

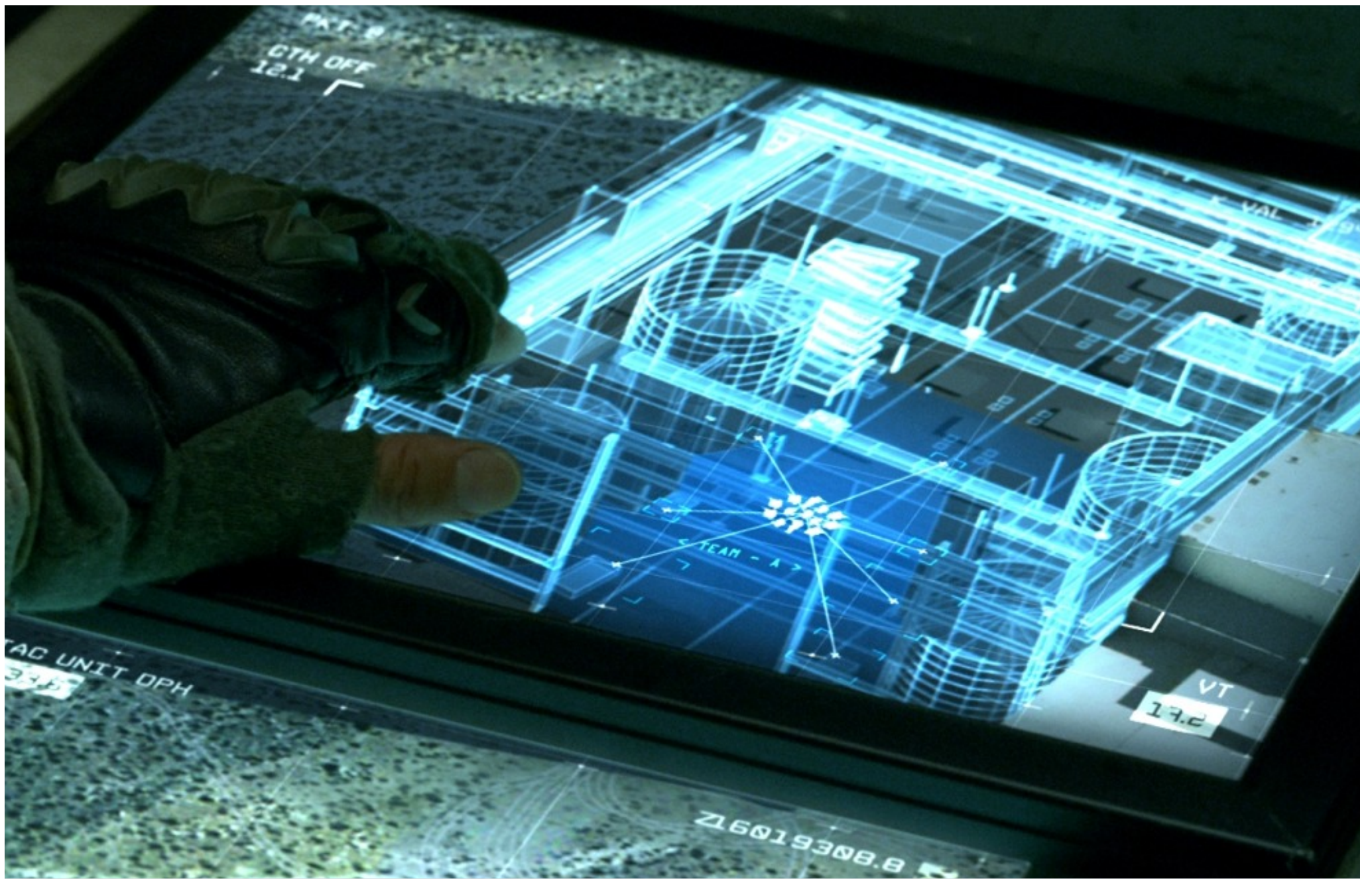
PERCEPTION & ACTION

ISIS3D Tutorial @ ITS 2013, St Andrews

Florian Daiber, Bruno Rodrigues De Araujo
Frank Steinicke, Wolfgang Stuerzlinger

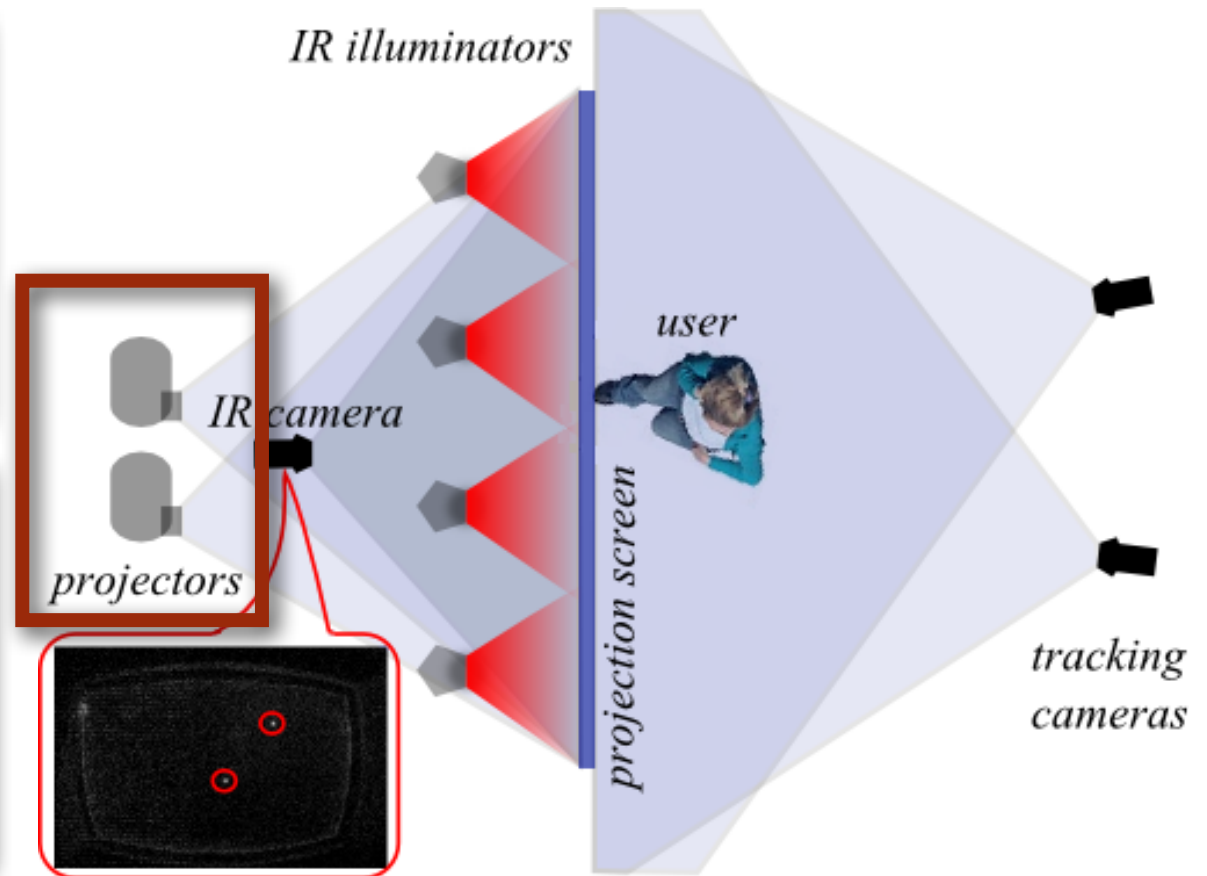


S. Spielberg: Minority Report, 2002



S. Sommers: *G.I. Joe*, 2009

TOUCHING THE 3RD DIMENSION



Bimanual (Multi-Touch-)Interaction, INTERACT 2009

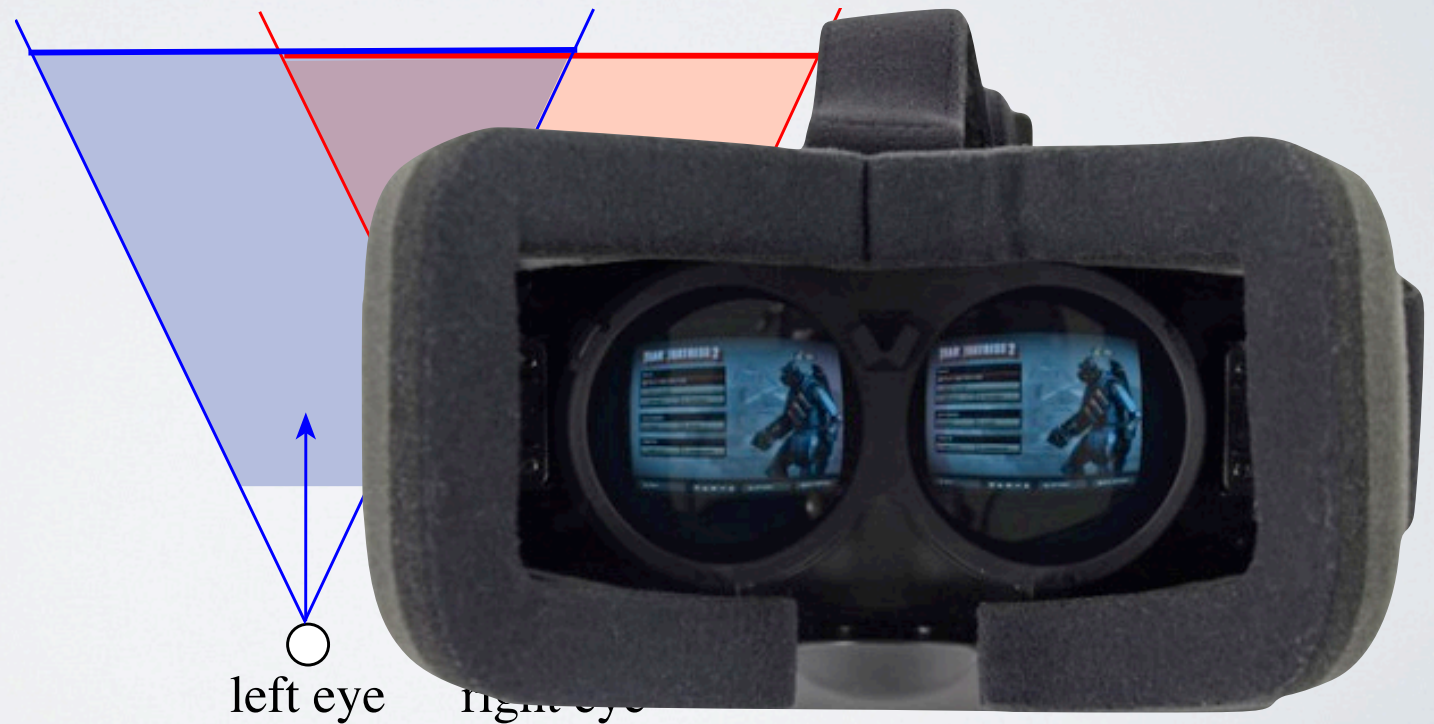
3D STEREOGRAPHICS





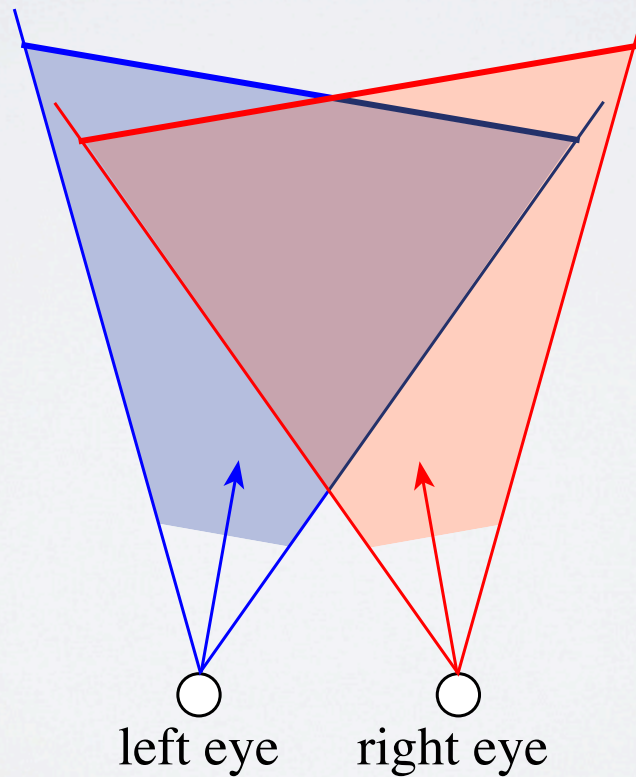
3D STEREOGRAPHICS

- *On-Axis*: translation of camera



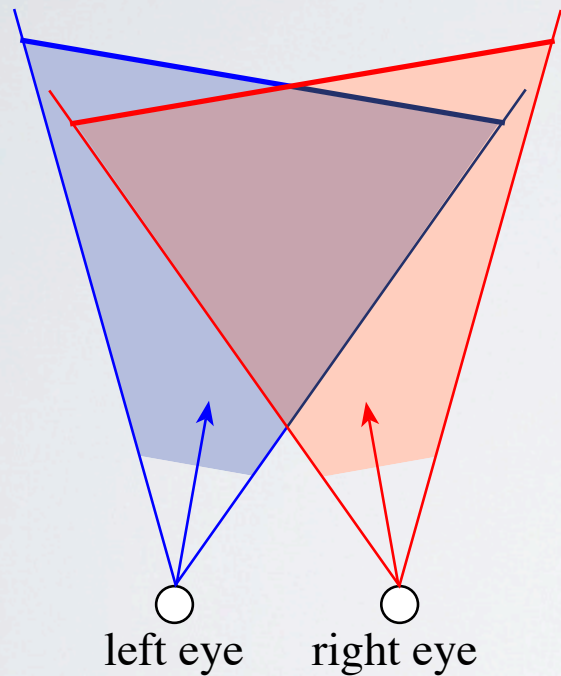
3D STEREOGRAPHICS

- *Toe-In*: translation and rotation of cameras

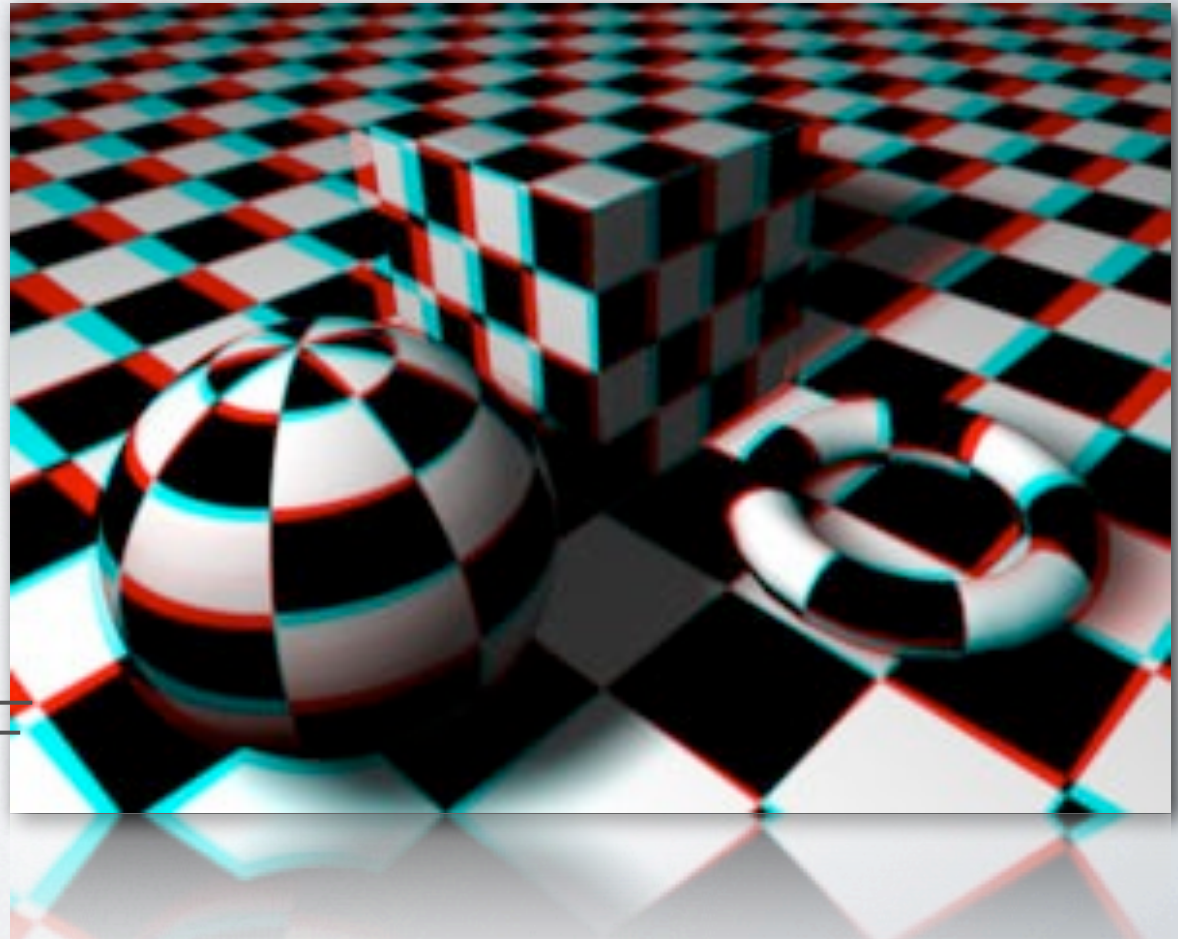


3D STEREOGRAPHICS

- drawback: vertical parallaxes

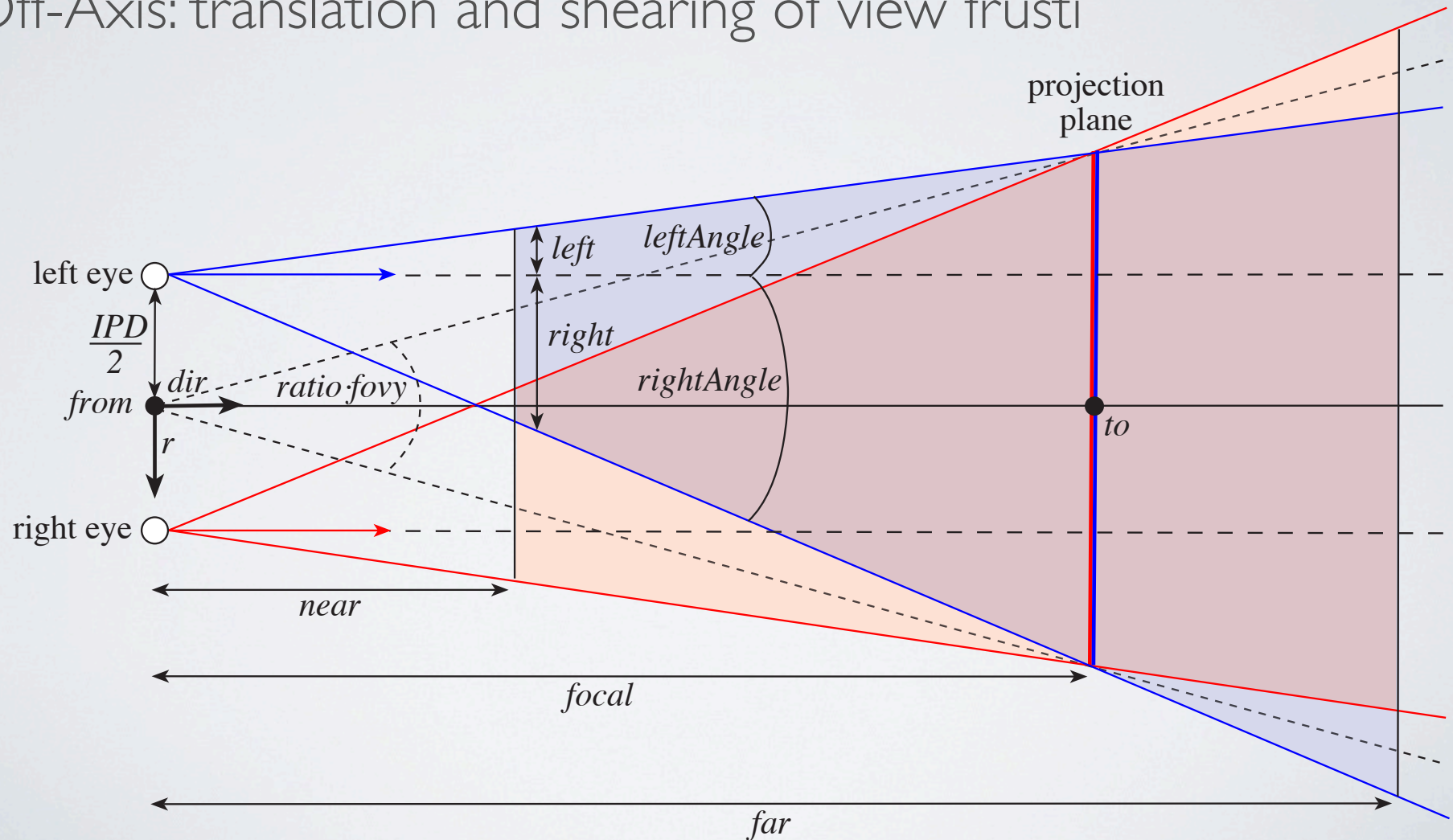


vertical parallaxes **I** 

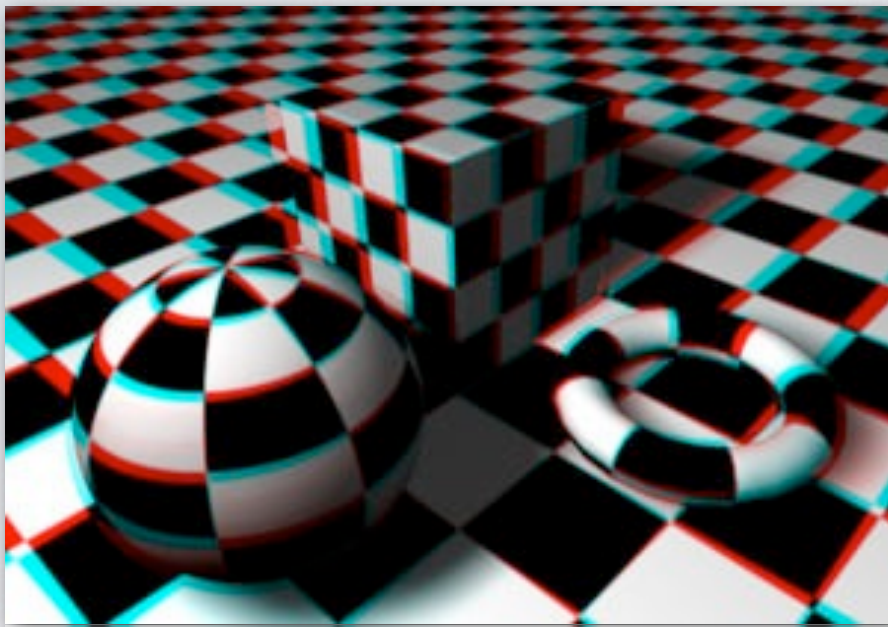


3D STEREOGRAPHICS

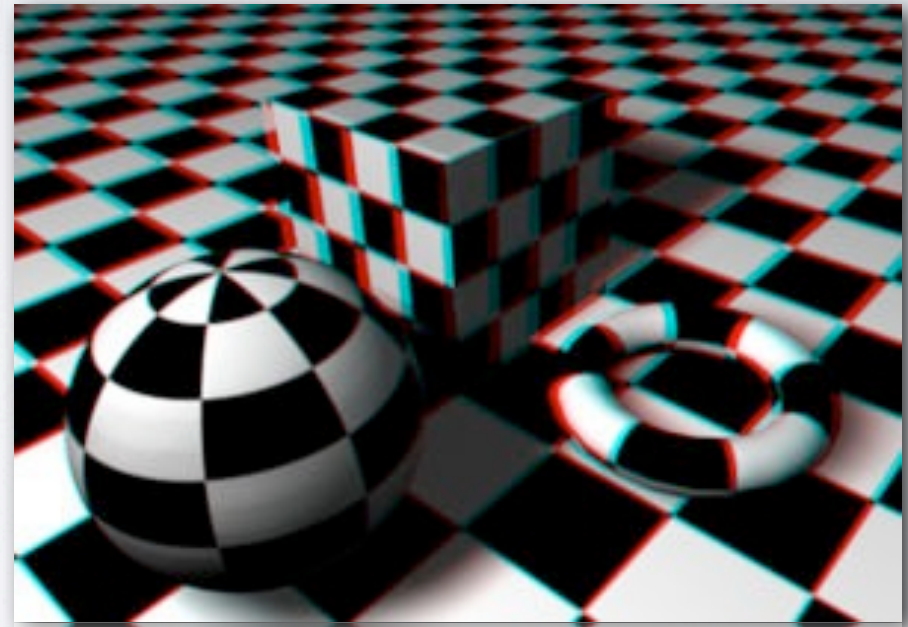
- Off-Axis: translation and shearing of view frusti



EXAMPLE: TOE-IN VS. OFF-AXIS

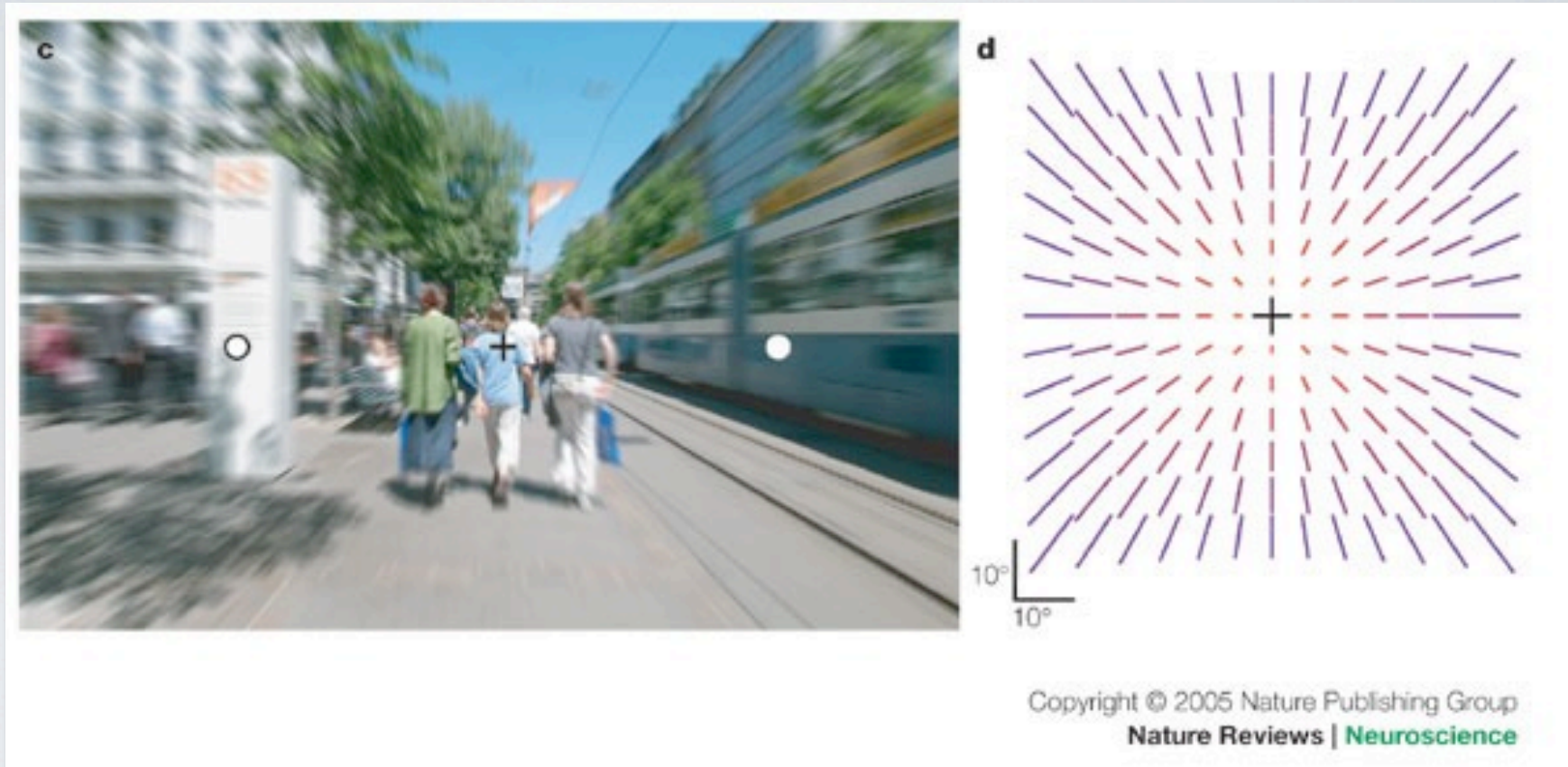


Toe-In



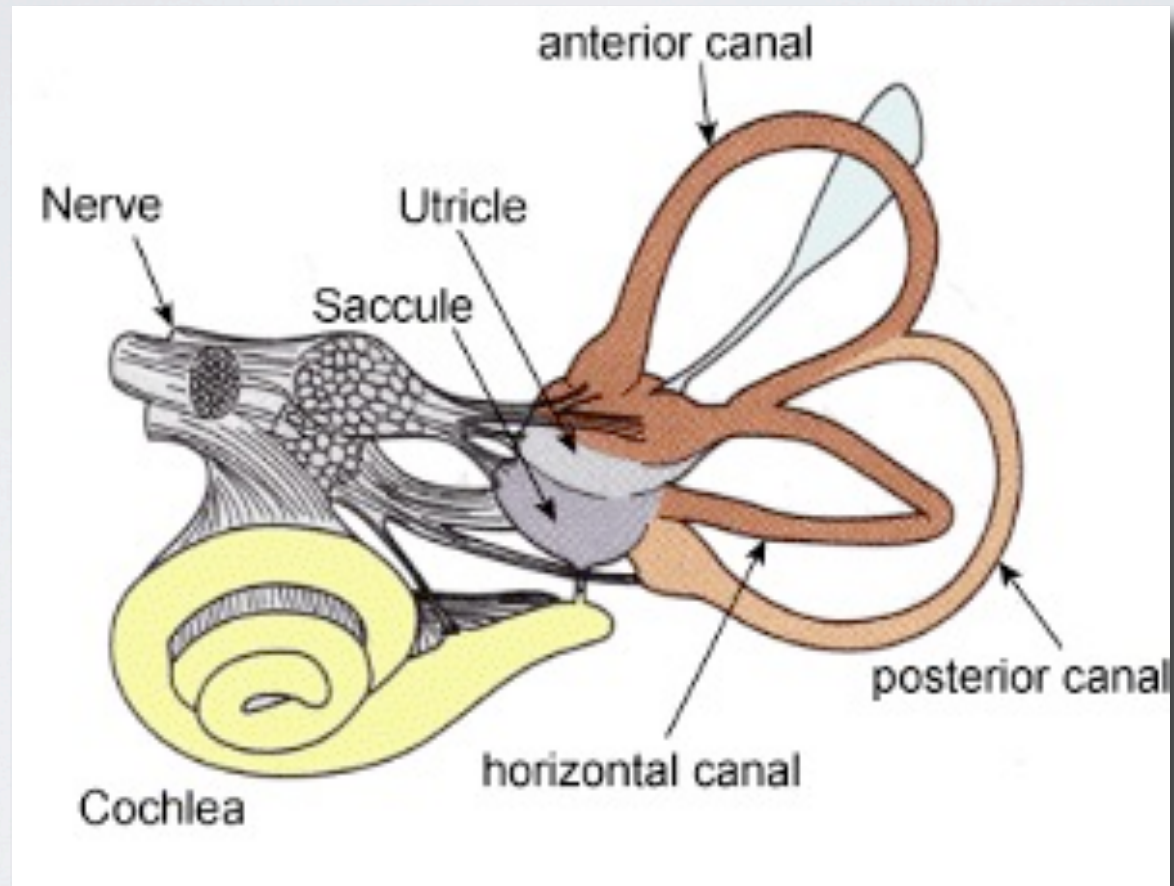
Off-Axis

VISUAL SELF-MOTION



J. Gibson: *Optic Flow*, 1940

VESTIBULAR SYSTEM



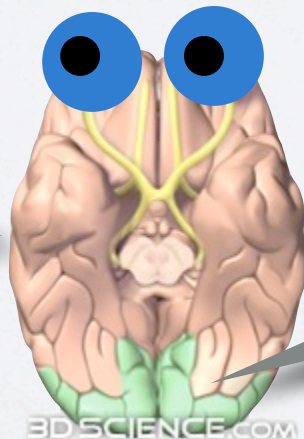
Cochlea

horizontal canal

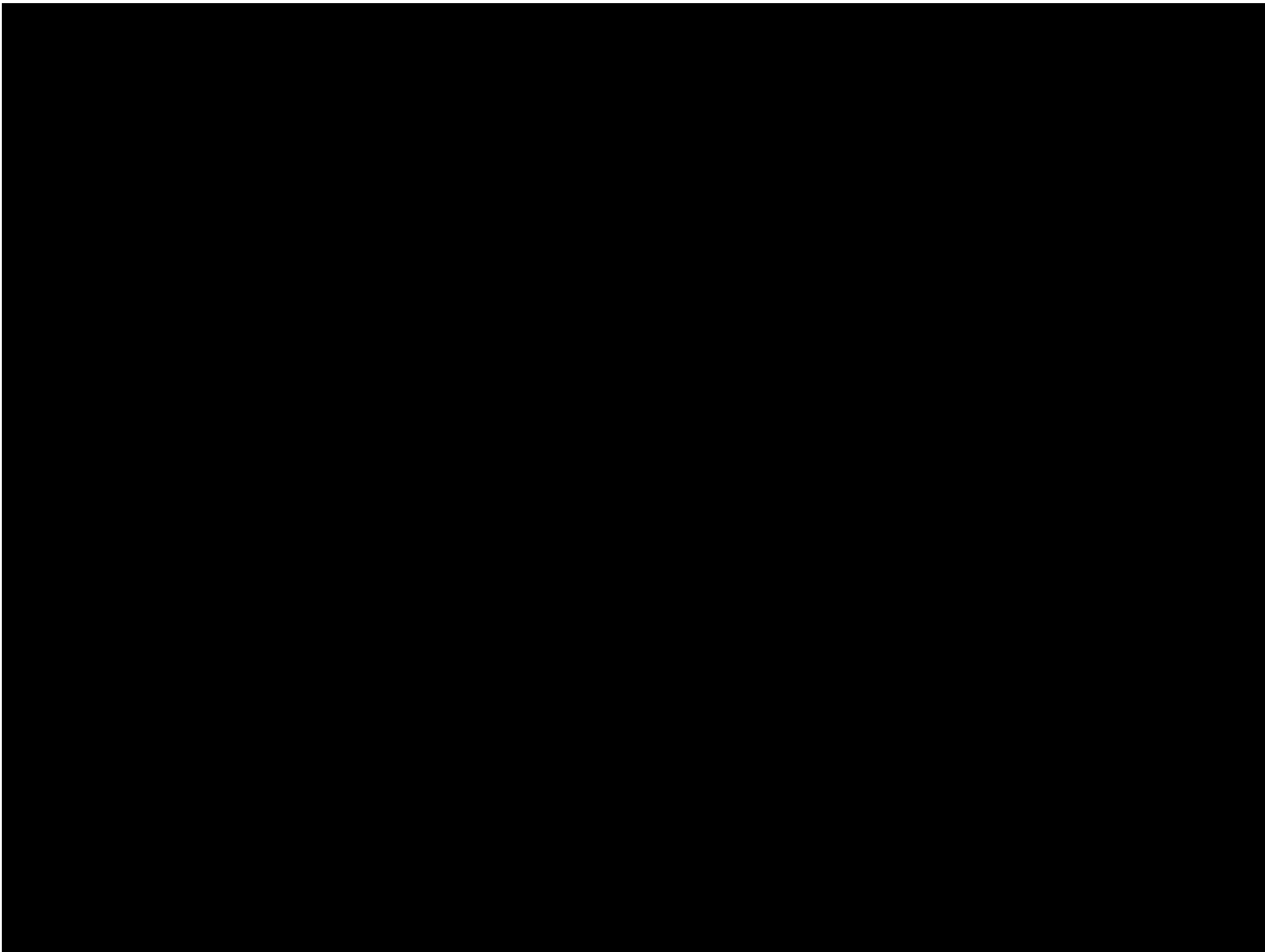
VISUAL-VESTIBULAR CONFLICT I



Body Senses:
Nope!



Visual Cortex:
Movement!



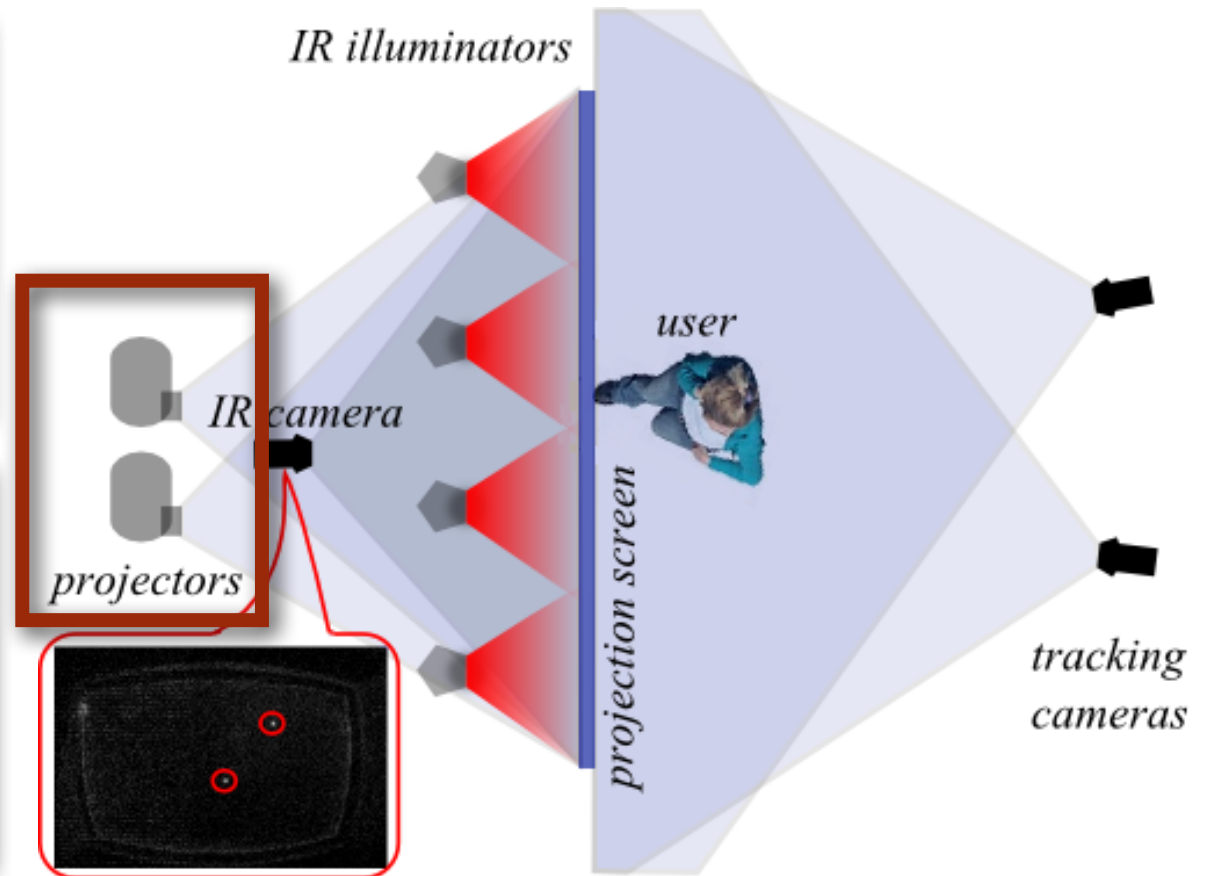
VISUAL-VESTIBULAR CONFLICT II



Visual Cortex:
Nope!

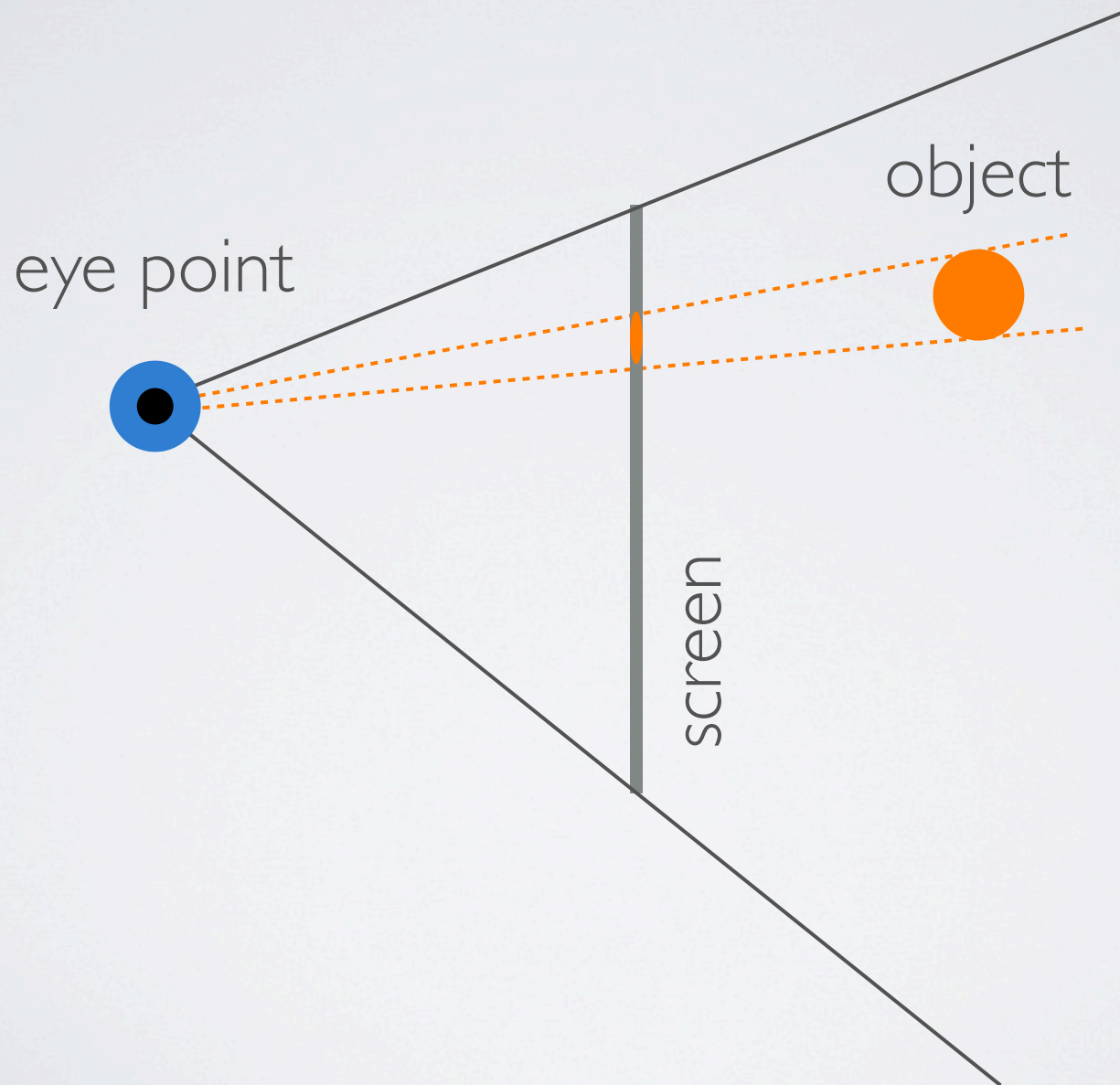
Body Senses:
Movement!

TOUCHING THE 3RD DIMENSION

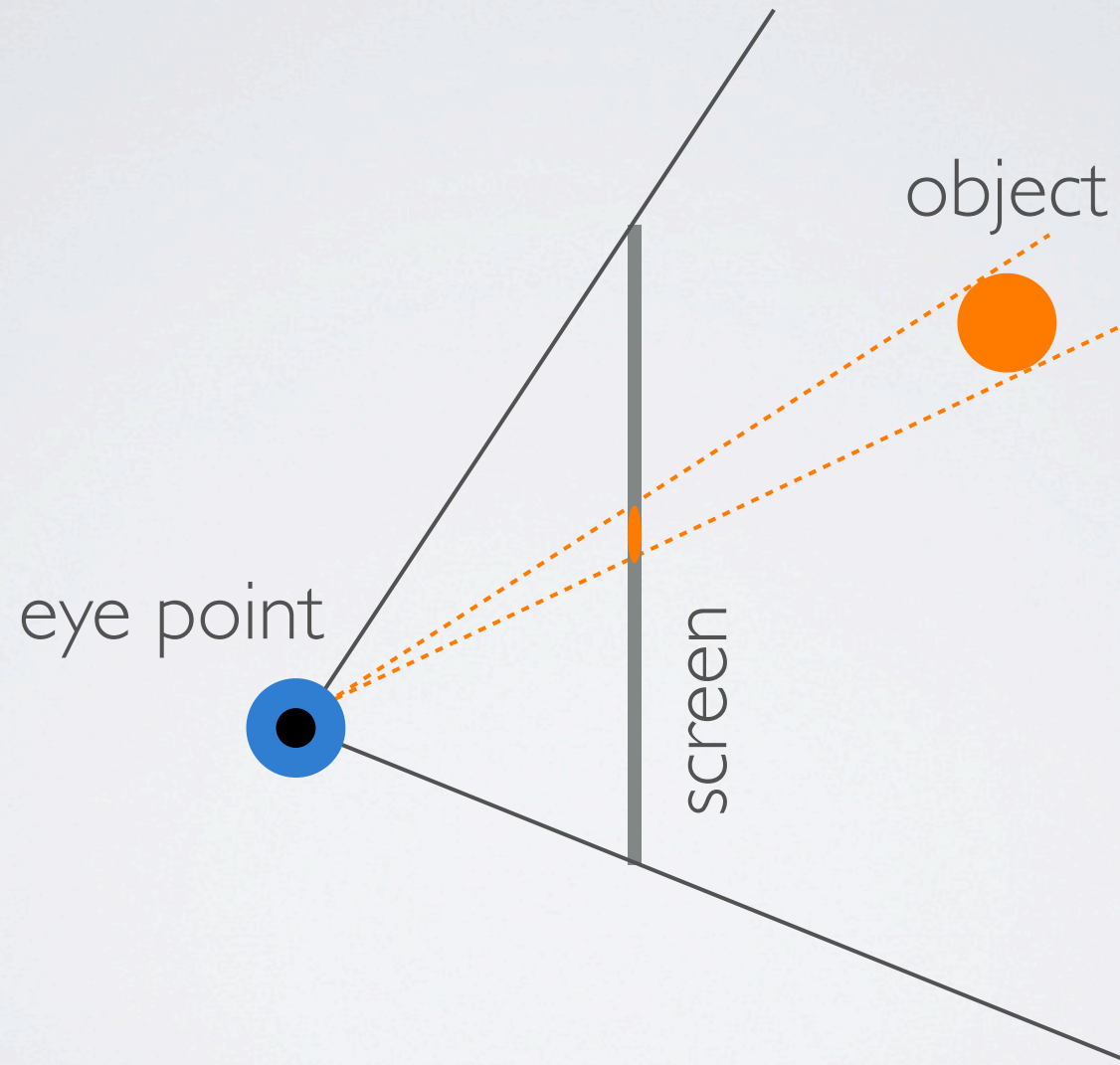


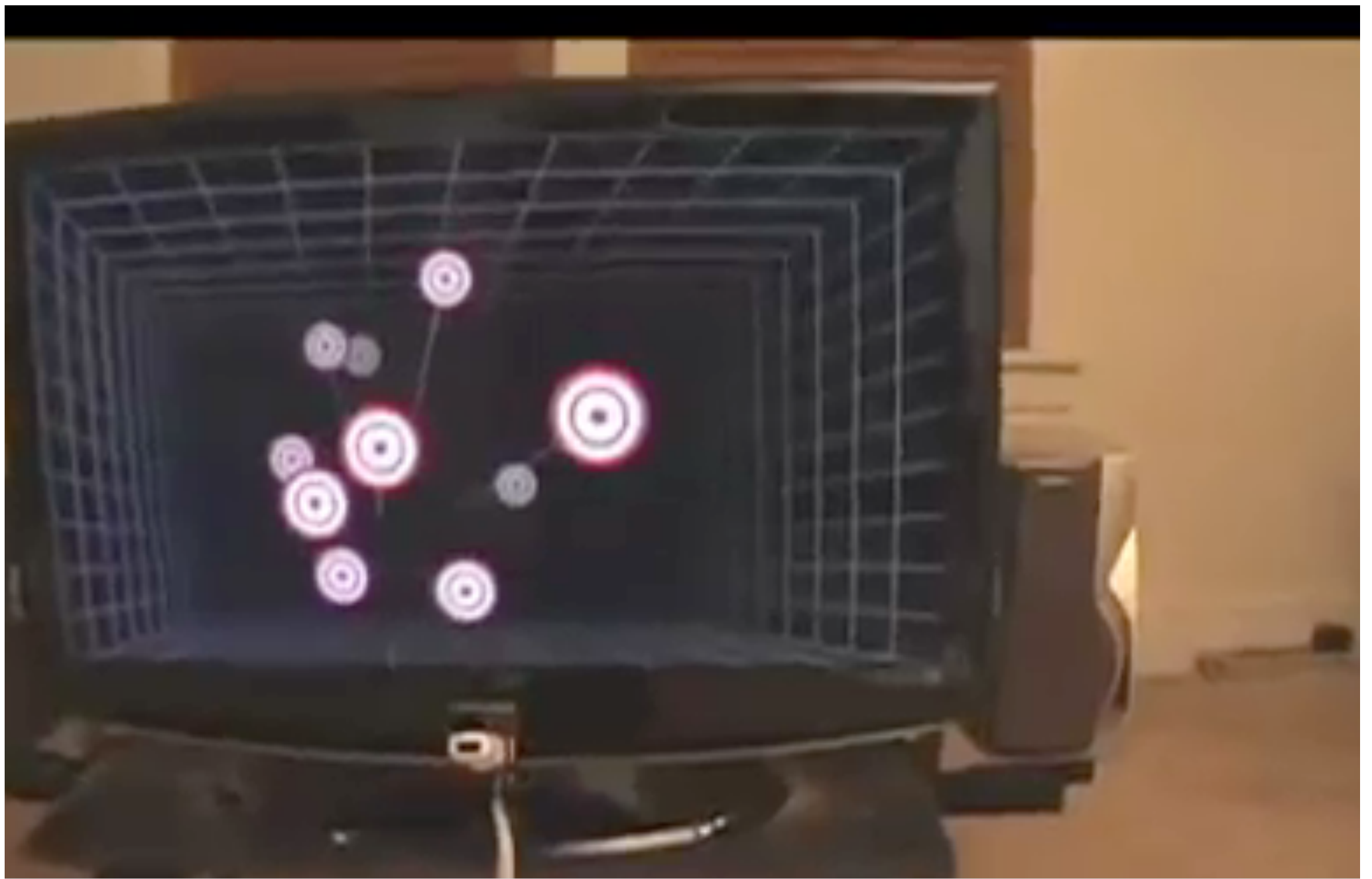
Bimanual (Multi-Touch-)Interaction, INTERACT 2009

EYE RELATIVE TO SCREEN



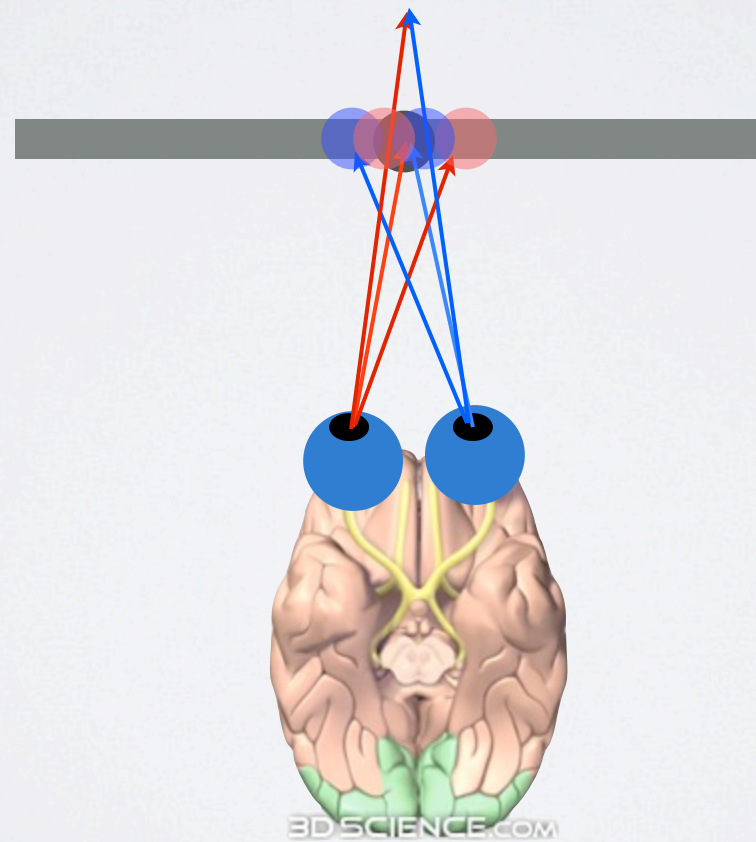
EYE RELATIVE TO SCREEN



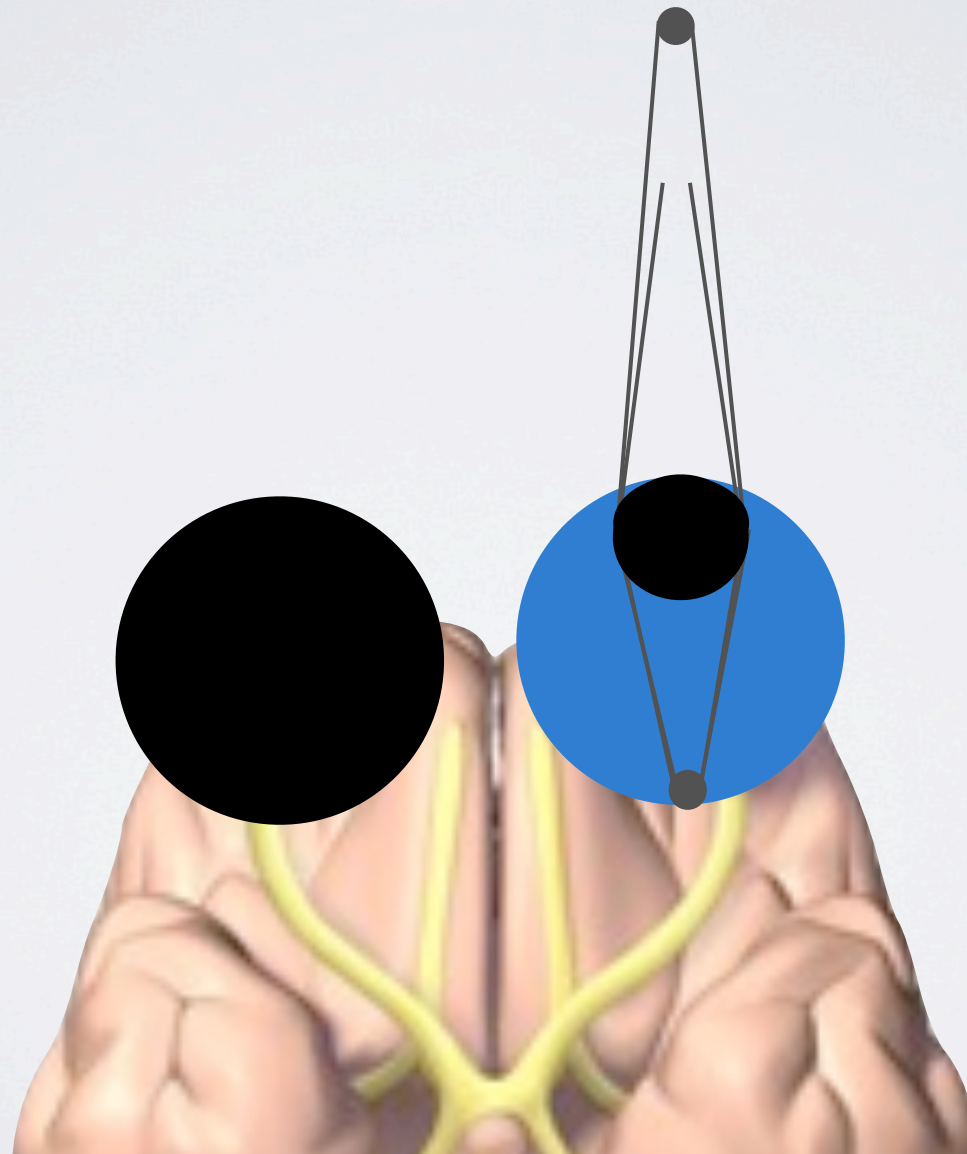


J. Lee: *Head Tracking with Wii Remote*, 2007

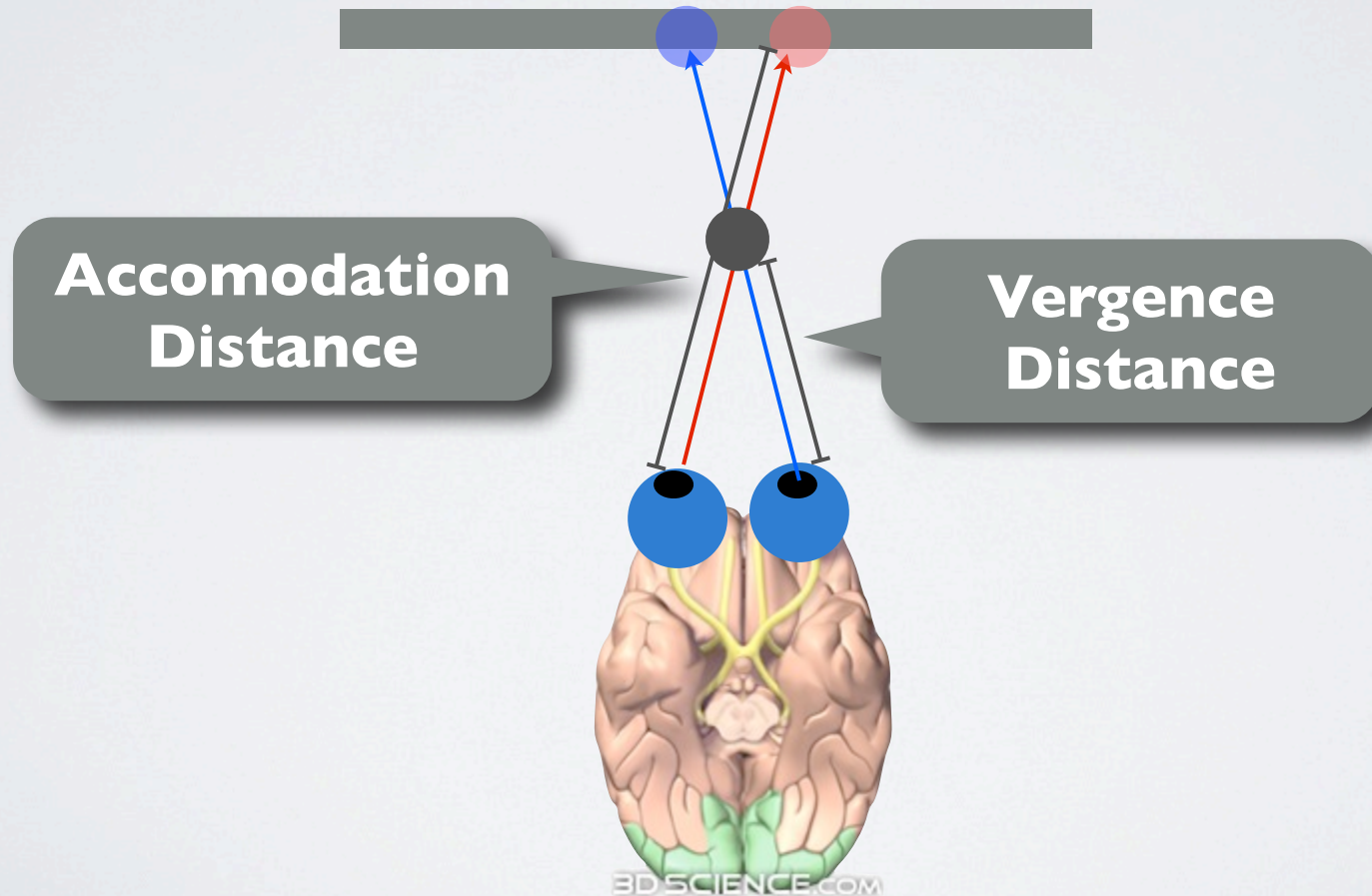
VERGENCE



ACCOMMODATION



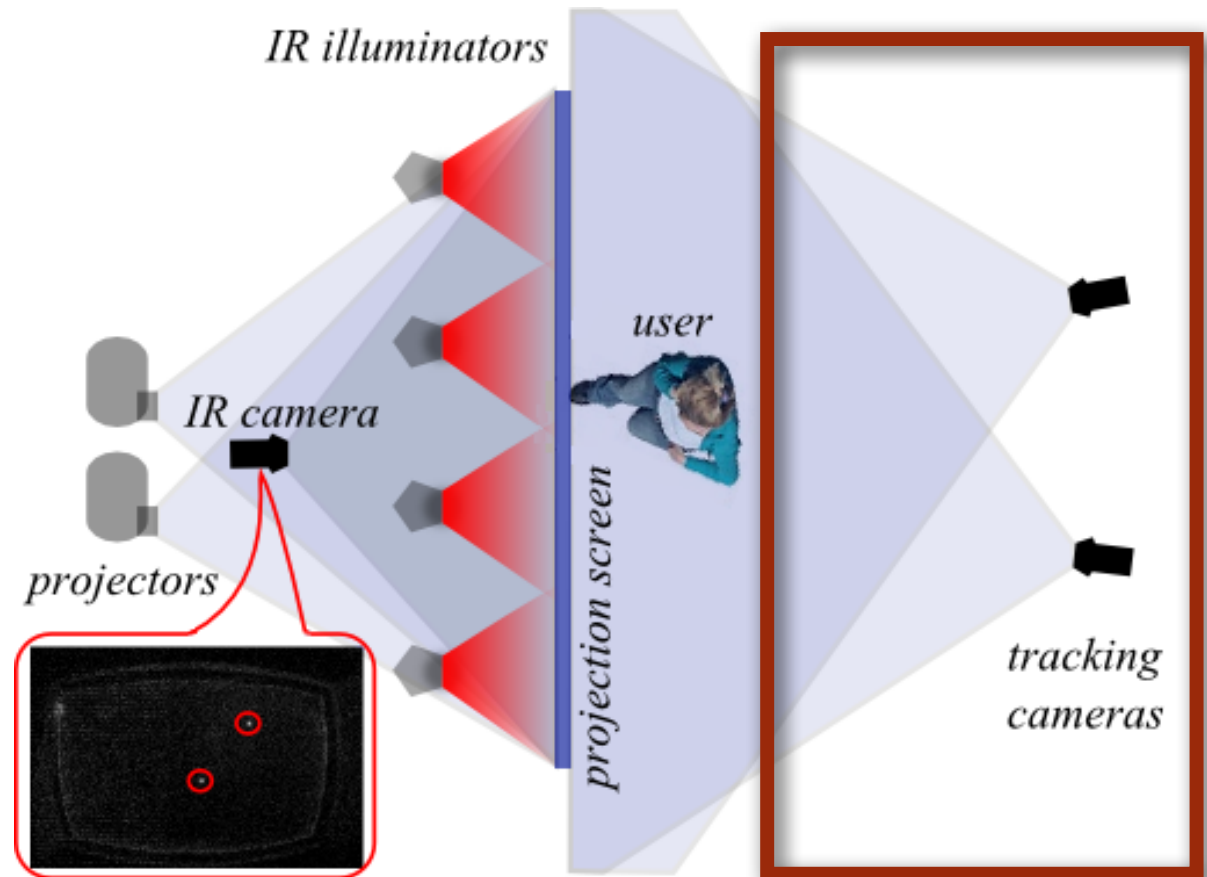
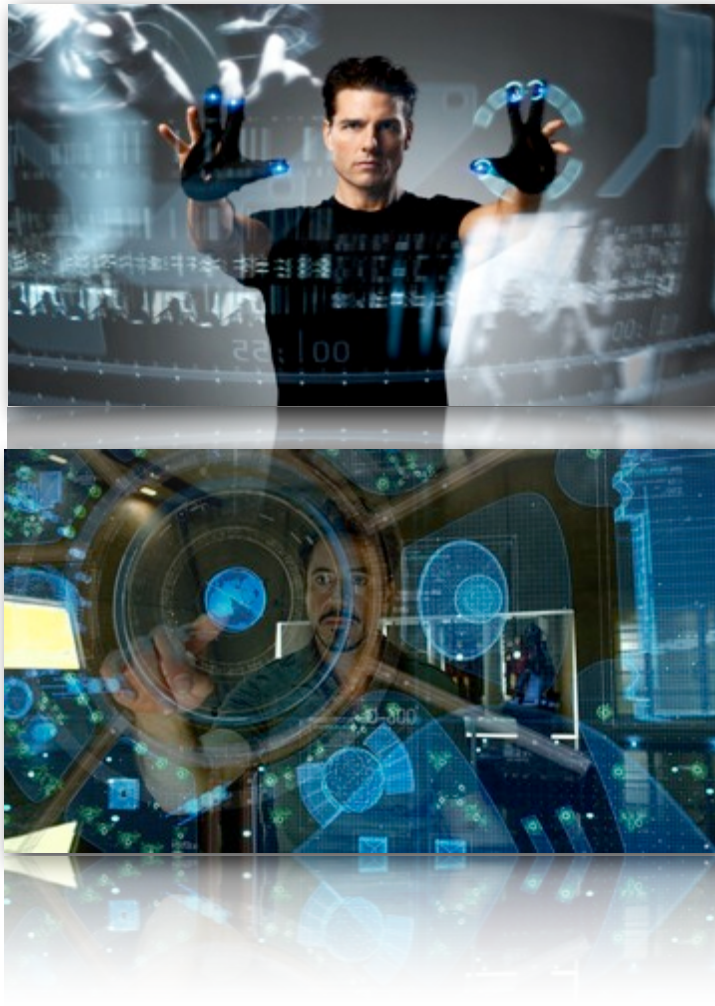
VERGENCE-ACCOMMODATION CONFLICT



WHERE DO USERS TOUCH?

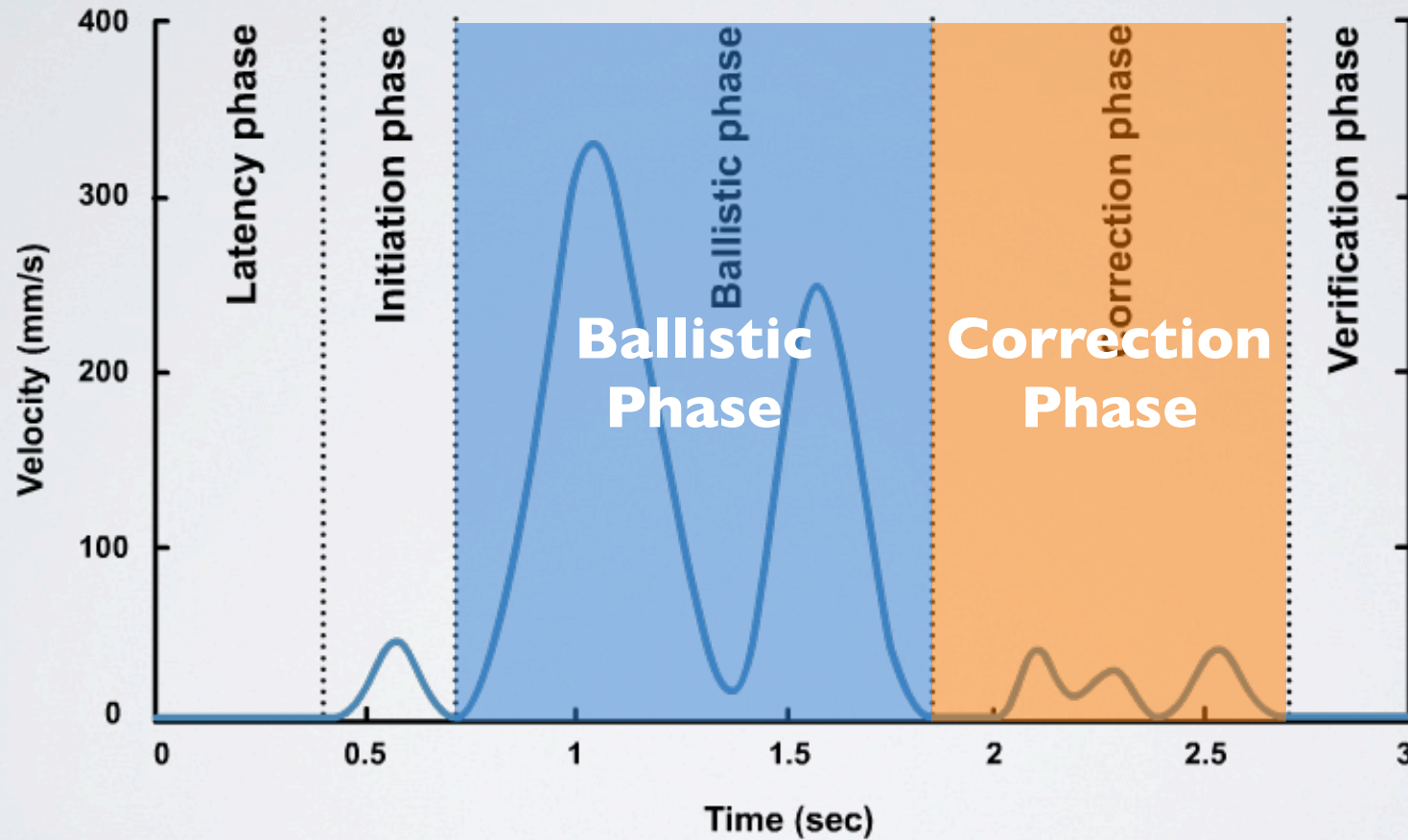


TOUCHING THE 3RD DIMENSION



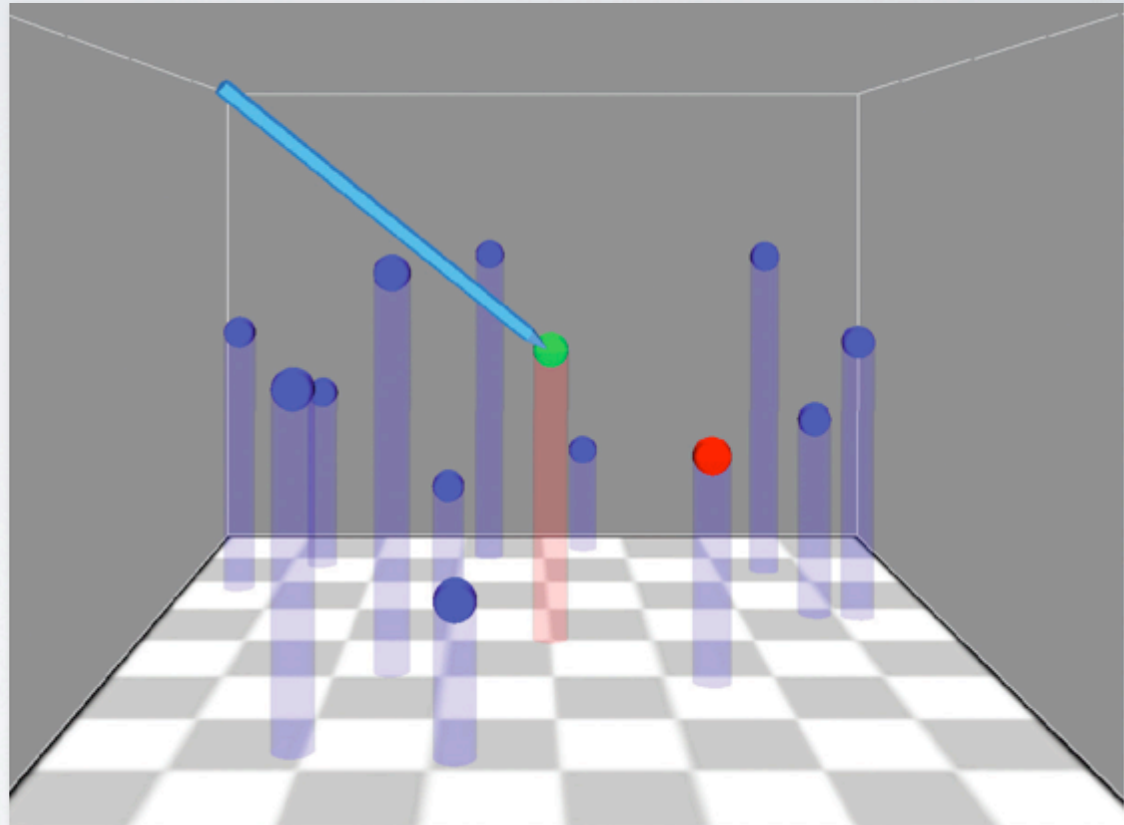
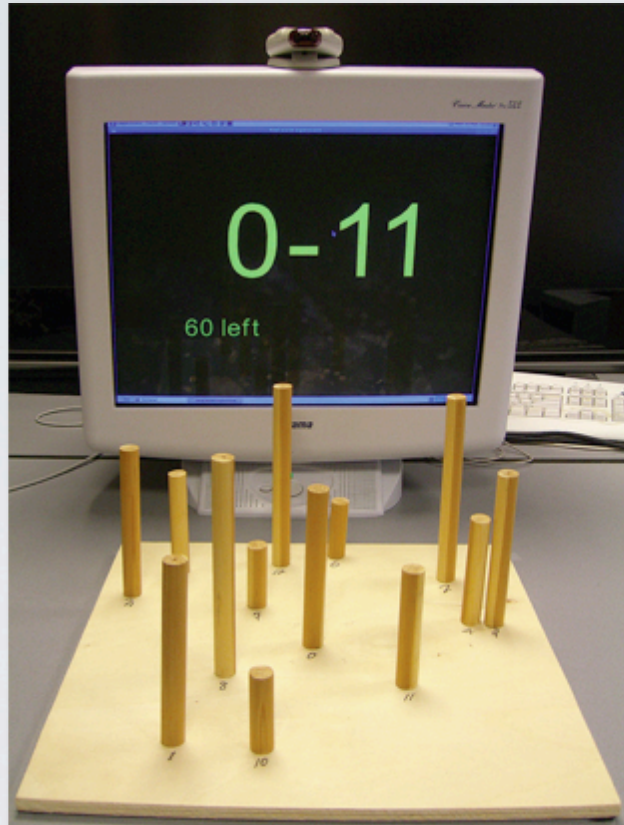
Bimanual (Multi-Touch-)Interaction, INTERACT 2009

3D GOAL-DIRECTED MOVEMENTS



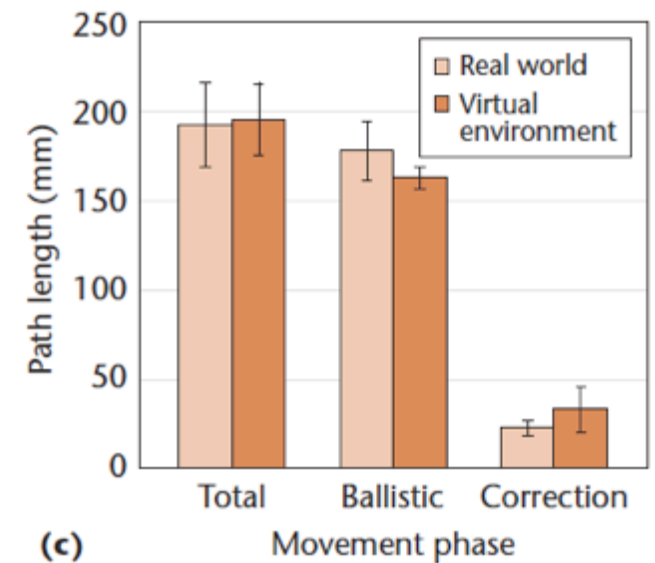
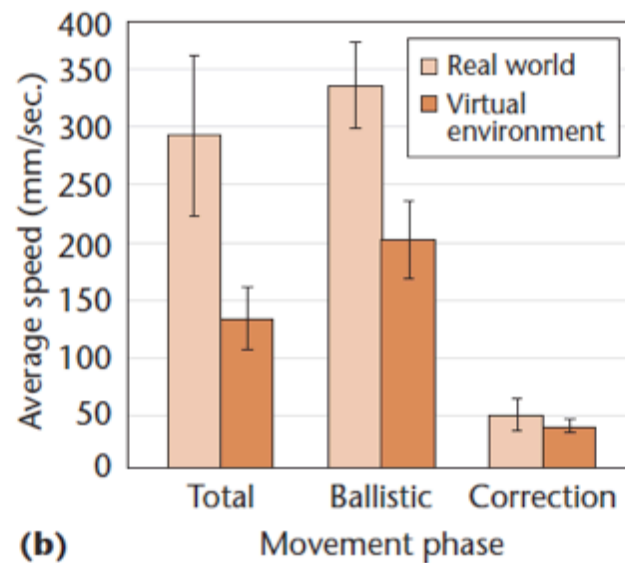
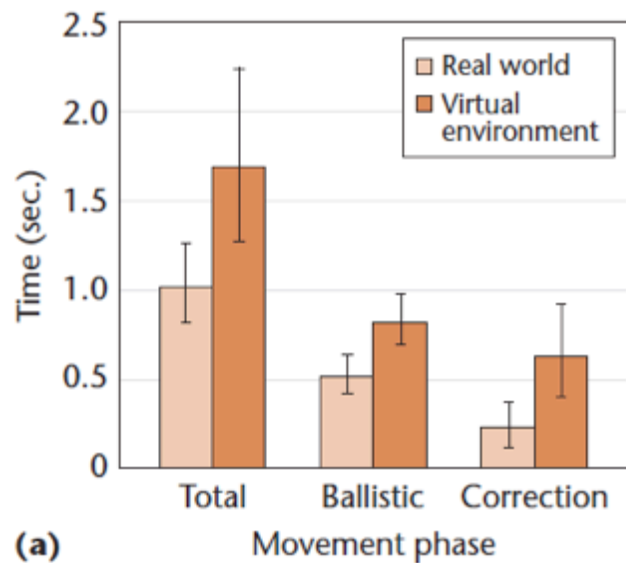
K. Nieuwenhuizen et al., IEEE CG&A, 2009

3D GOAL-DIRECTED MOVEMENTS



K. Nieuwenhuizen et al., IEEE CG&A, 2009

3D GOAL-DIRECTED MOVEMENTS



K. Nieuwenhuizen et al., IEEE CG&A, 2009



Touching floating Objects, EG JVRC, 2010

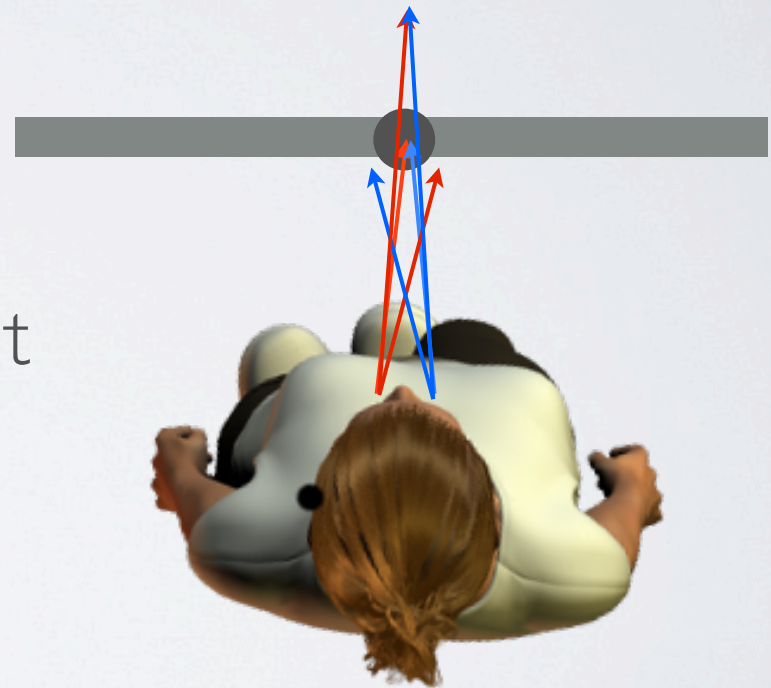


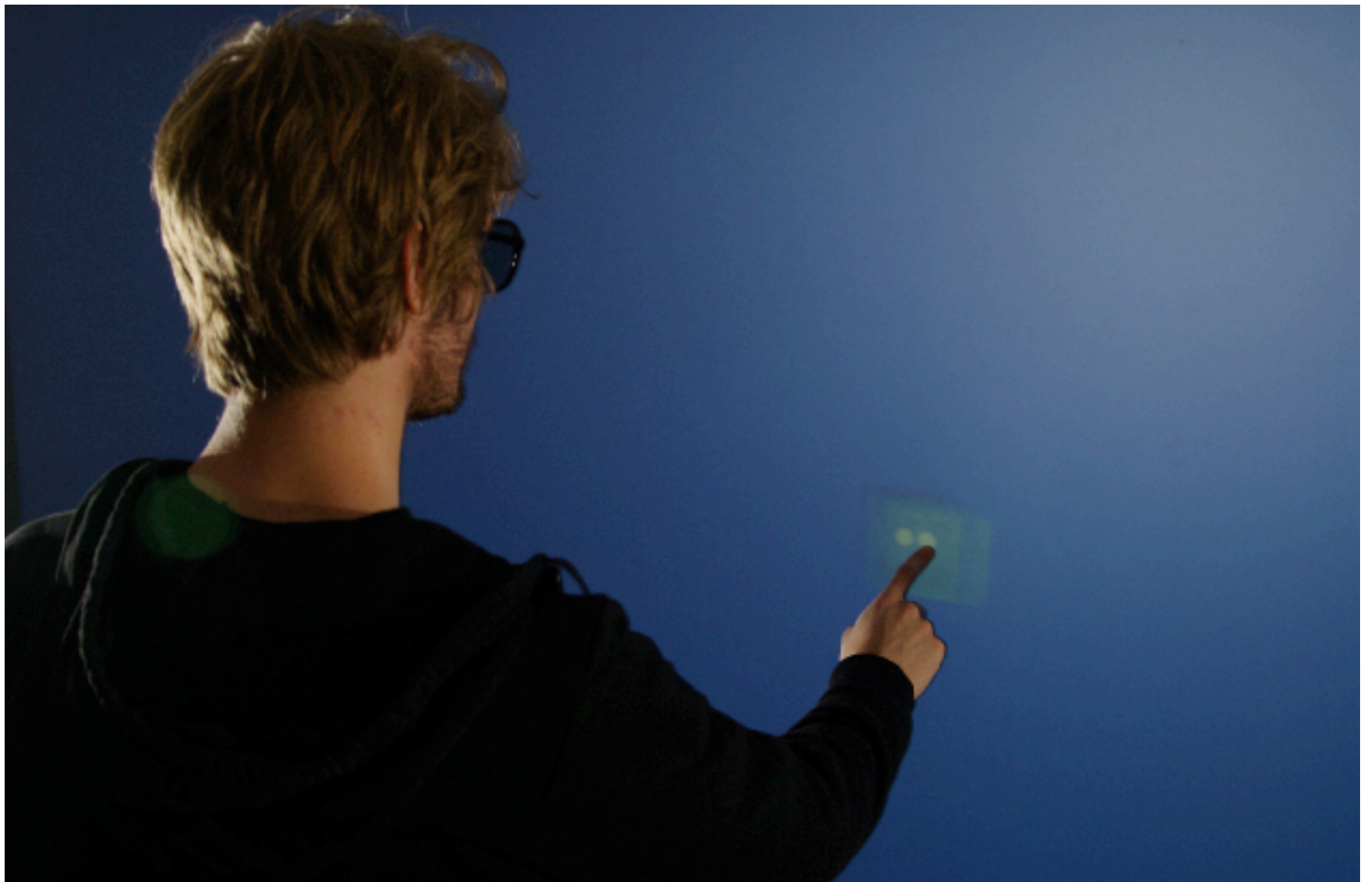
Touching floating Objects, EG JVRC, 2010

WHERE DO USERS TOUCH?



right eye (D) *middle* eye (M) left eye (N)
dominant eye (D) eye (M) eye (N)

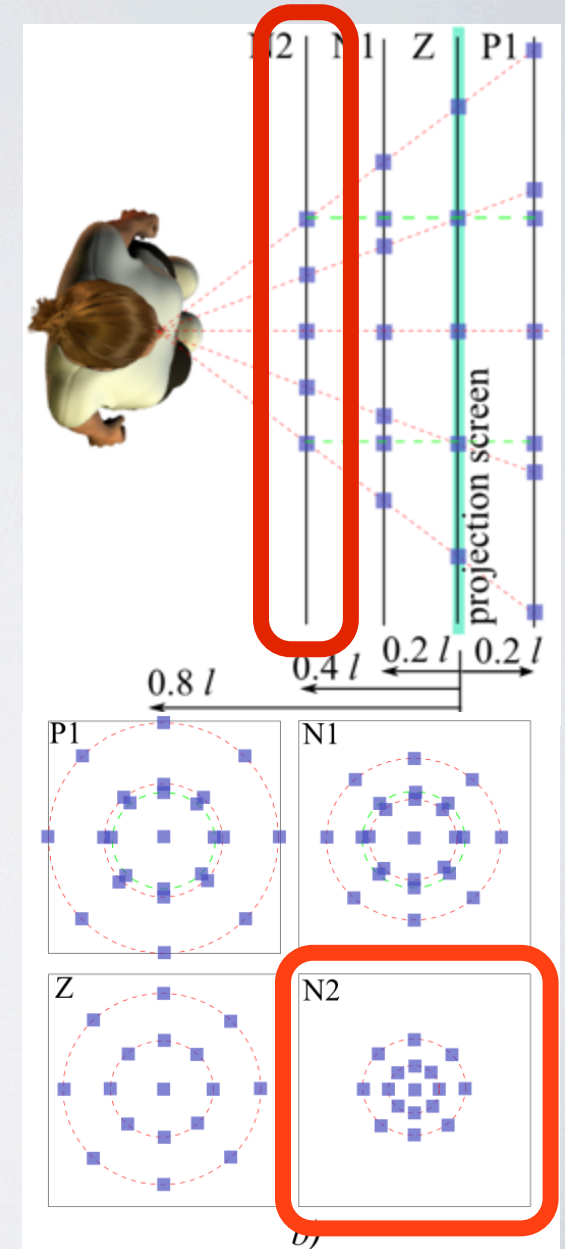


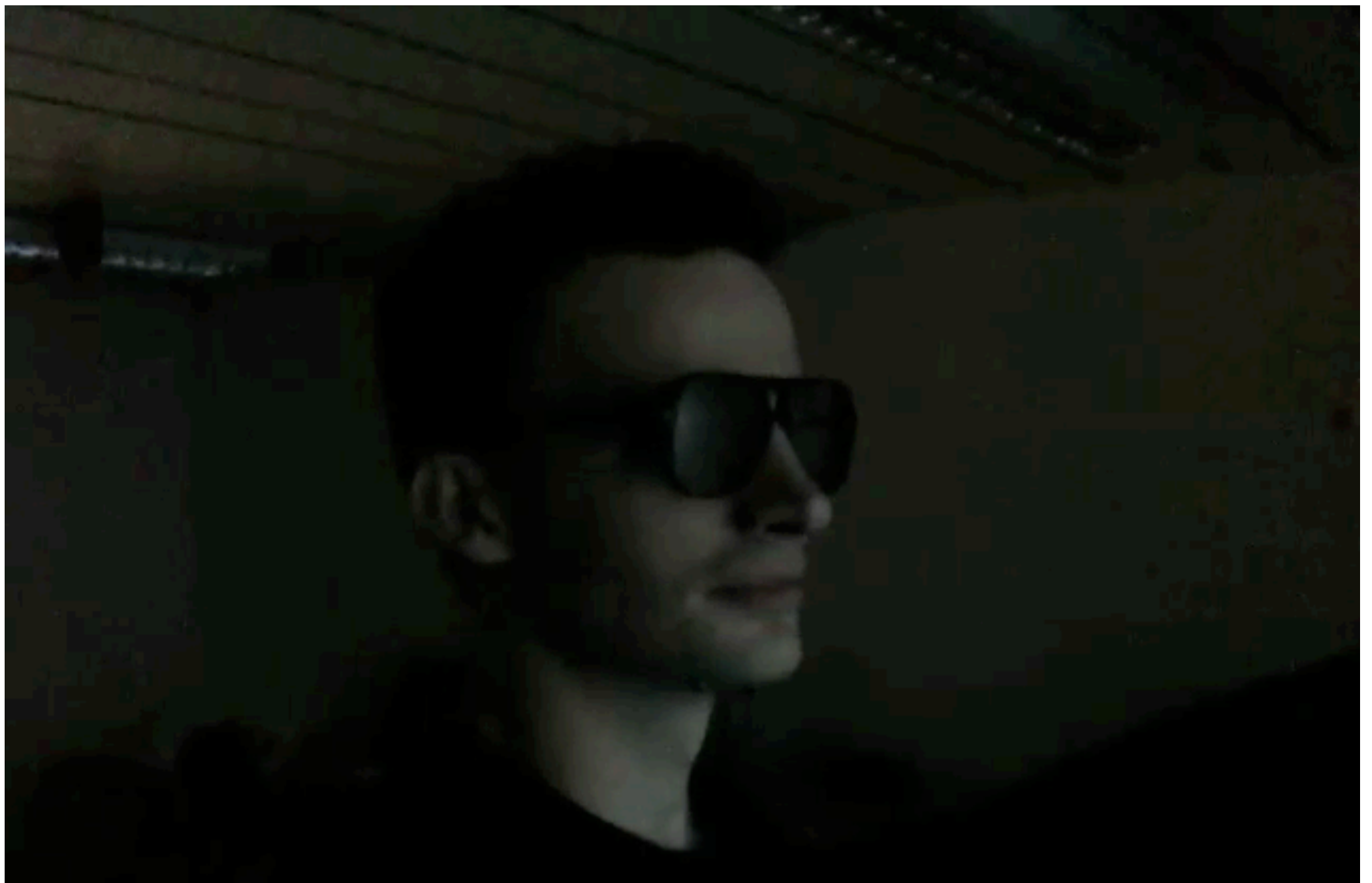


2D Touching 3D Stereoscopic Objects, ACM CHI 2011

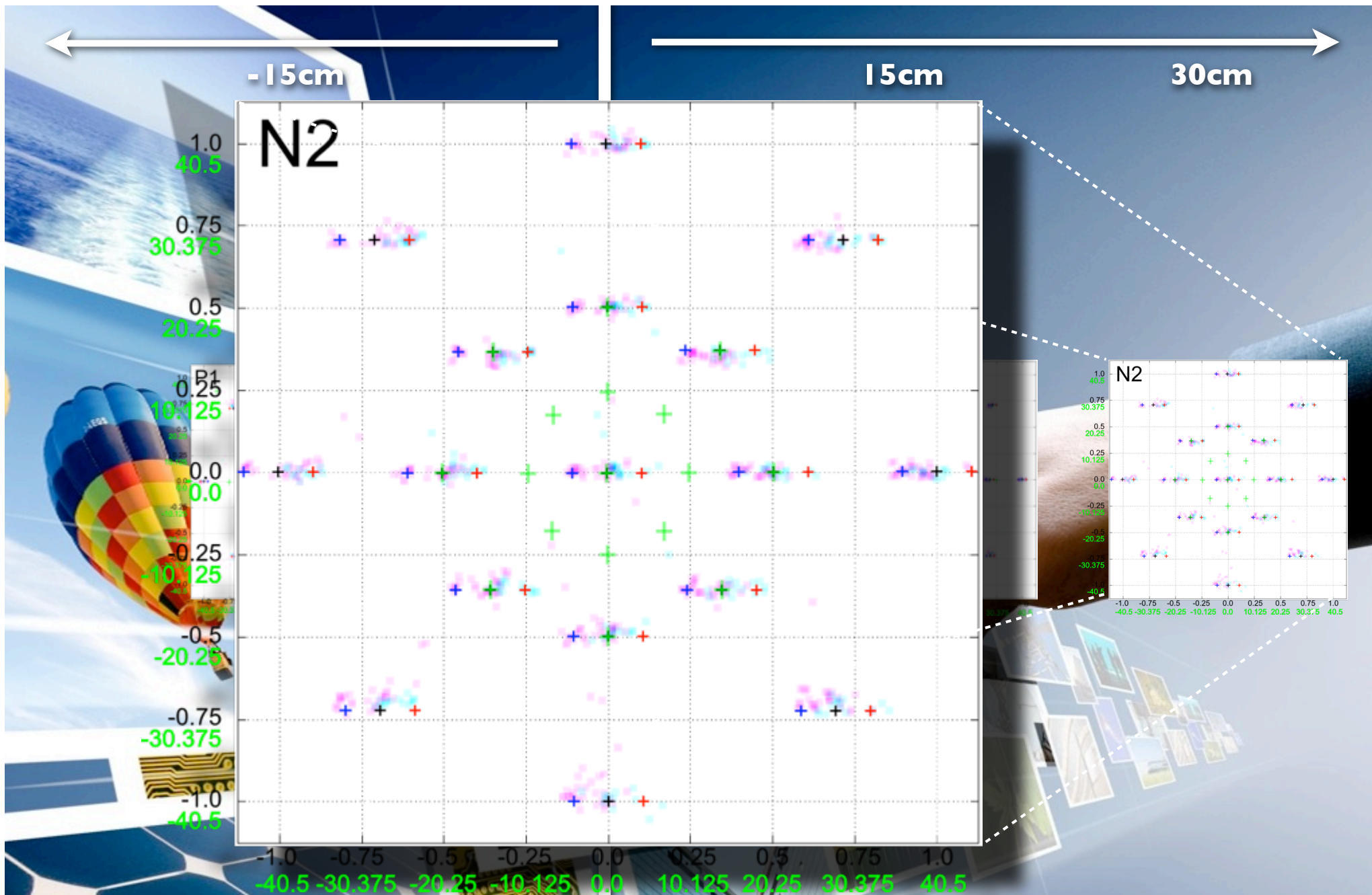
EXPERIMENT

- Stimuli:
Semitransparent box with solid sphere inside
- Concentric circles centered in users' point of view
- 4 parallax planes (N2, N1, Z, P1)
- Parametrized by users' height

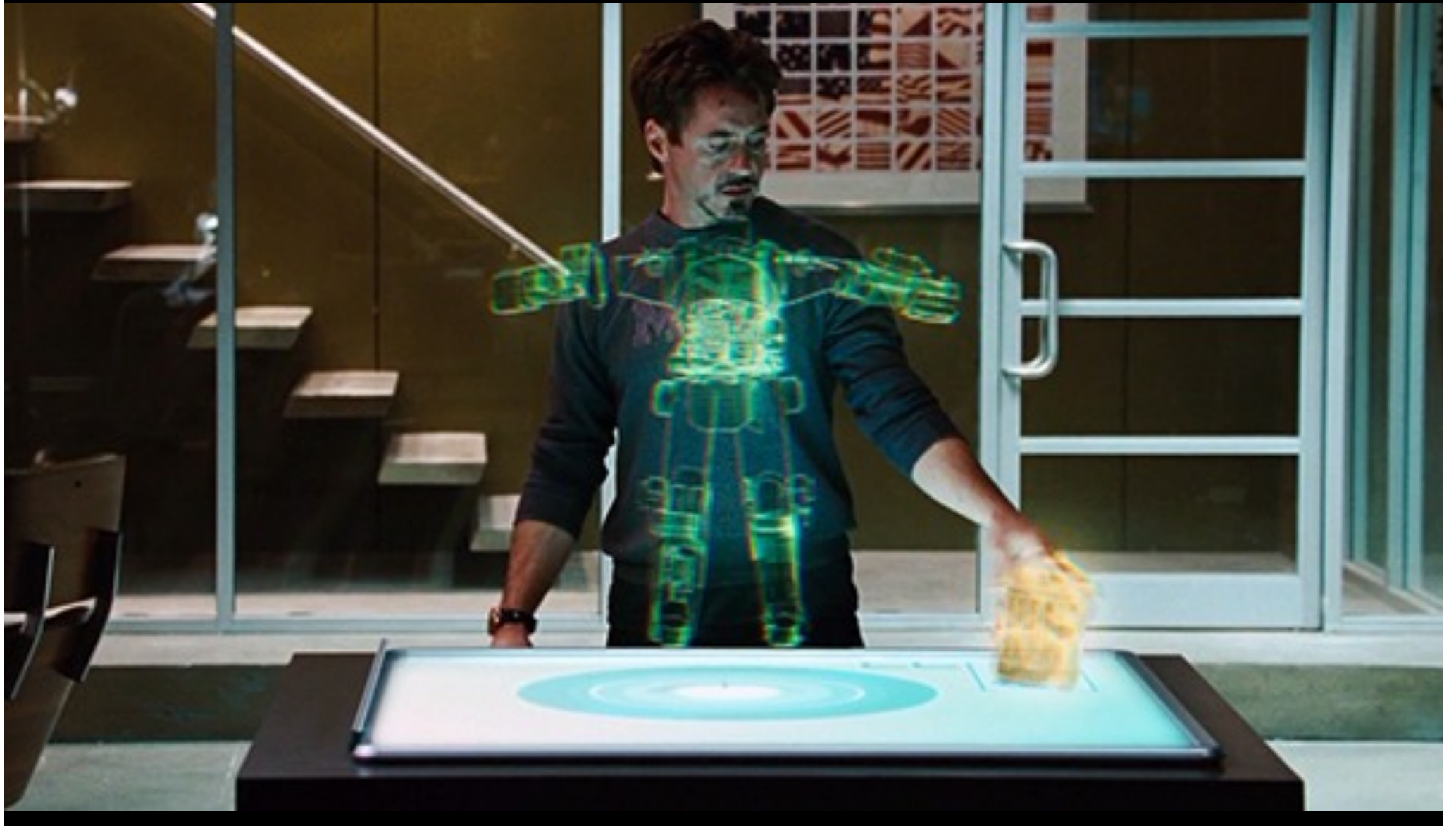




2D Touching 3D Stereoscopic Objects, ACM CHI 2011

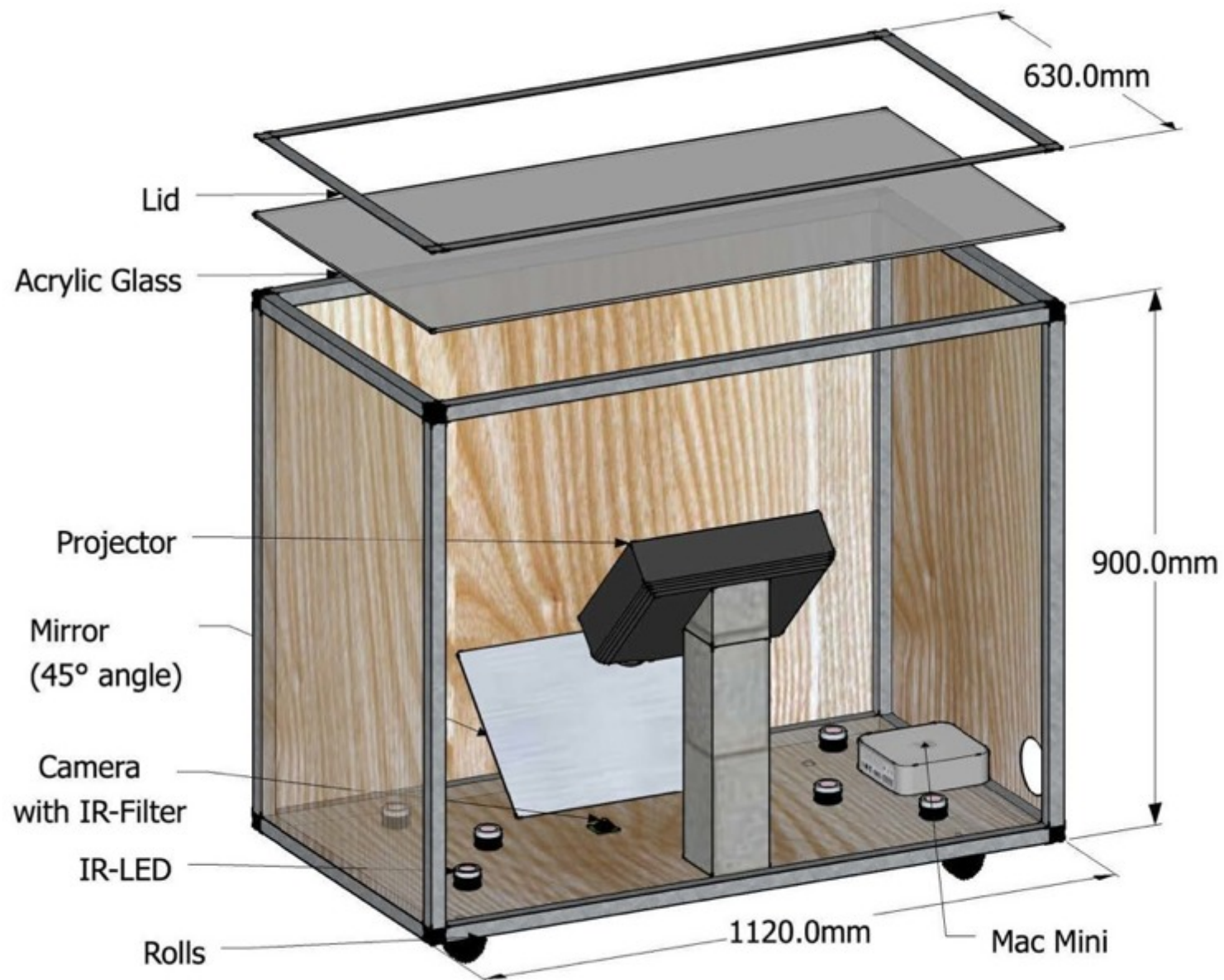


2D Touching 3D Stereoscopic Objects, ACM CHI 2011

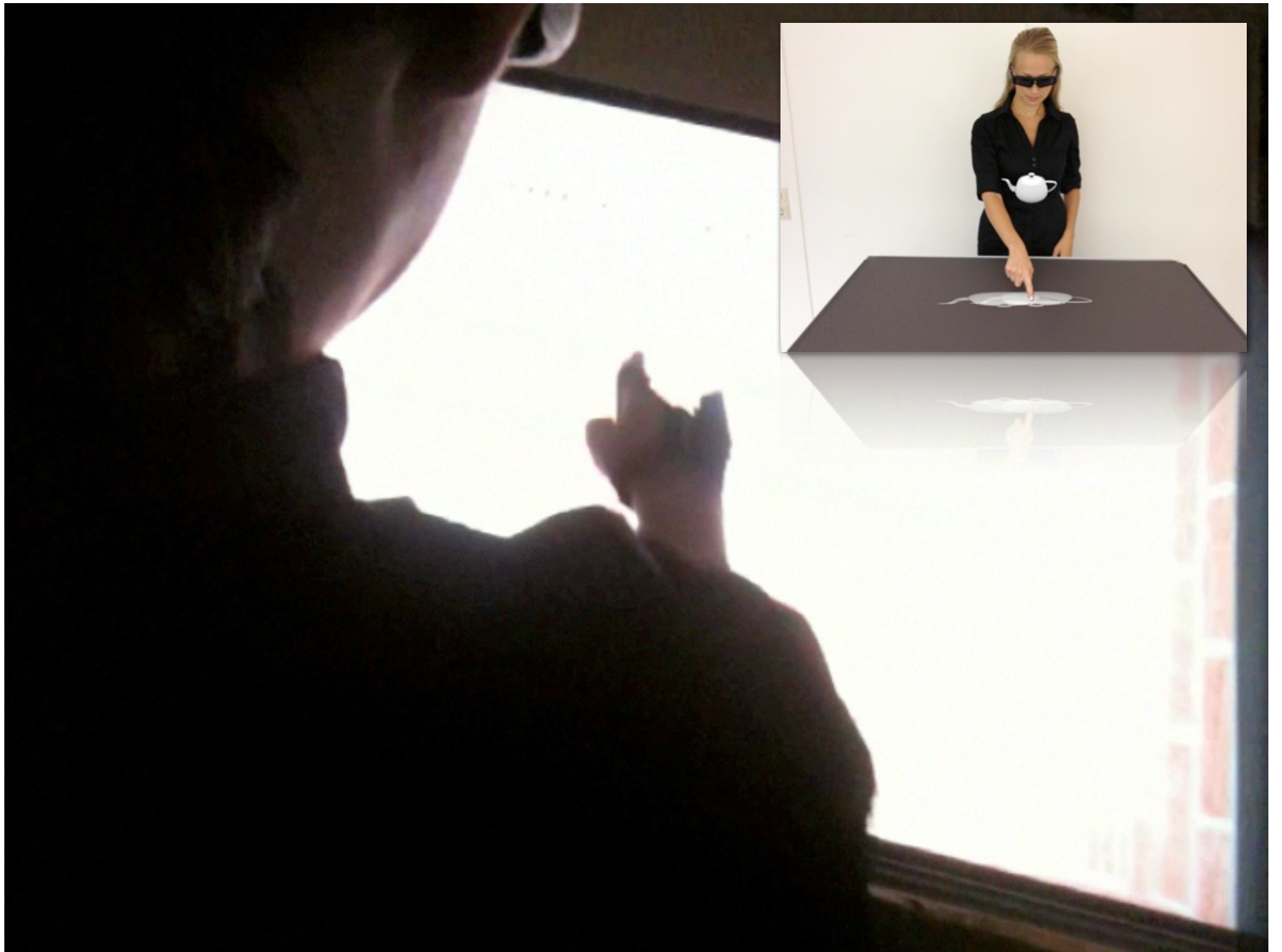


J. Favreau: Iron Man 2, 2010

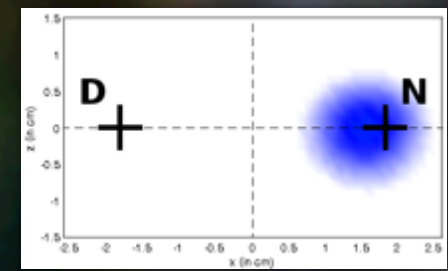
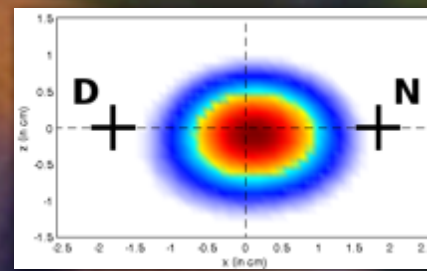
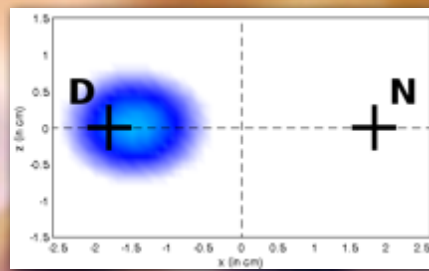
J. Favreau: Iron Man 2, 2010



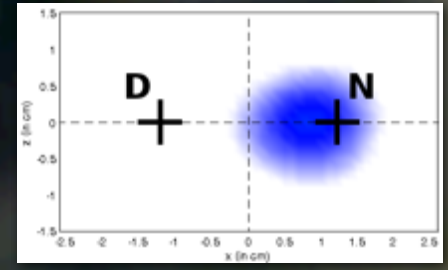
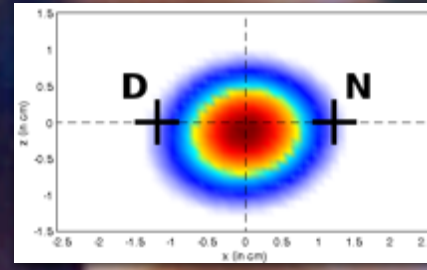
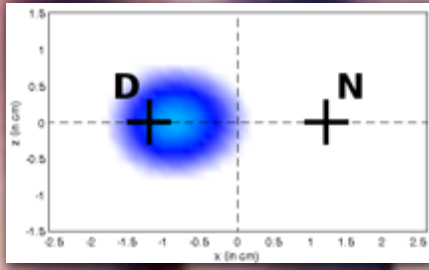
SmartBox, IEEE VR 2012



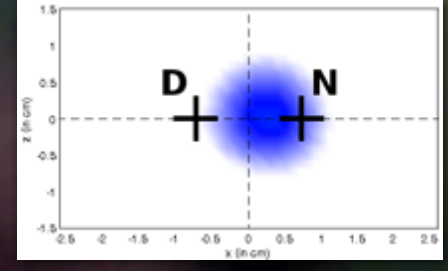
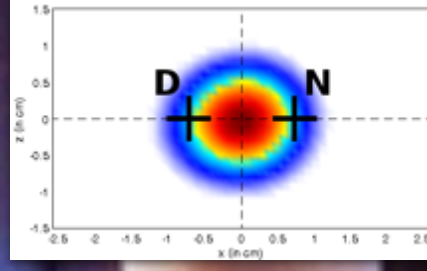
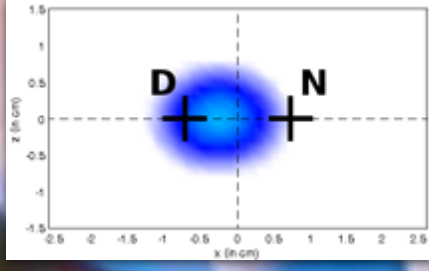
20cm



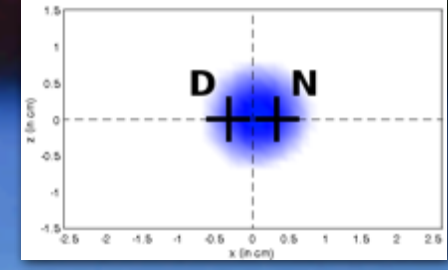
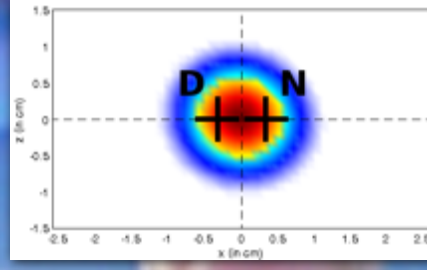
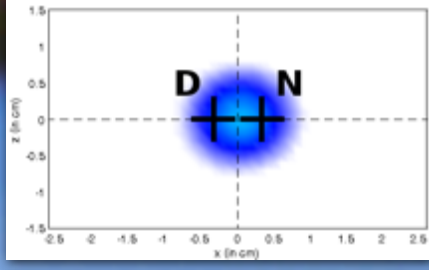
15cm



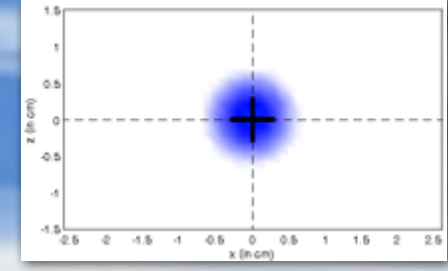
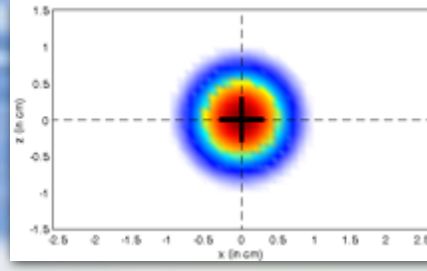
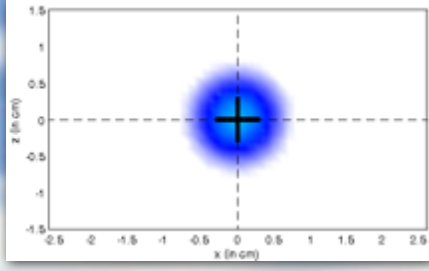
10cm

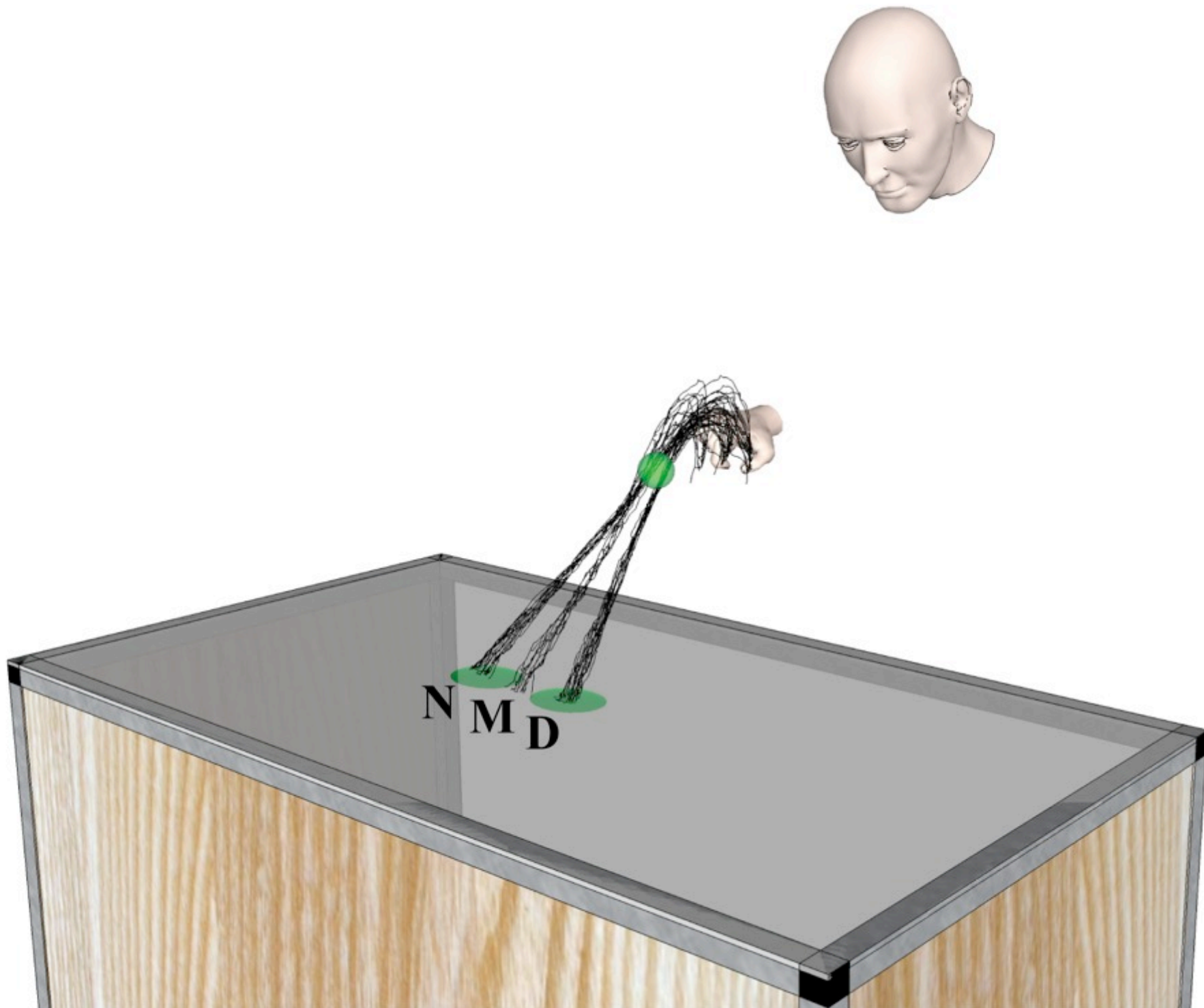


5cm

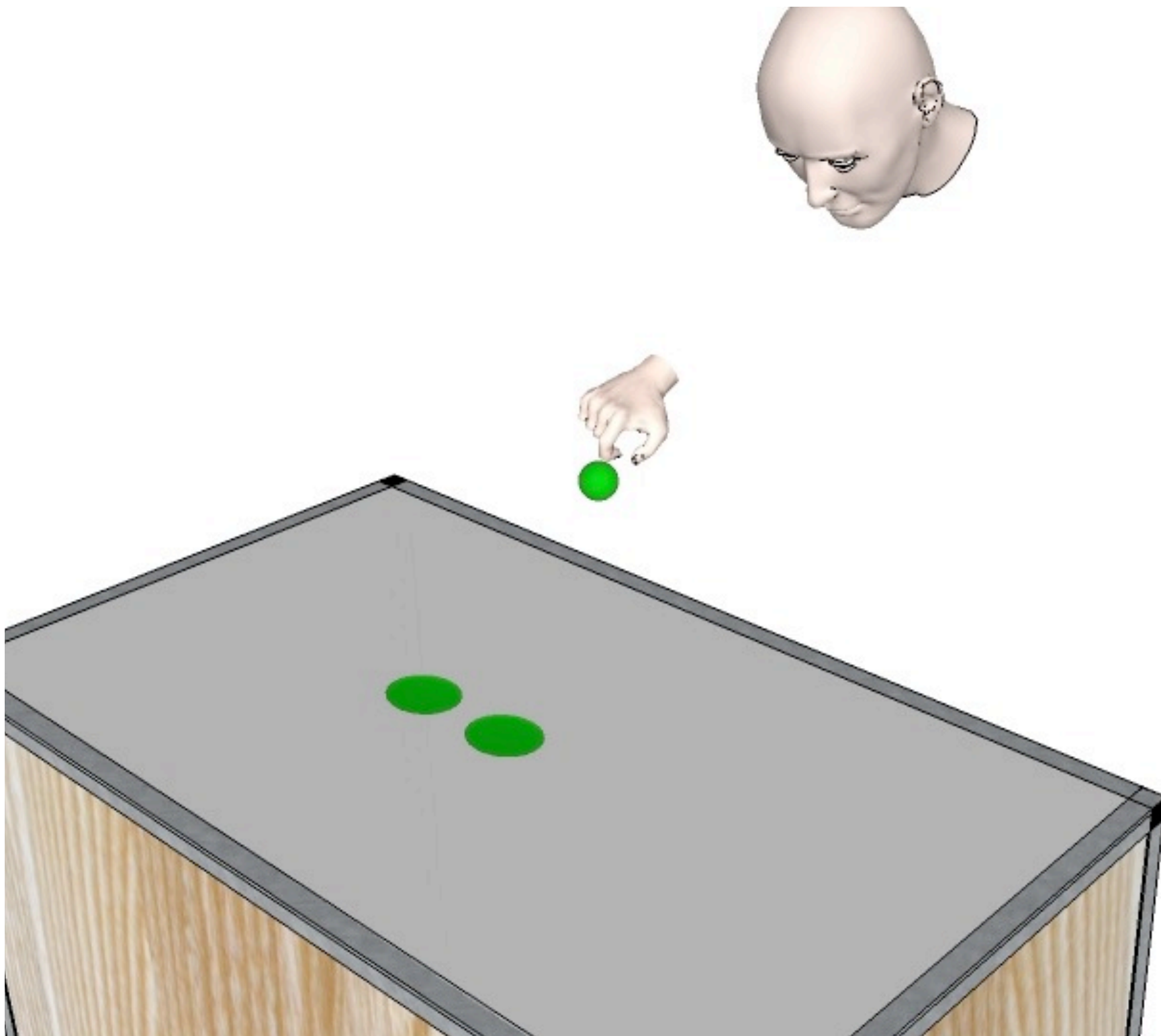


0cm









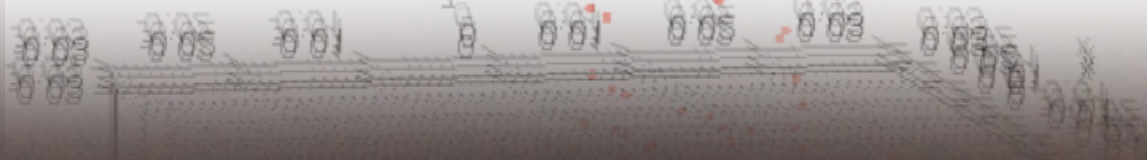
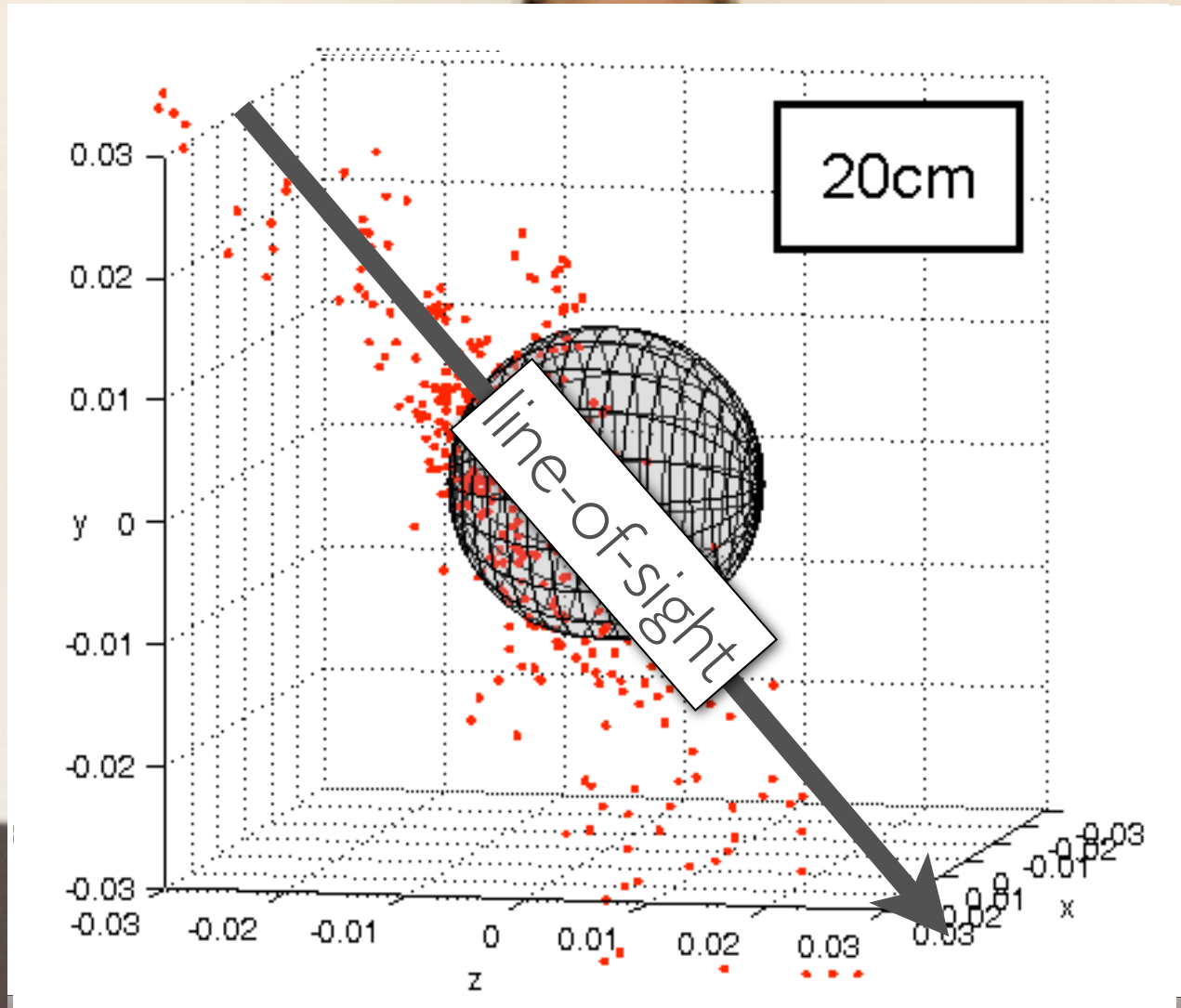
20cm

15cm

10cm

5cm

0cm



WRAP UP

- **ISIS3D** provide very **impressive UX**
- **but:** involves **visual/tactile/vestibular conflicts** which **hinder** interaction **performance & predictability**
- **users** dissolve conflicts **differently**, e.g., users *touch* 3D stereoscopic objects at ***different*** 2D locations
- **ISIS3D** provides new possibilities for **perceptual illusions**, e.g., **integration** of **visual & haptic feedback**