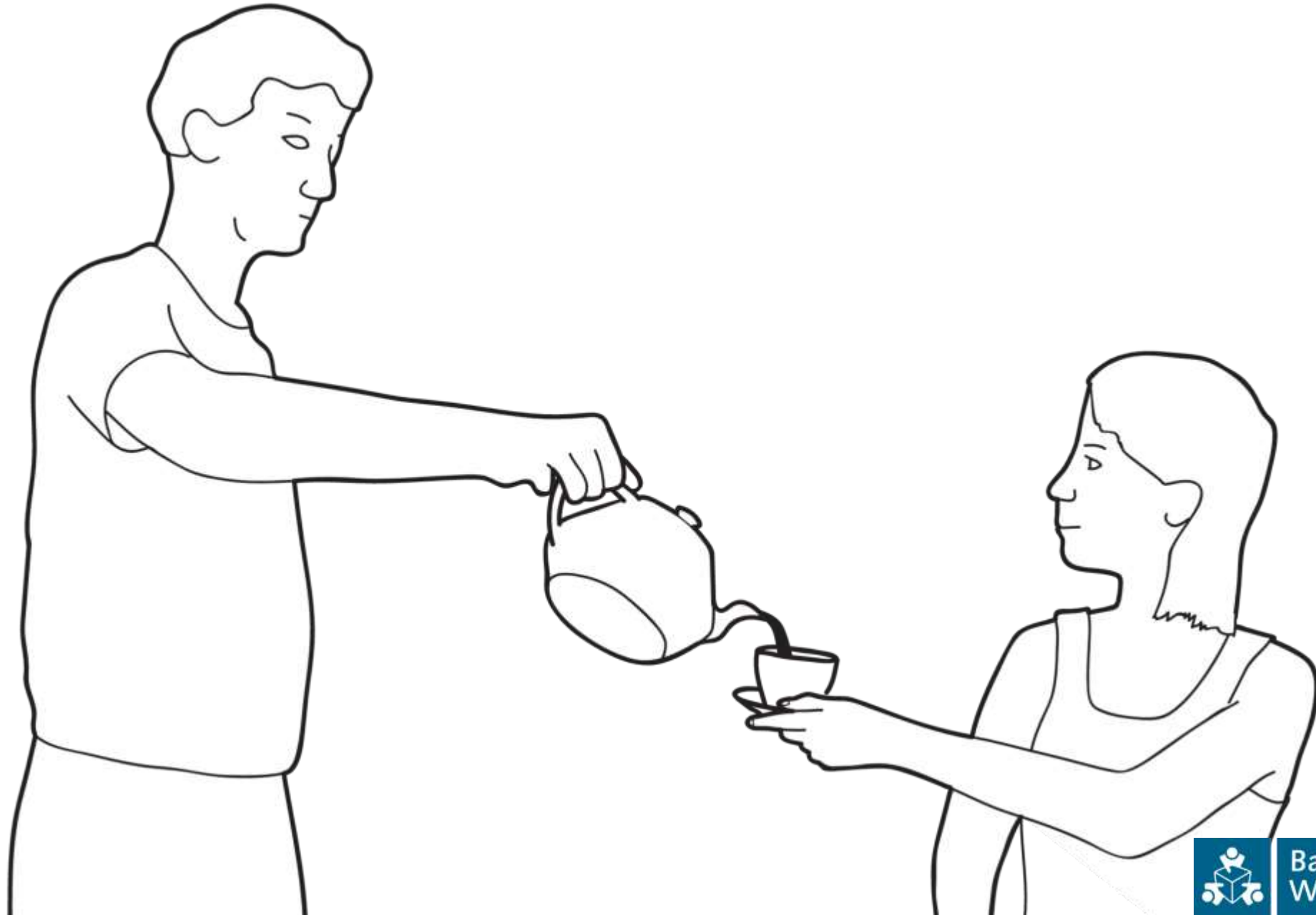
Real-Time 3D Video Avatars (e.g. Fusion4D)



Group-to-Group Immersive Telepresence



Requirements for Effective Cooperation



Workspace Awareness

- „up-to-the-moment understanding of another person’s interaction with the shared workspace”
 - What
 - How
 - When
 - Who
 - Where






Workspace Awareness through Workspace Coherence

- Consequential communication,
- Feedthrough, and
- Intentional communication

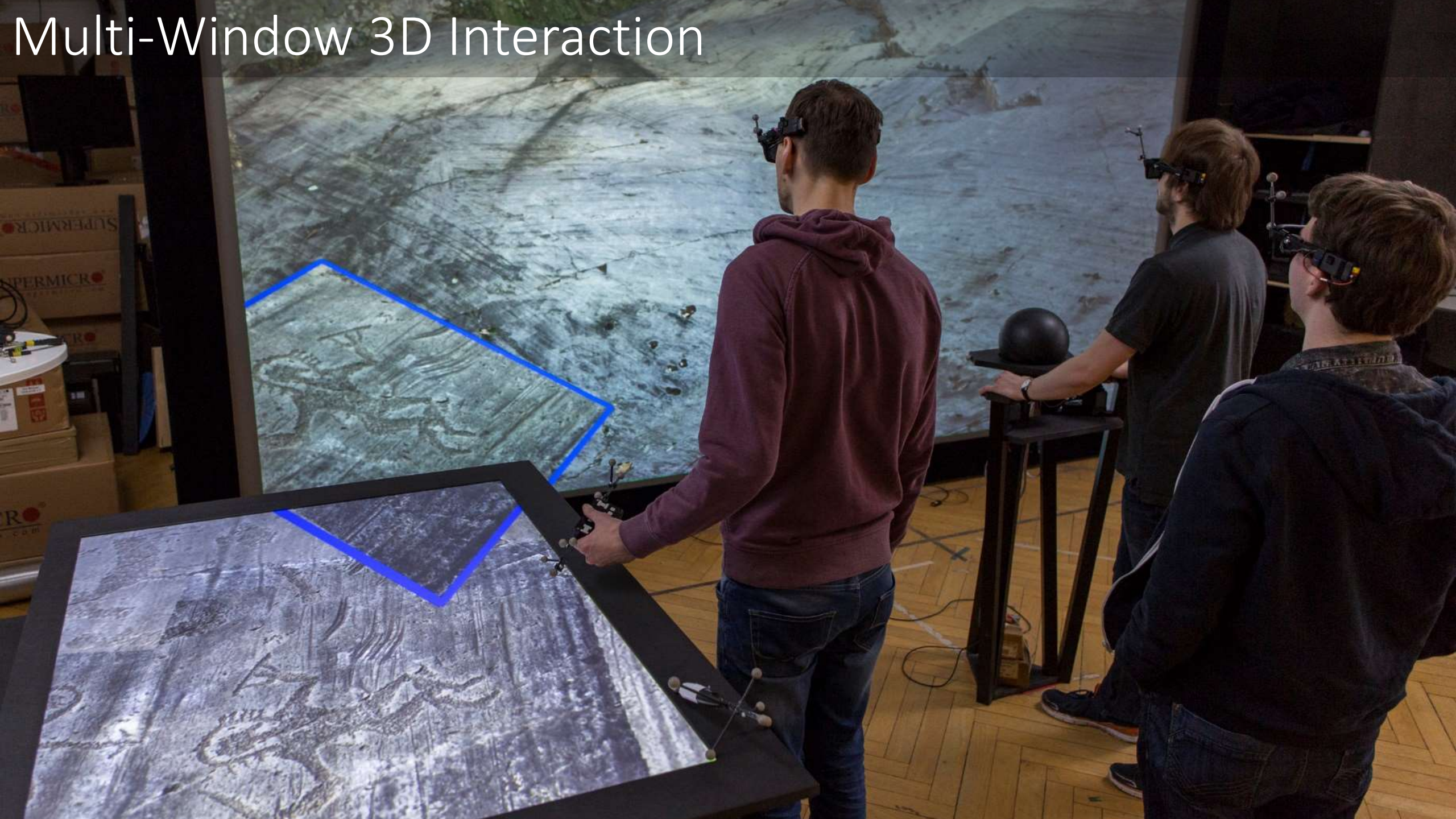


Emergent Territoriality

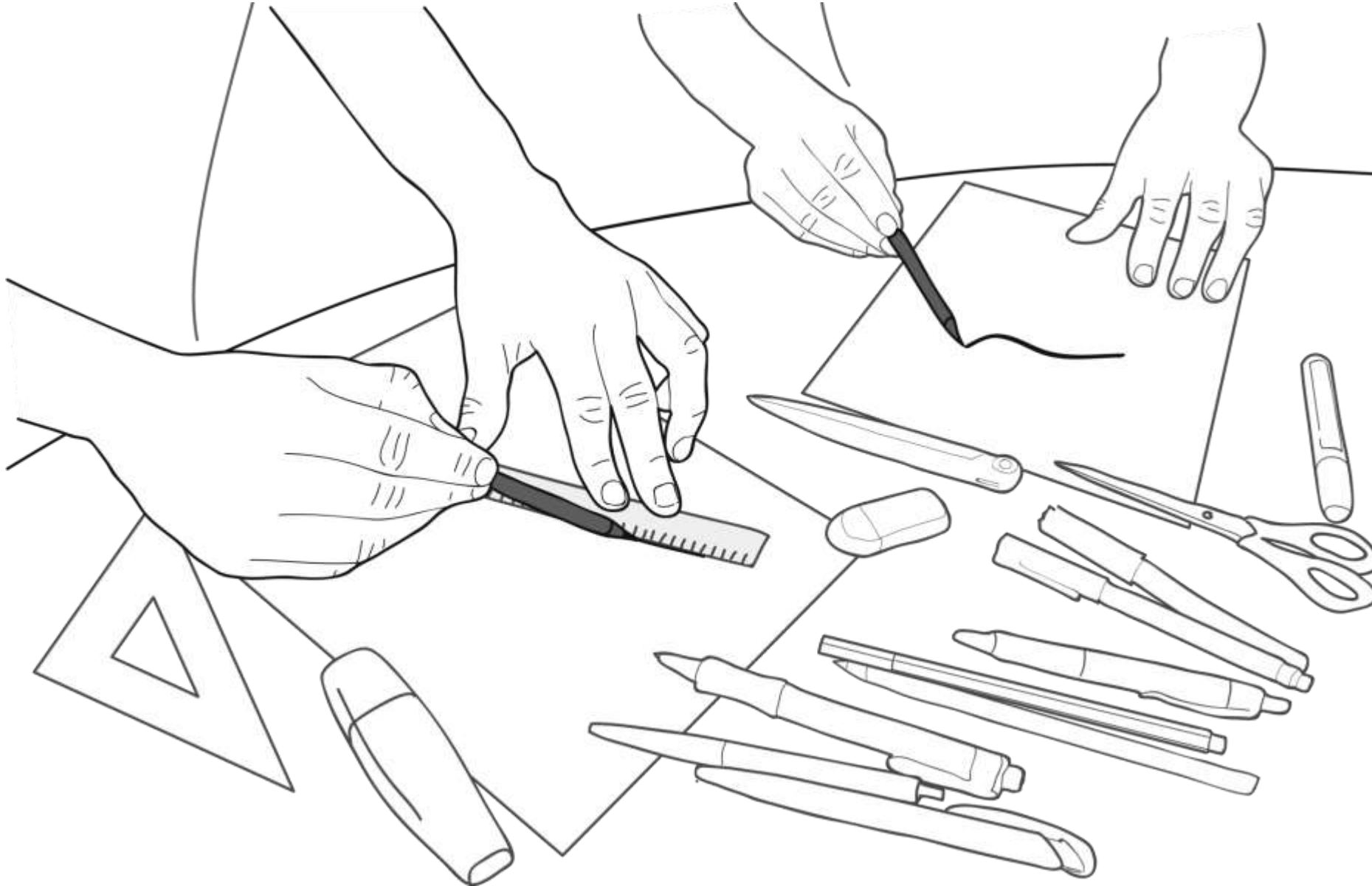
- Group 
- Private 
- Storage 



Multi-Window 3D Interaction



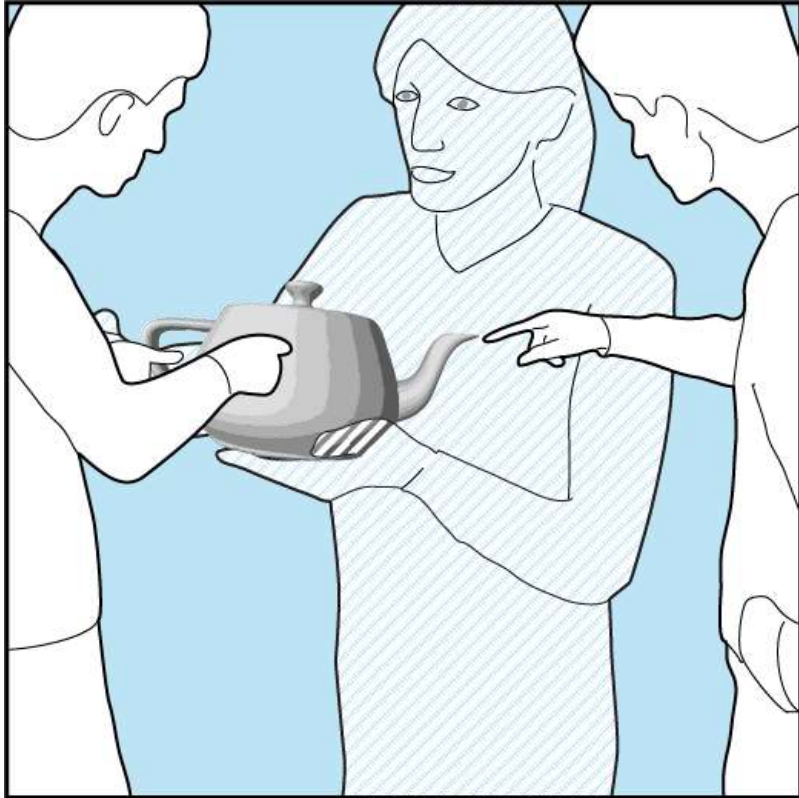
Complementarity



Tool Combinations

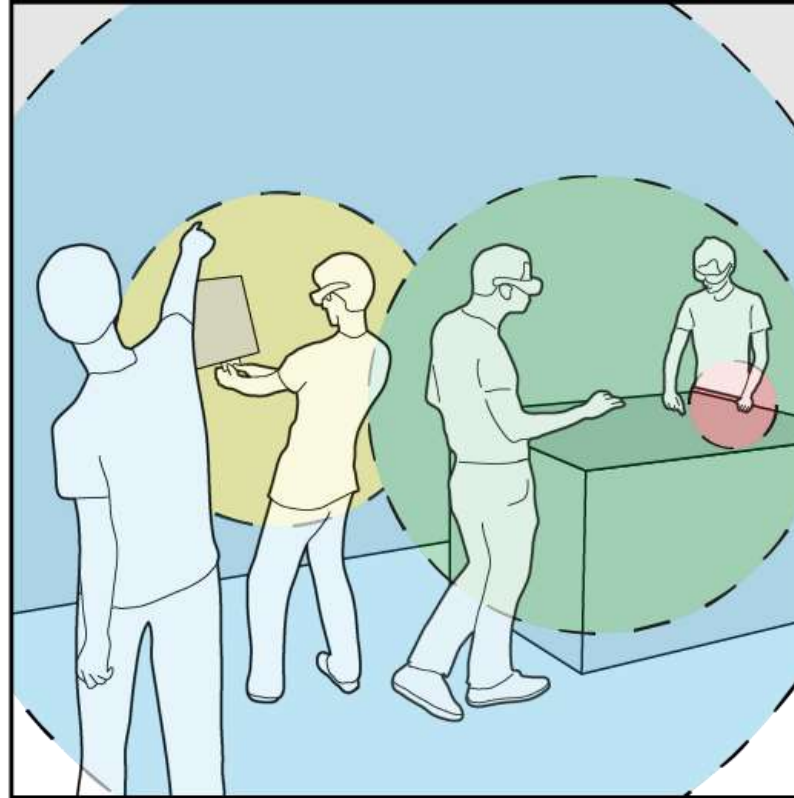


Workspace Coherence



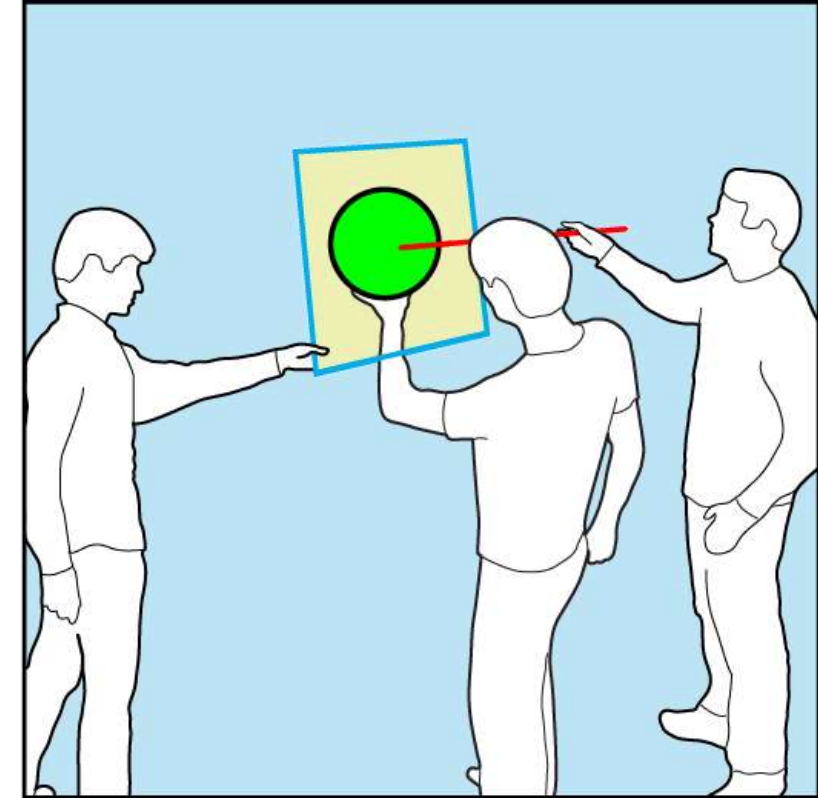
Gutwin & Greenberg 2002

Emergent Territoriality



Scott et al. 2004

Complementary Capabilities



Benford et al. 2000