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VR World Congress 4/12/2017

In AR and VR, we are obsessed with creating a rich sense of reality!

Your VR Living Room

Work

Communication

Holoportation UIST 2016

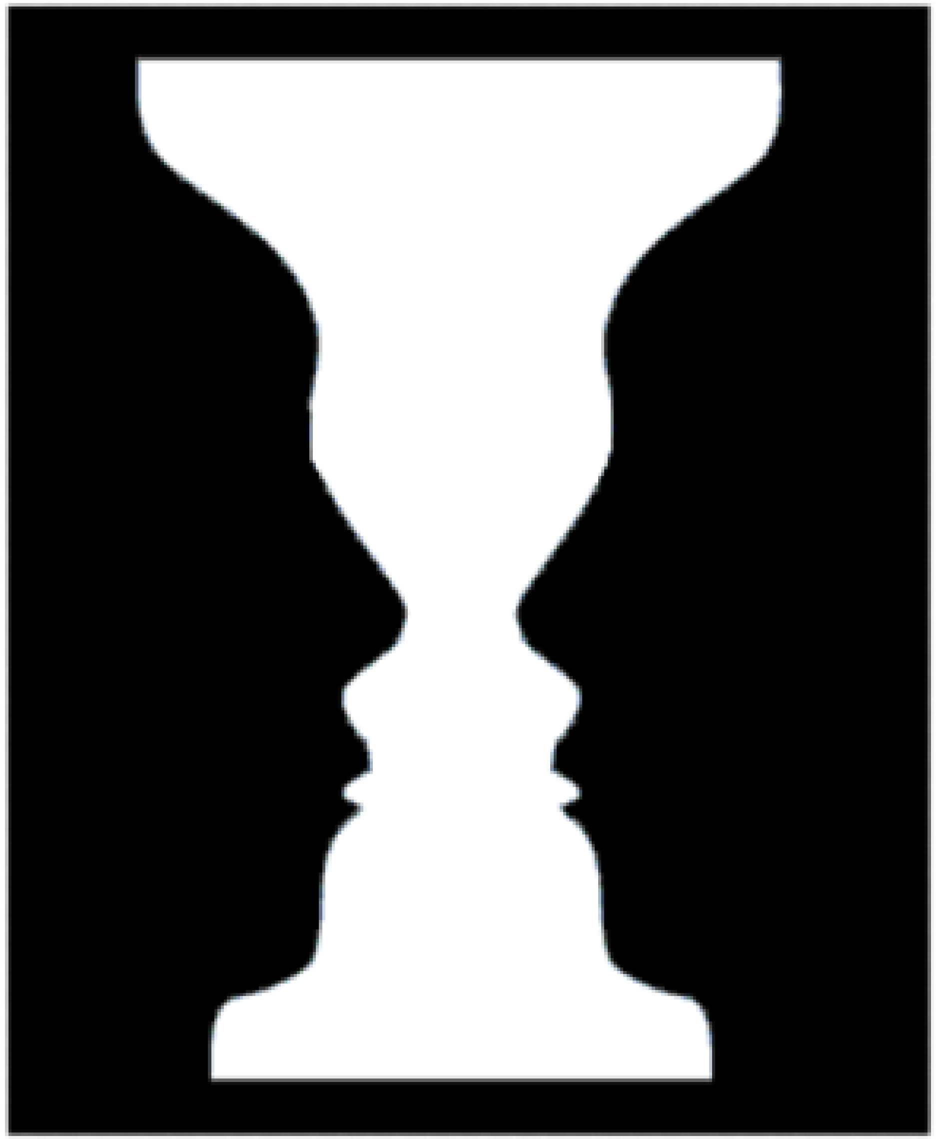
Is chasing reality the best strategy?

The ‘world’ is a framed and malleable construct that the user creates in their mind.

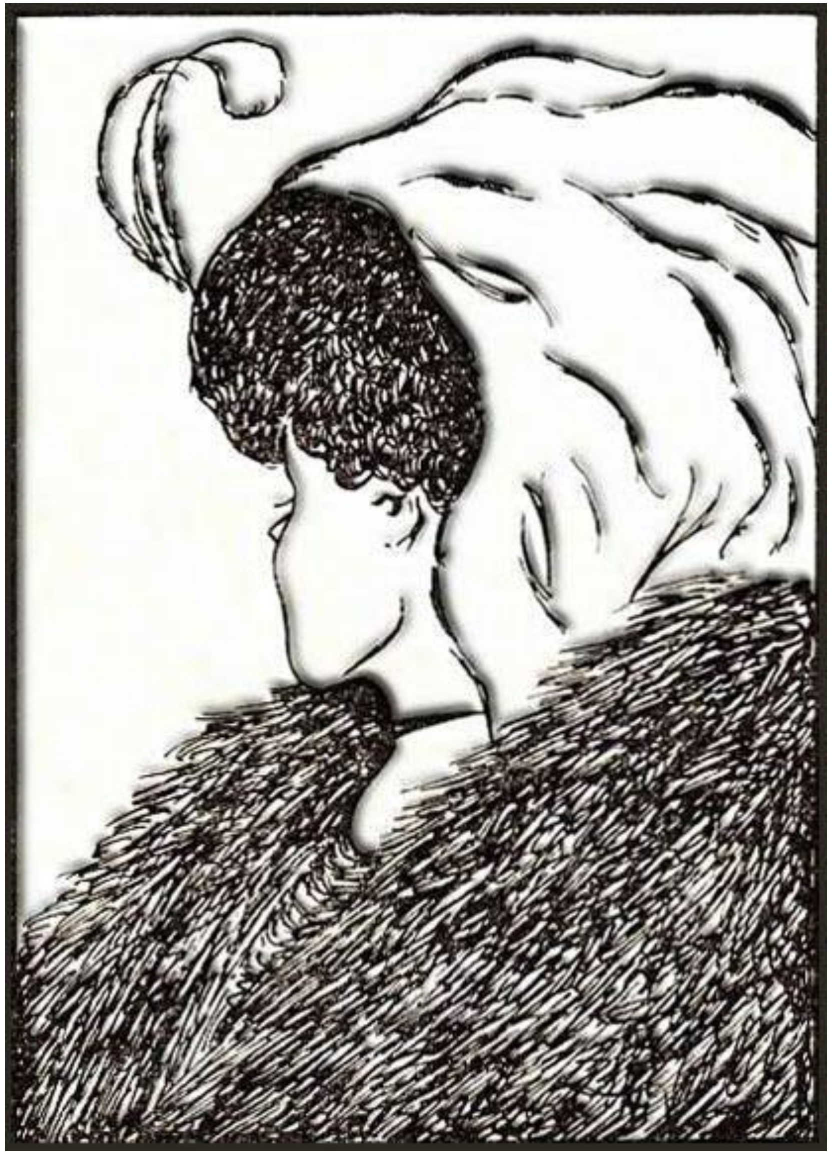
Mark Bolas, 2012

What is “real” vs. what we “perceive as real” is not necessarily the same!

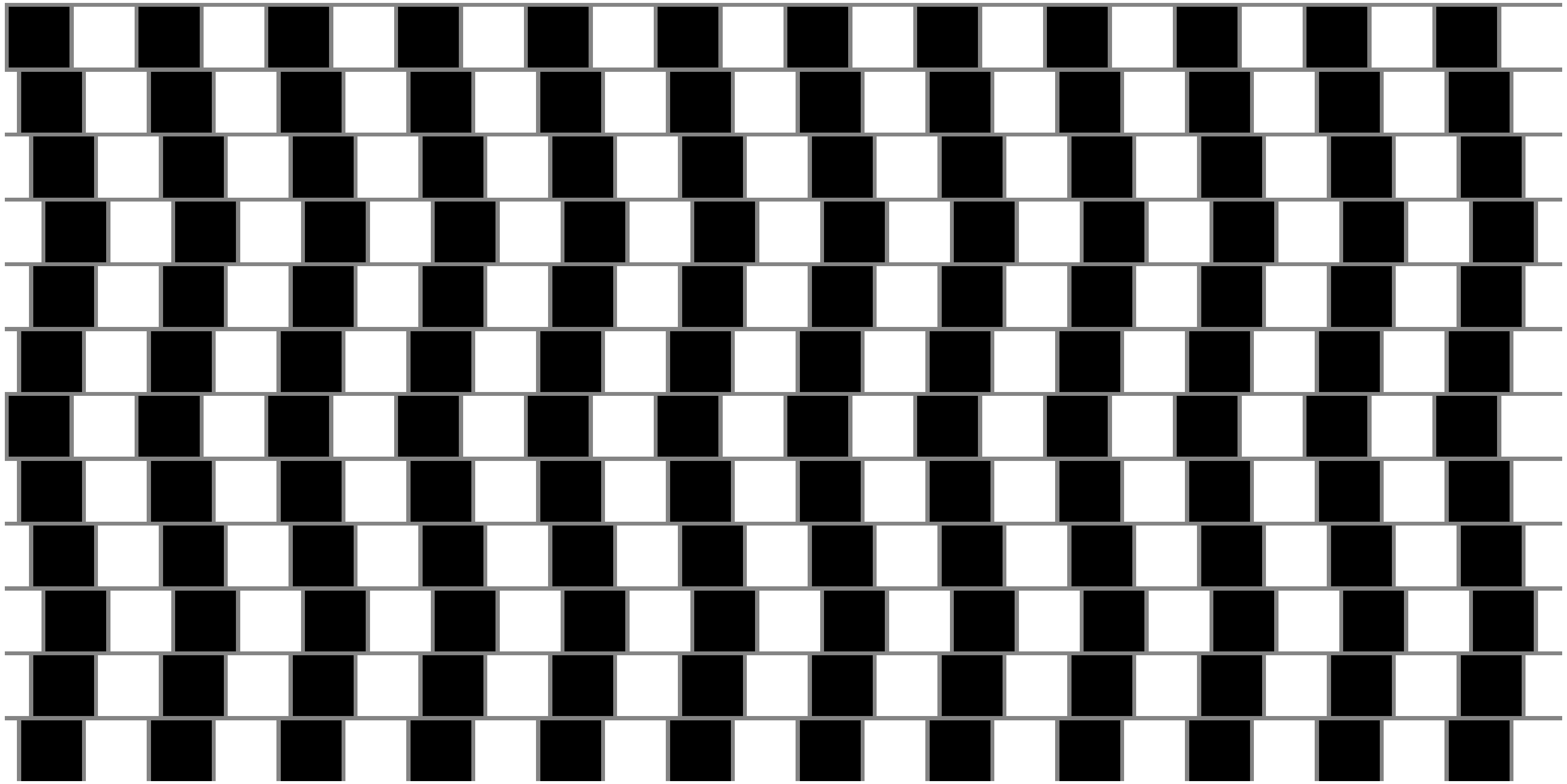
Faces or vase?



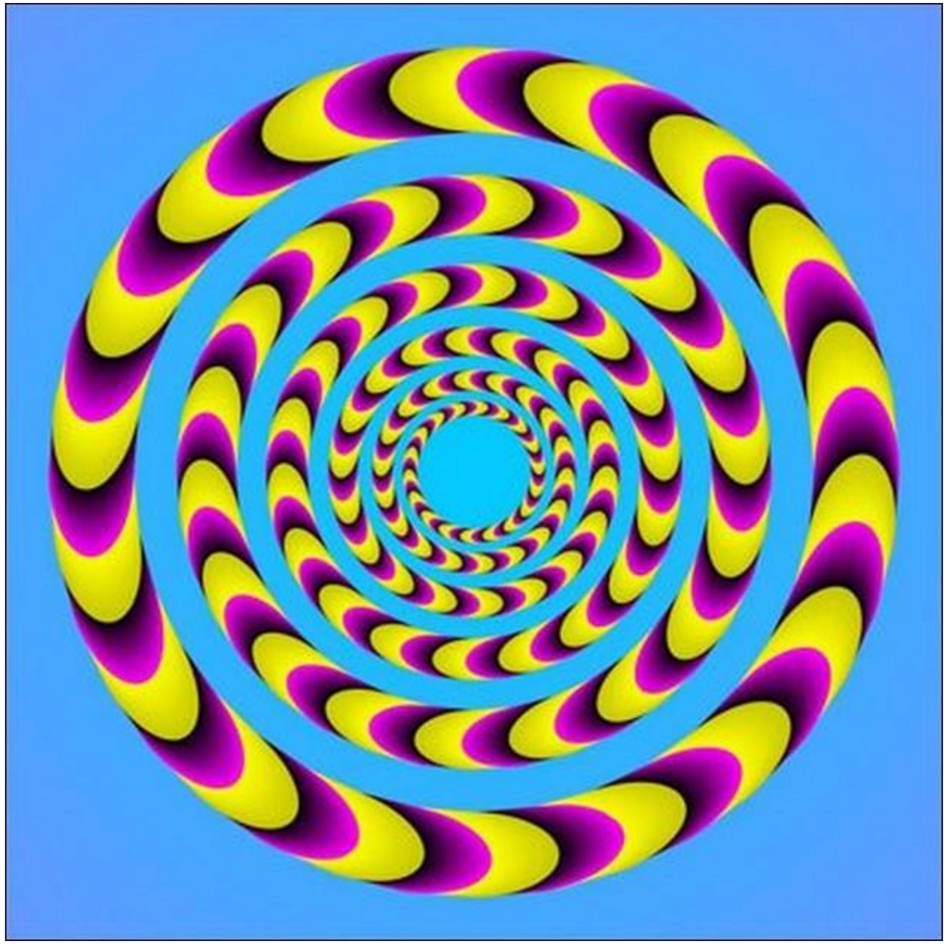
Young or old?



Straight or crooked?



Moving or static?



Perception

the neurophysiological processes, including memory, by which an organism becomes aware of and interprets external stimuli

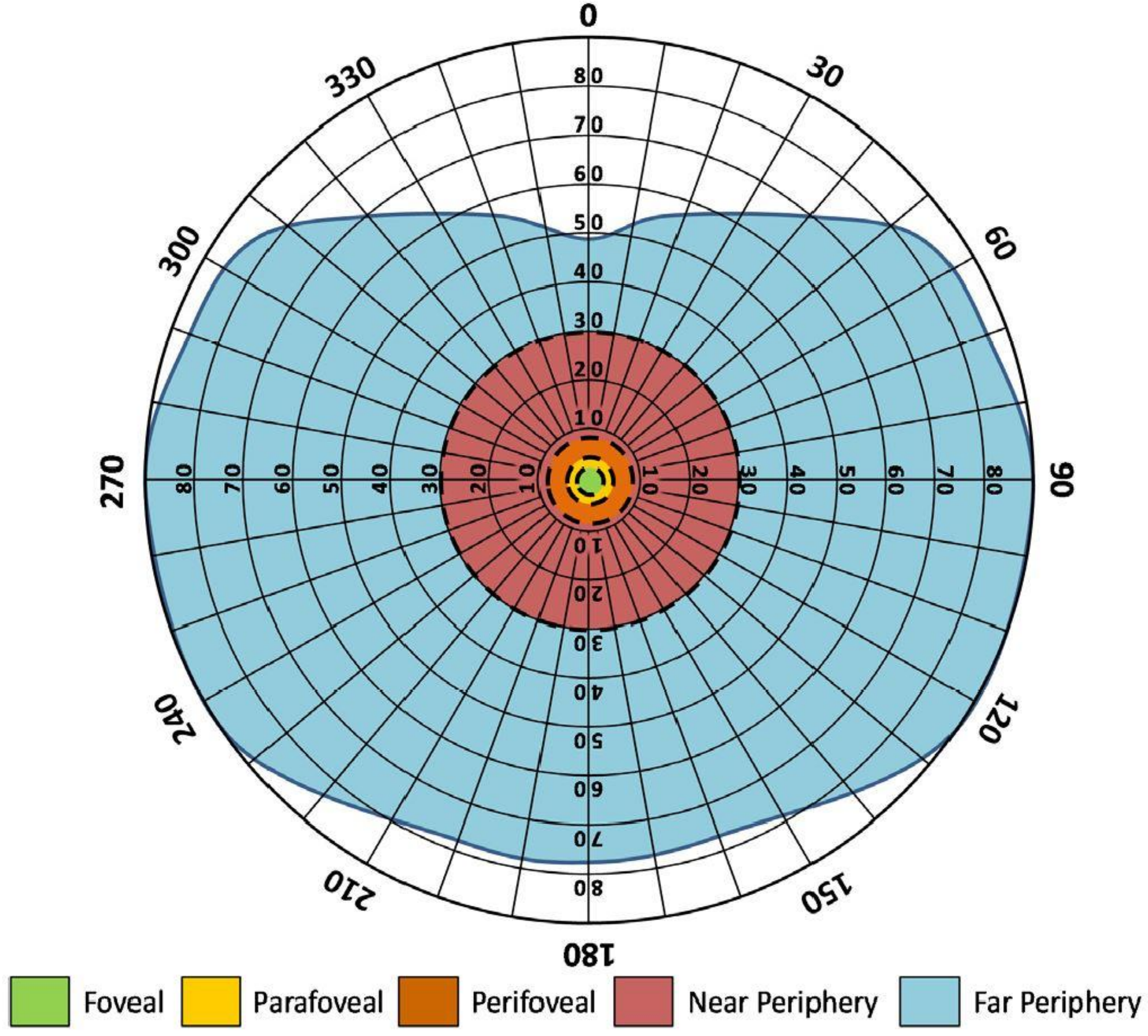
Insisting on “as real as possible” designs can lead to sub-optimal AR/VR experience.

Think about AR/VR interfaces as perceptual illusions that give the user the perception of reality!

Example #1

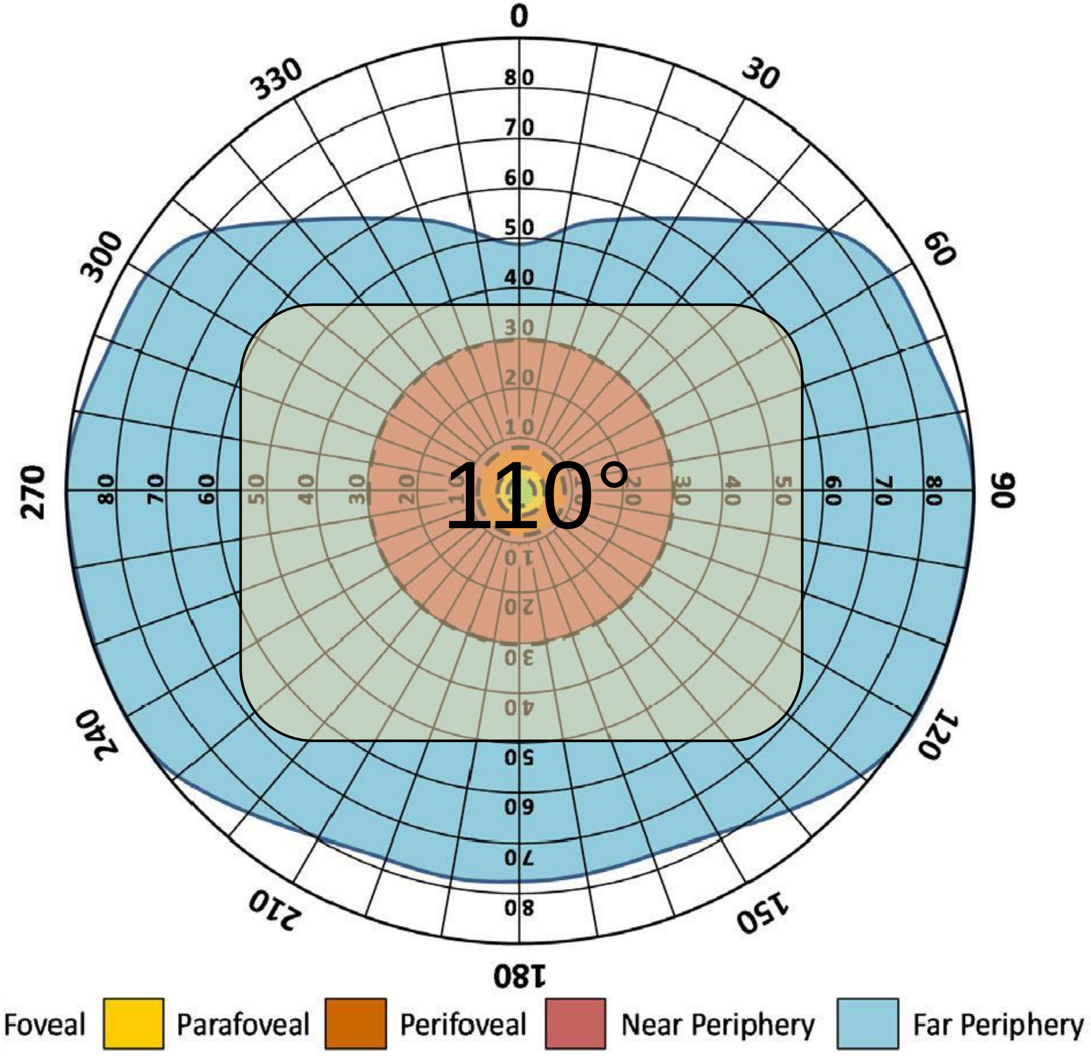
Sparse Peripheral Displays

Human FOV



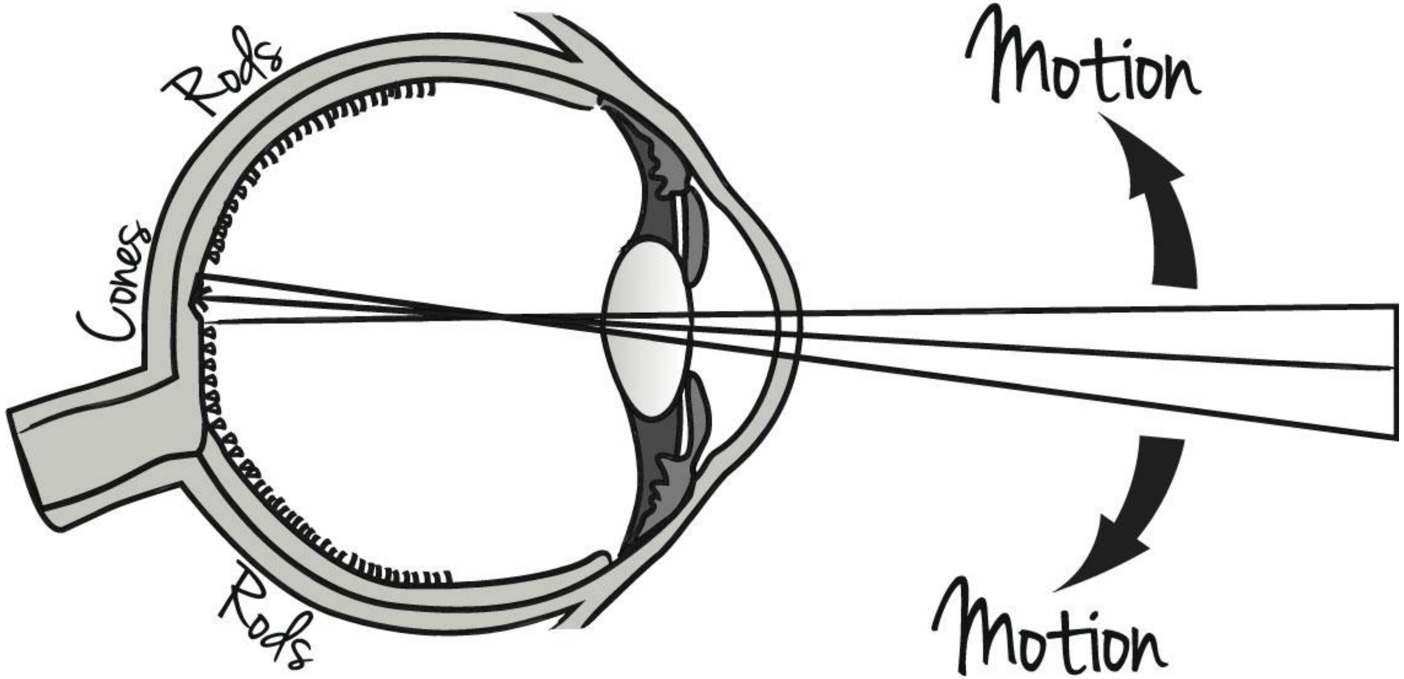
Regions within the human binocular field of view. Adapted from Taylor [39], Boring et al. [3], and Strasburger et al. [36].

VR FOV



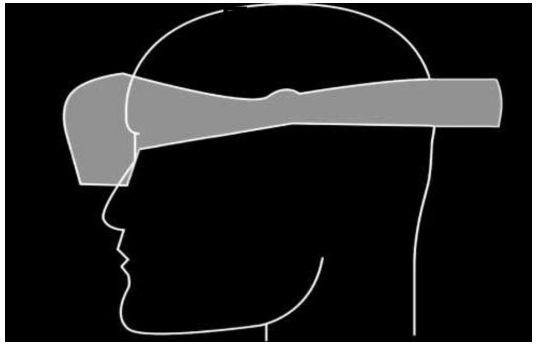
Regions within the human binocular field of view. Adapted from Taylor [39], Boring et al. [3], and Strasburger et al. [36].

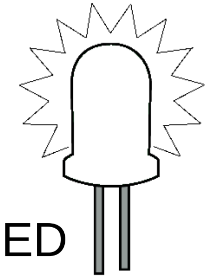
However, the periphery does not need to be the same as the focus!



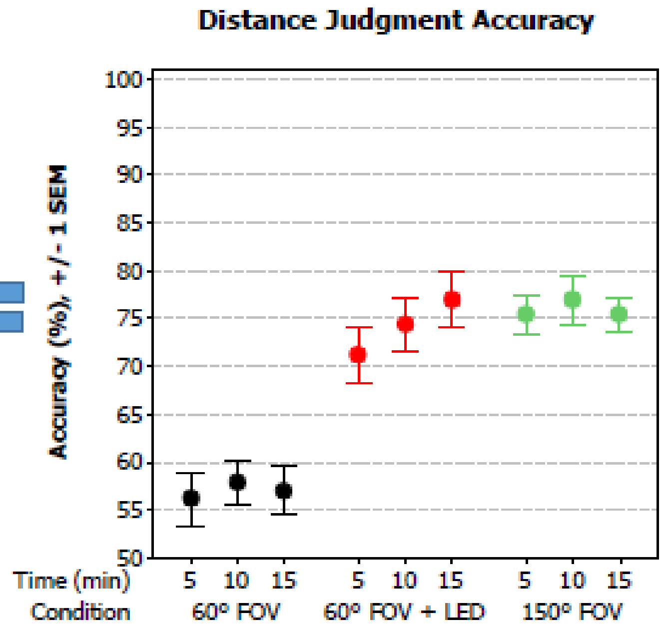
Illuminated Periphery = Better Perception of Distance in VR

HMD 60deg



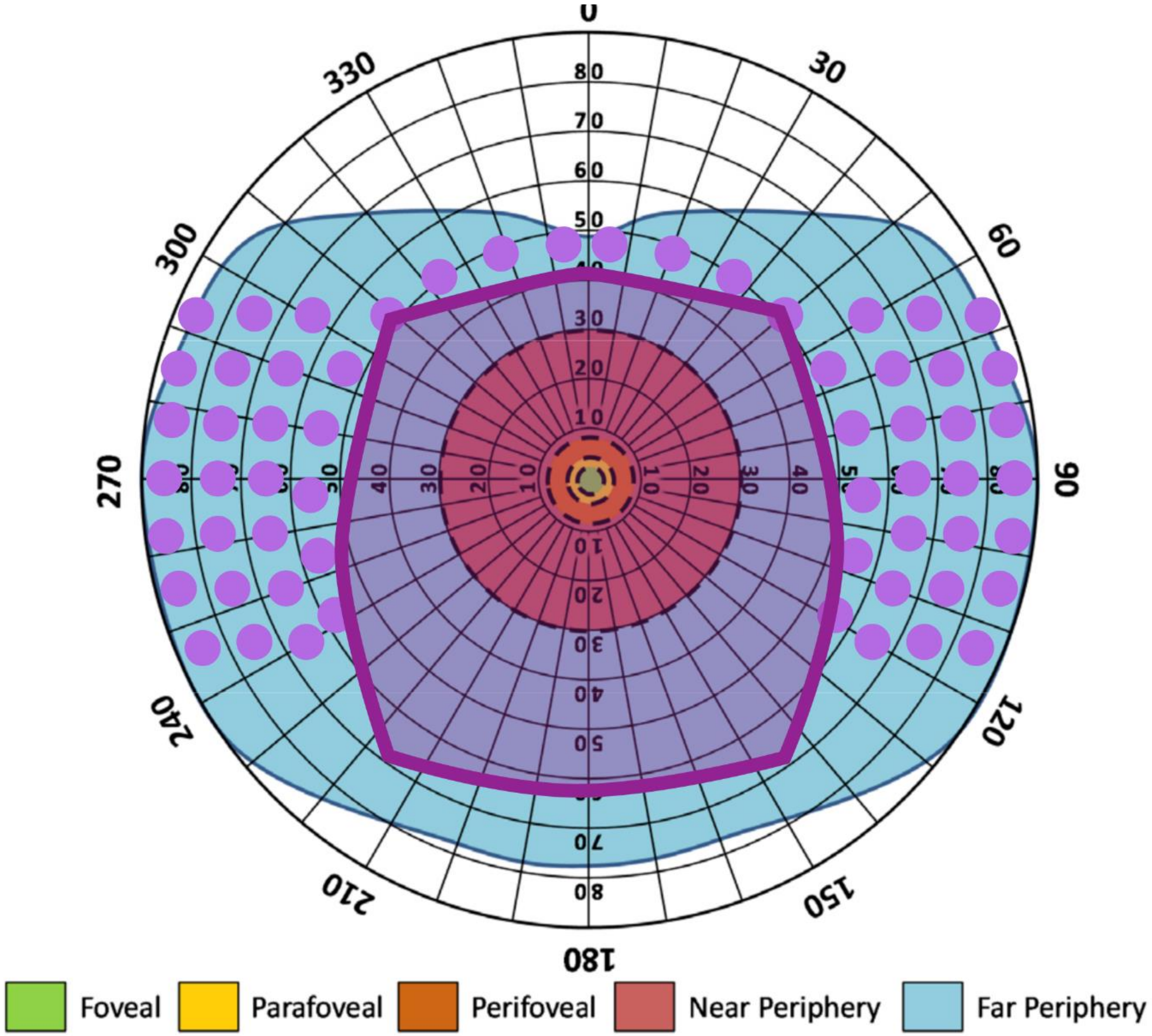


LED



A. Jones, E. Swan, S. Ellis, M. Bolas. Symposium on Applied Perception in Graphics and Visualization 2011.

Sparse Peripheral Displays



Xiao and Benko. ACM CHI 2016

Inside Oculus Rift DK2

Xiao and Benko. ACM CHI 2016

Countervection Stimulus

Example #2

Peripheral Illusions

VR Today

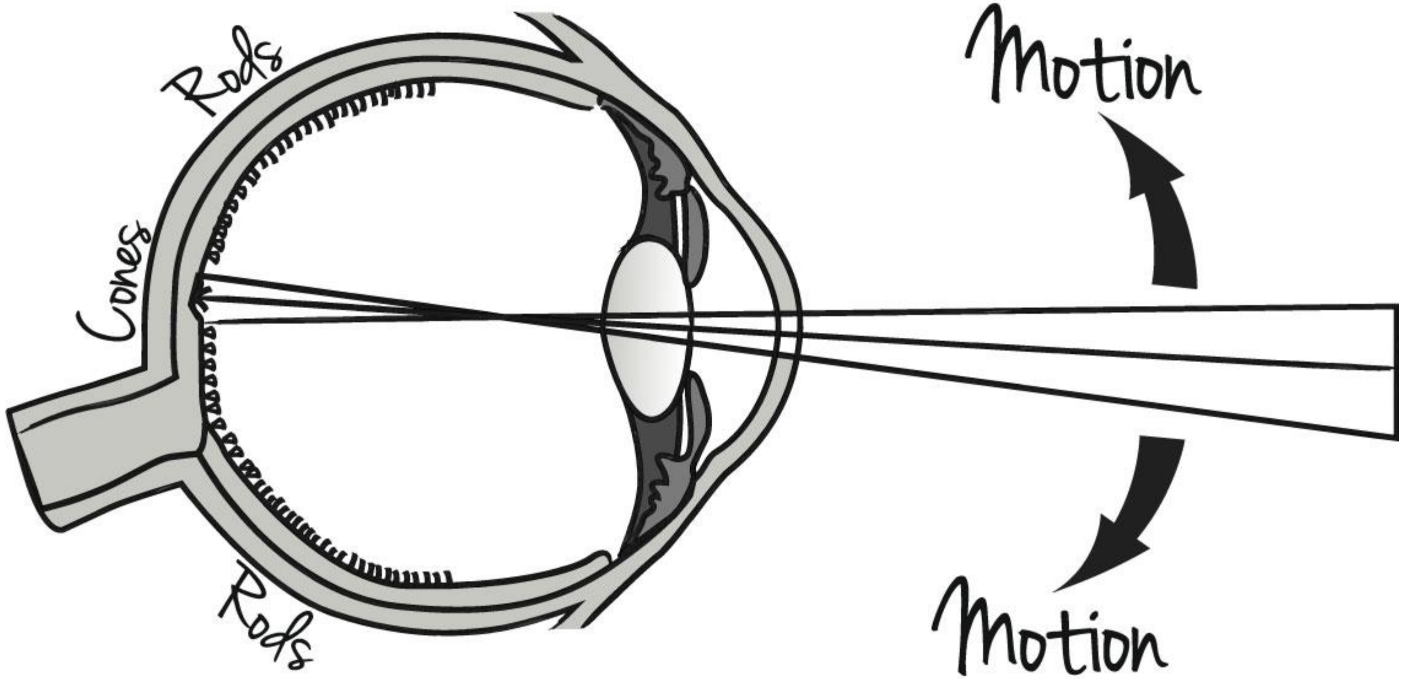
AR Today

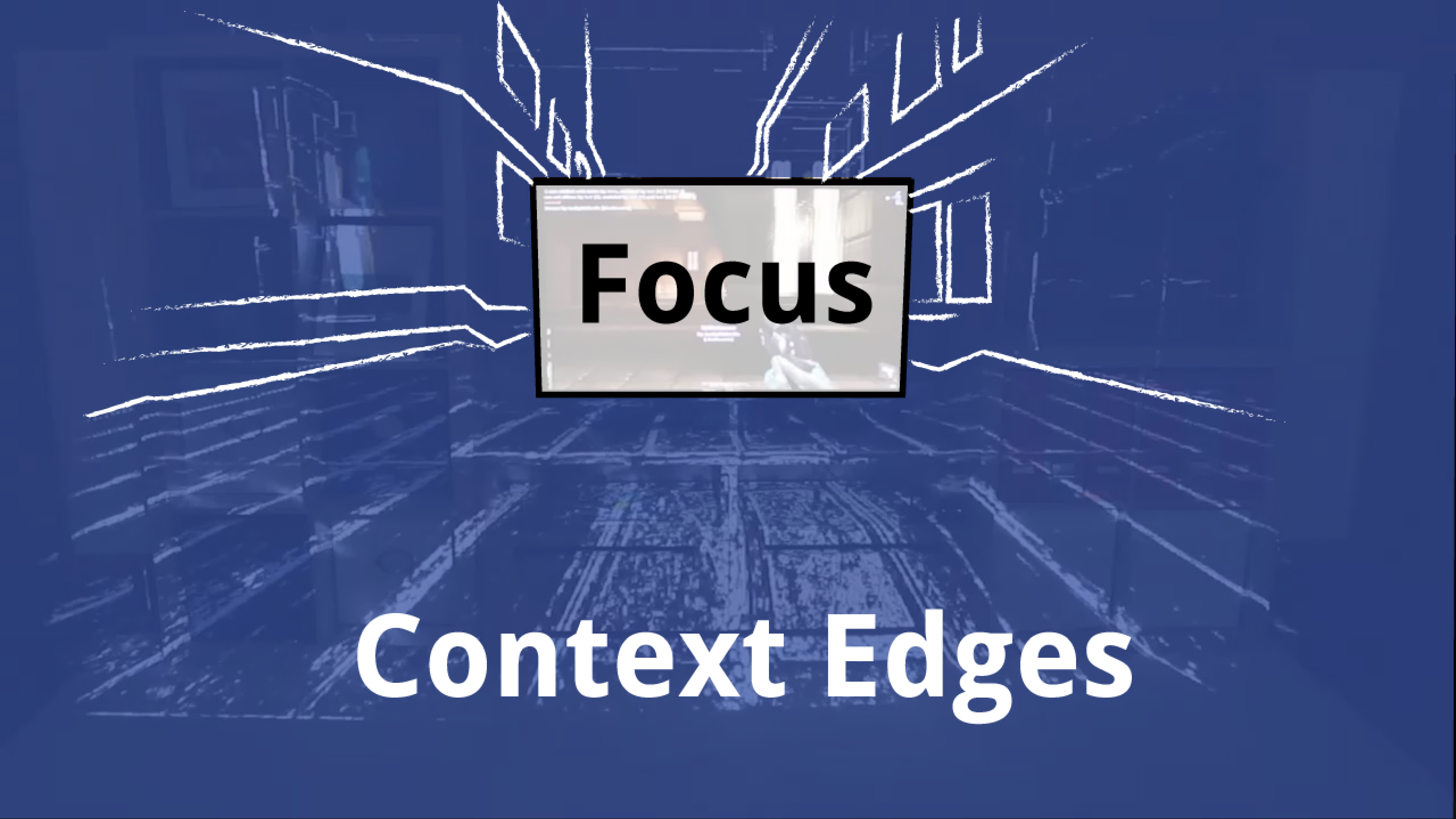
IllumiRoom

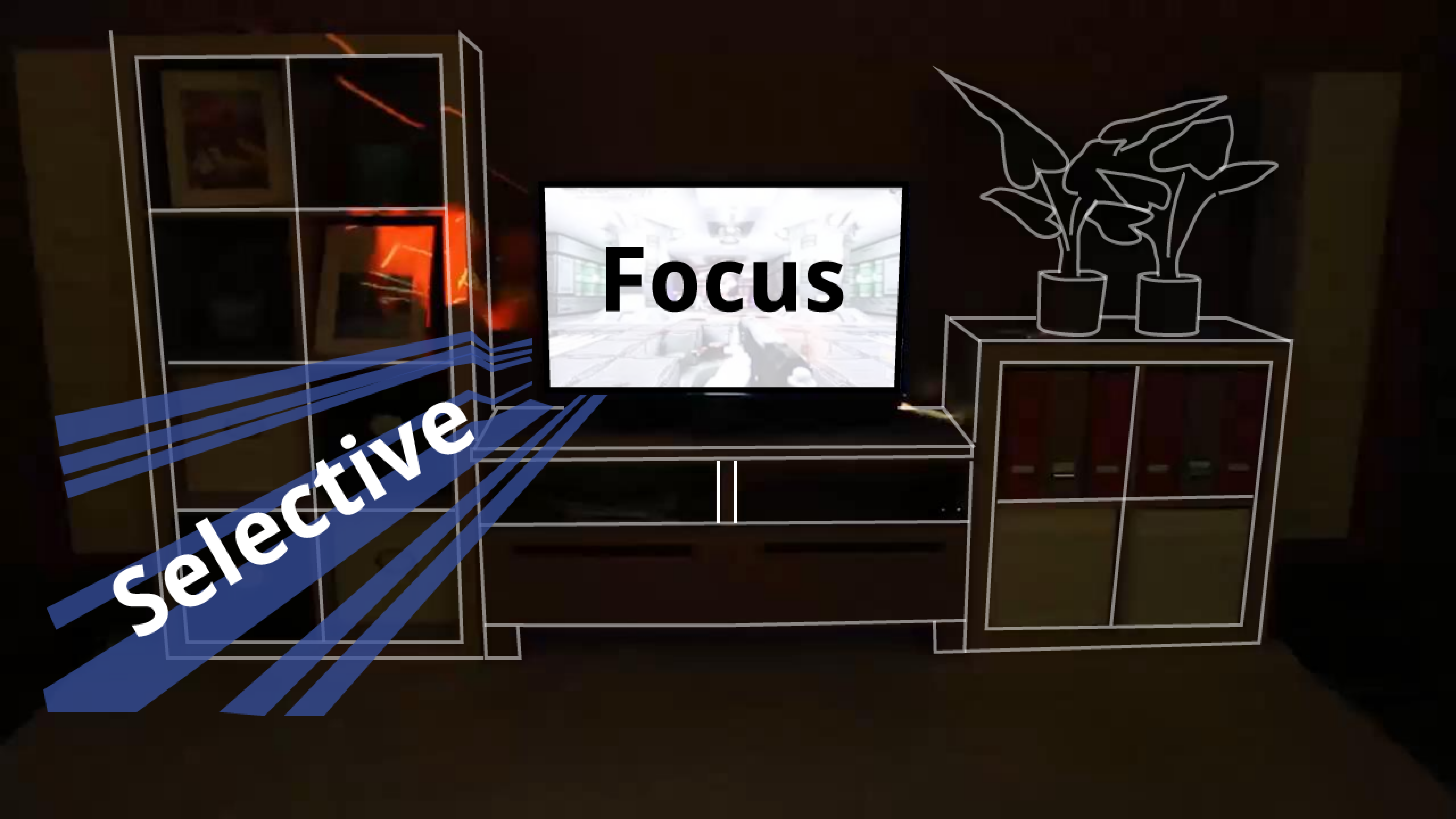
Jones, Benko, Ofek and Wilson, CES Las Vegas and ACM SIGCHI 2013

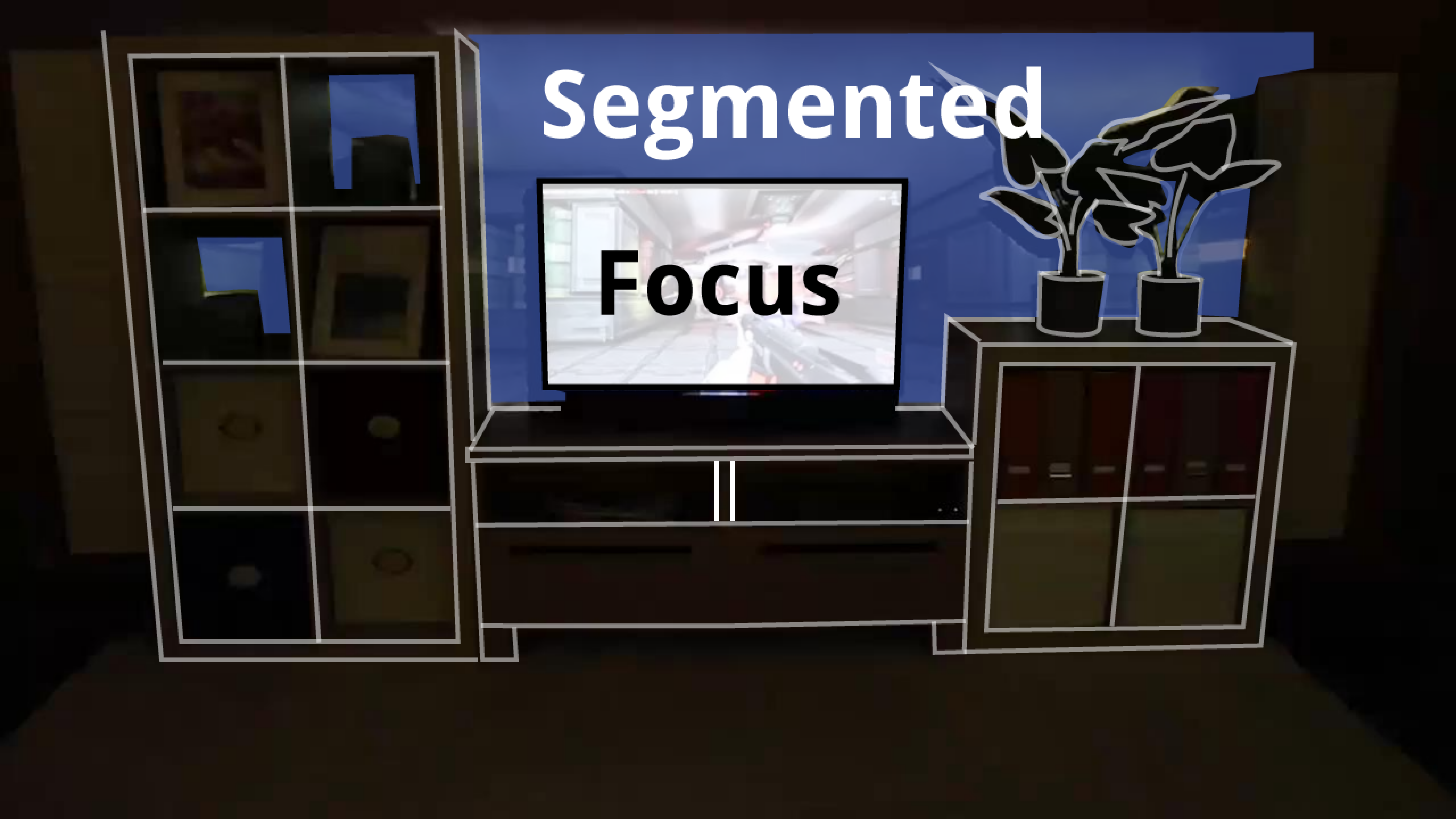

Focus
Context Full

The periphery does not need to be the same as the focus!



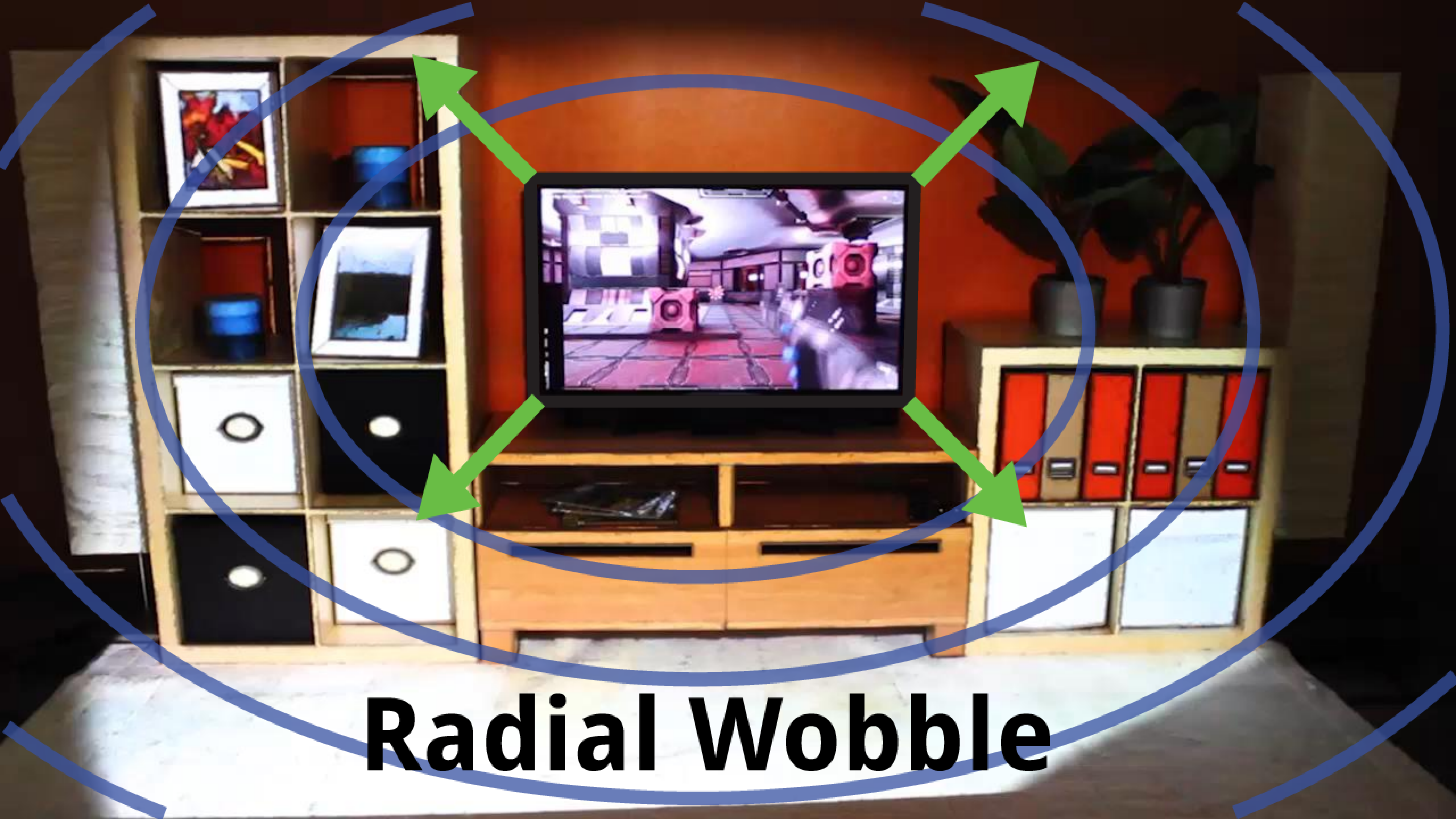

Focus
Context Edges


Focus
Selective


Segmented
Focus


Appearance


Snow


Radial Wobble


Lighting

Example #3

Perspective Projection Mapping

Surface Shading

IllumiRoom, CHI 2013

LightSpace, UIST 2010

RoomAlive, UIST 2014

Perspective 3D views?

Edgar Mueller

Felice Varini

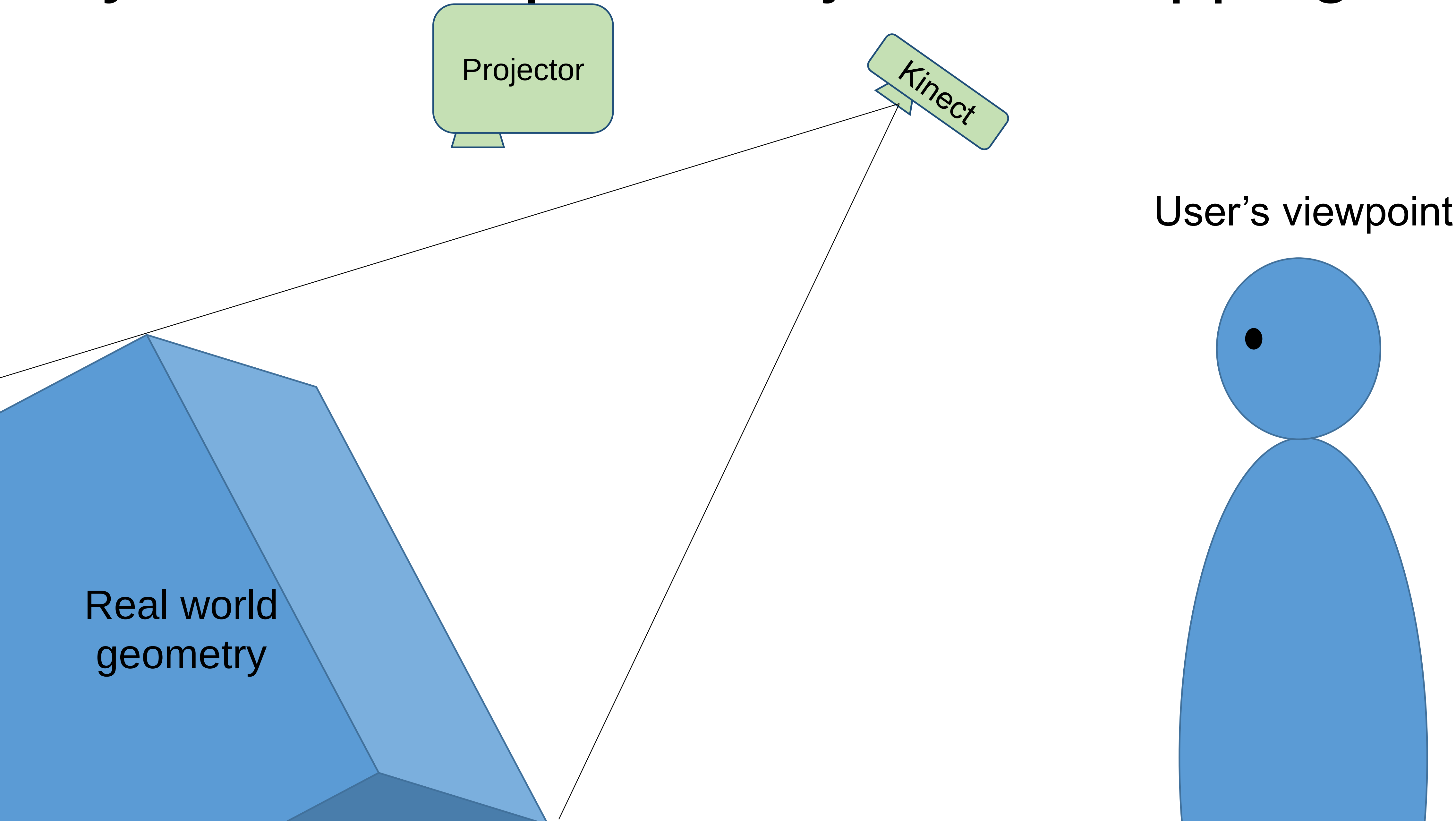

OUT

Pro-Cam Unit

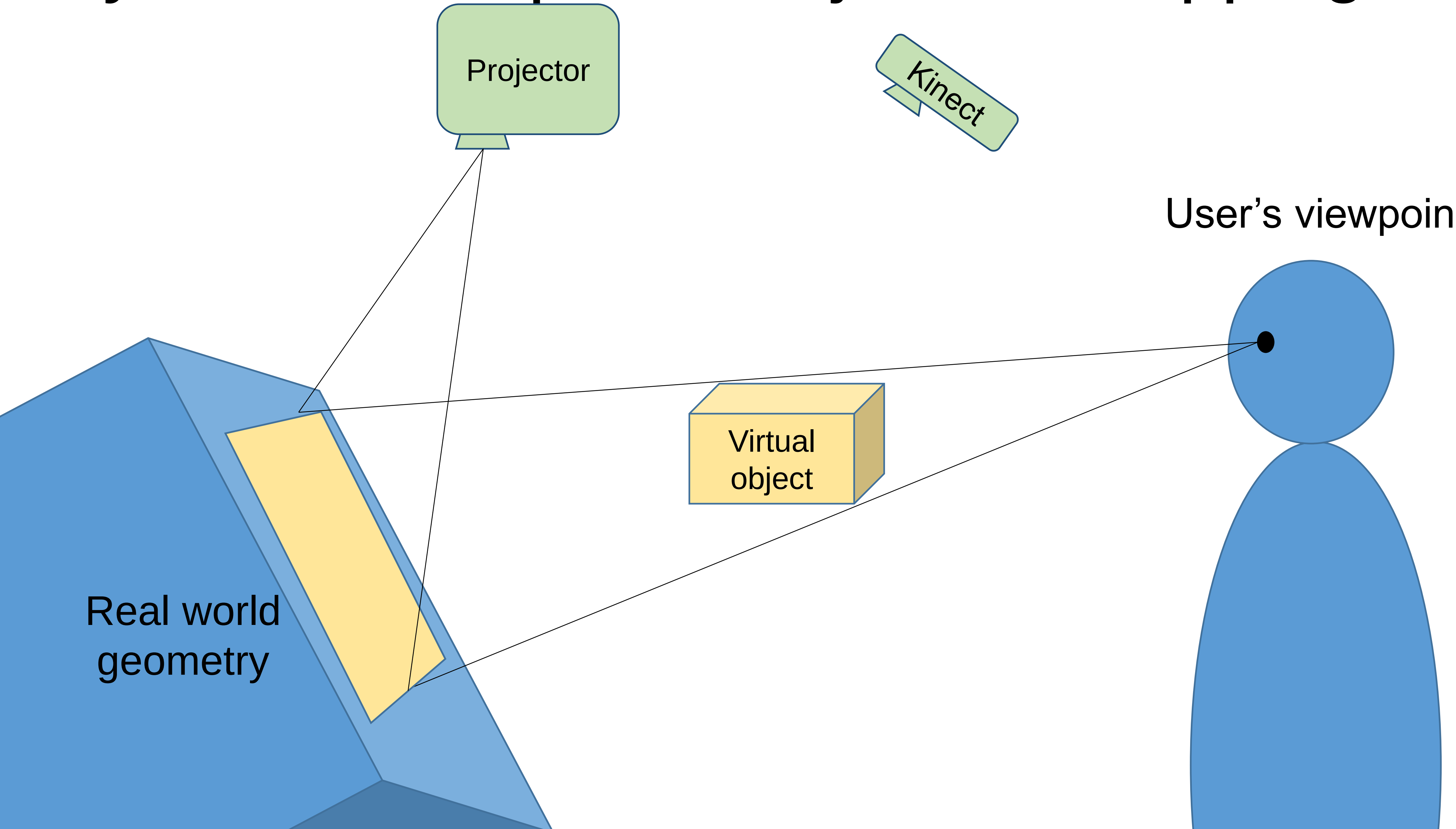
Projector

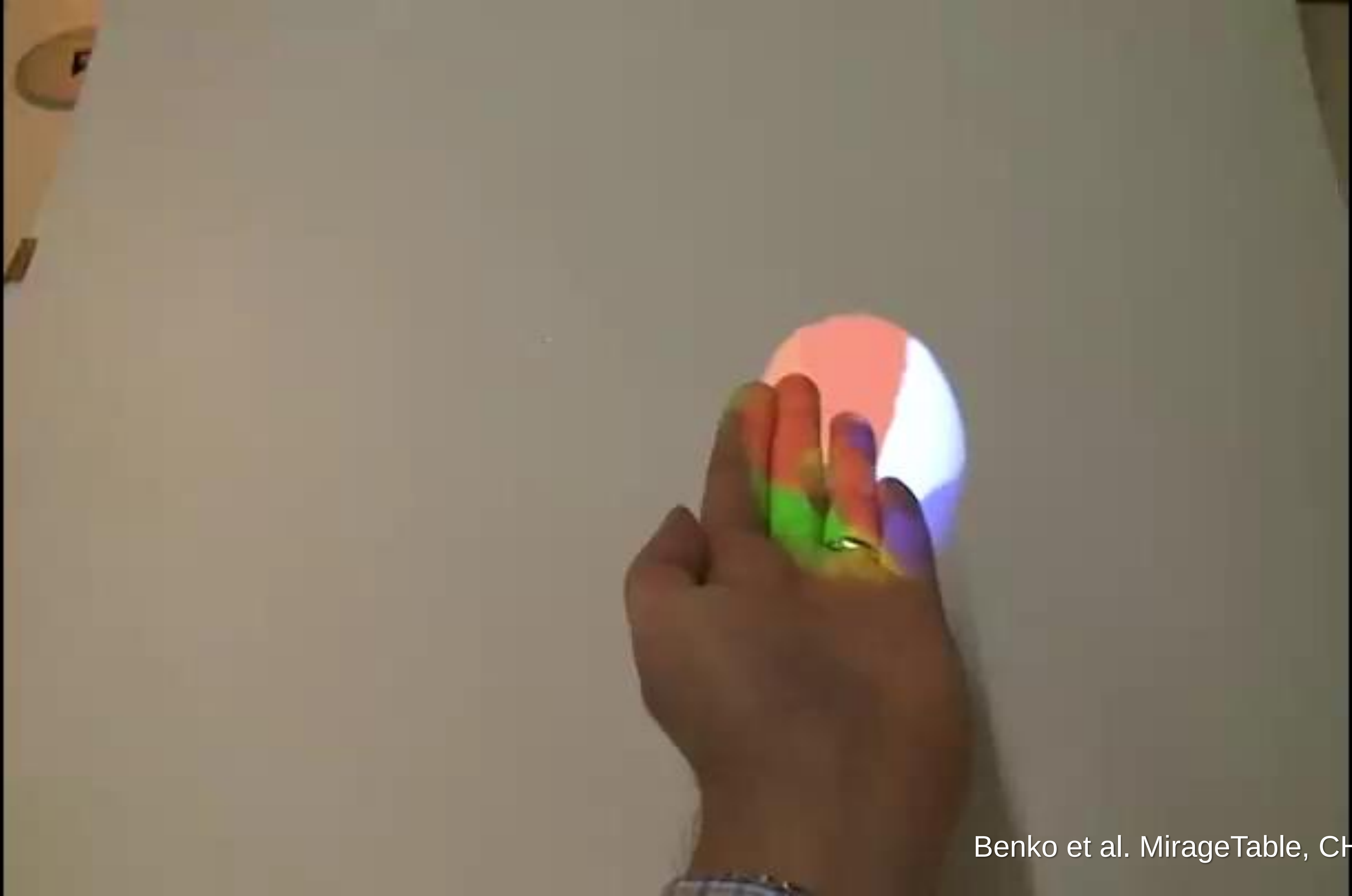
Depth Camera
(Kinect)

Dynamic Viewpoint Projection Mapping

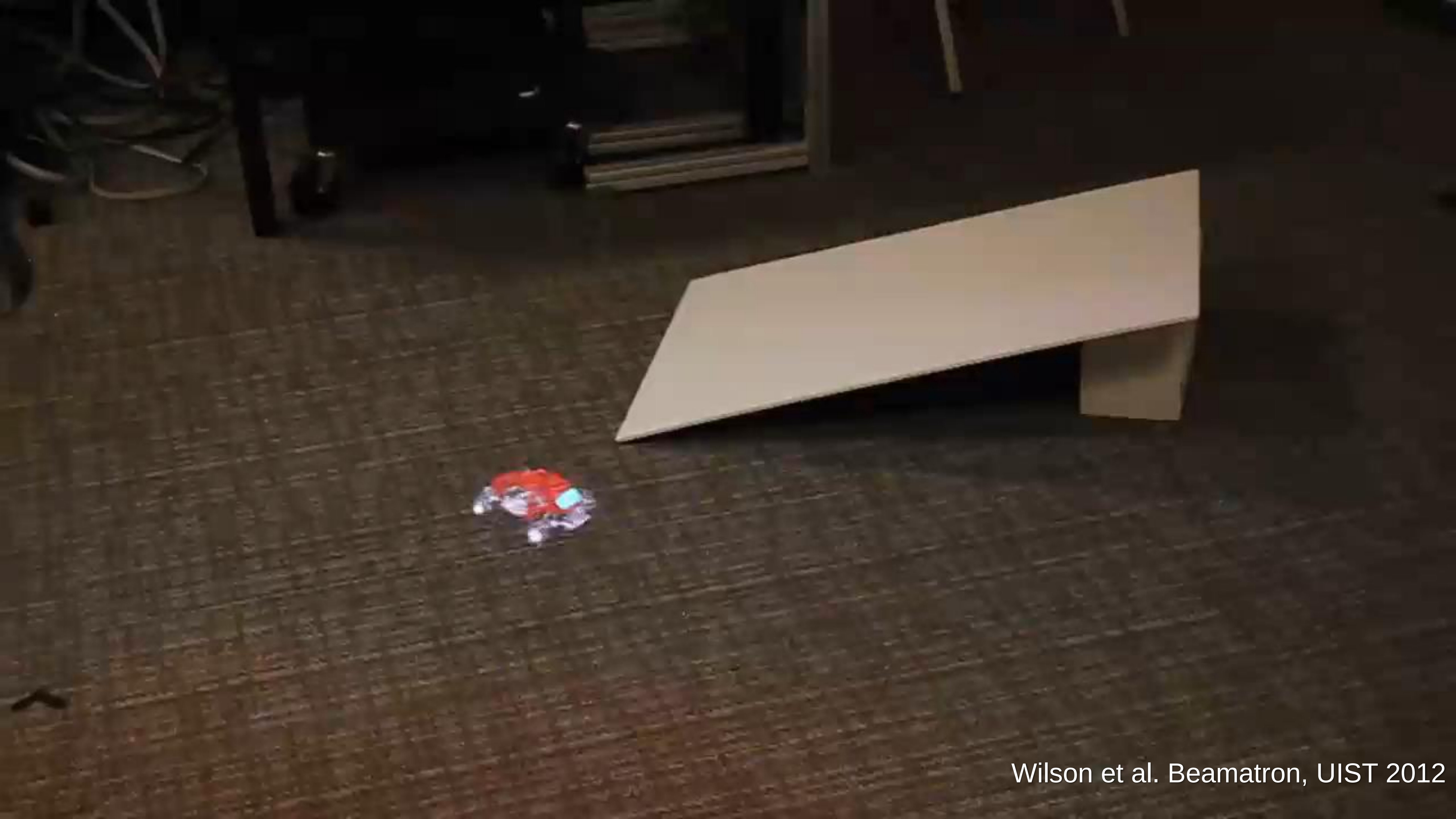


Dynamic Viewpoint Projection Mapping



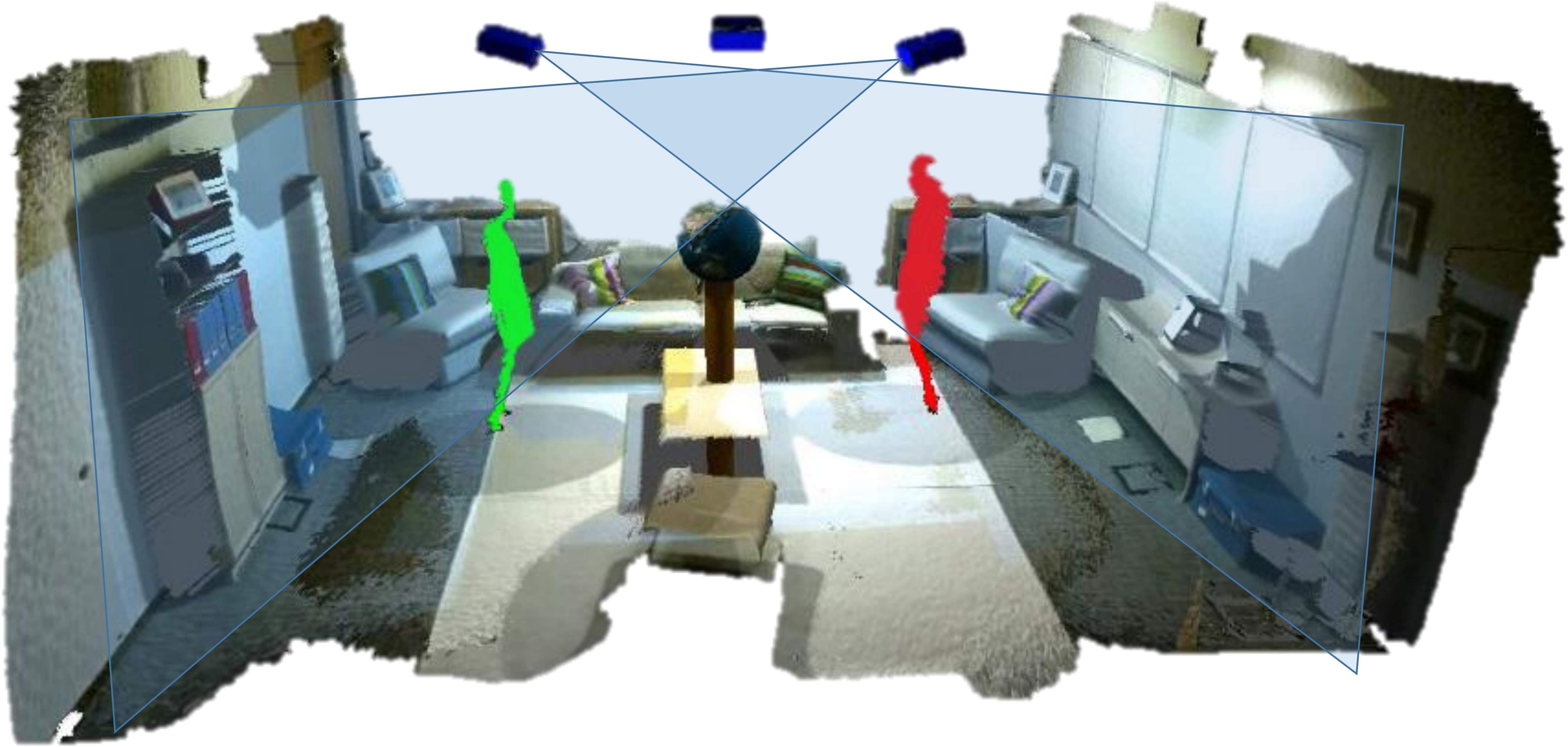


Benko et al. MirageTable, CHI 2012



Wilson et al. Beamatron, UIST 2012

We can even do this for two people!



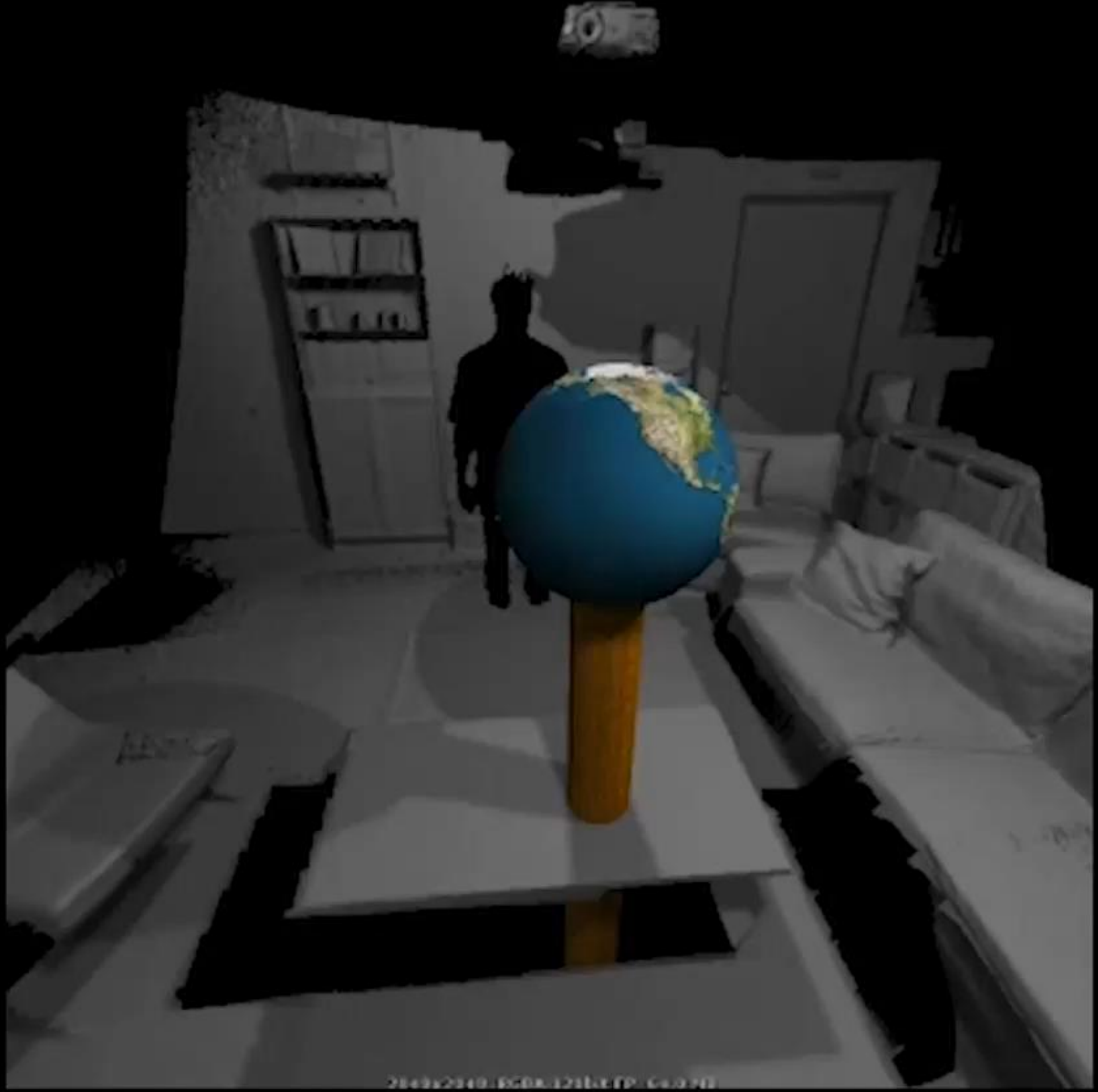
Benko, Wilson, and Zannier. ACM UIST 2014.

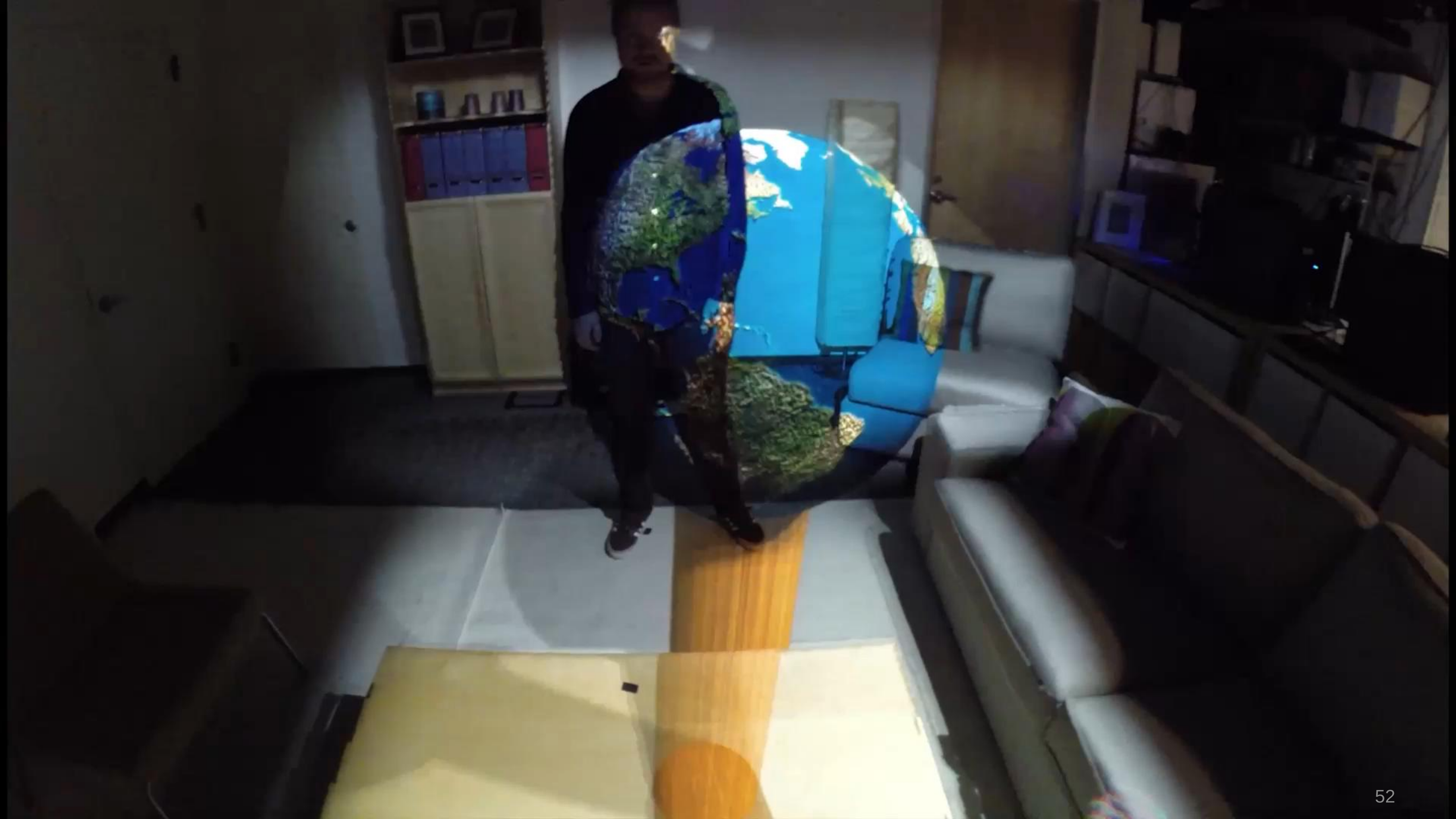

Target


Projected


User’s POV


OLD NAVY
CALIFORNIA



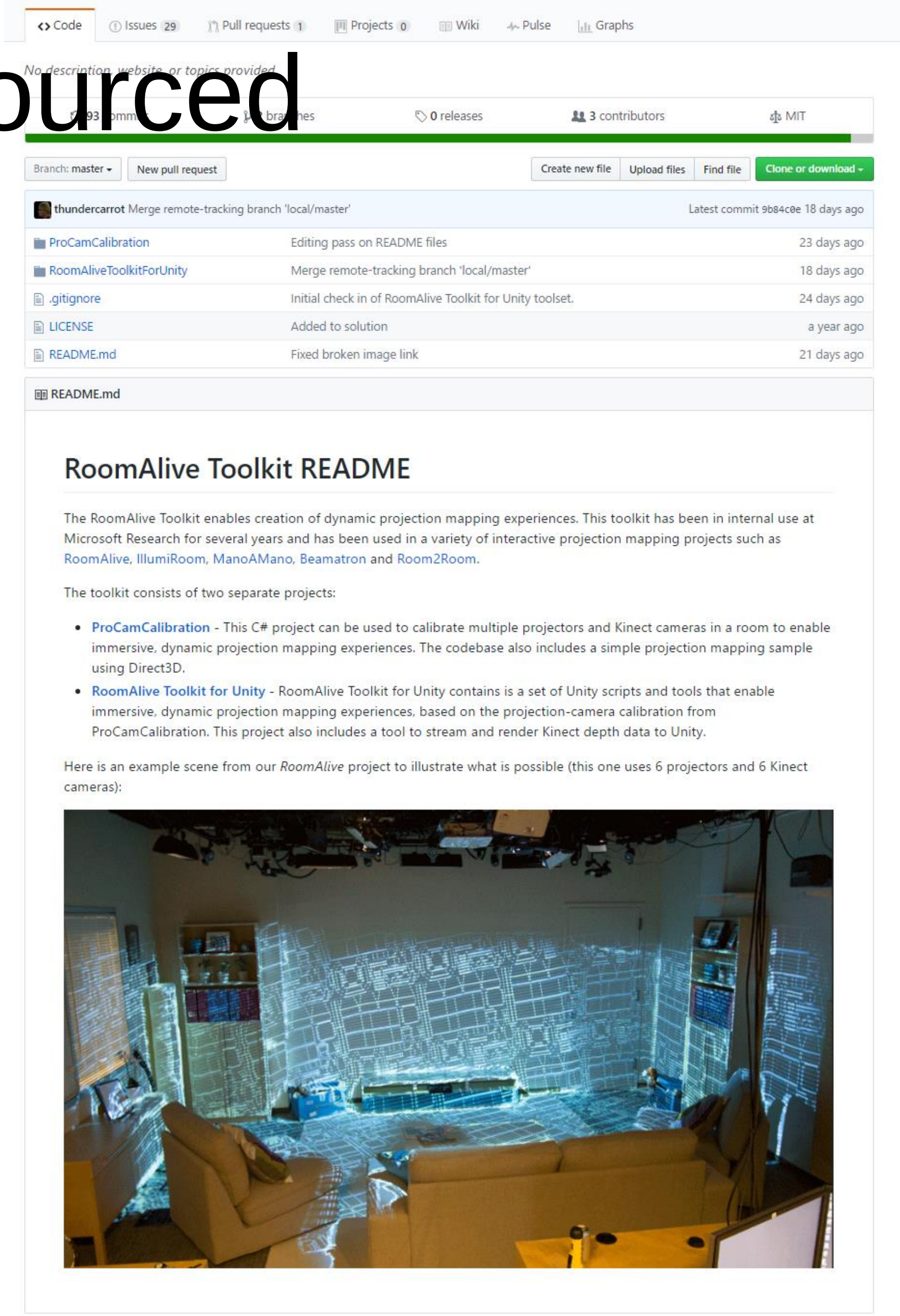


RoomAlive Toolkit is Open Sourced

Multi-Kinect multi-projector projection mapping toolkit

Includes: calibration utilities, real-time depth mesh streaming and rendering shaders, and Unity bindings

Get the code:
https://github.com/Kinect/RoomAliveToolkit/



Example #4

Haptic Retargeting

Realistic Haptics in VR?

Phantom

CyberGrasp Glove

Passive Haptics Rocks!

But, passive haptics approach doesn’t scale!

Haptic Retargeting

Dynamic Repurposing of Passive Haptics
for Enhanced Virtual Reality Experiences

Mahdi Azmandian, Mark Hancock
Hrvoje Benko, Eyal Ofek, Andy Wilson
Microsoft Research

SIGCHI 2016

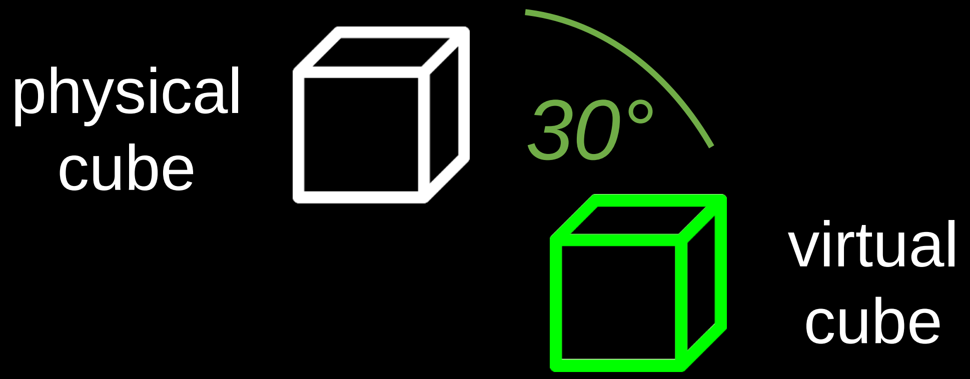
Body Warping

physical cube

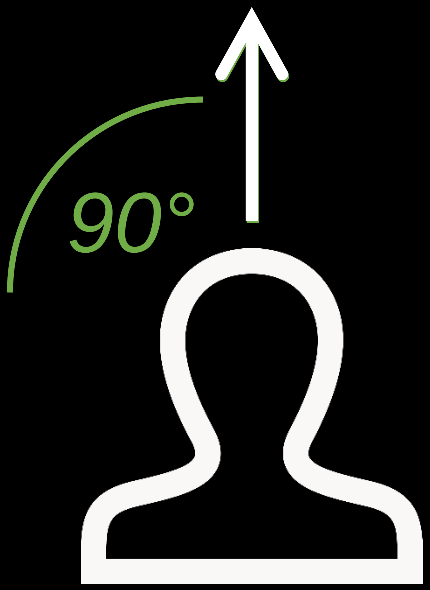
virtual cube

The Rendered Body Shifts to The Right

World Warping

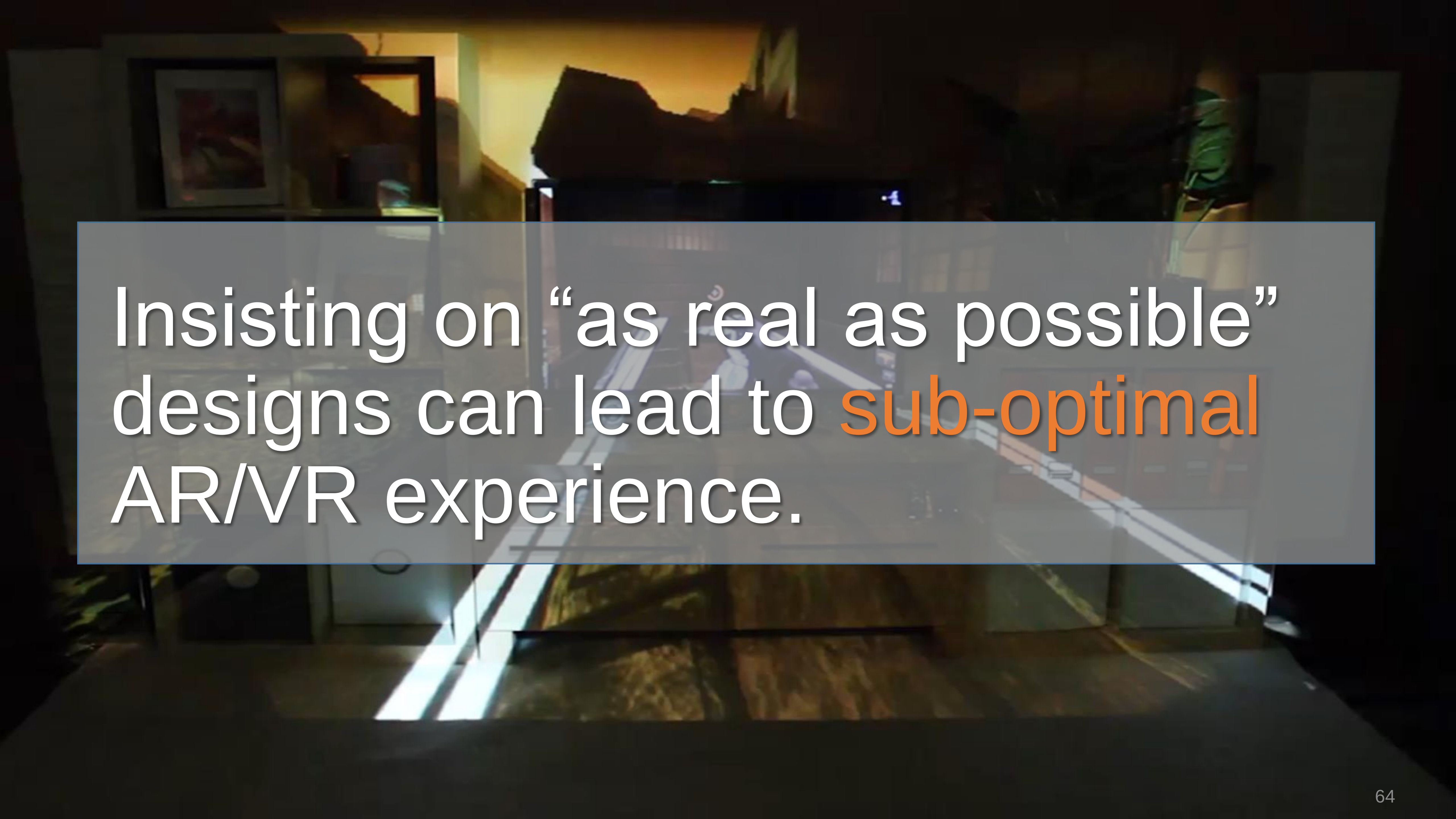


The World Also Rotates
(At Different Rate)



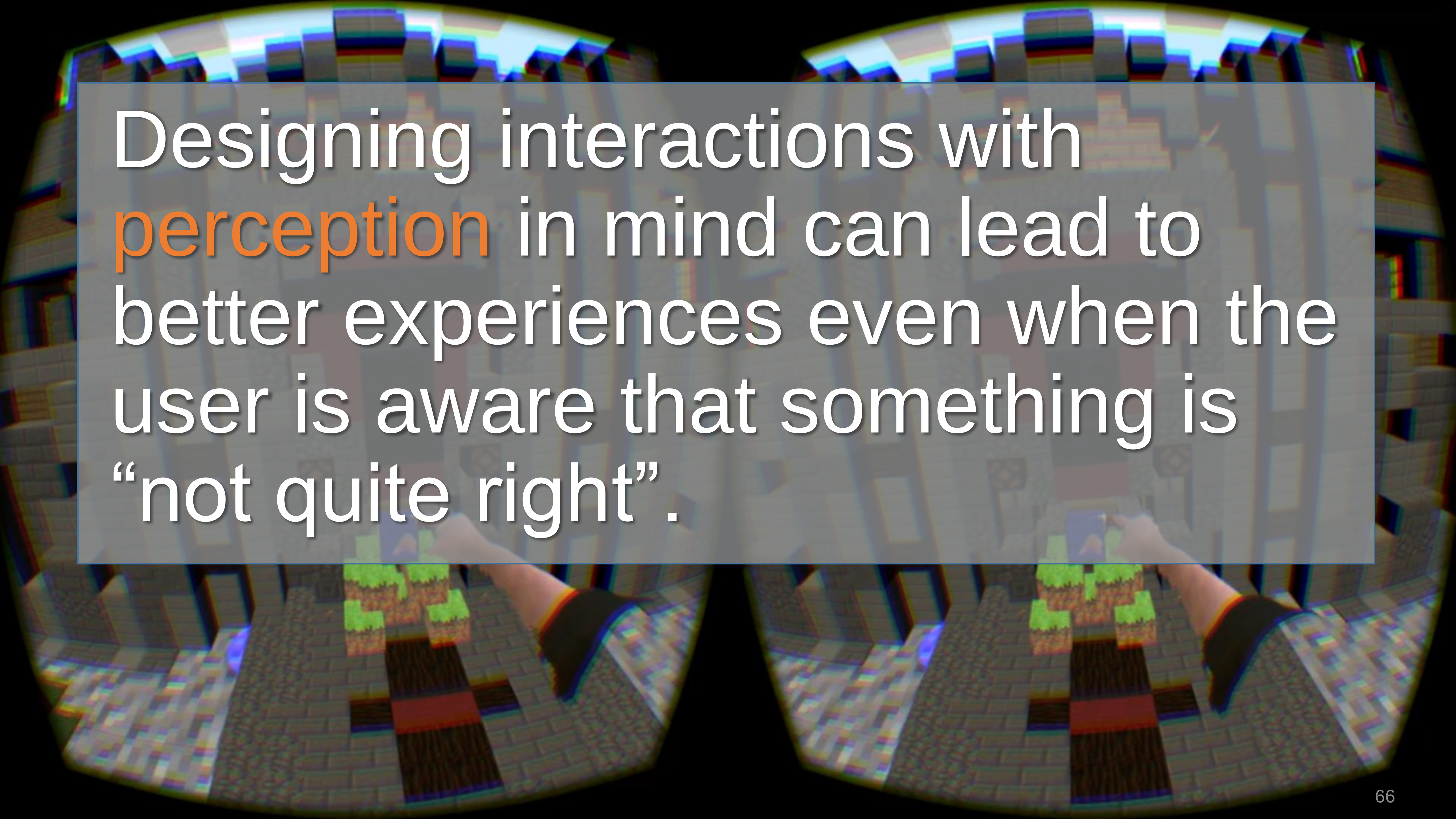
Putting it all together…

Haptic retargeting allows physical props to be reused for haptics by leveraging the dominance of vision to retarget people's hand motions.



Insisting on “as real as possible” designs can lead to sub-optimal AR/VR experience.

Human perception offers clues on how to effectively engage and trick the user.



Designing interactions with perception in mind can lead to better experiences even when the user is aware that something is “not quite right”.

To get the best VR/AR experience, one should cheat as much as possible in a perceptually salient way.

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