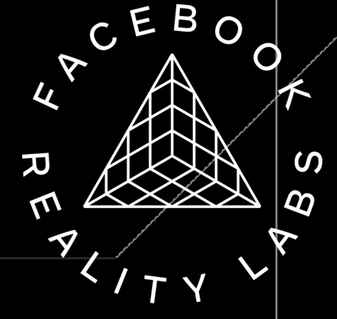
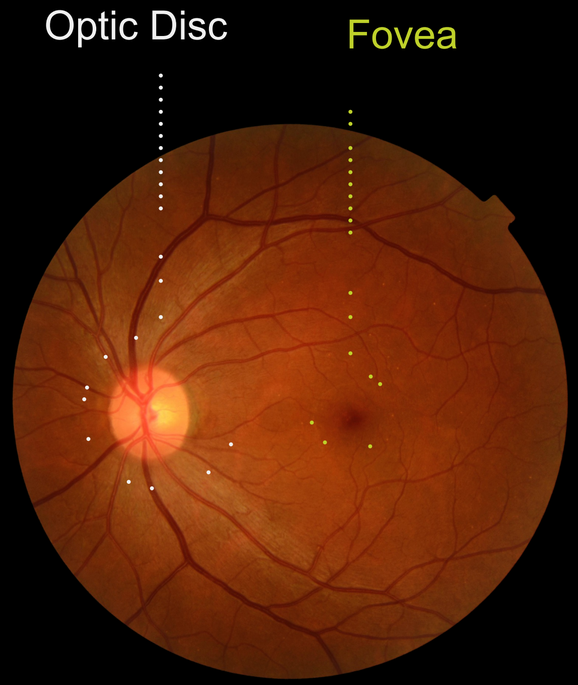
Human perception challenges in AR design

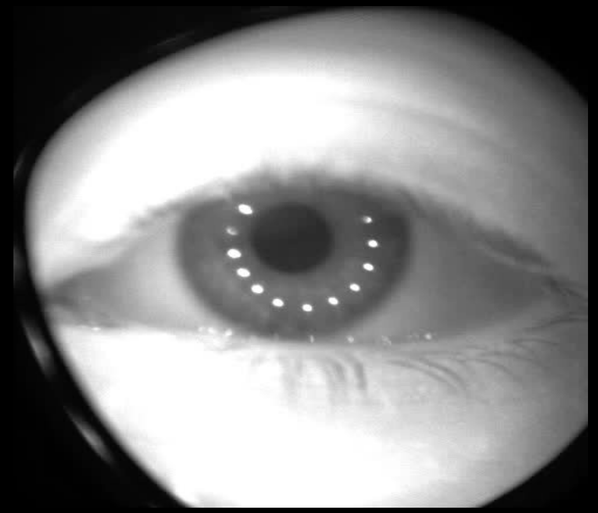
Byron Taylor
FRL

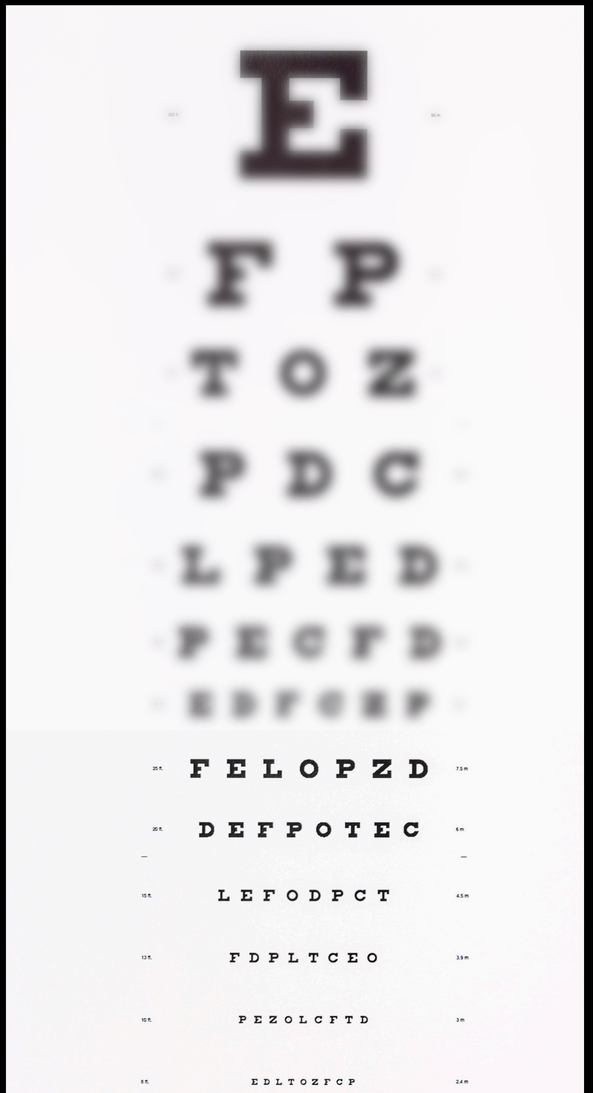


June 2021

Want to see in the dark?


Optic Disc
Fovea




E
F P
T O Z
P D C
L P E D
P E C F D
E D F C Z P
F E L O P Z D
D E F P O T E C
L E F O D P C T
F D P L T C E O
P E Z O L C F T D
E D L T O Z F C P

VR

Oculus Rift and Rift S

Oculus Go

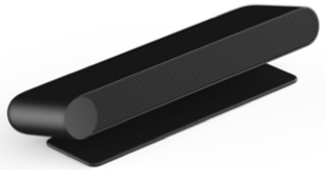
Oculus Quest

Portal

Portal+

Portal

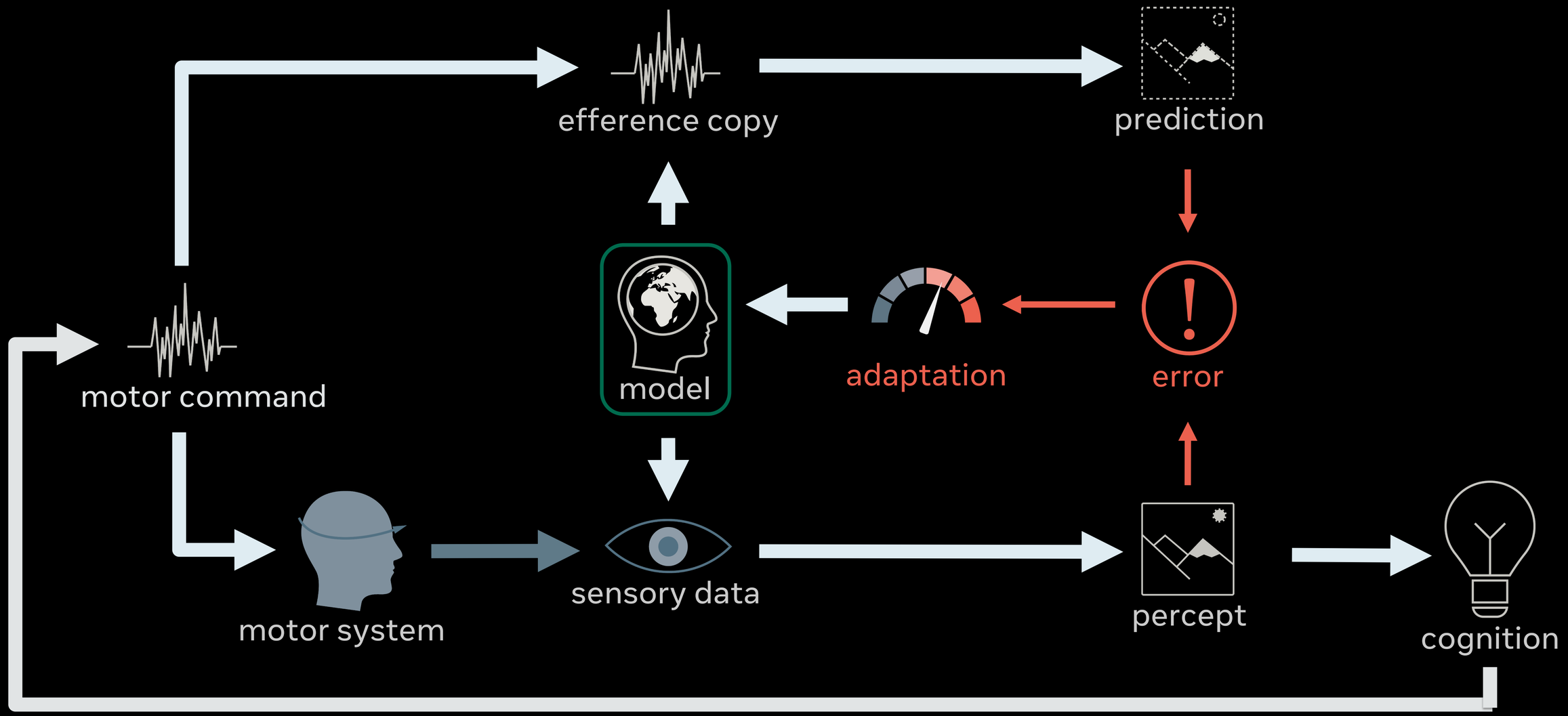
Portal Mini

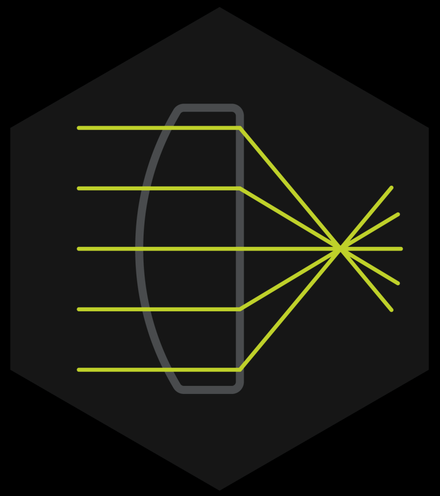


Portal TV

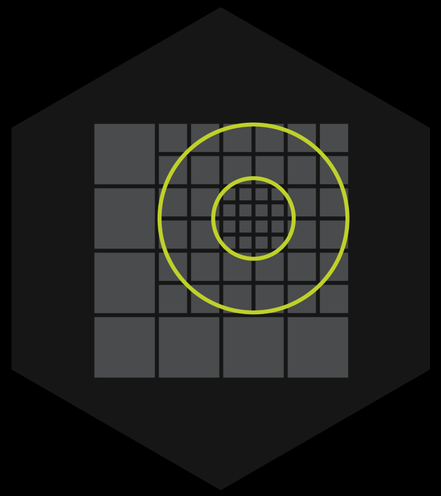
246

the sensorimotor loop

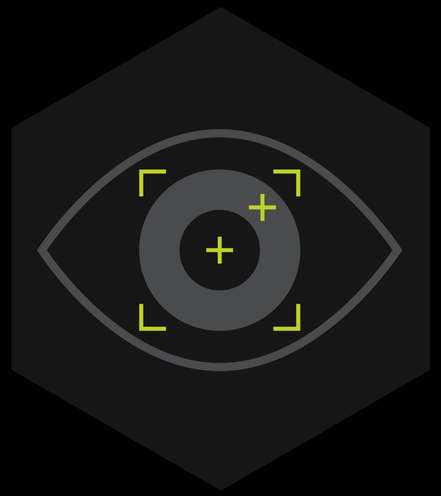




OPTICS & DISPLAYS



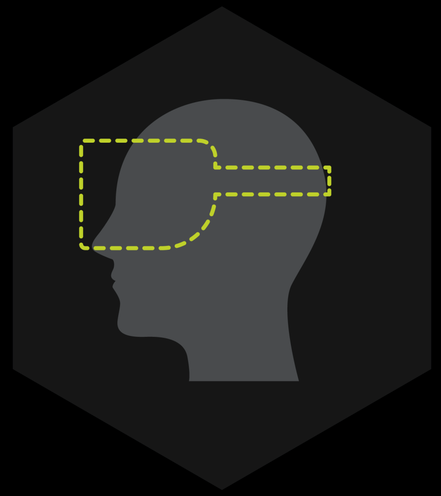
GRAPHICS



EYE
TRACKING

AUDIO

INTERACTION



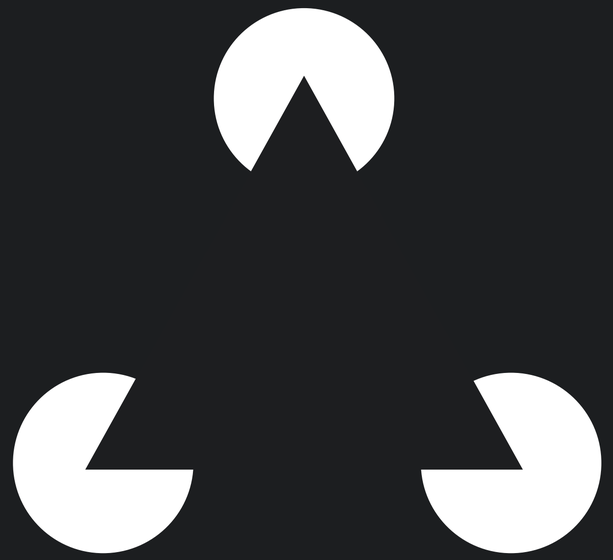
ERGONOMICS

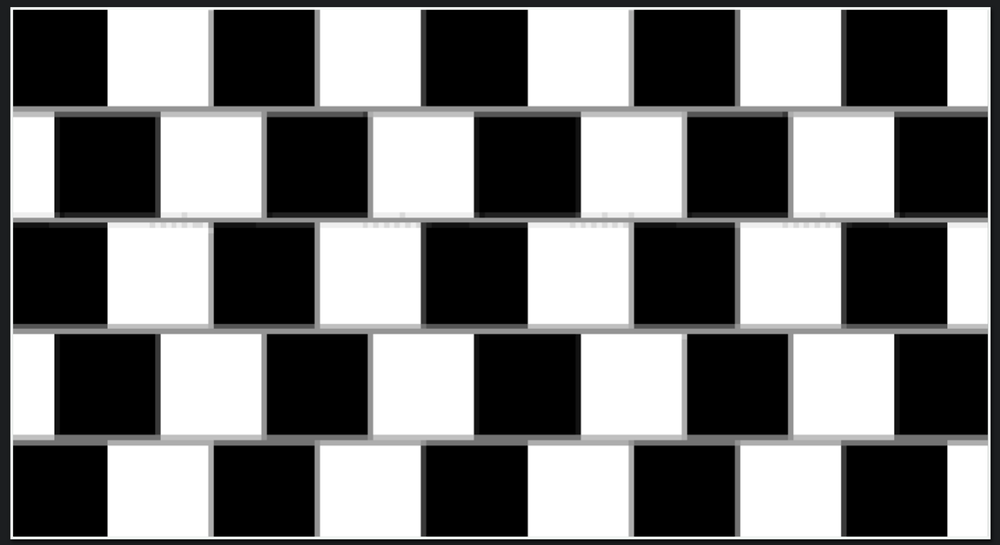
COMPUTER VISION

The visual system does not create

exact representations

of the physical world.





Gregory, R.L., Heard, P., Perception (Volume 8, Issue 4)
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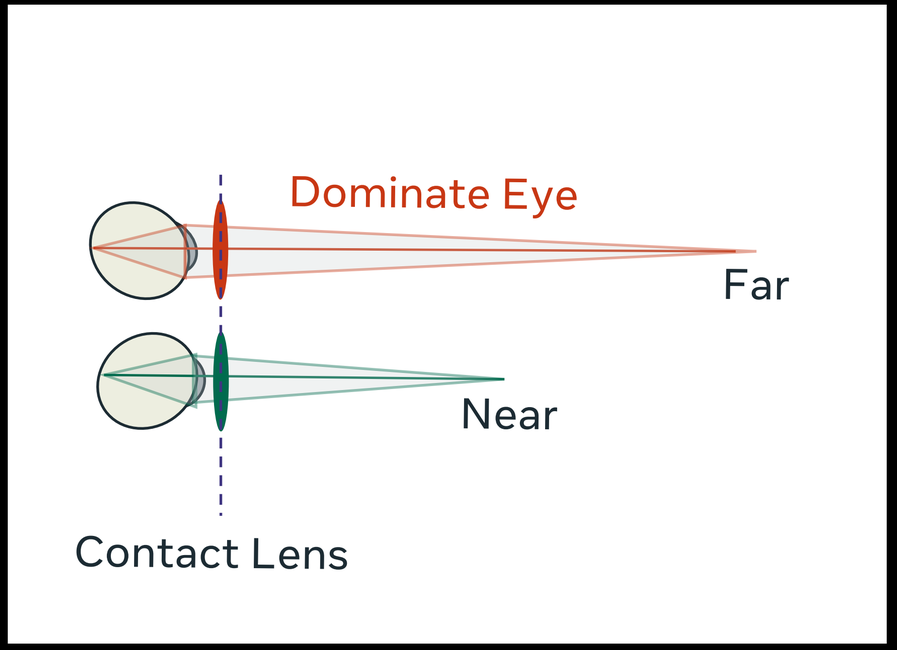
Adaptation

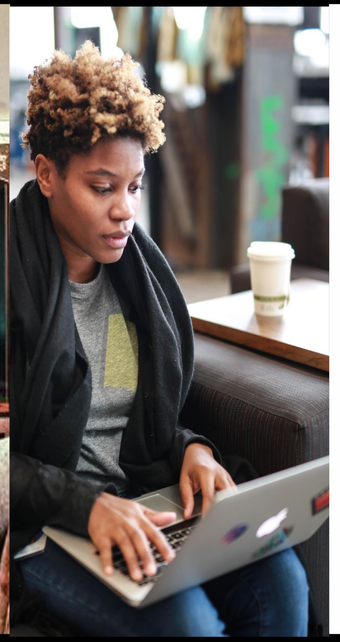
Blended Vision

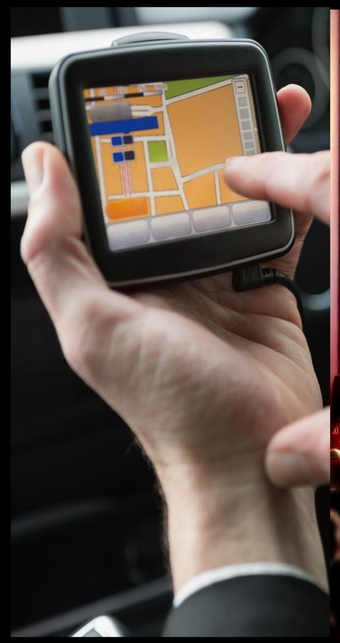


Prism Adaptation

Von Helmholtz, & Southall (2005). *Treatise on physiological optics* (Vol. 3). Courier Corporation.

Emissive Displays

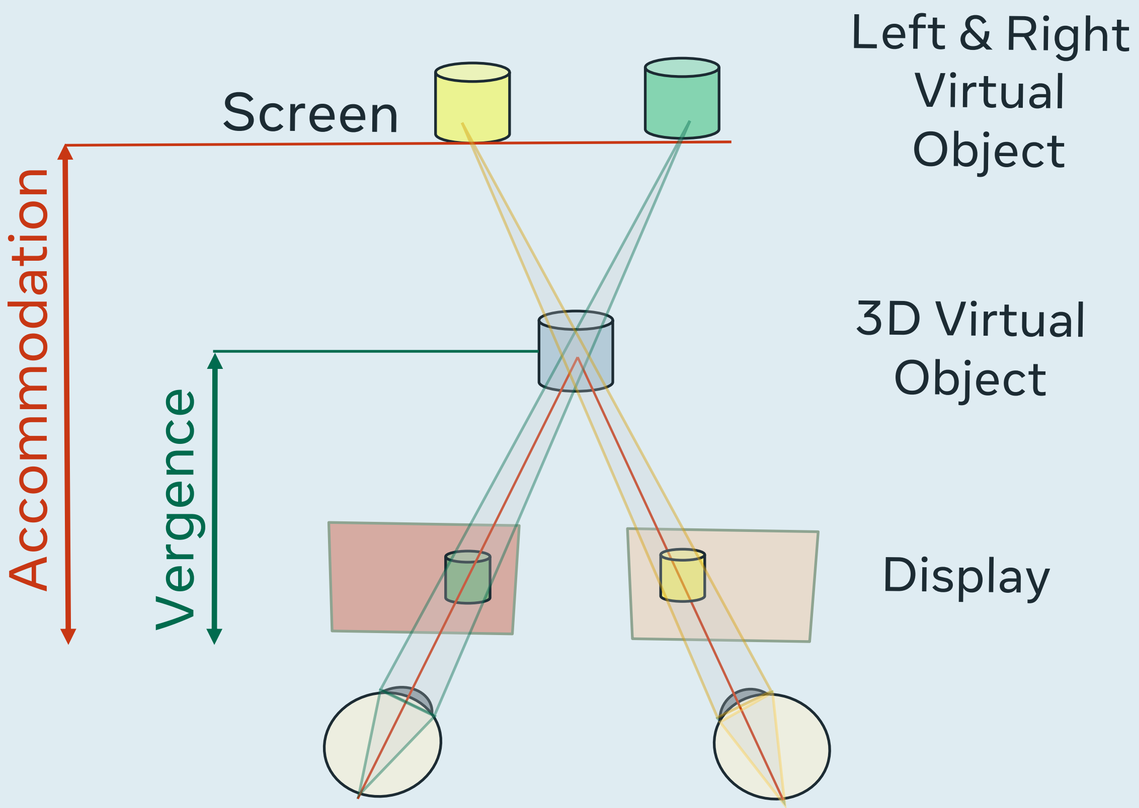




Virtual 3D Images

People participate in accommodation-vergence conflict in VR to get 3D images

- **Accommodation** driven by image blur
- **Vergence** driven by binocular image disparity
- **Accommodation** and **vergence** are normally coupled



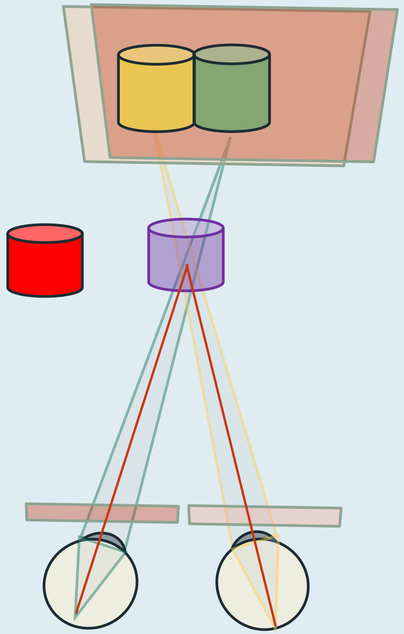
AR displays pose a challenge to current metrics due to challenges with additivity and dynamically changing environments.

Additive Displays

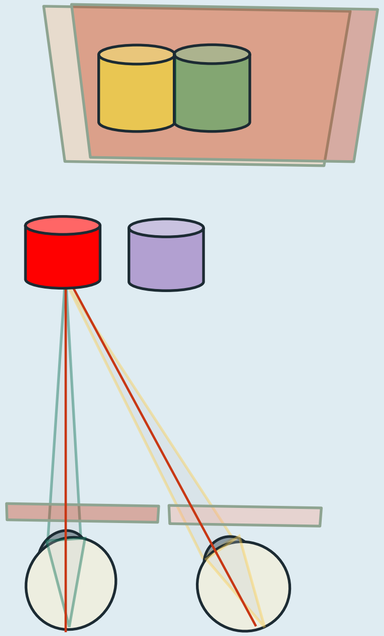
Background is uncontrolled

Objects switch from Virtual to Real

Focus on Virtual Object



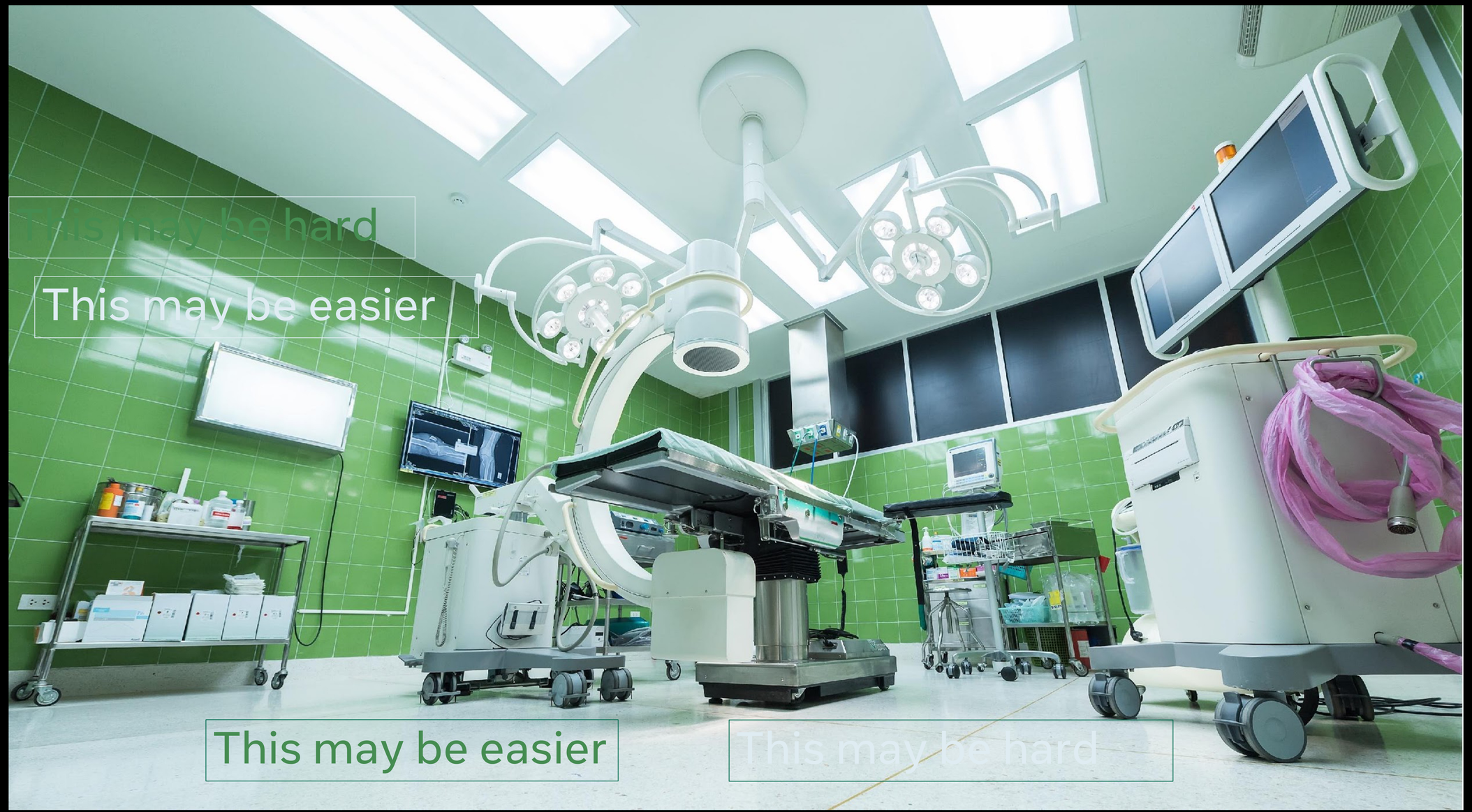
Focus on Real Object

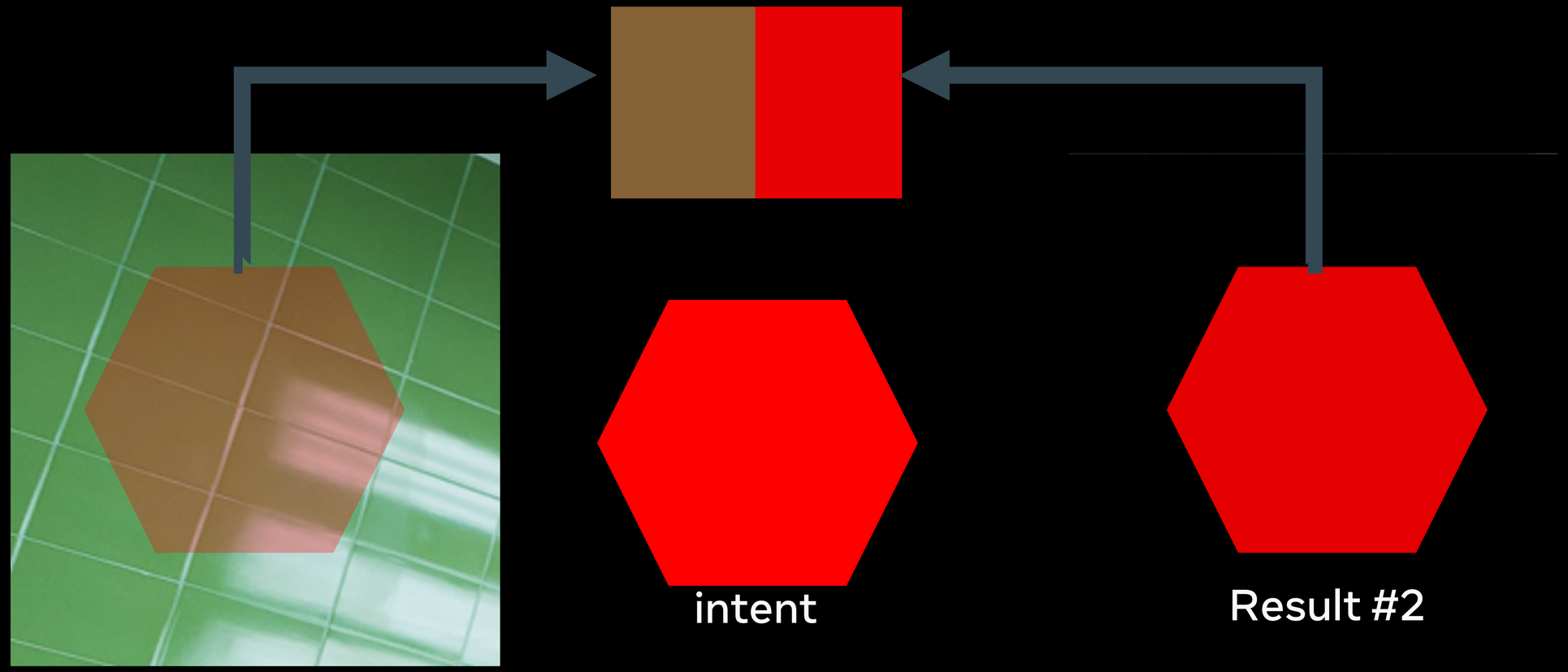


Additive text is hard(er) to read

Improving legibility

Color contrast




intent
Result #2
Result #1

Final Thoughts

The most challenging part of AR design might not be the hardware, but understanding the minimum requirement set (i.e. shortcuts) for immersion and engagement from people.

We are only beginning to understand what is going to make compelling AR from a human perceptual perspective, i.e. what matters and what does not matter.

Equations will not fully guide us, so development in this field will only progress through actual studied interaction with hardware across a wide set of people. It is going to be exciting to watch the development. Stay tuned, I know I will…

Thank you

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