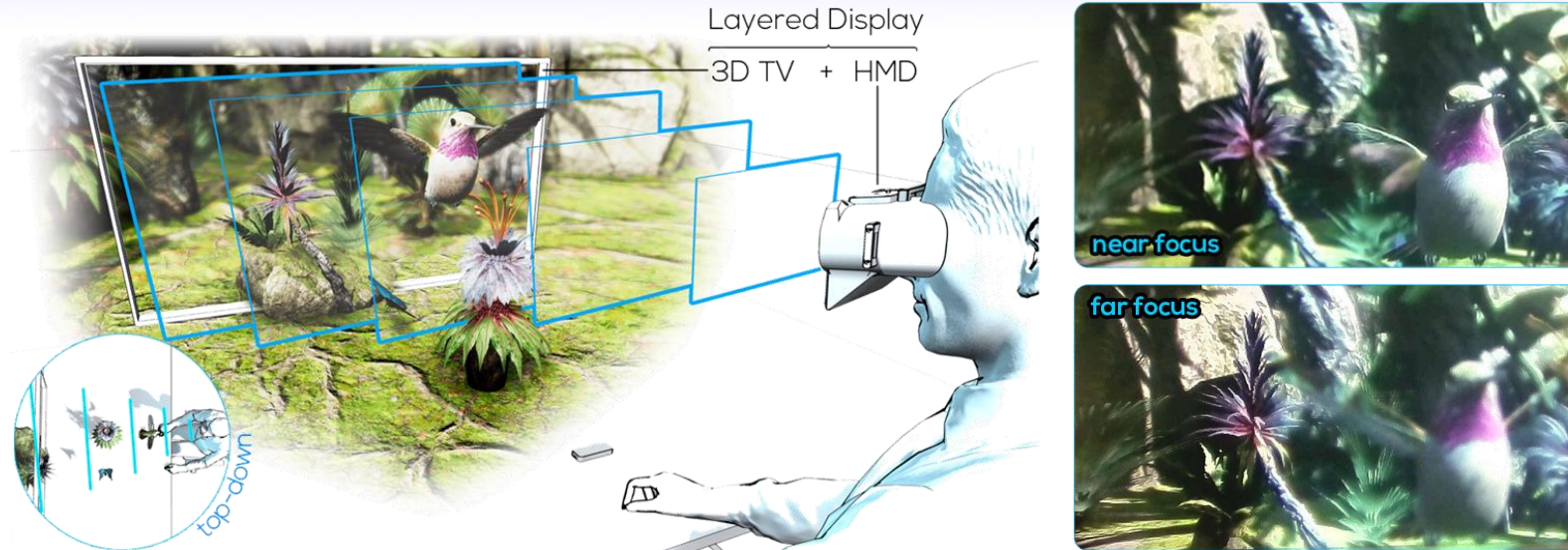


Off-Axis Layered Displays:

Hybrid Direct-View/Near-Eye Mixed Reality with Focus Cues



Christoph Ebner
Graz University of Technology

Peter Mohr
Graz University of Technology

Tobias Langlotz
University of Otago

Yifan (Evan) Peng
The University of Hong Kong

Dieter Schmalstieg
Graz University of Technology

Gordon Wetzstein
Stanford University

Denis Kalkofen
Graz University of Technology &
Flinders University, Adelaide



Off-Axis Layered Displays



Direct-View Displays

- Direct-view displays are ubiquitous
- 3D direct-view displays provide additional depth cues
- Limited depth range



Head-Mounted Displays (HMD)s

- Augmented reality displays & virtual reality displays
- Similar perceptual disadvantages as 3D direct-view displays
- Layered displays to extend the zone of comfort
- Usually fewer pixels-per-degree than direct-view displays



Microsoft HoloLens 2



Varjo XR-3



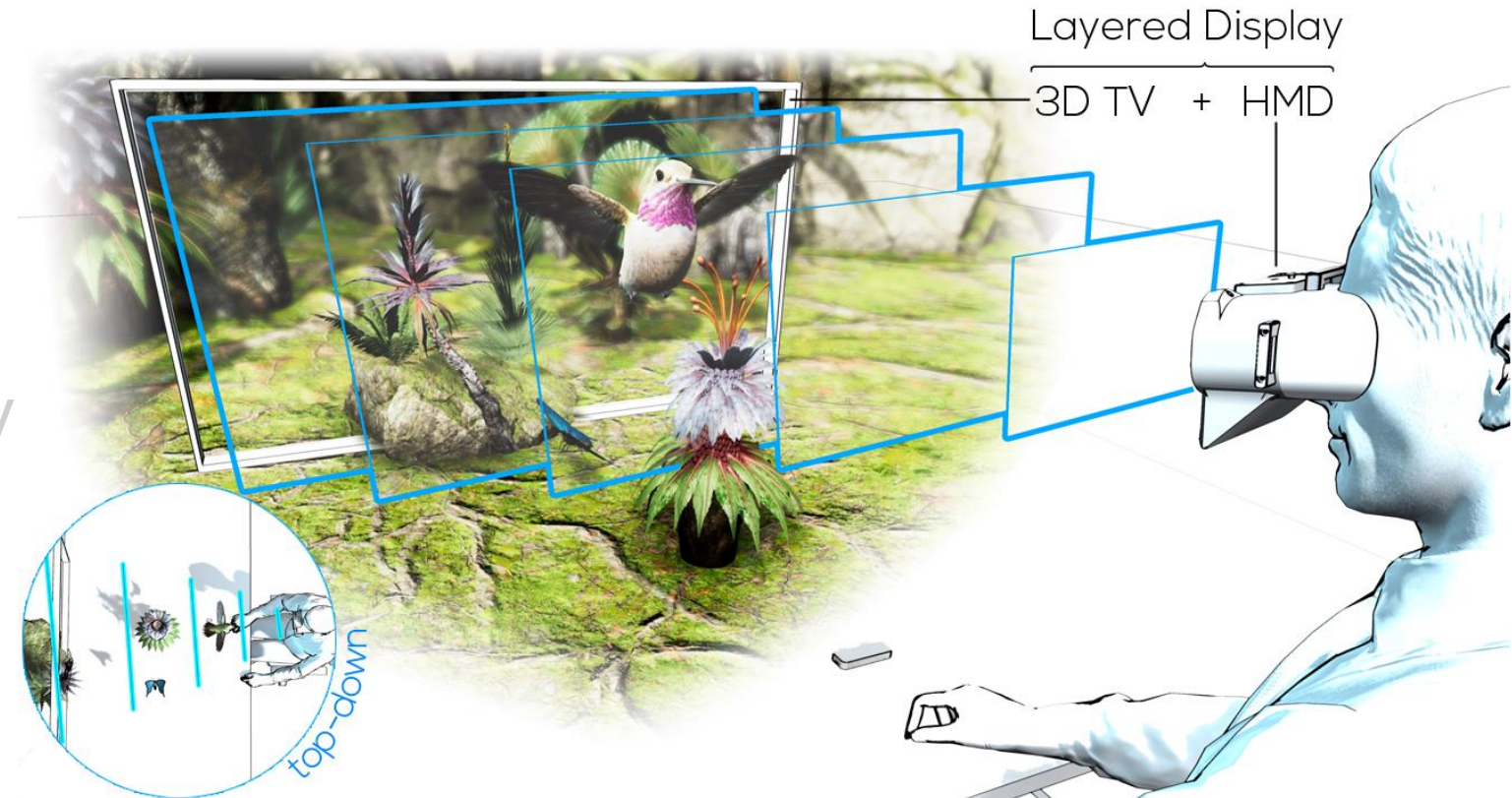
PlayStation VR2

Off-Axis Layered Displays

- Combine direct-view display and HMD

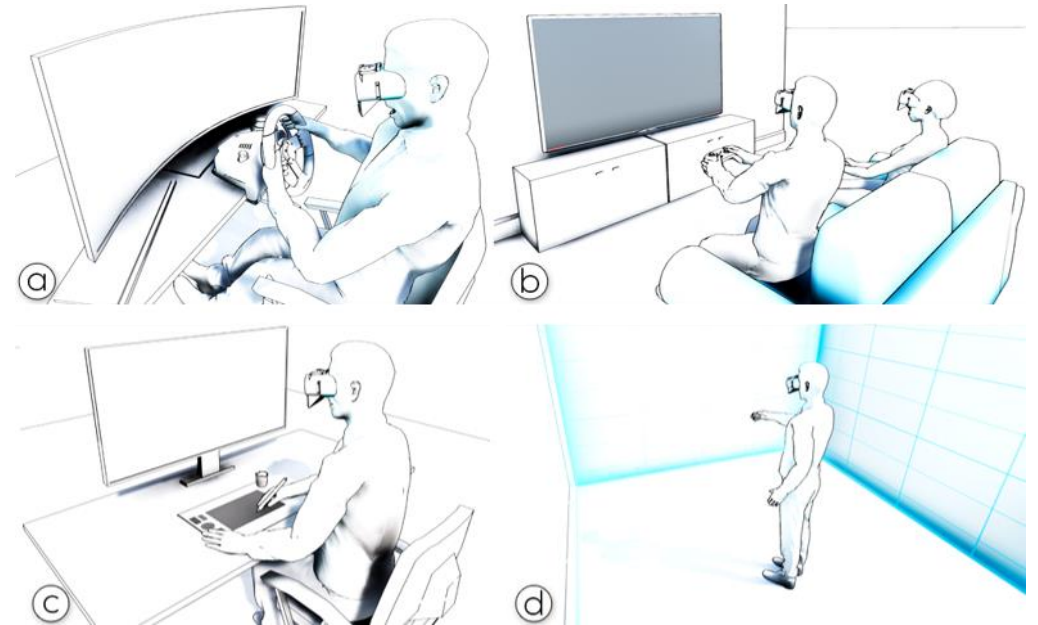
- Layered architecture

- User wears HMD and looks at direct-view display

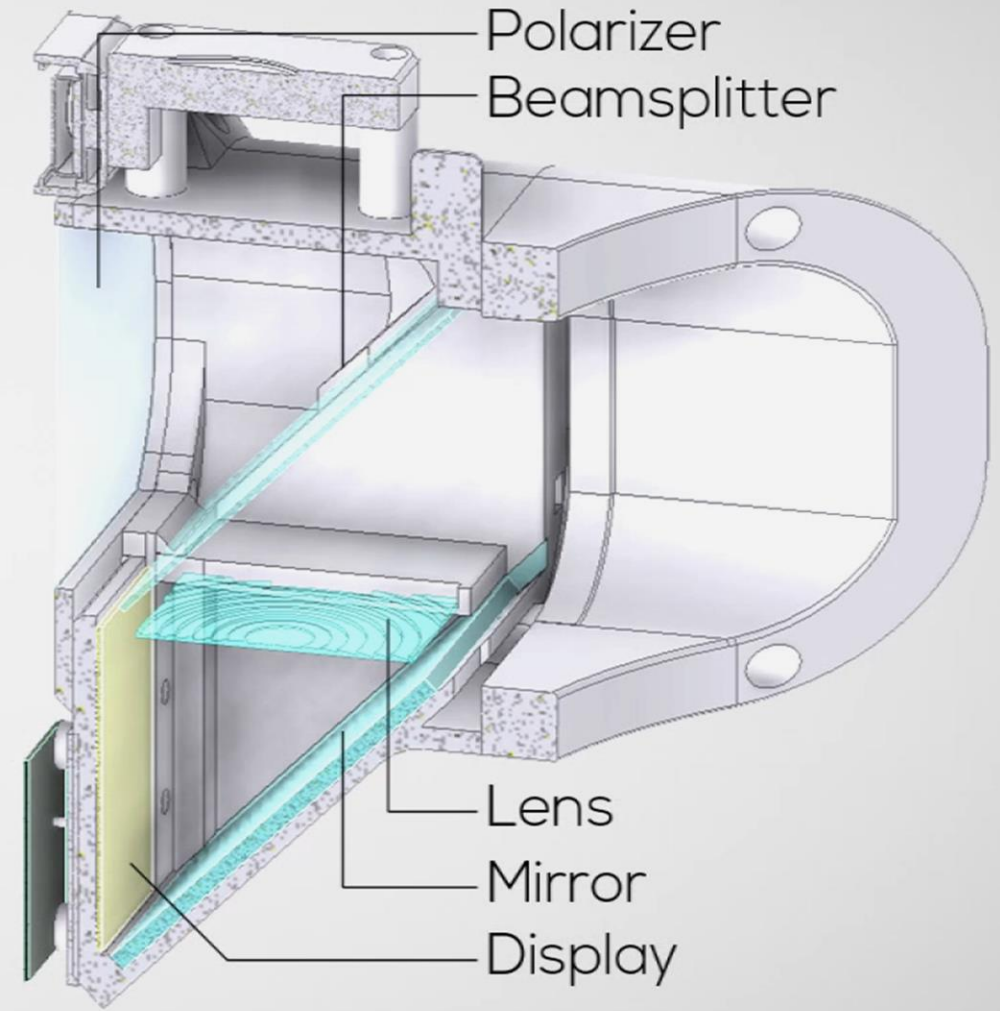


Applications

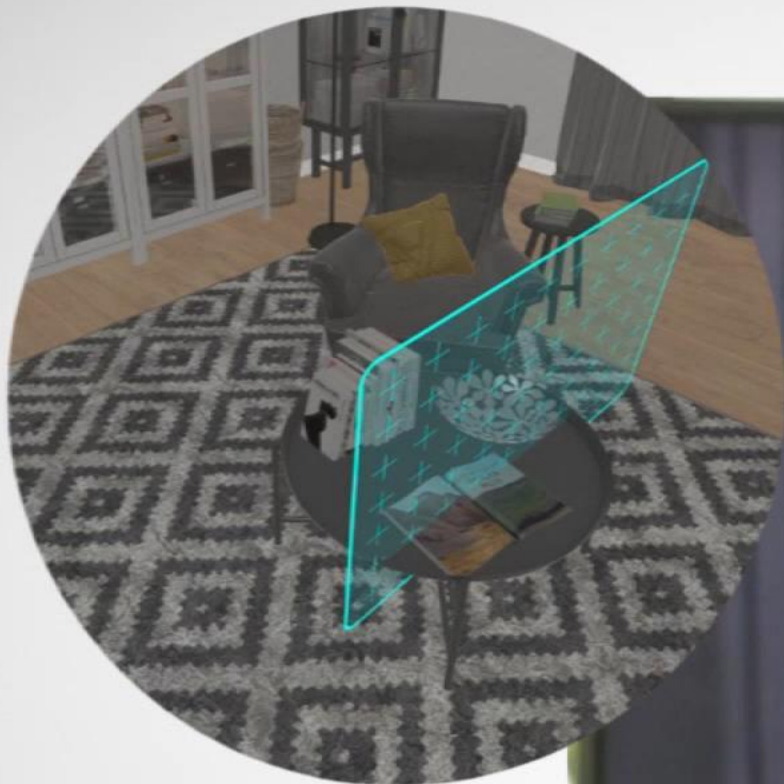
- a) Gaming
- b) Multi-user interaction
- c) CAD modeling in stereo
- d) Interaction/exploration in a CAVE



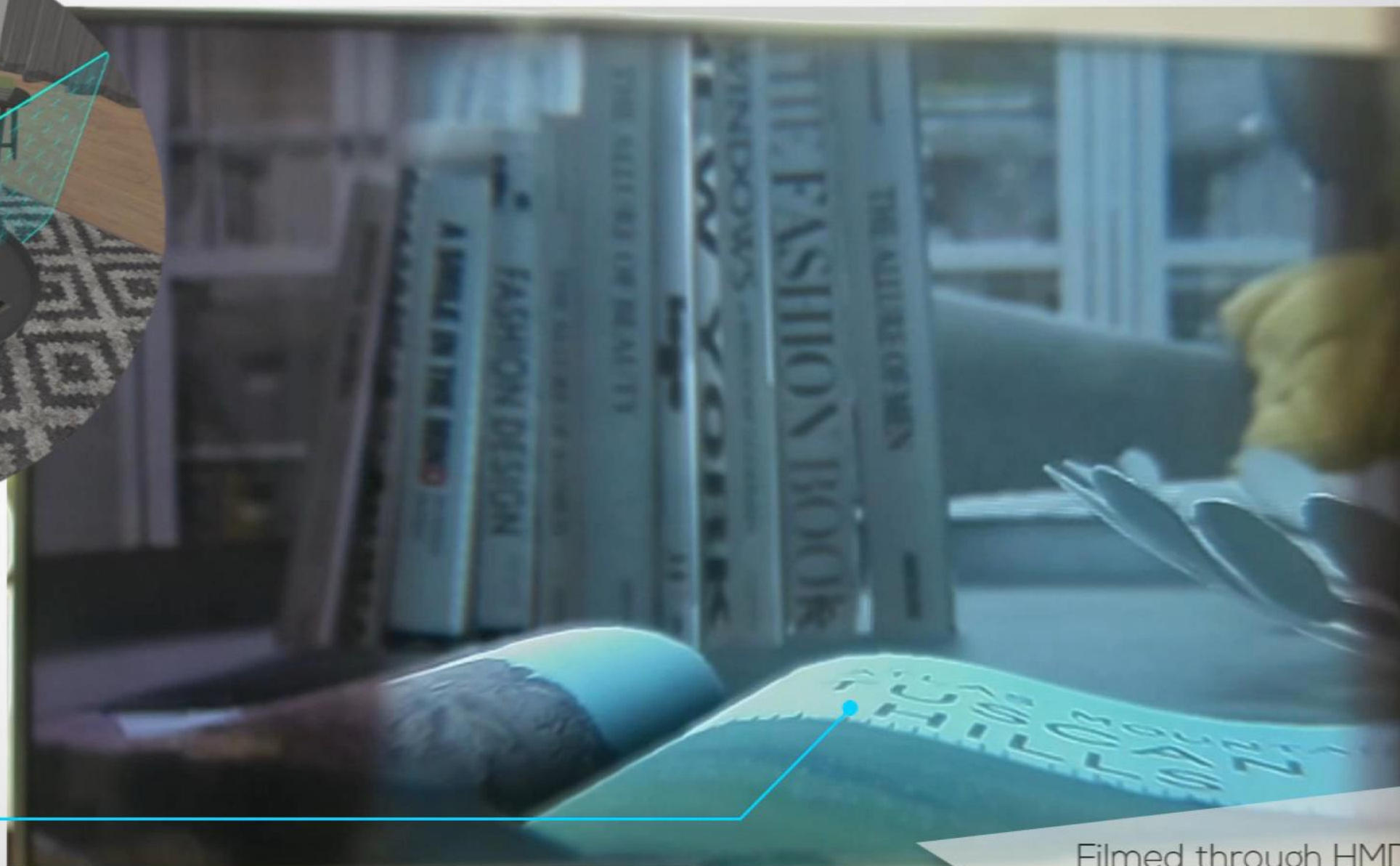
Off-Axis Layered Displays



Off-Axis Layered Displays



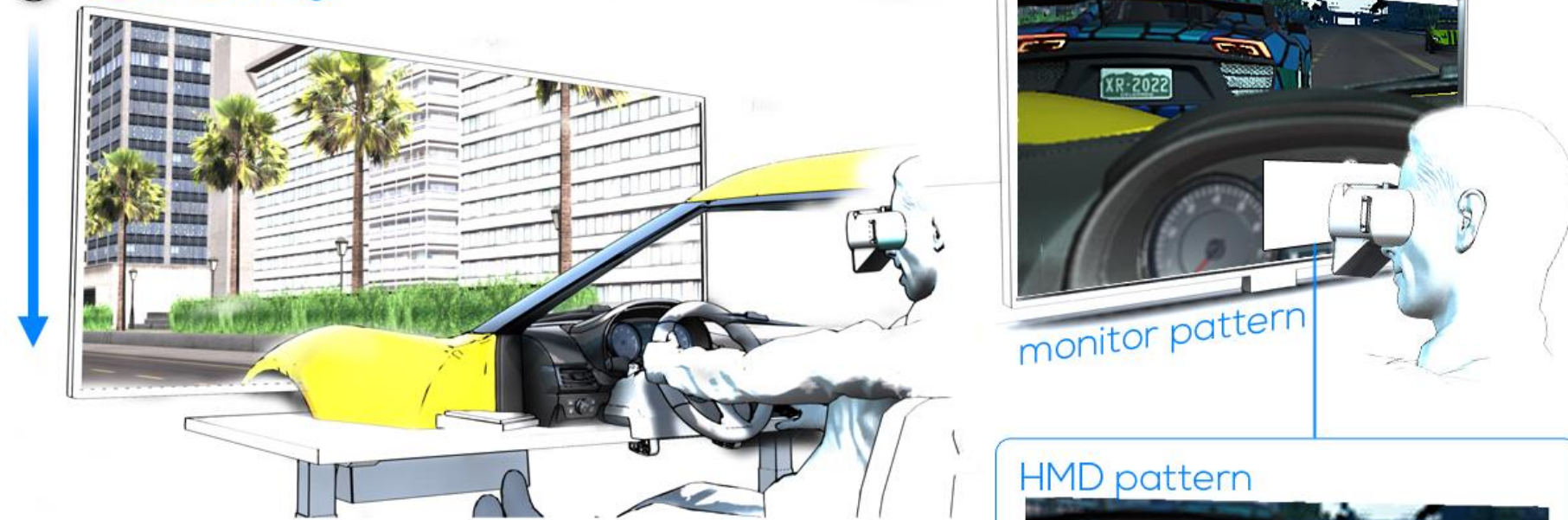
near focus



Filmed through HMD

Pipeline

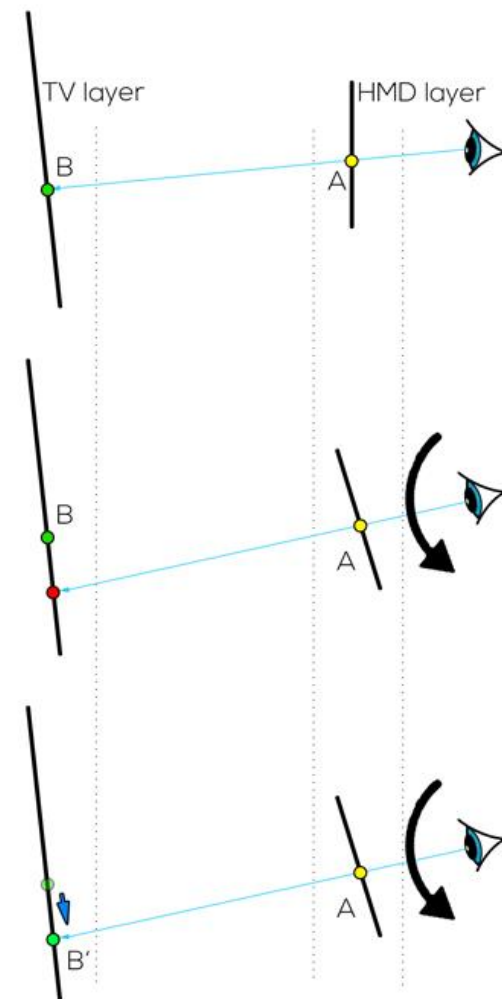
a) pose tracking



b) focal stack rendering



c) layer decomposition

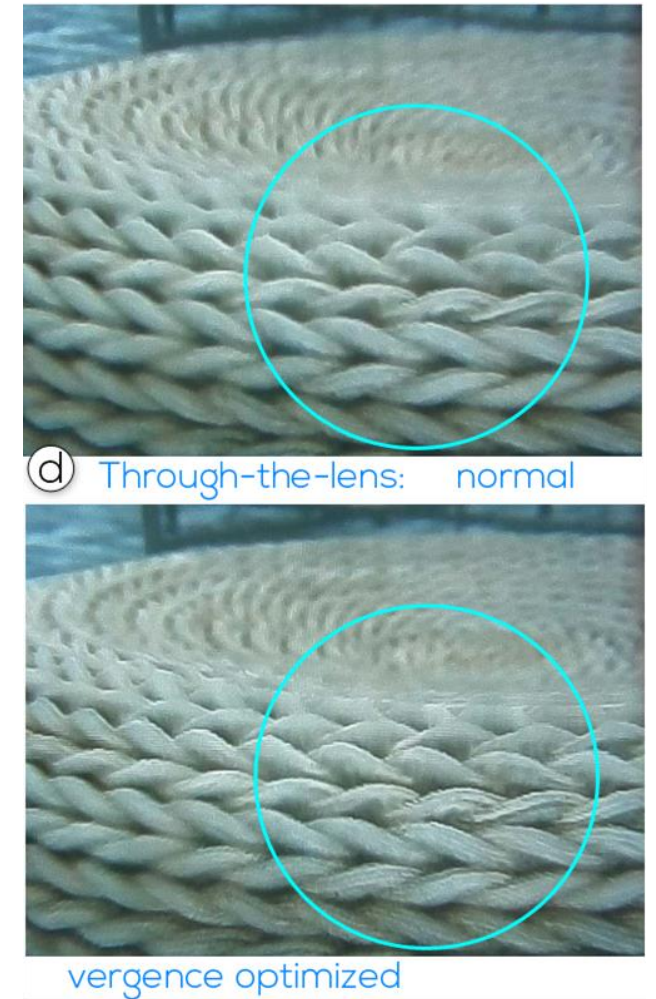
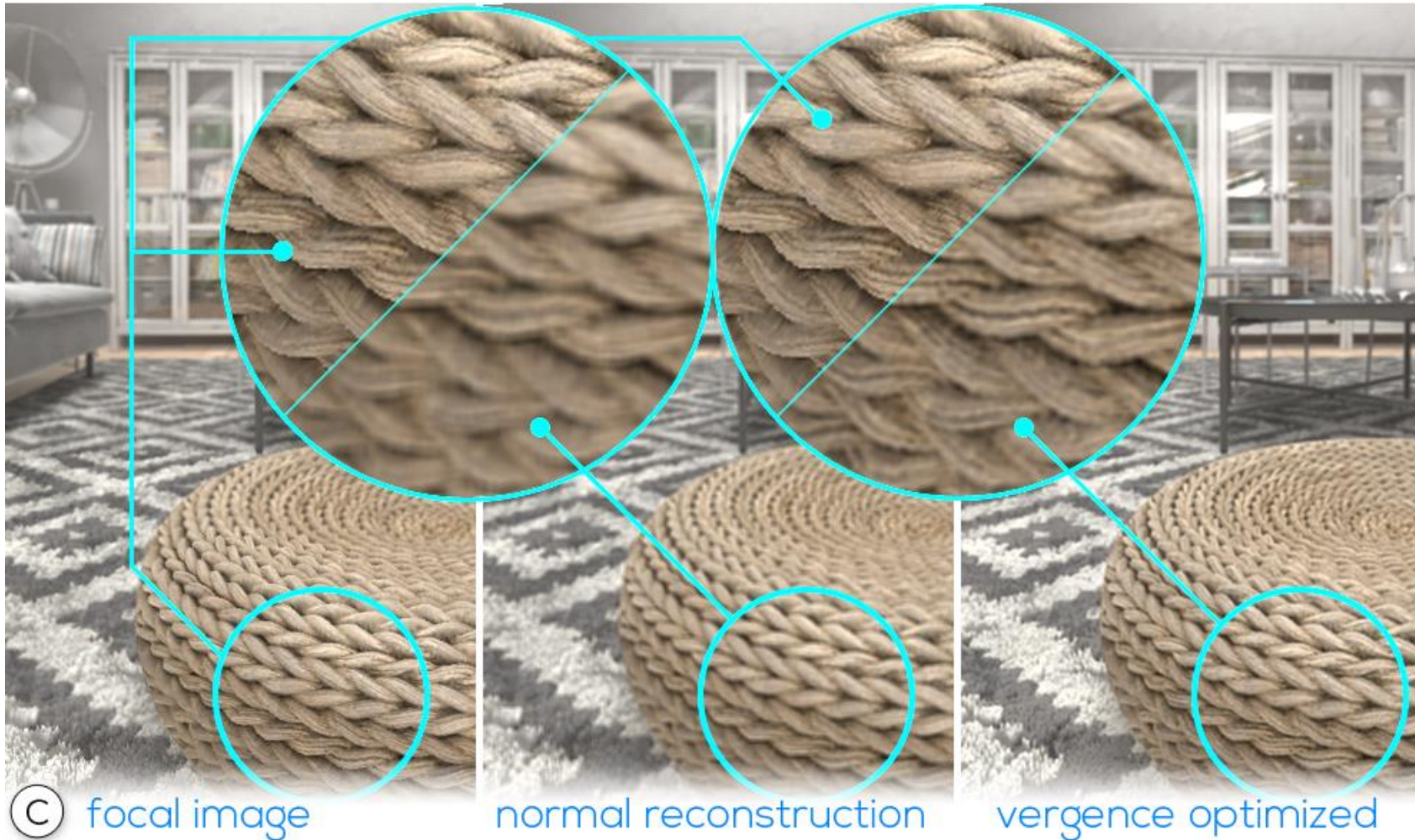


d) warping

Through-the-Lens Results

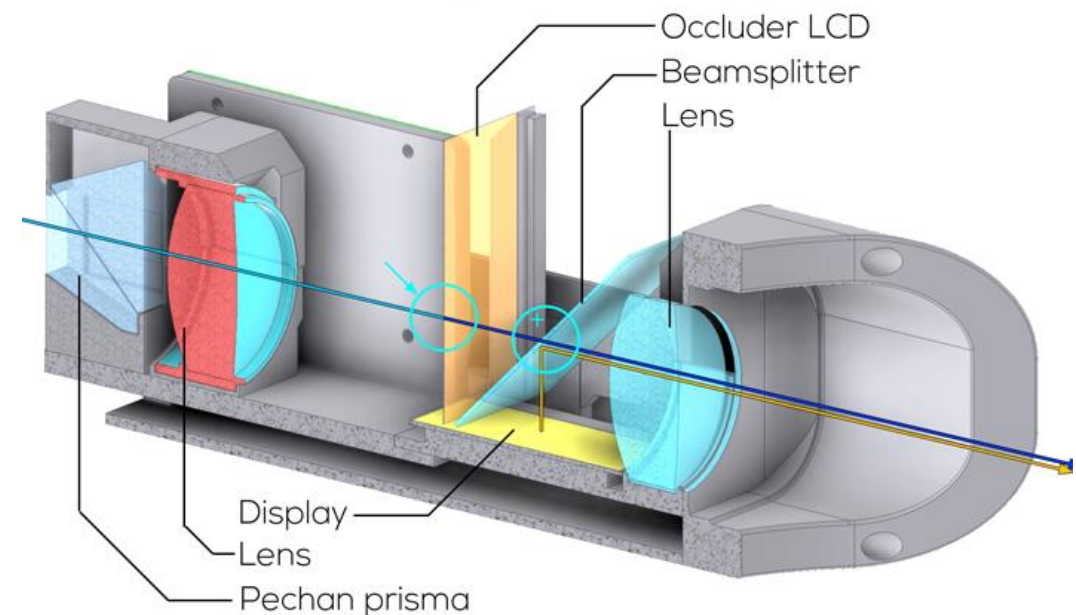


Vergence-Driven Optimization

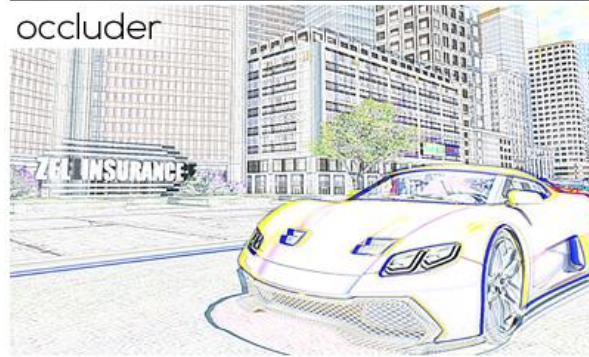


Monoscopic Direct-View Displays

- Support for monoscopic direct-view displays
- Relay lens system with LCD
TV · LCD + HMD
- Multi-user interactions



Results: Monoscopic Direct-View Displays



patterns



perceived image **without** occluder



perceived image **with** occluder

Off-Axis Layered Displays:

Hybrid Direct-View/Near-Eye Mixed Reality with Focus Cues

