



The Office of the Future – smart collaboration systems

Carlo Beltrame
Ubiquitous Computing Seminar 2014

Vision



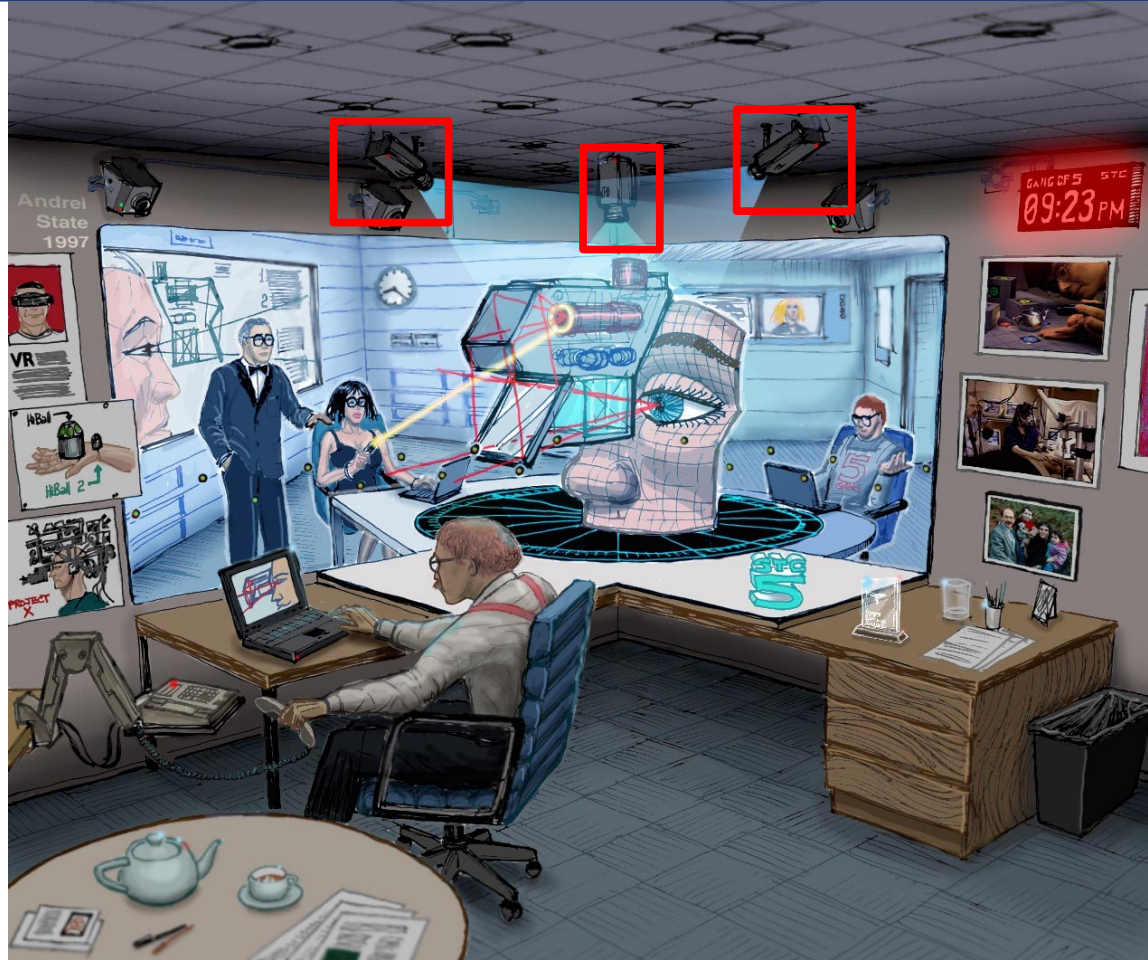
[Raskar1998]

Vision



[Raskar1998]

Vision – projectors



[Raskar1998]

Vision – projection surfaces



[Raskar1998]

Vision – projection turned off



[Raskar1998]

Vision – projection turned off



[Raskar1998]

Vision – uneven projection surface



[Raskar1998]

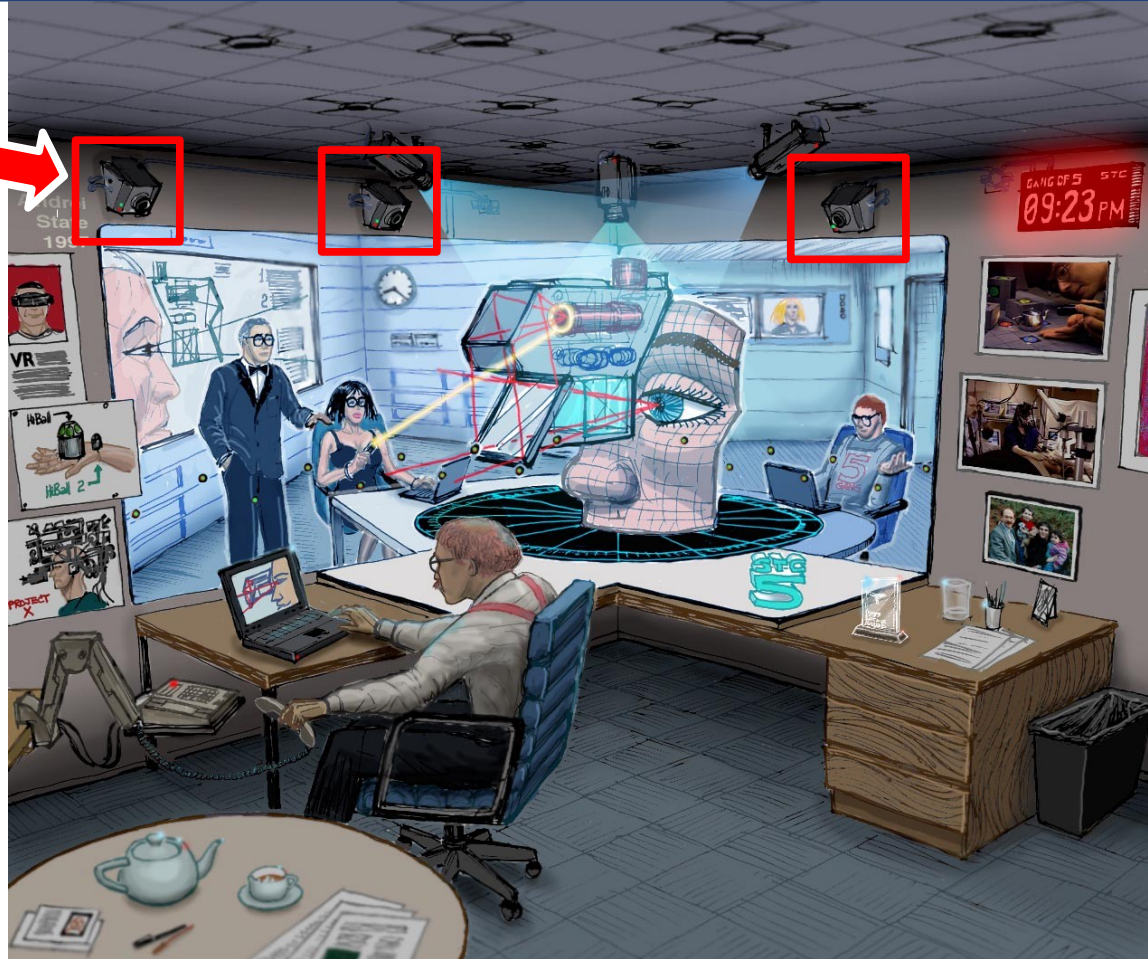
Vision – uneven projection surface



[Raskar1998]

Scene Capture

capture
device



[Raskar1998]

Kinect



Kinect

150\$

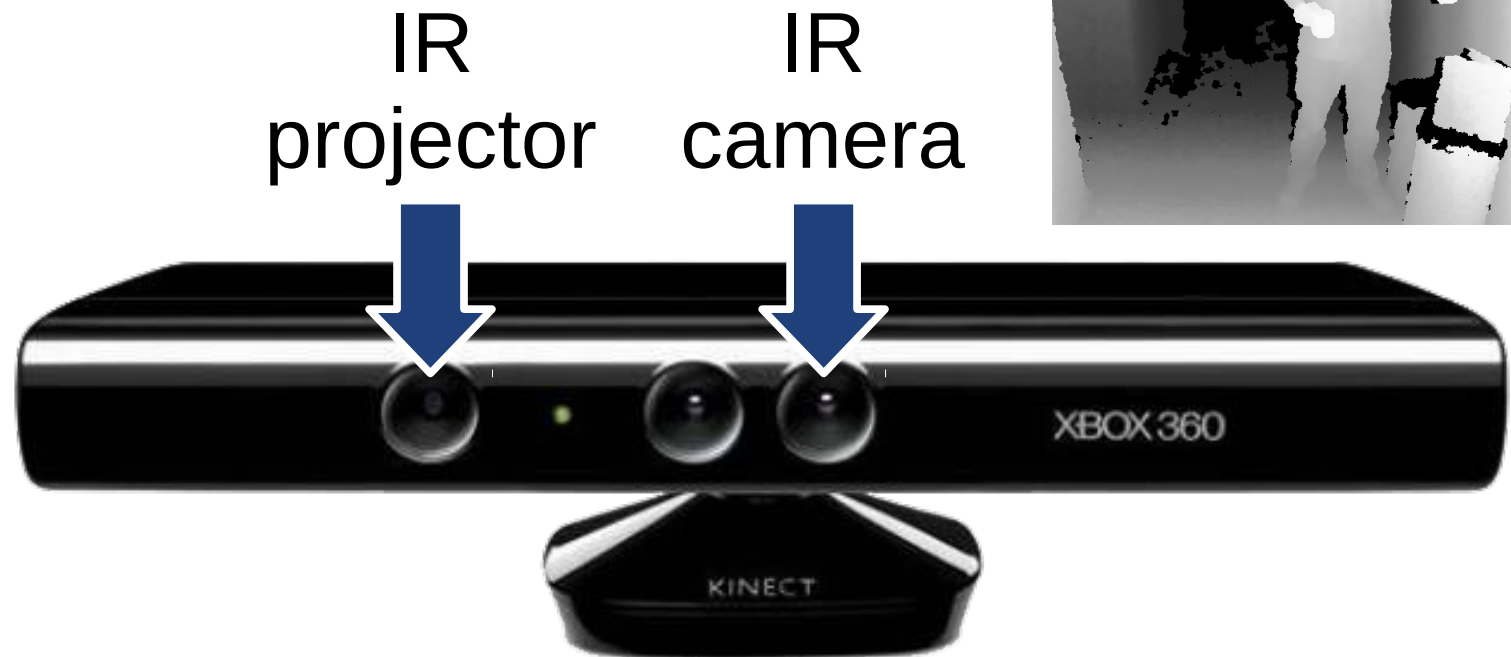


Kinect – RGB camera

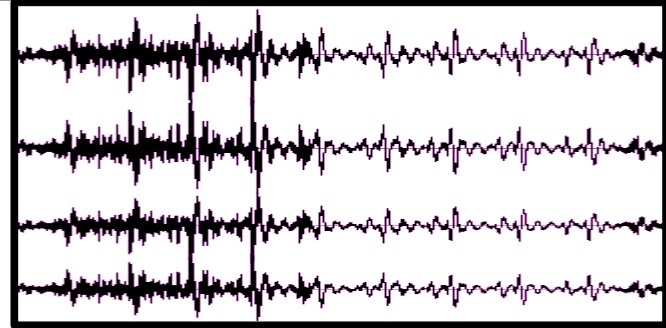
RGB
camera



Kinect – depth sensor

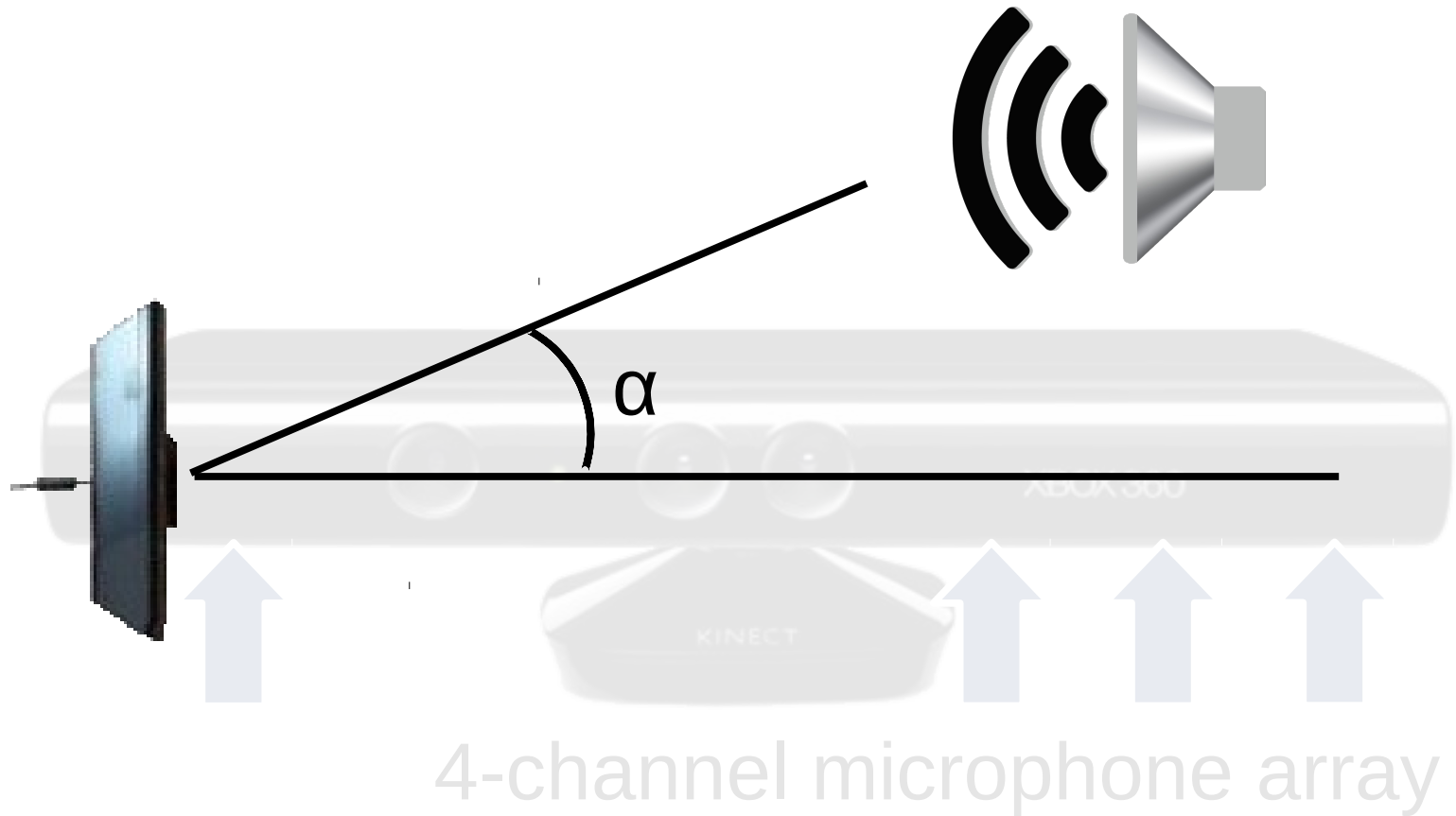


Kinect – microphone array



4-channel microphone array

Kinect – audio source angle



RGB camera



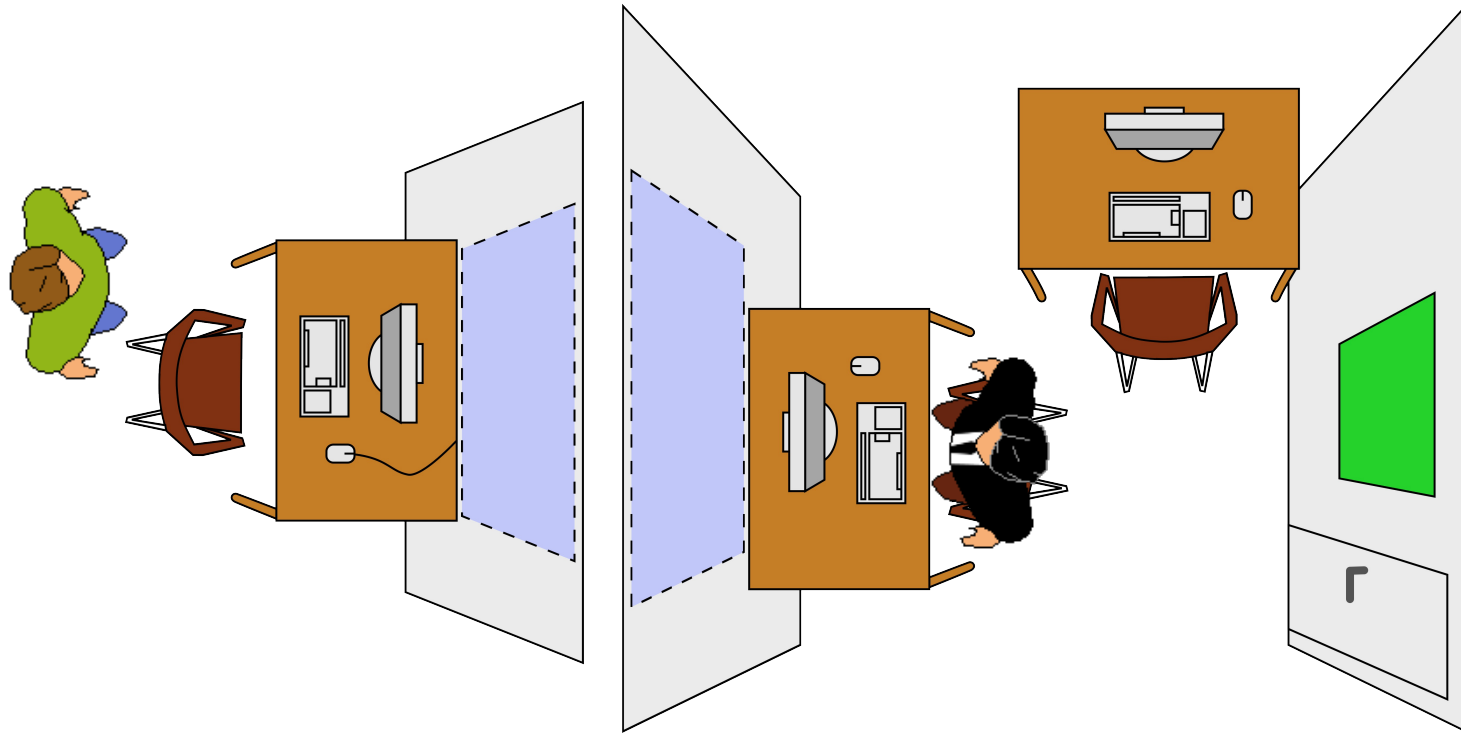
RGB camera – frustum



RGB camera – widescreen capture

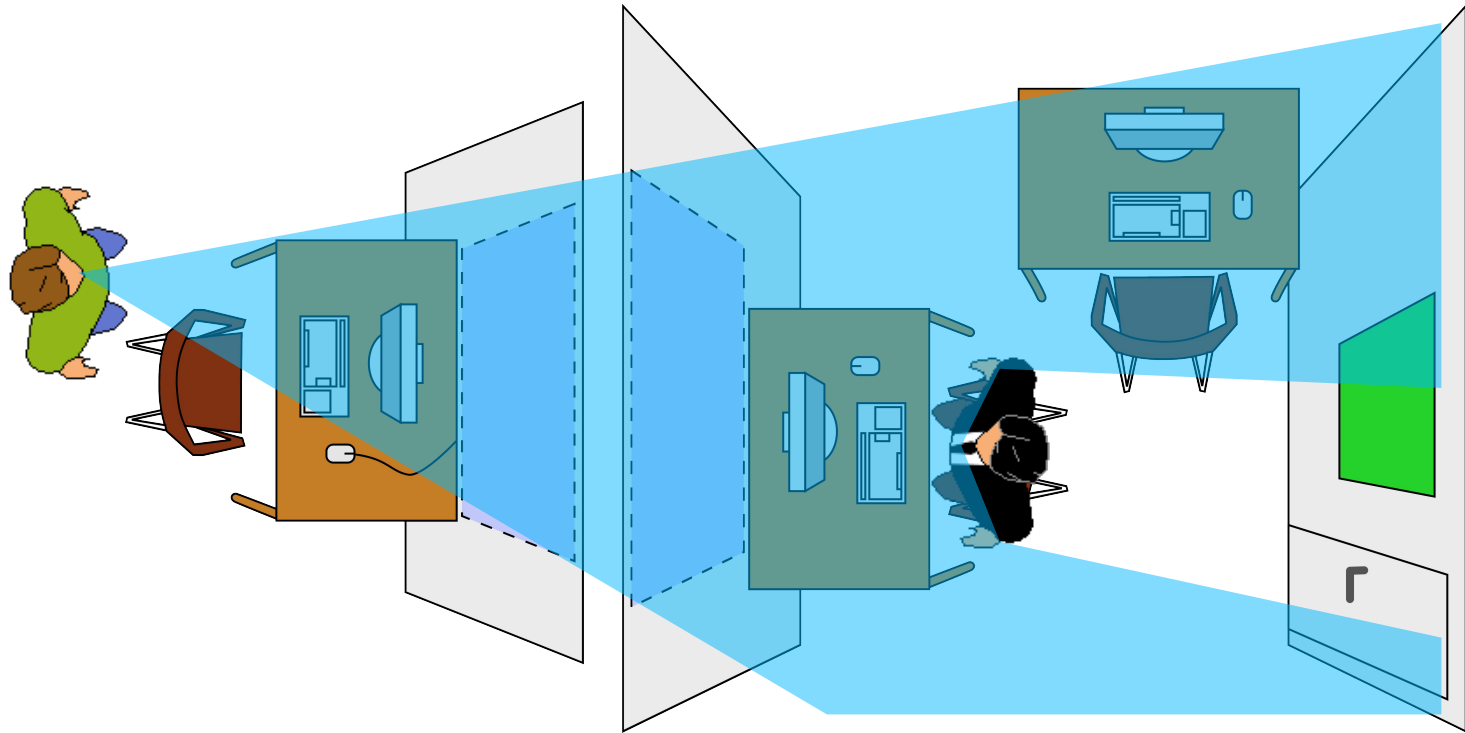


Scene Capture

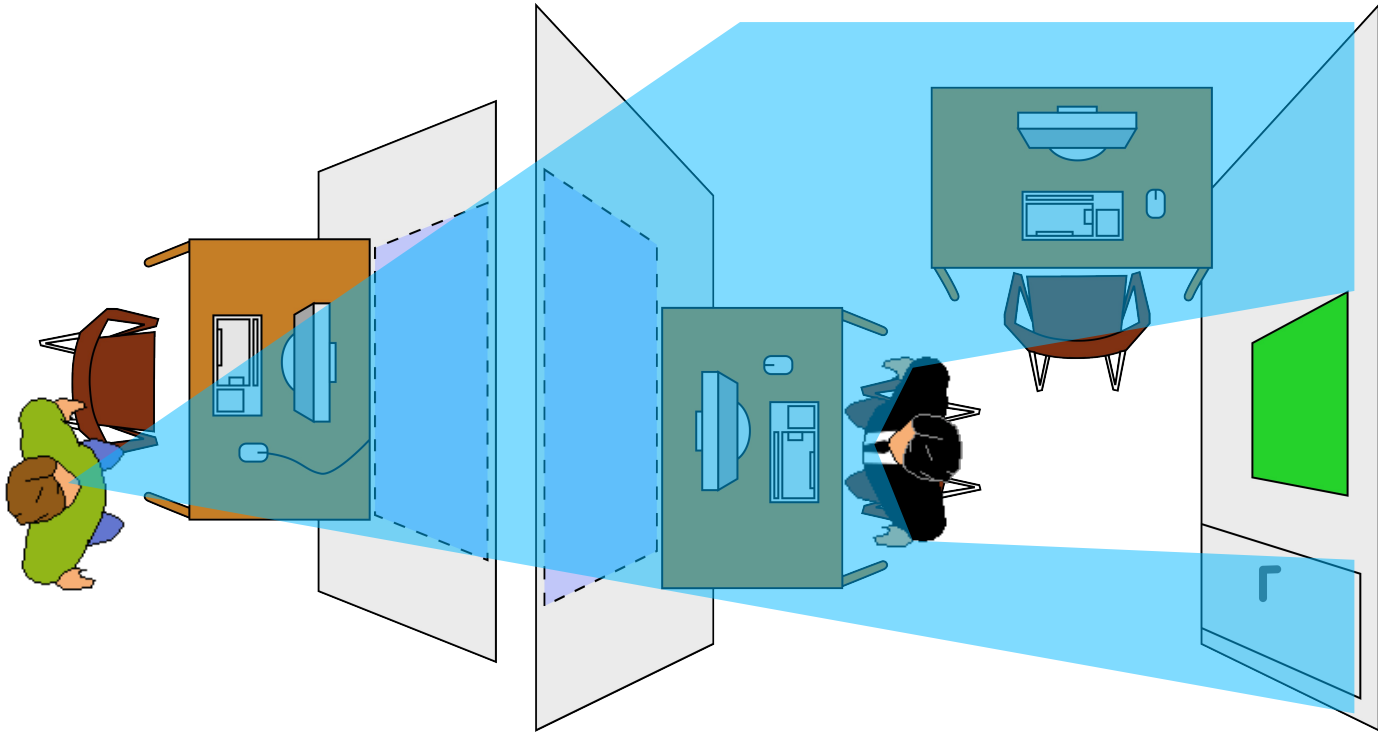


Adapted from [Maimone2012a]

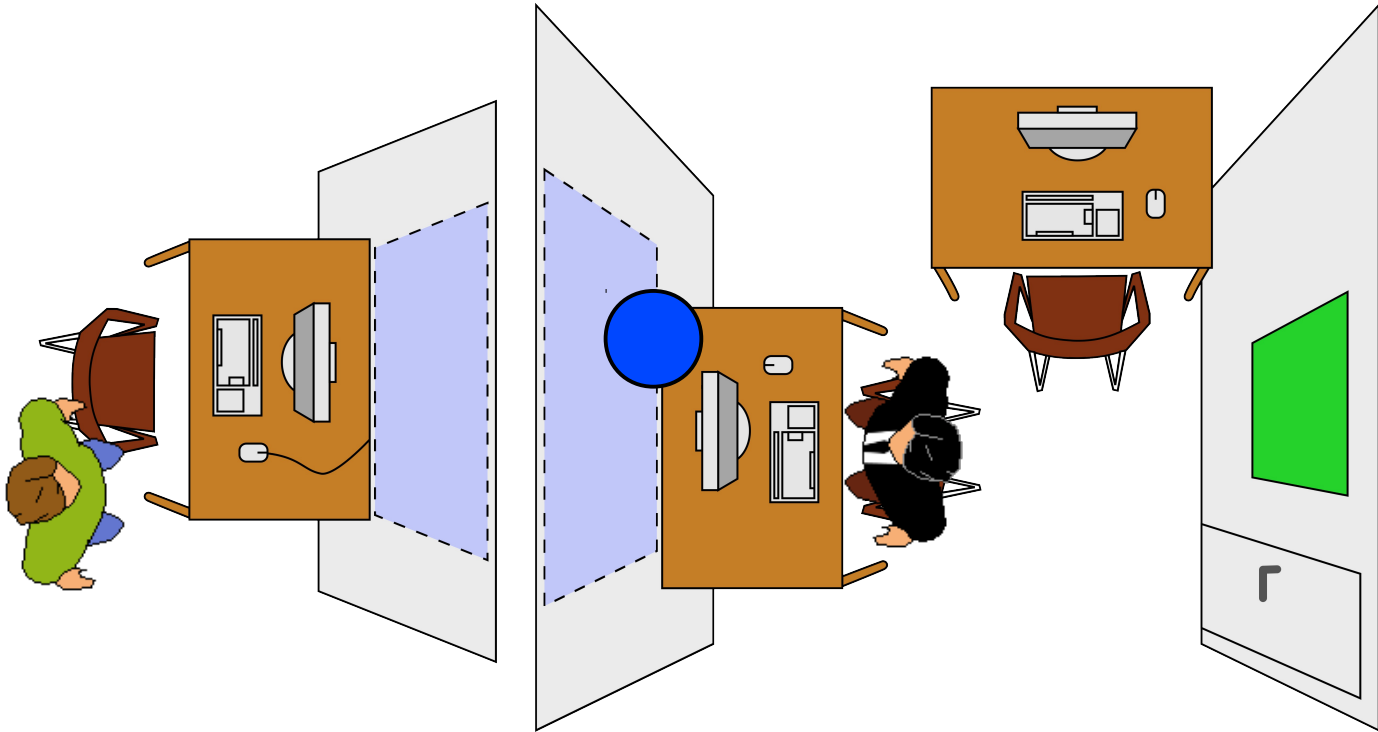
Scene Capture



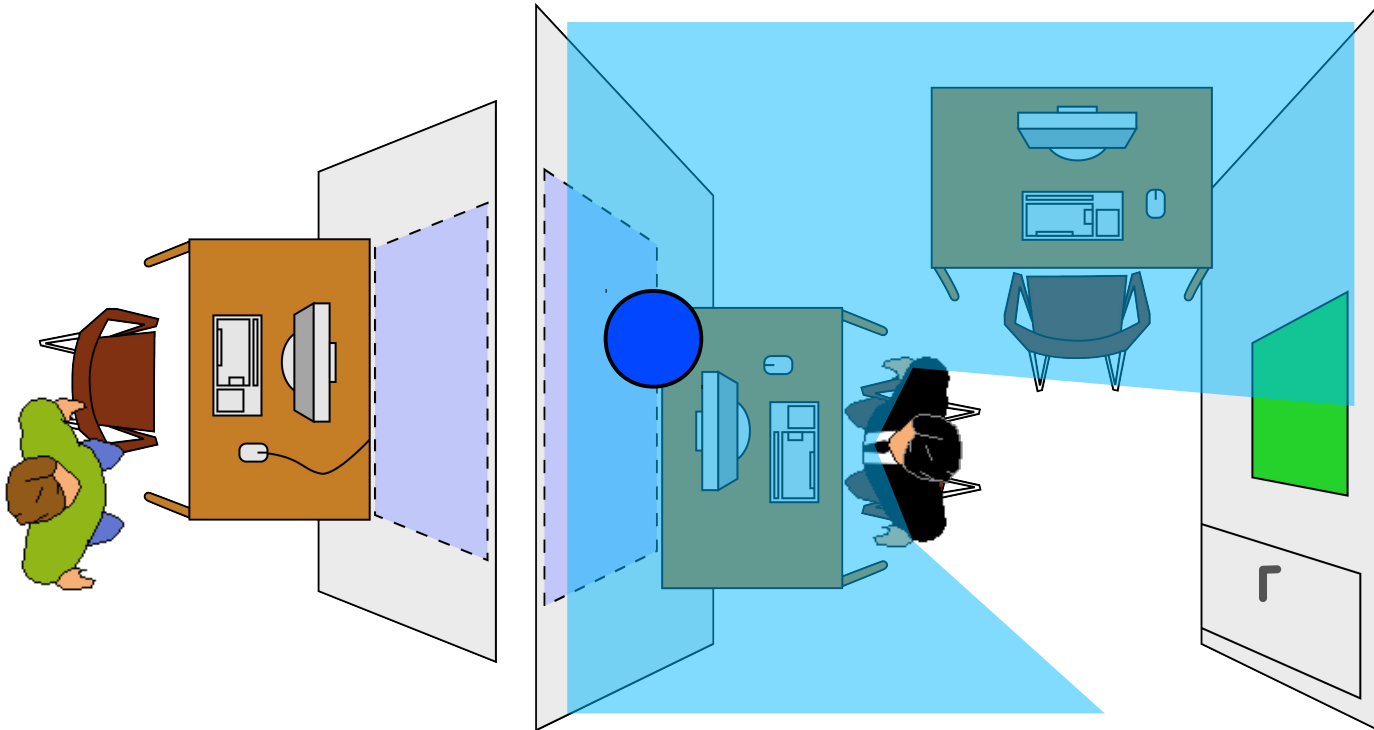
Scene Capture – viewpoint change



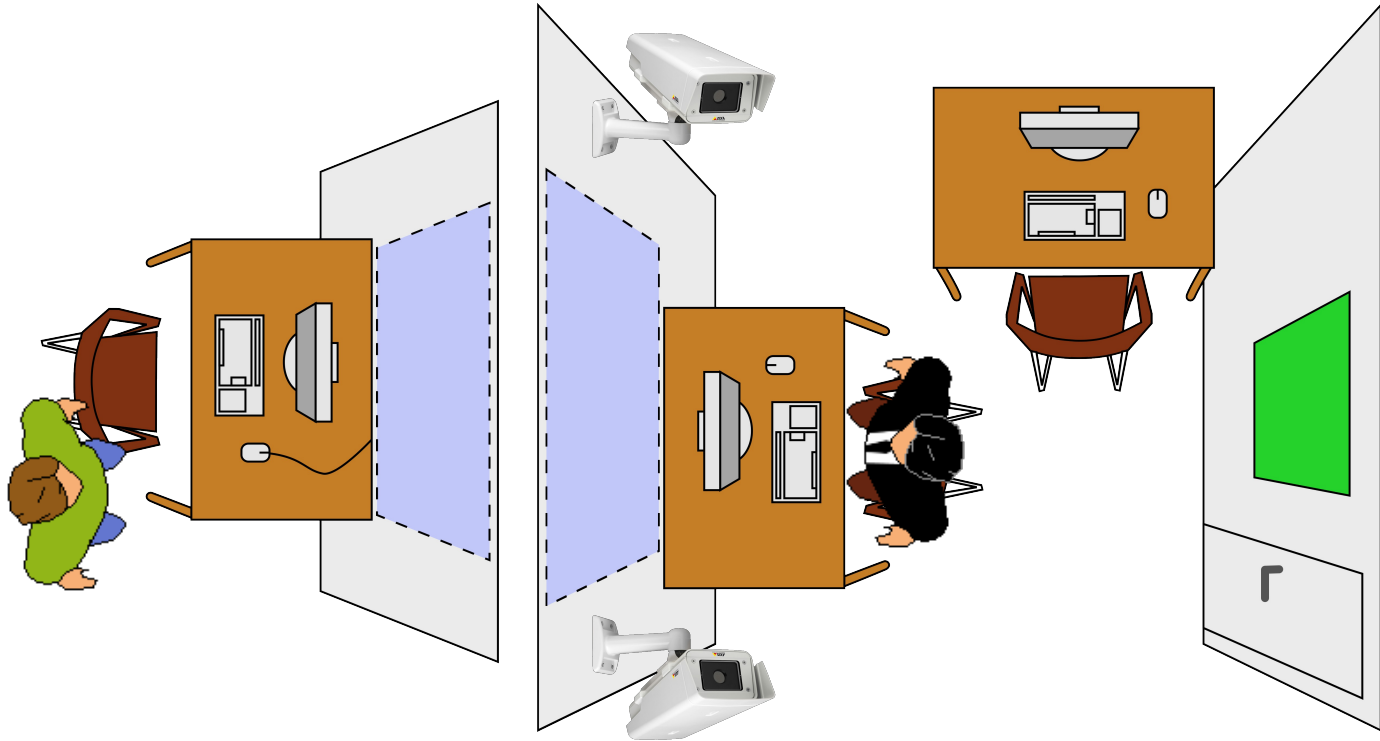
Scene Capture – 360° camera



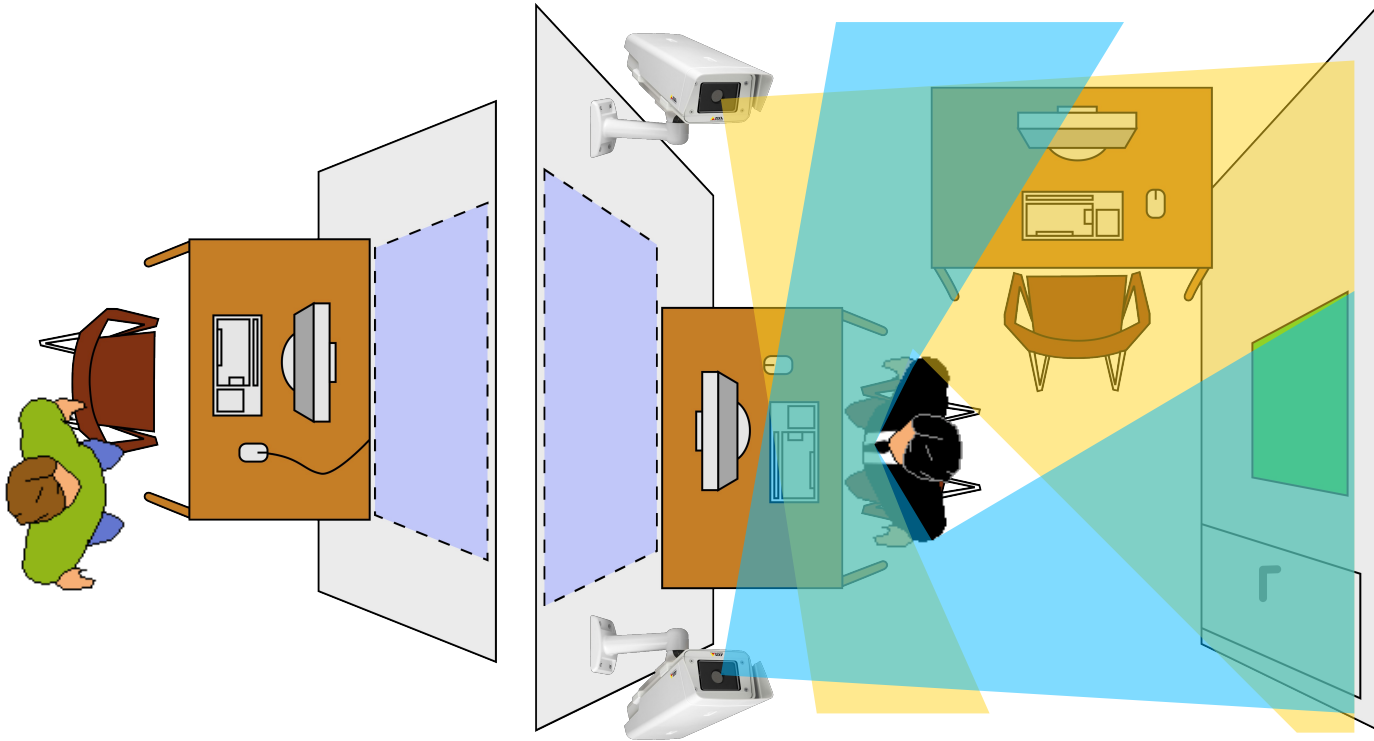
Scene Capture – 360° camera



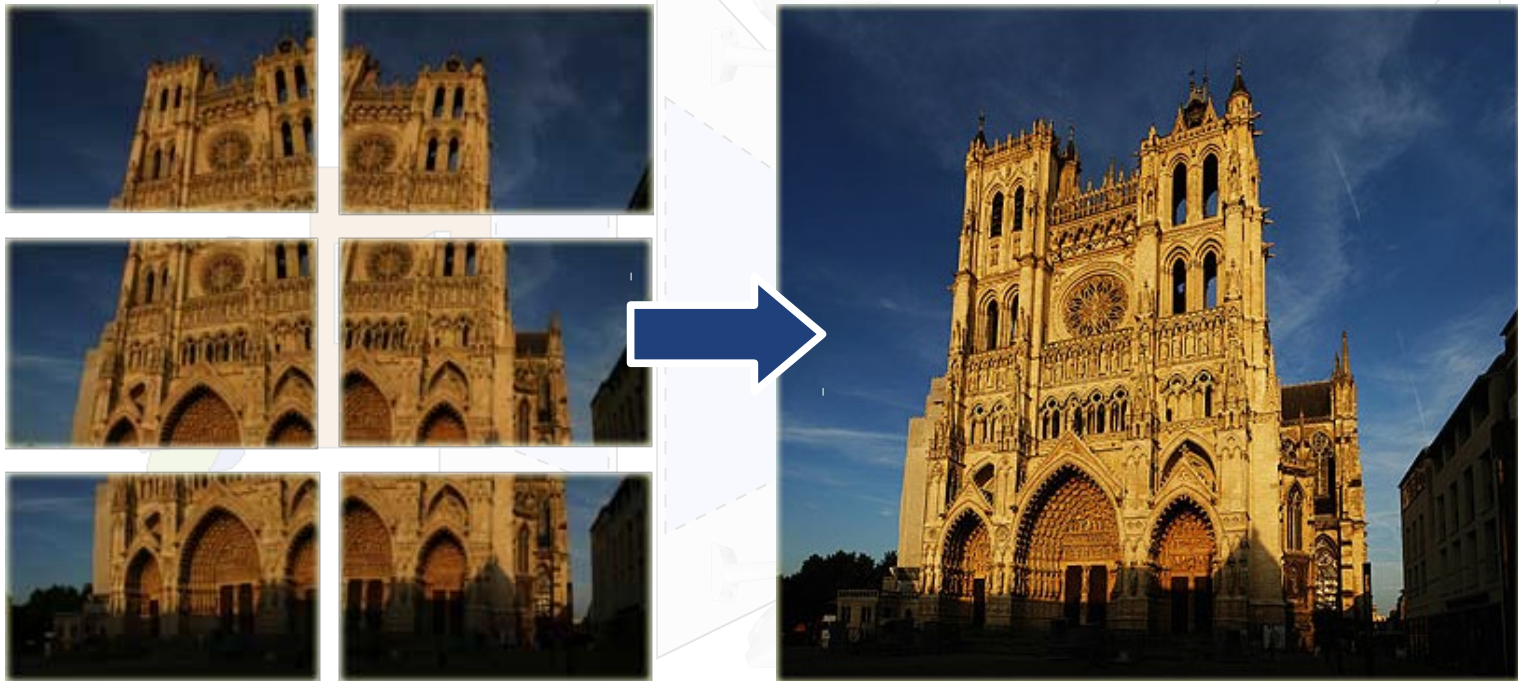
Scene Capture – multiple cameras



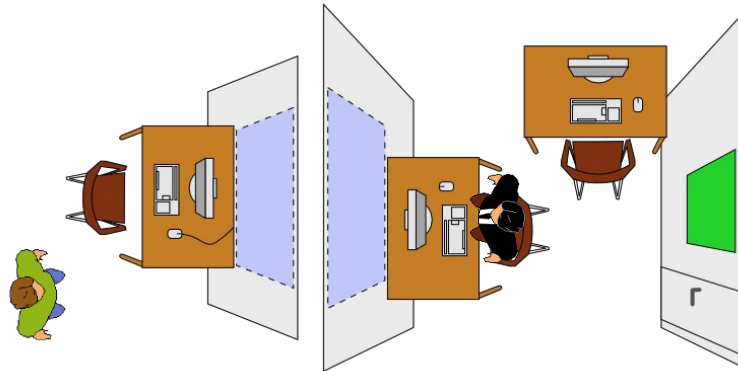
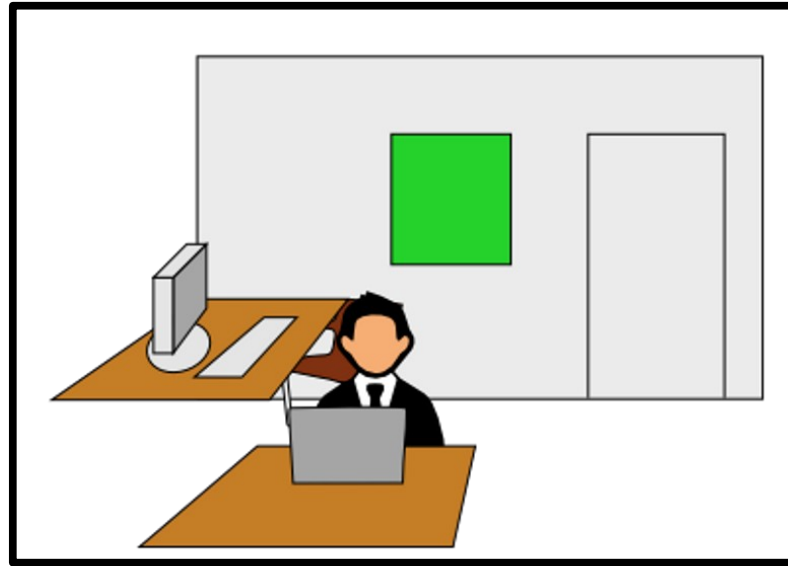
Scene Capture – multiple cameras



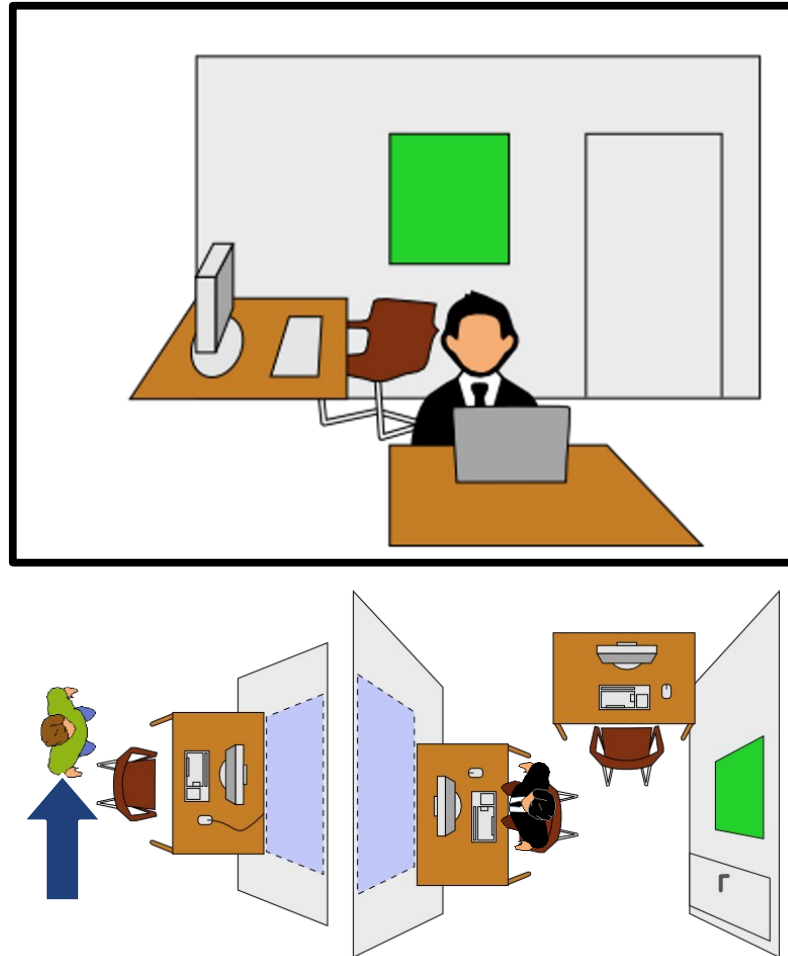
Scene Capture – image stitching



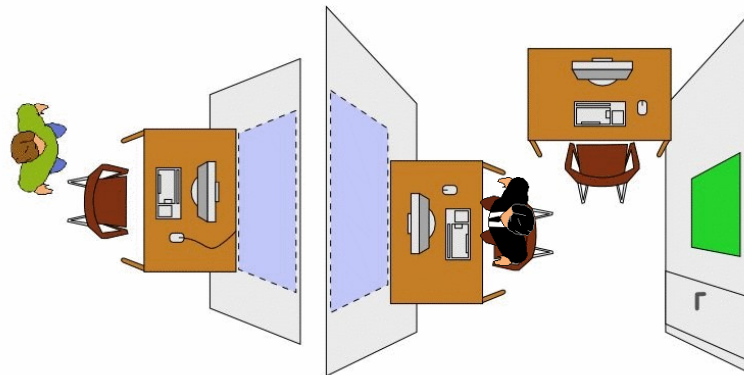
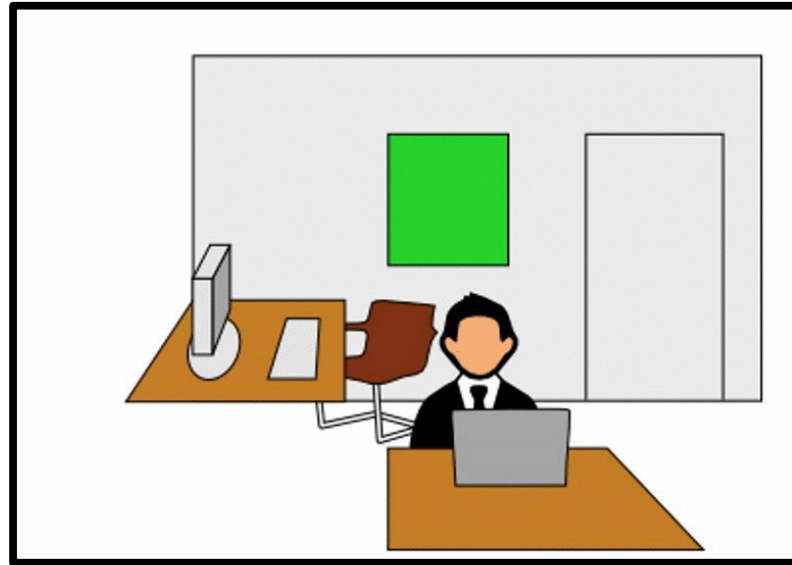
Scene Capture – viewpoint change



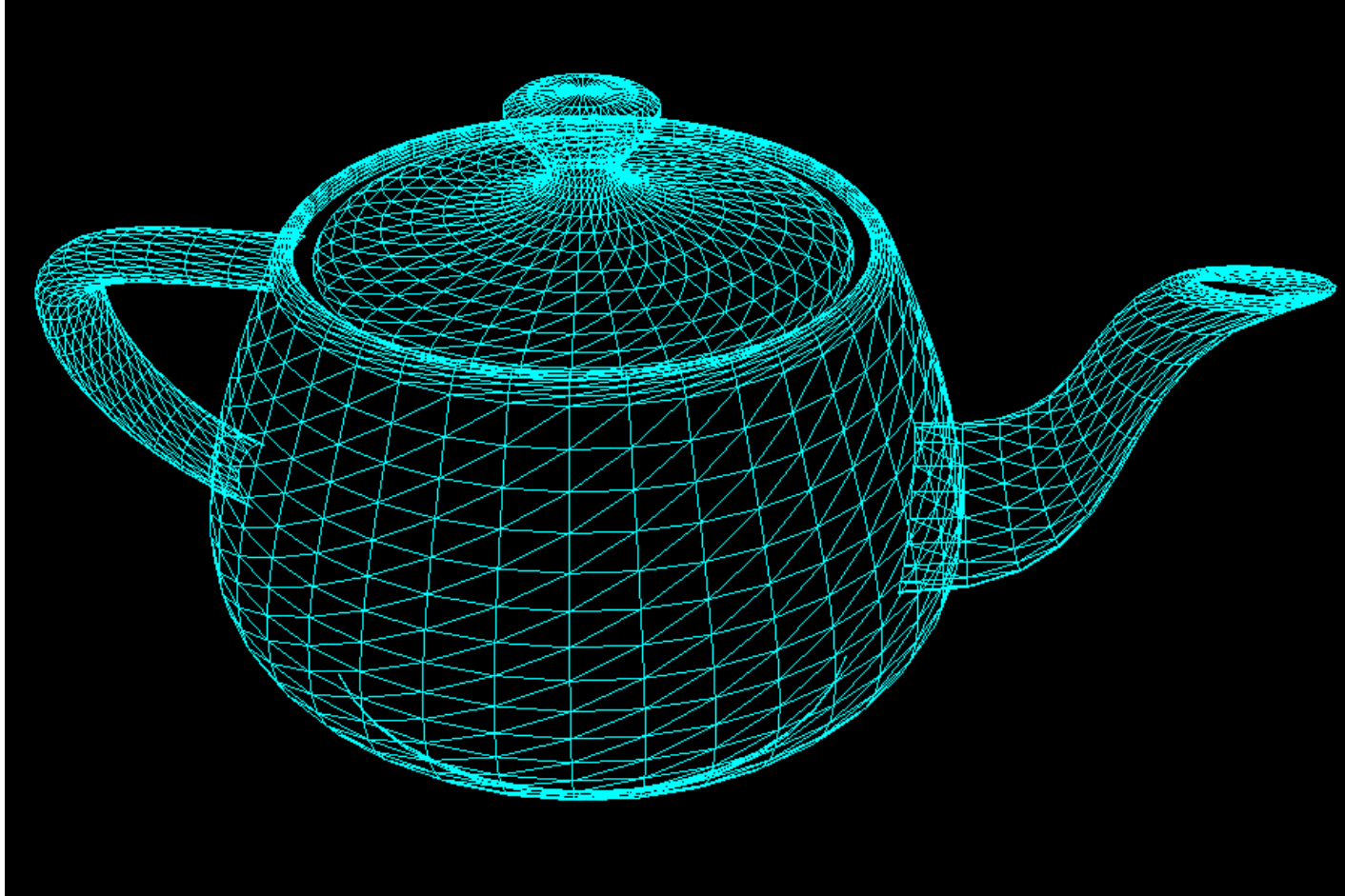
Scene Capture



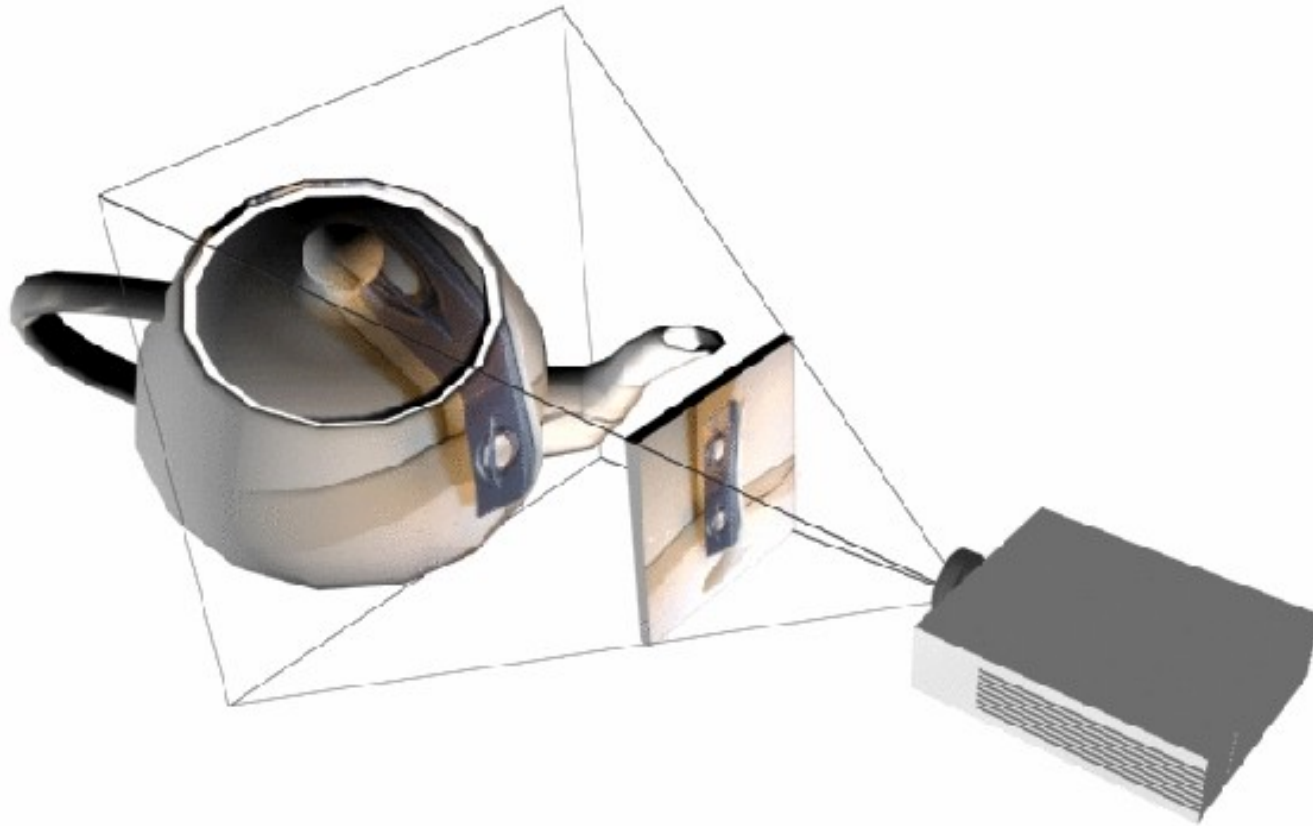
Scene Capture – continuous viewpoints



Scene Capture – 3D model



Scene Capture – projective textures



Depth sensor

IR
projector

IR
camera



Depth sensor – structured light

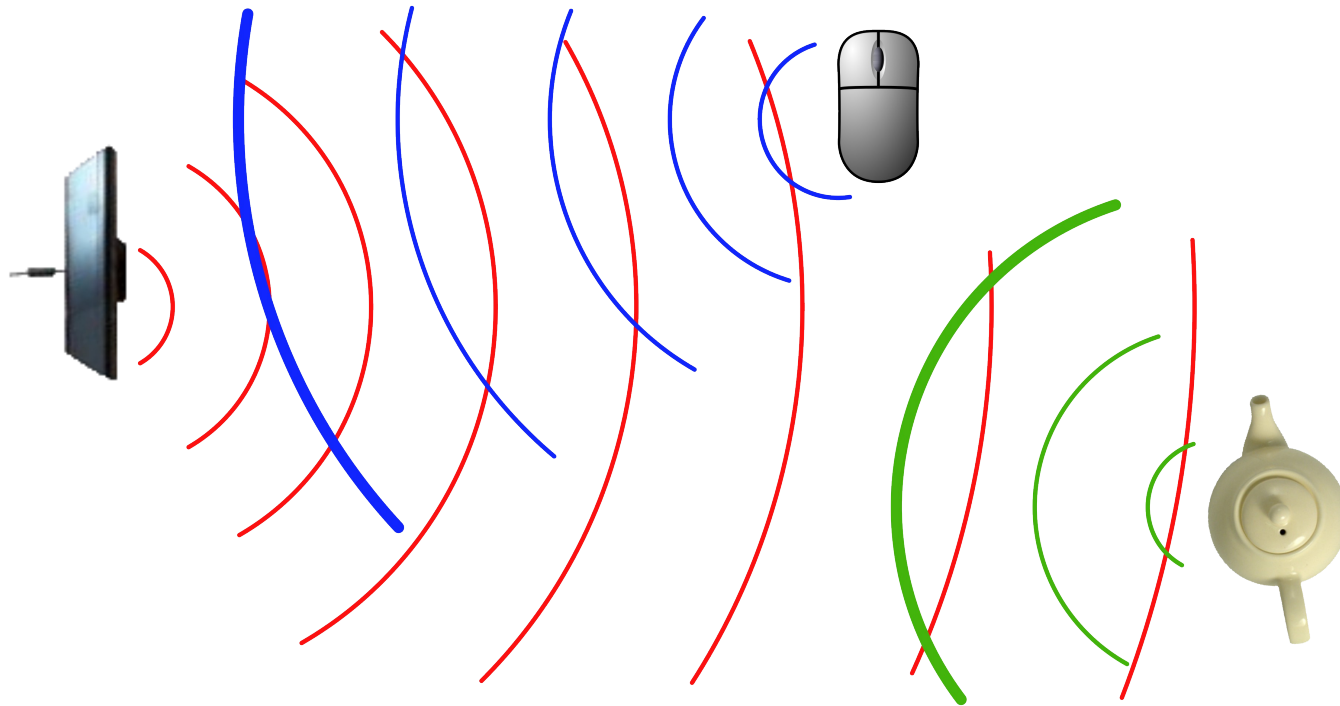
IR



IR



Depth sensor – time of flight

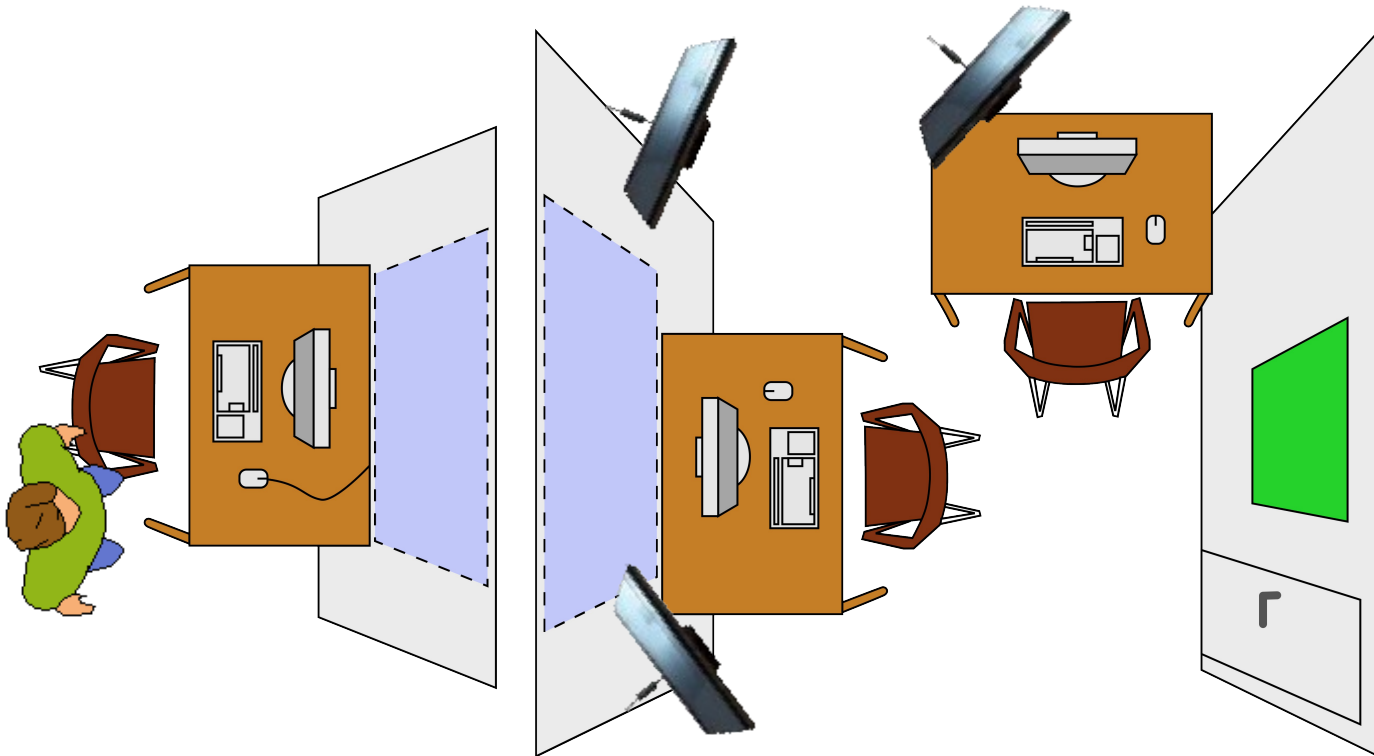


Depth sensor – result



[Maimone2012b]

Depth sensor – multiple sensors



Depth sensor – interference



[Maimone2012a]

Depth sensor – interference



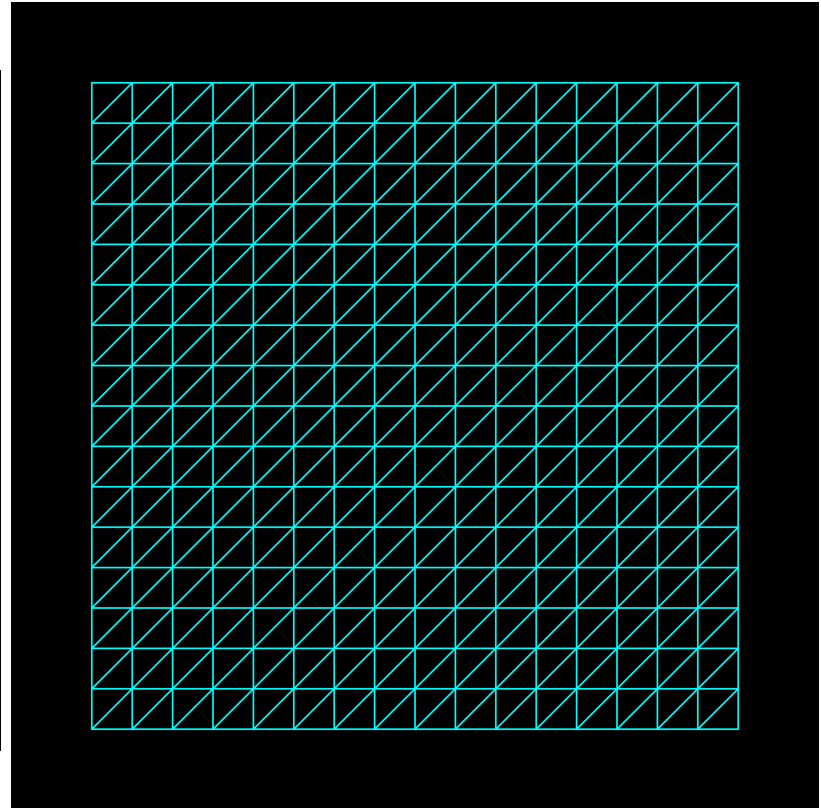
[Maimone2012a]

Depth sensor – interference

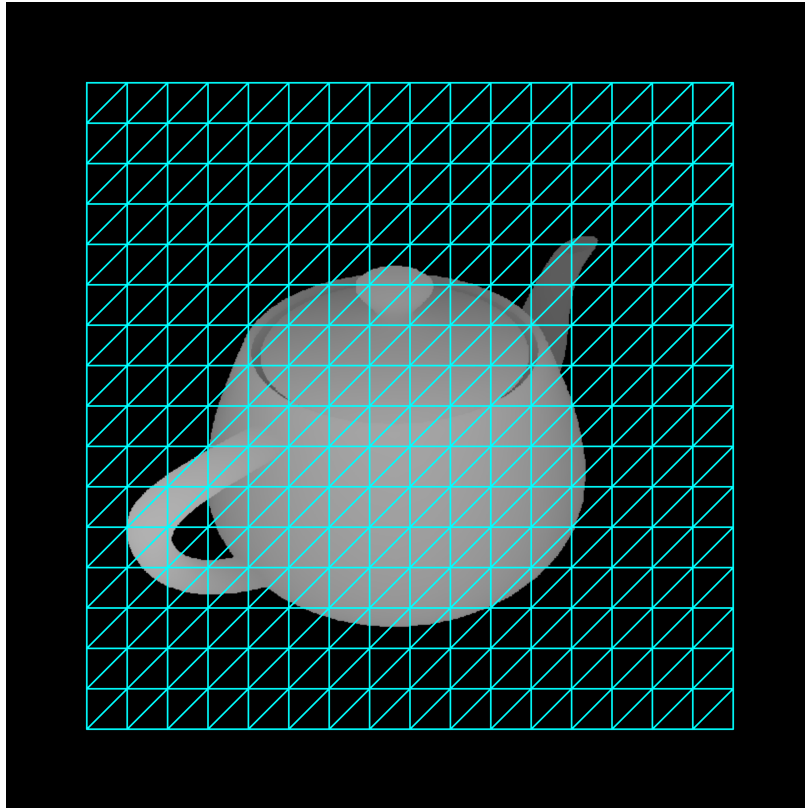


[Maimone2012a]

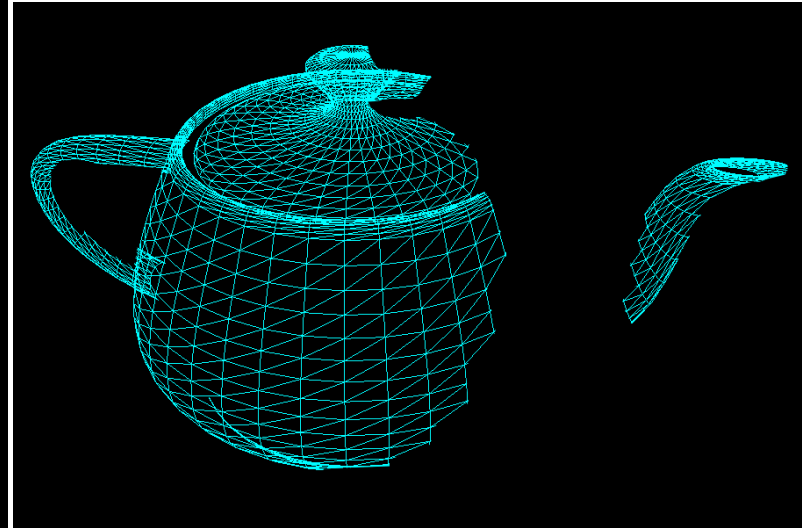
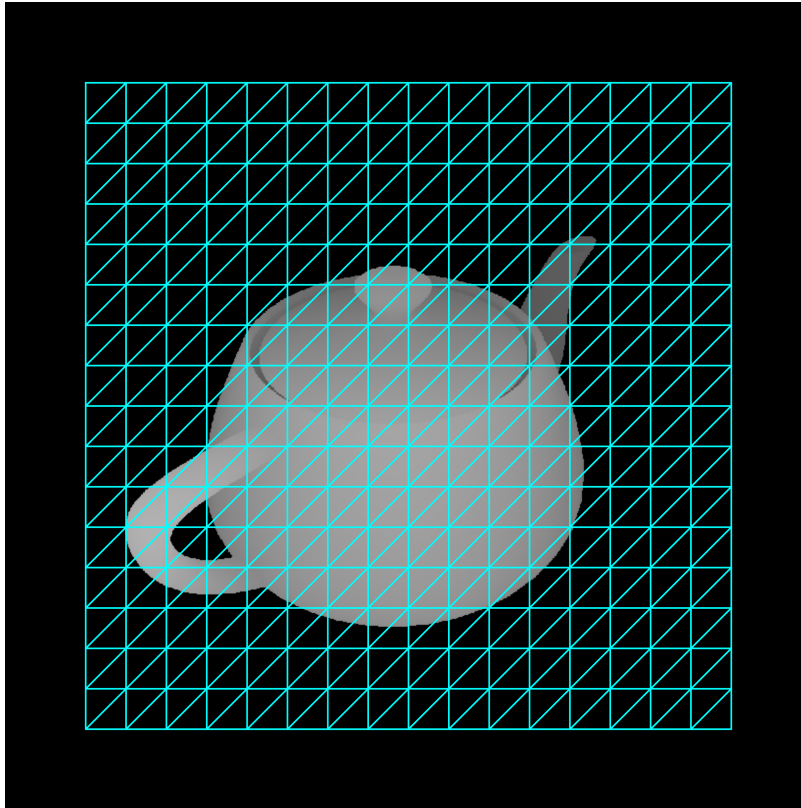
3D reconstruction



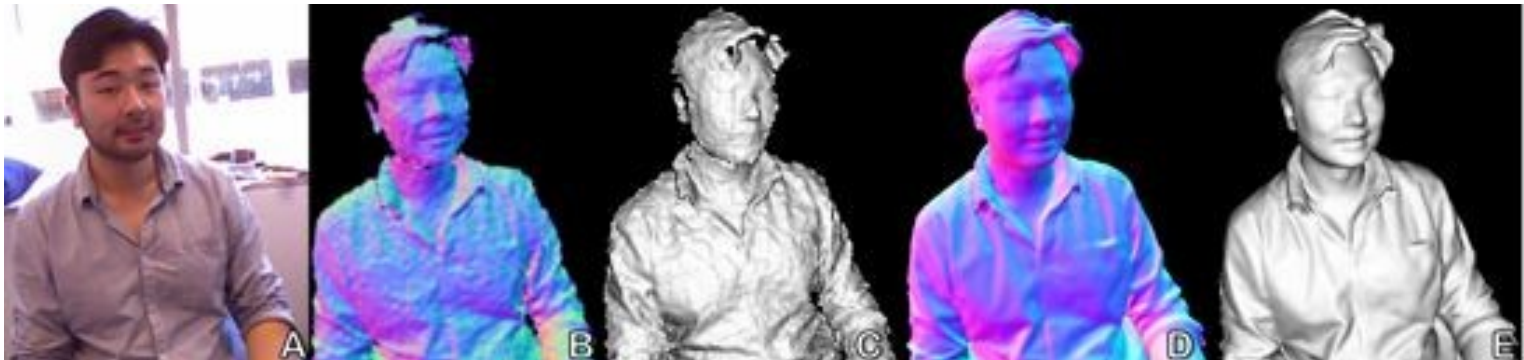
3D reconstruction



3D reconstruction

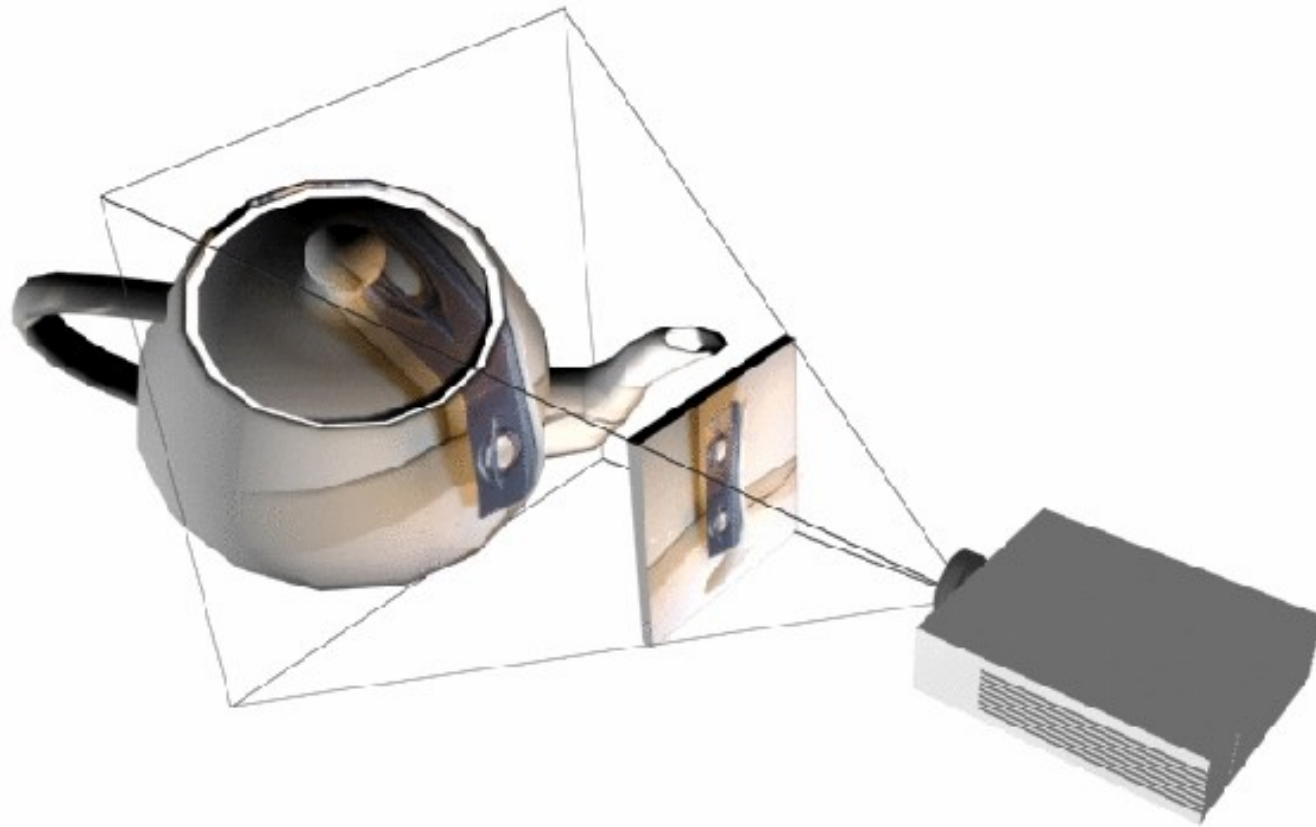


3D reconstruction – KinectFusion

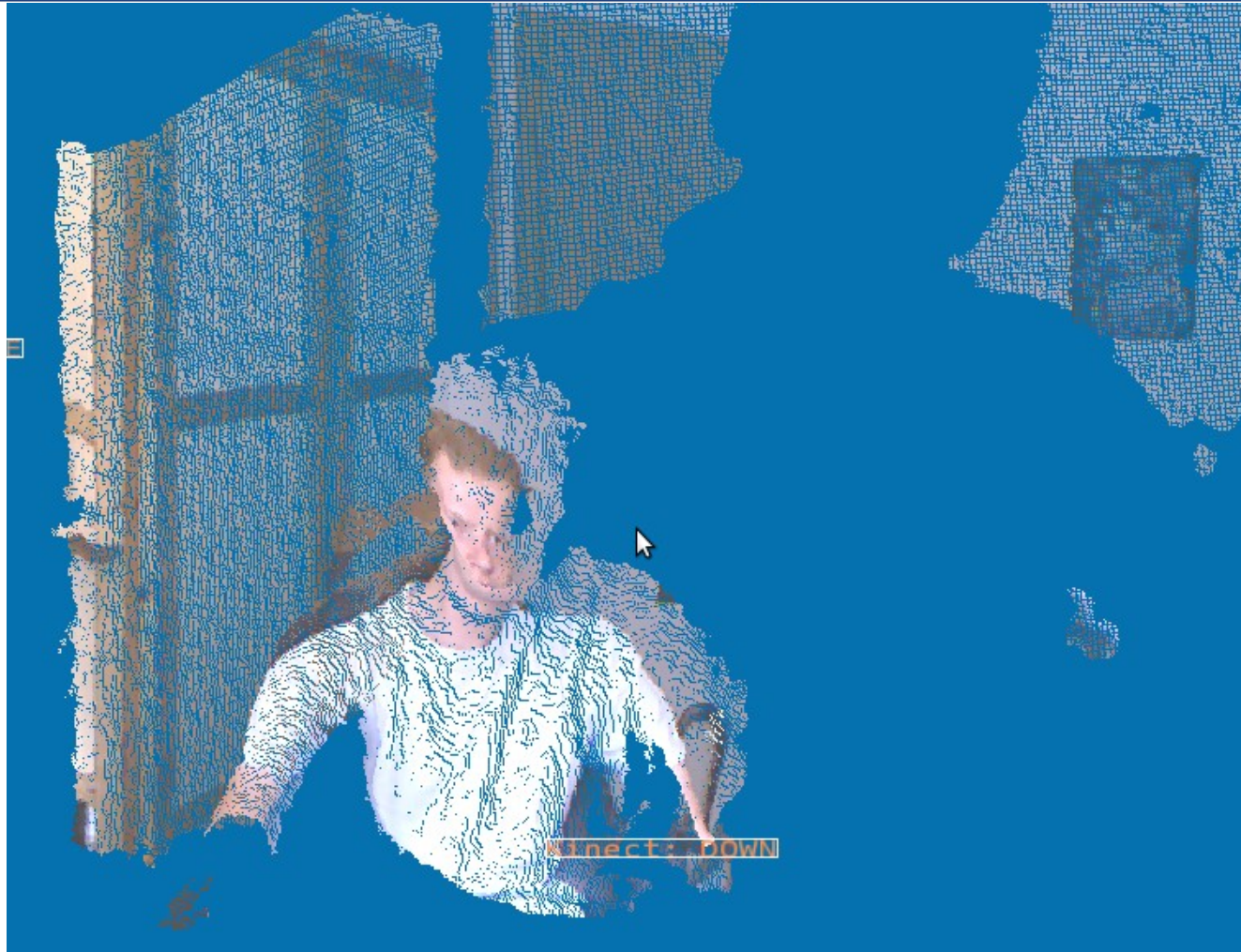


[Izadi2011]

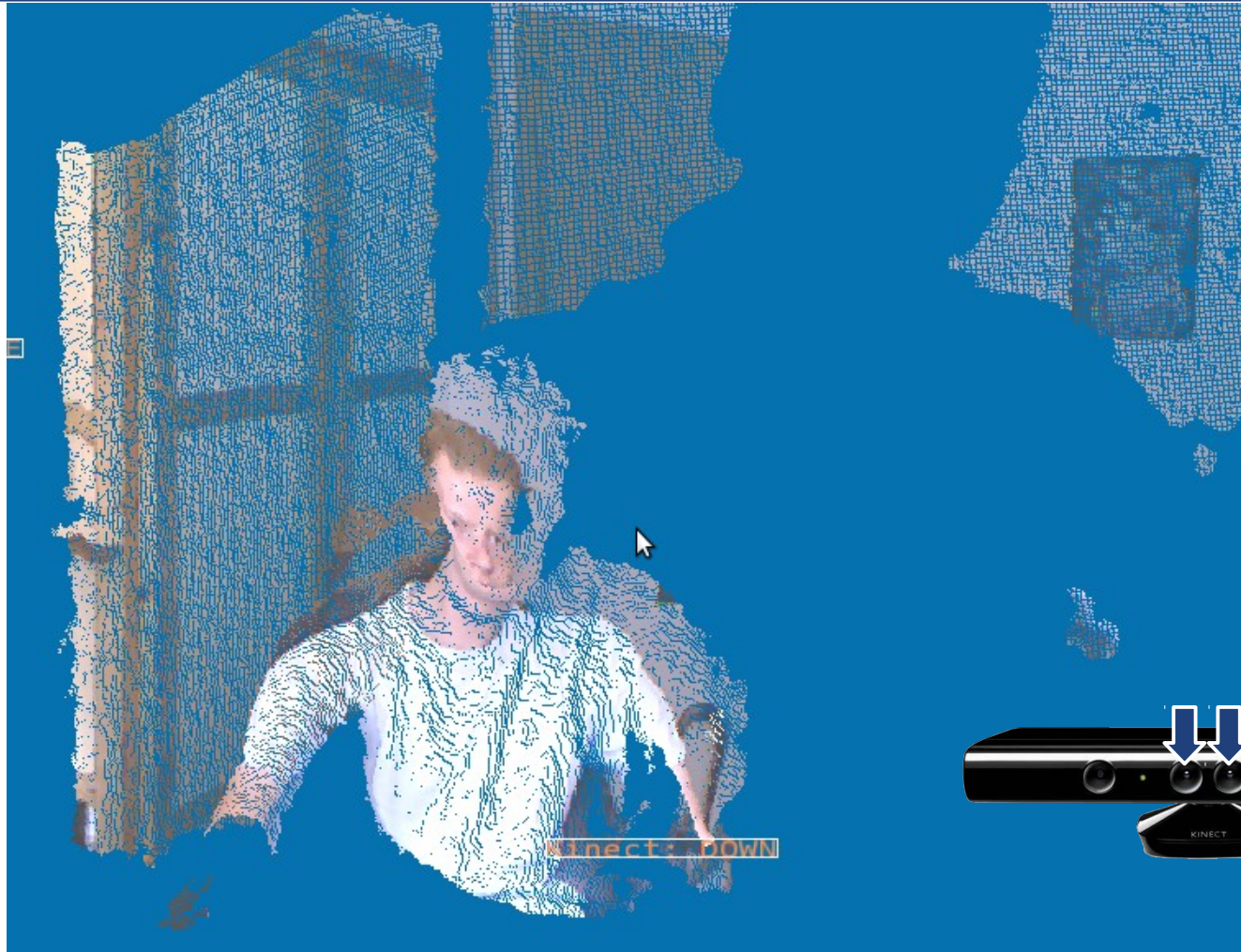
3D reconstruction



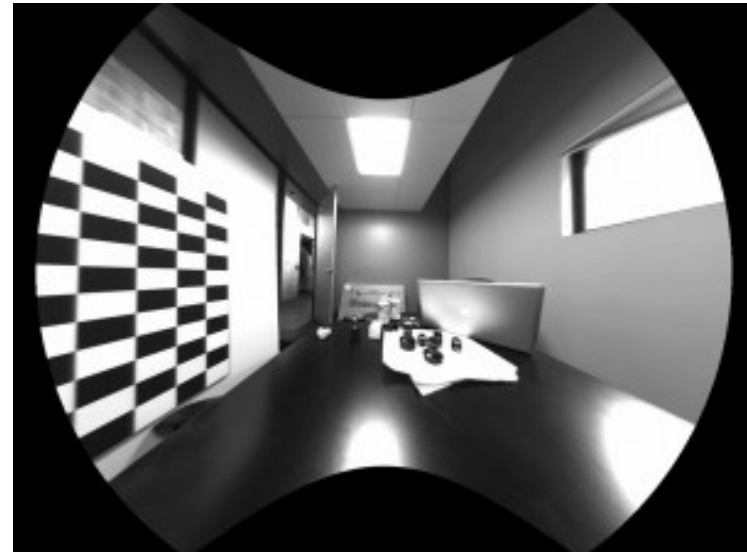
Registration – without calibration



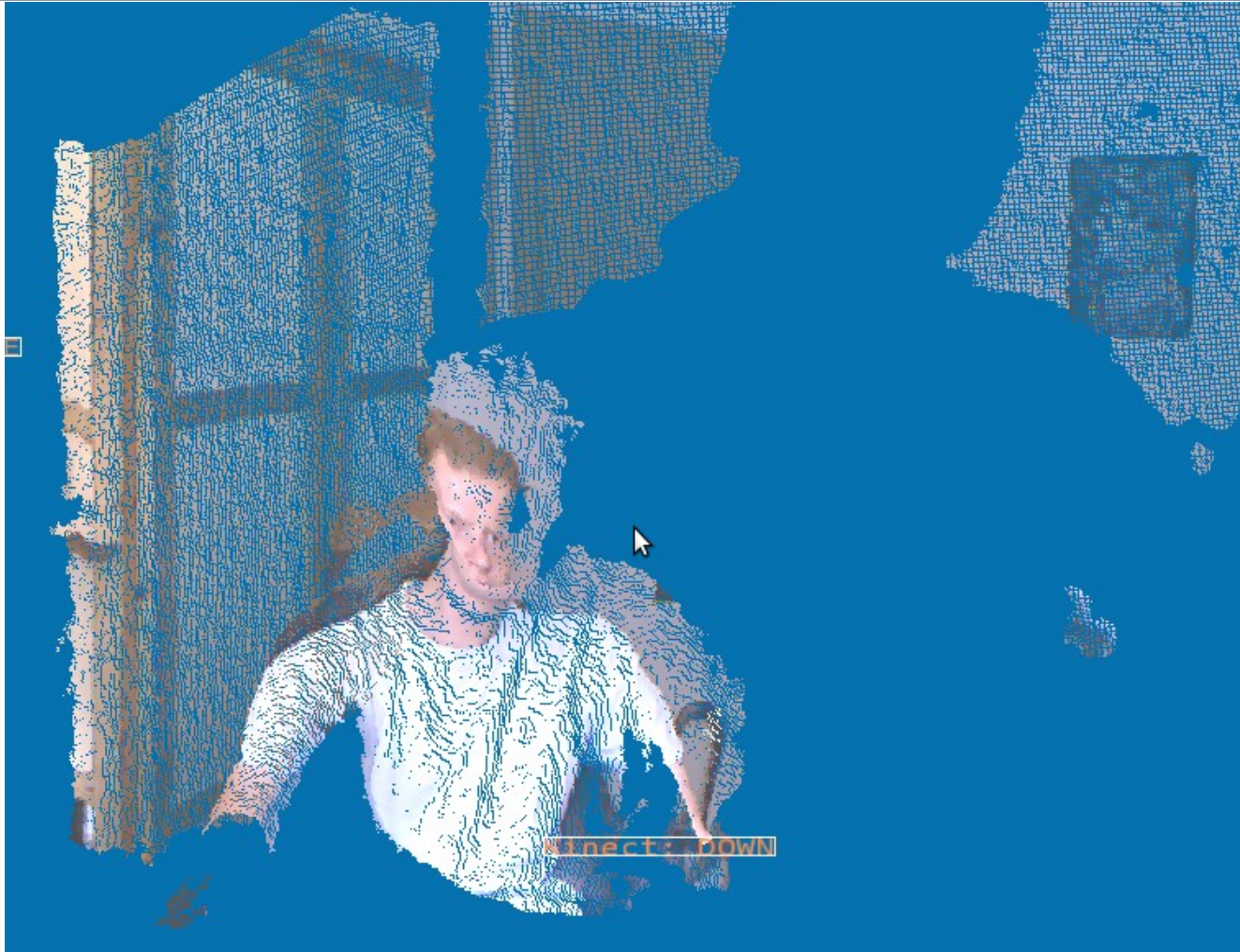
Registration – without calibration



Calibration – radial distortion



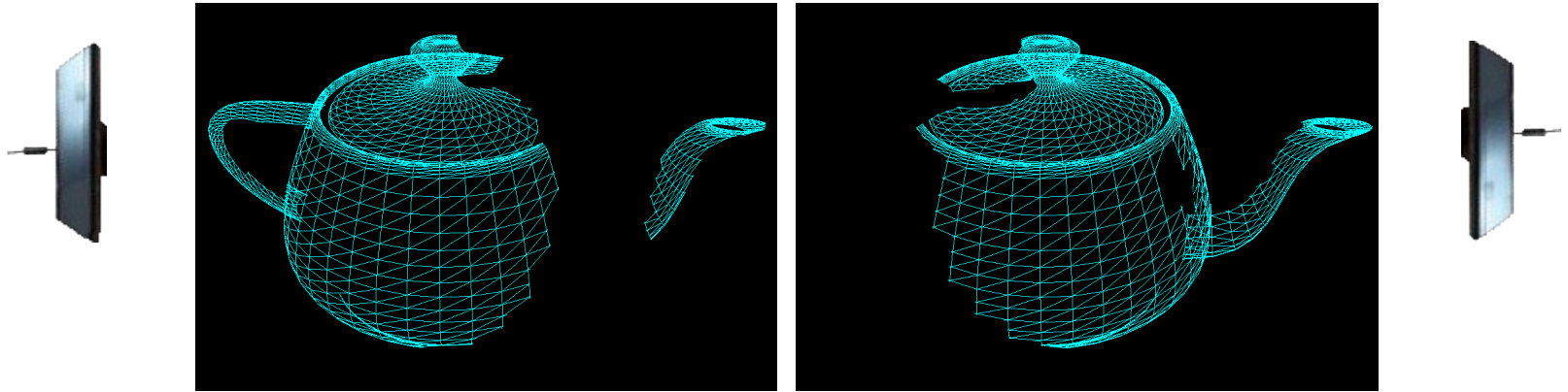
Calibration – extrinsic parameters



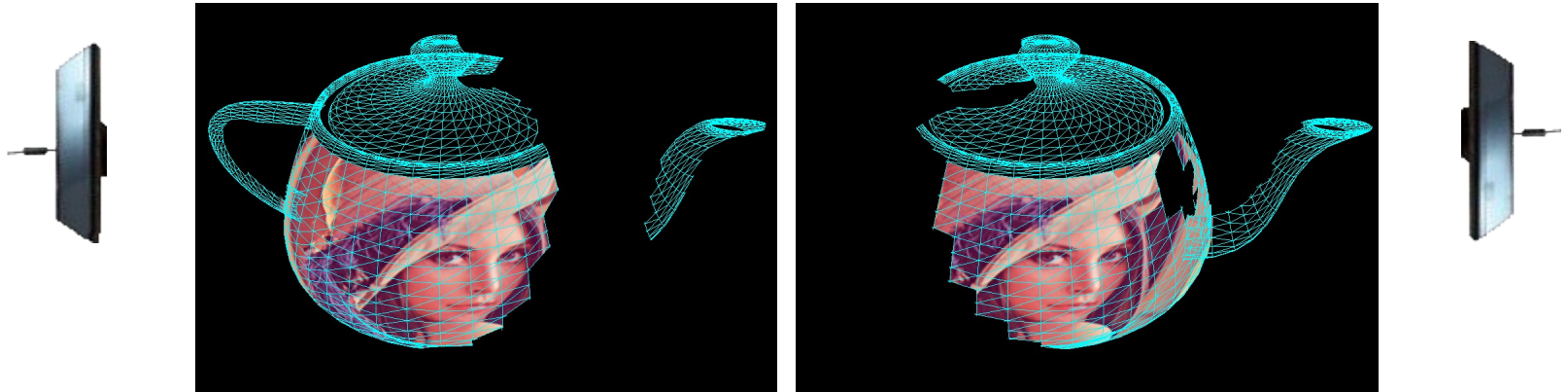
Calibration – extrinsic parameters



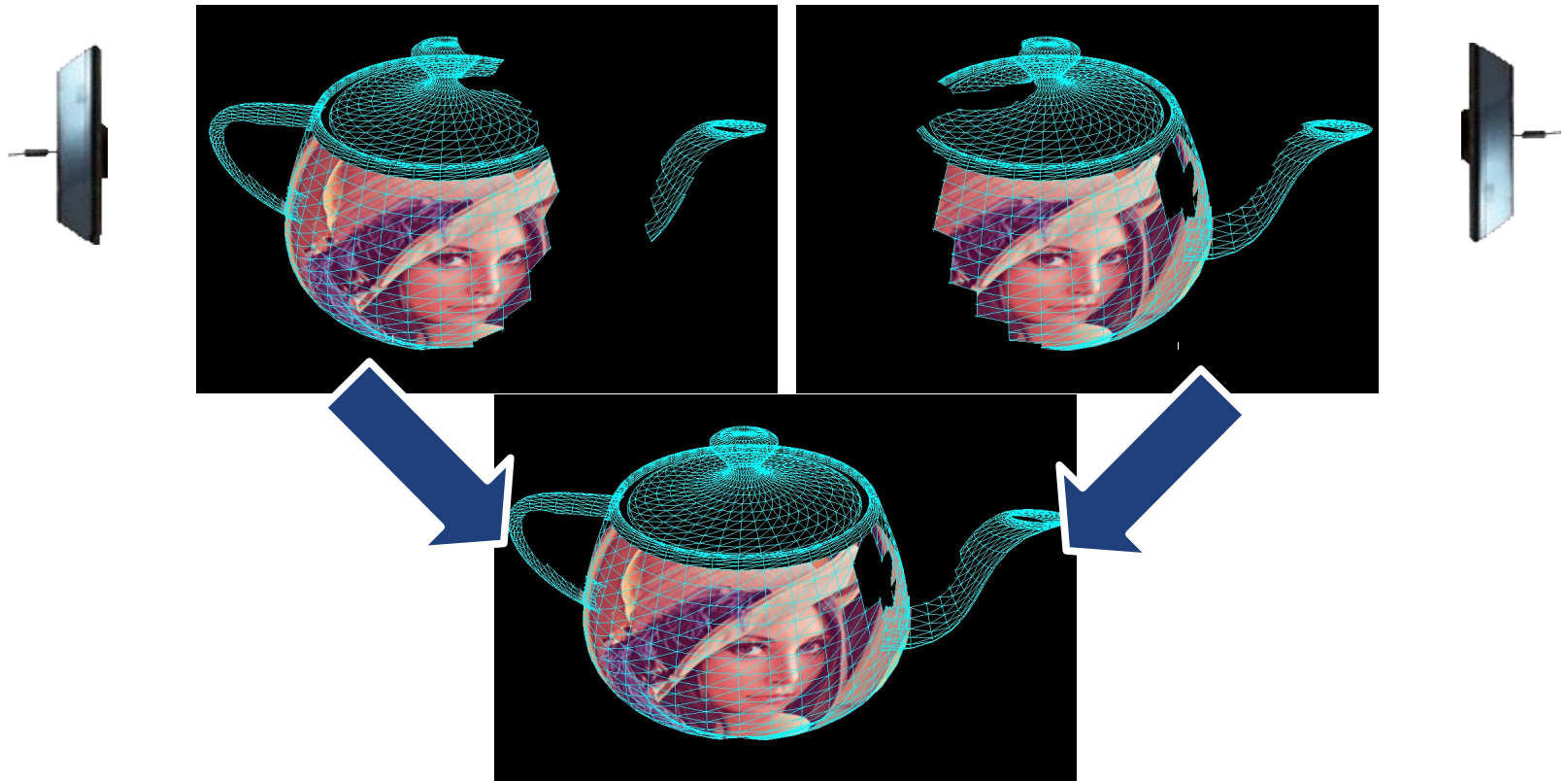
Registration



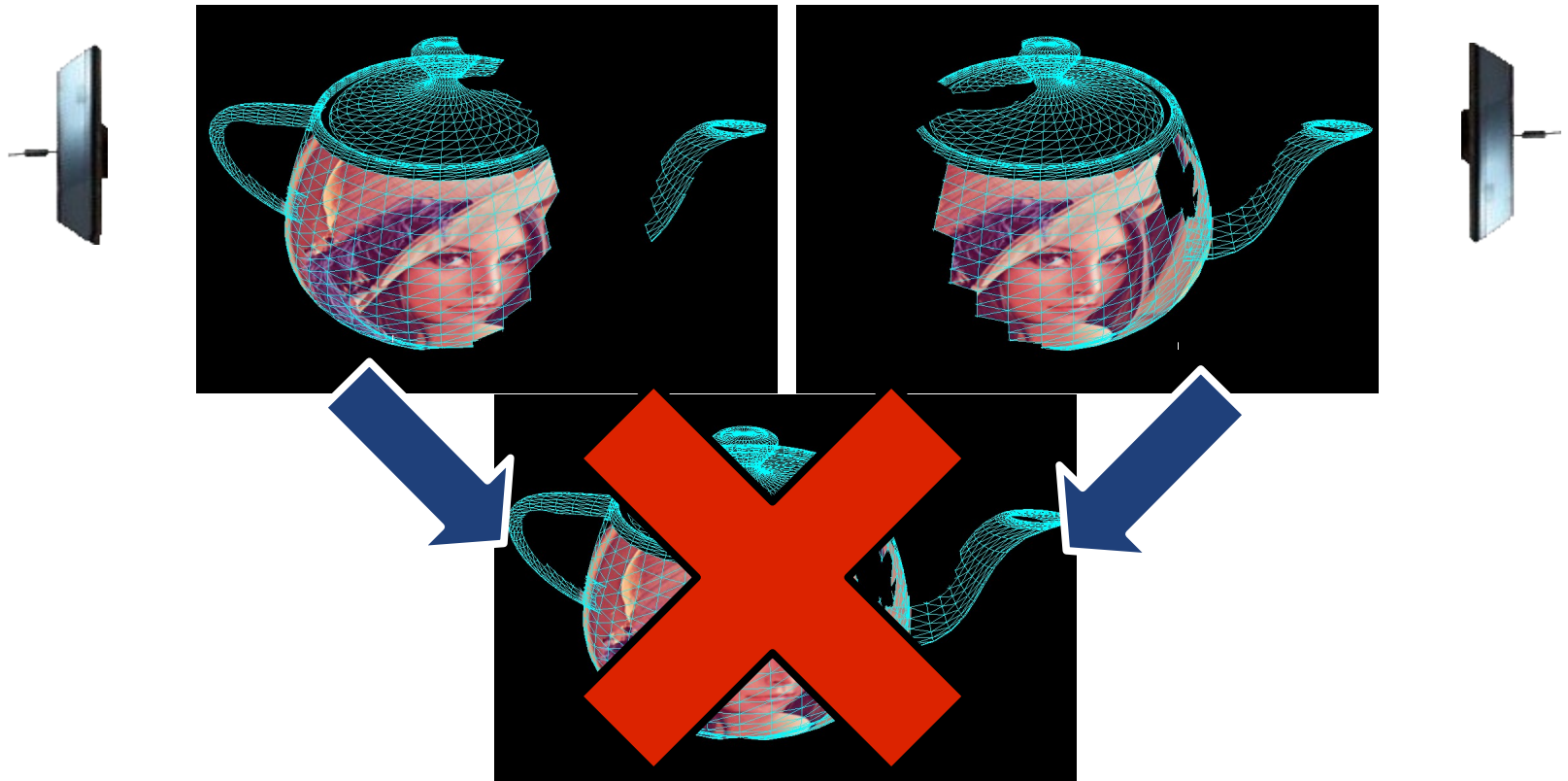
Registration



Registration



Registration

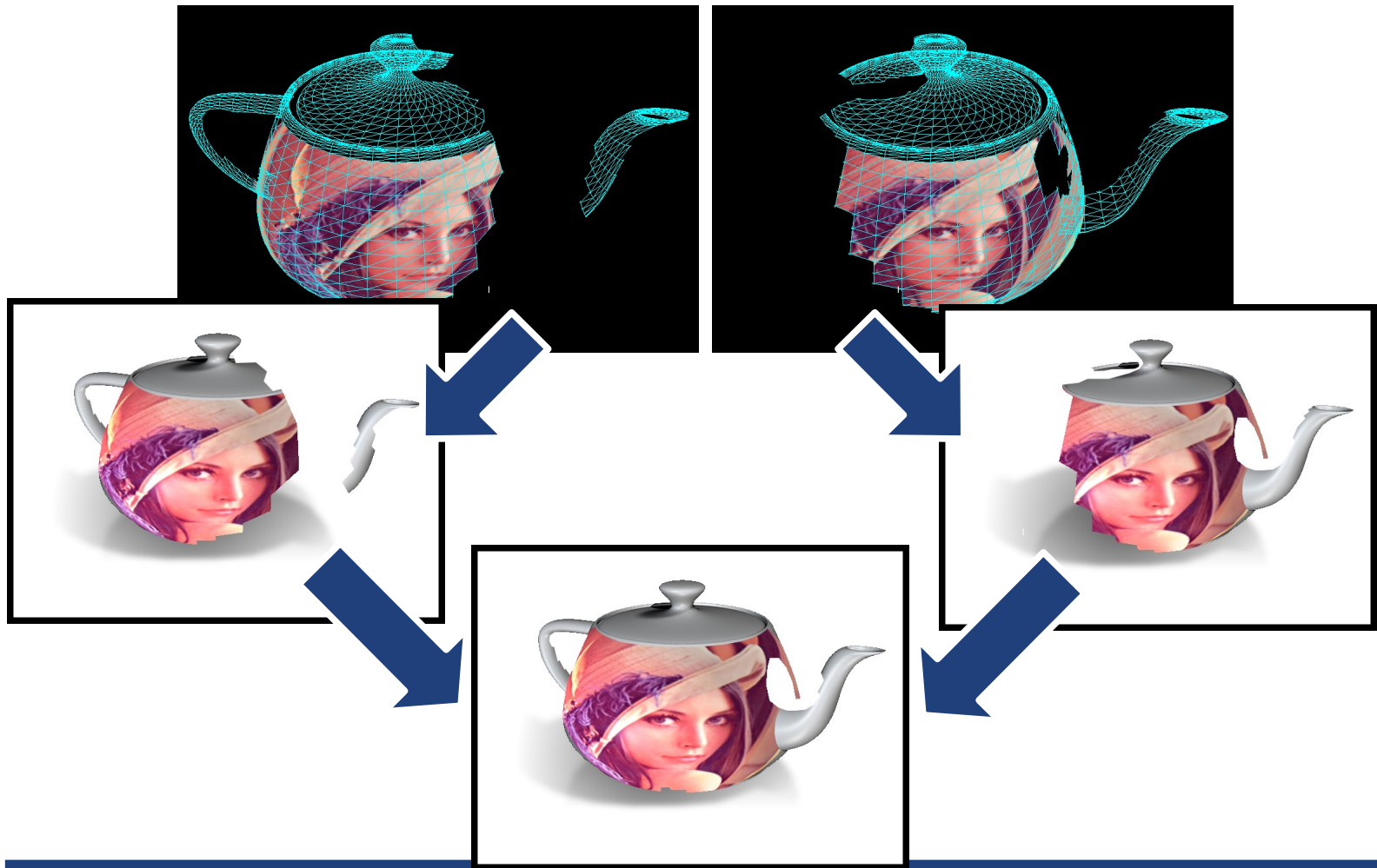


Registration

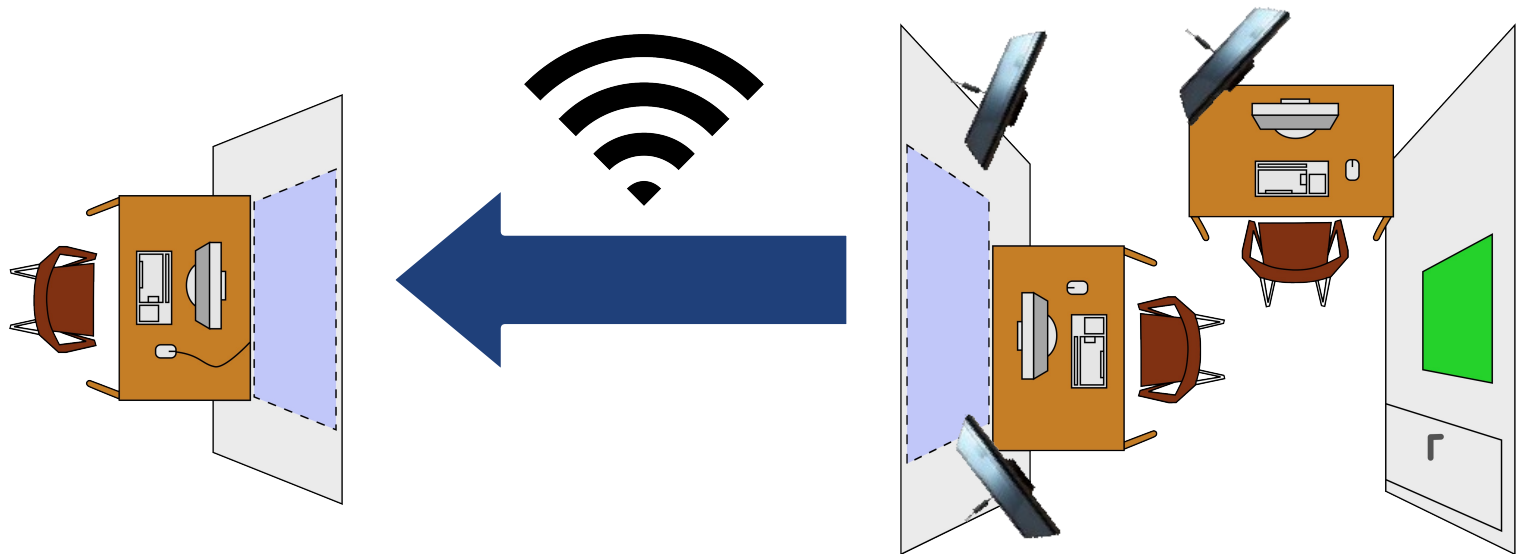


[Raskar1998]

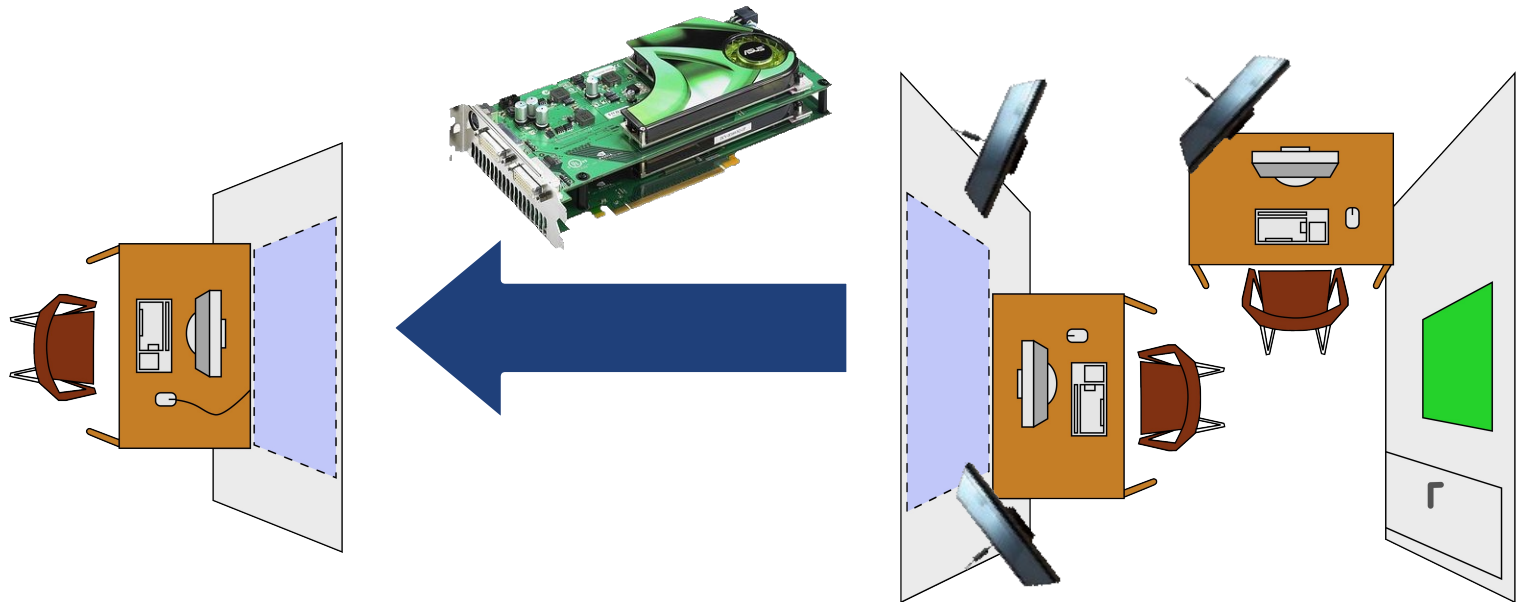
Registration – merging in 2D



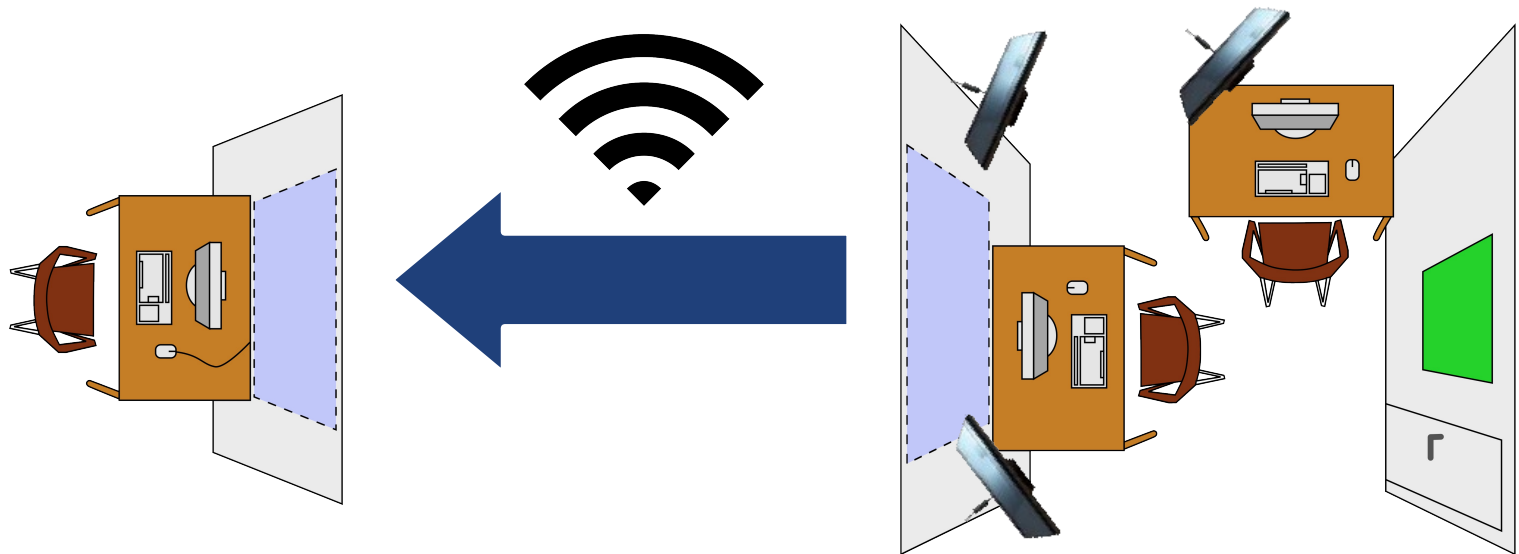
Transmission



Transmission



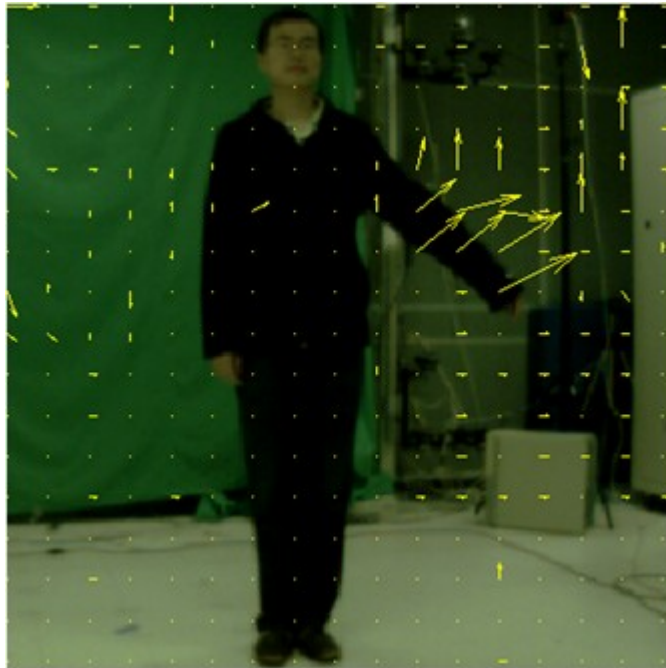
Transmission



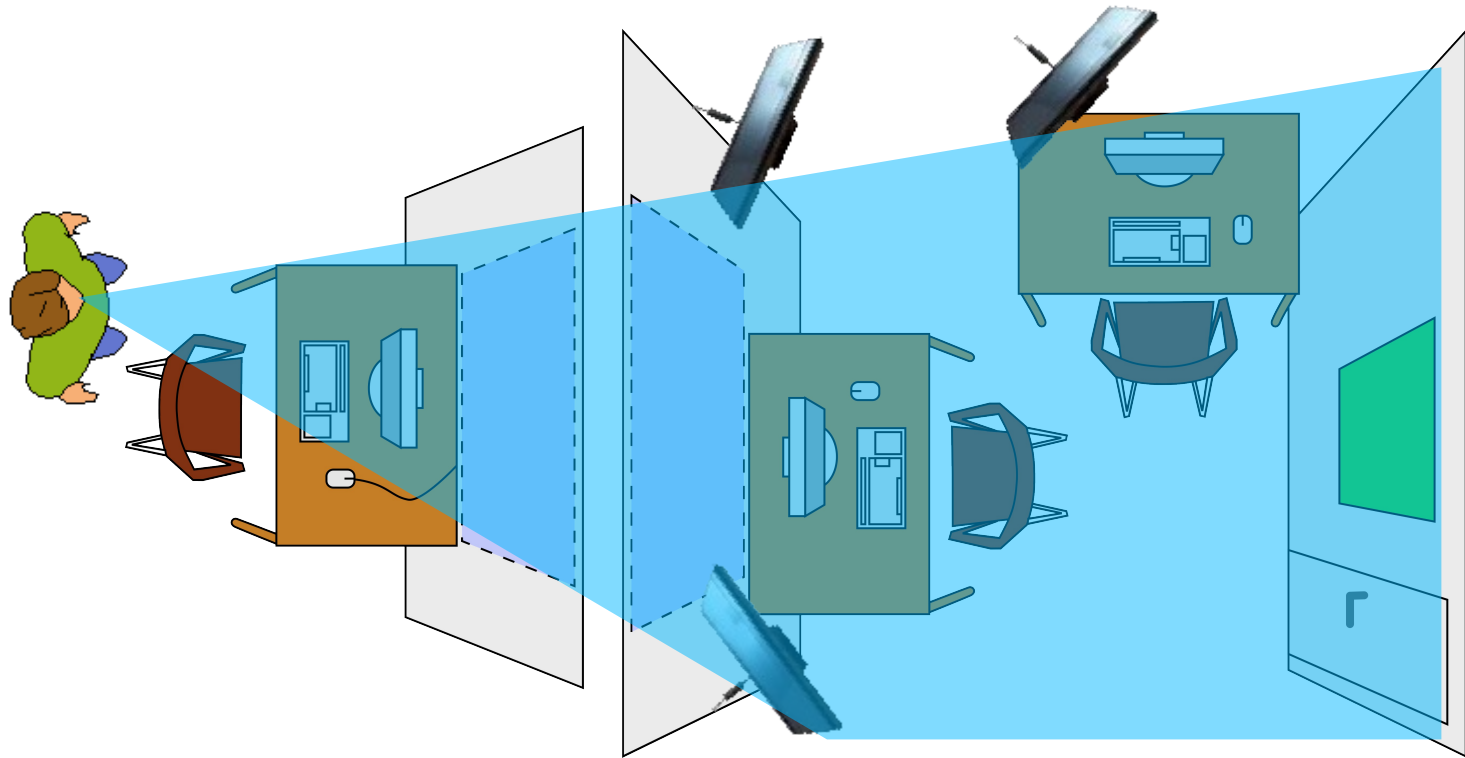
Transmission – optical flow



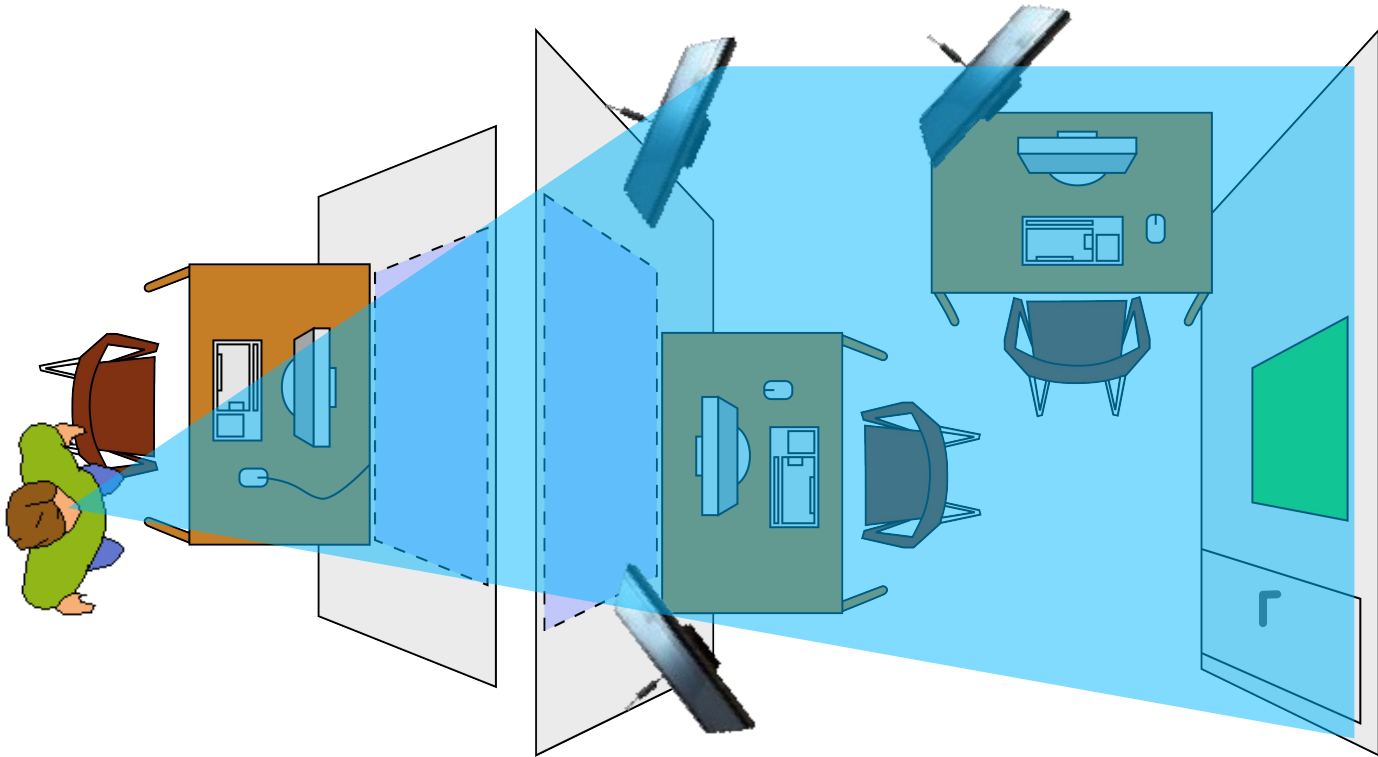
Optical flow applied to 3D models



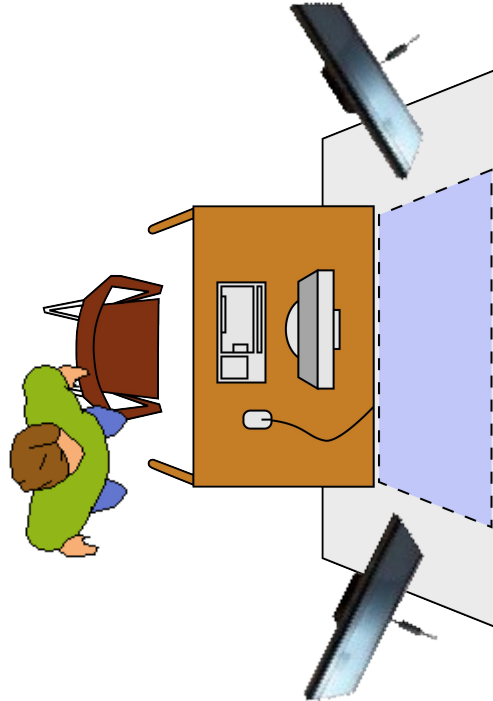
Rendering



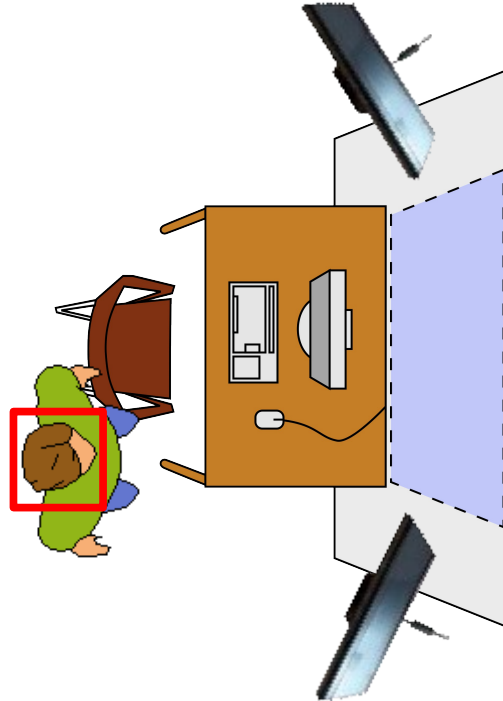
Rendering – viewpoint change



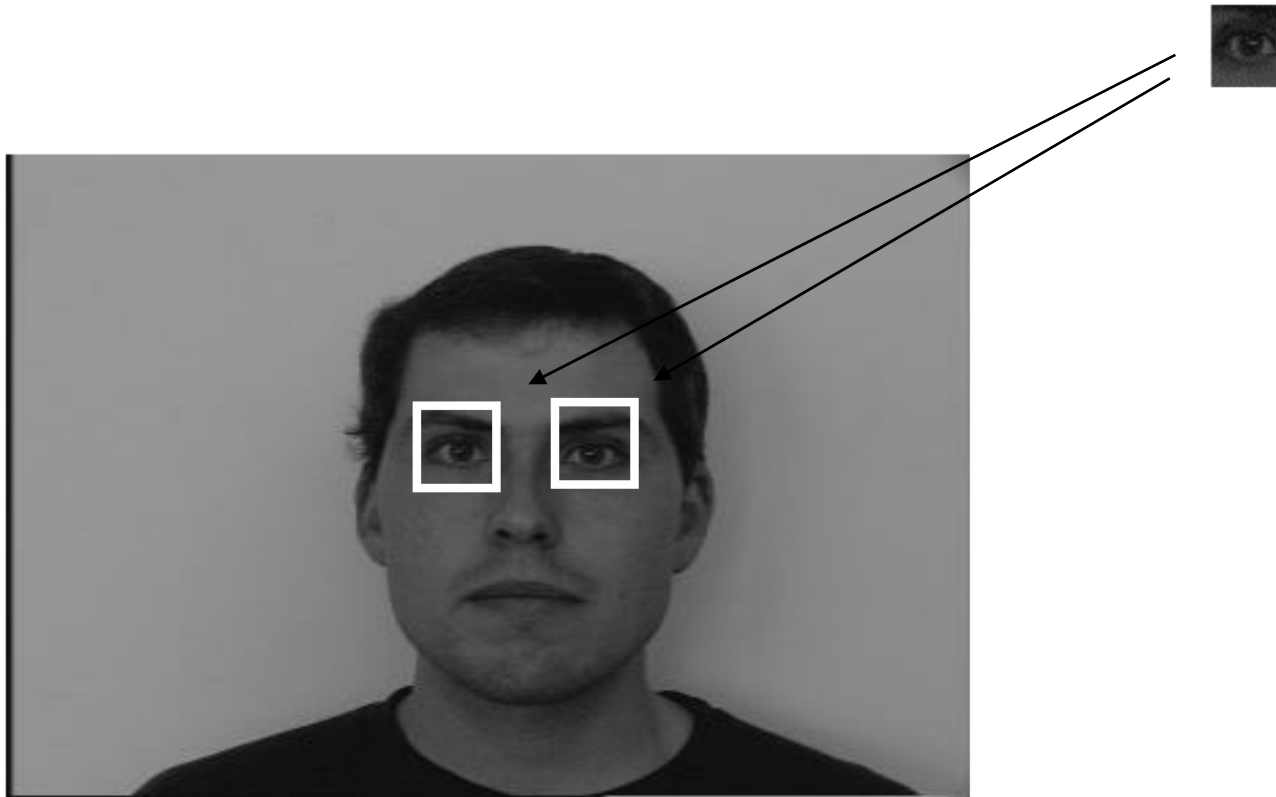
Rendering



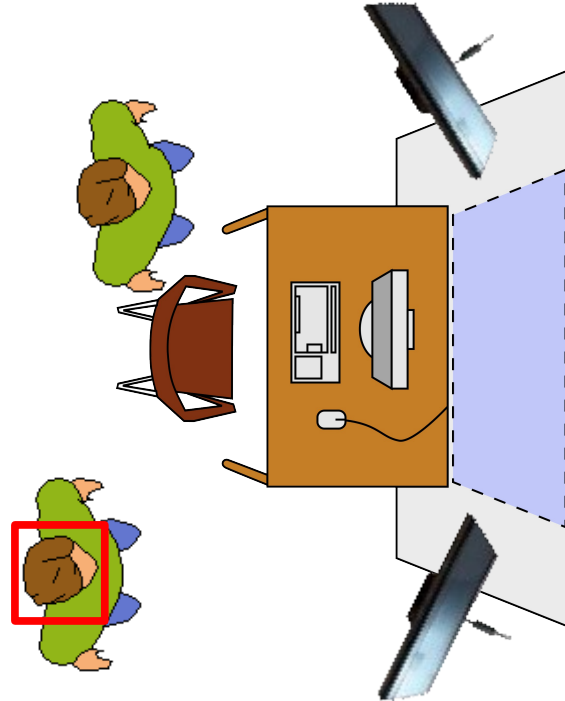
Rendering – head detection



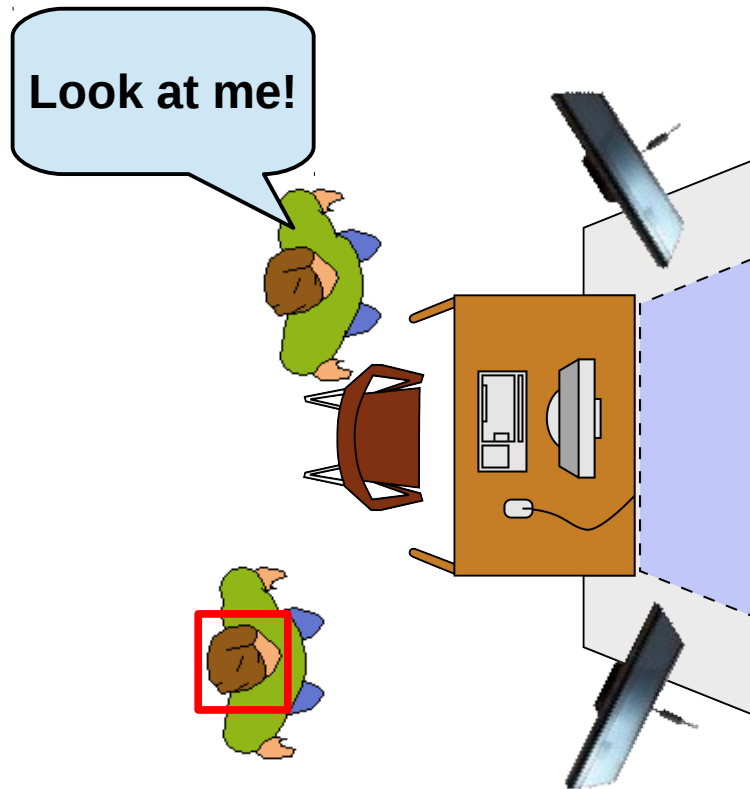
Rendering – template matching



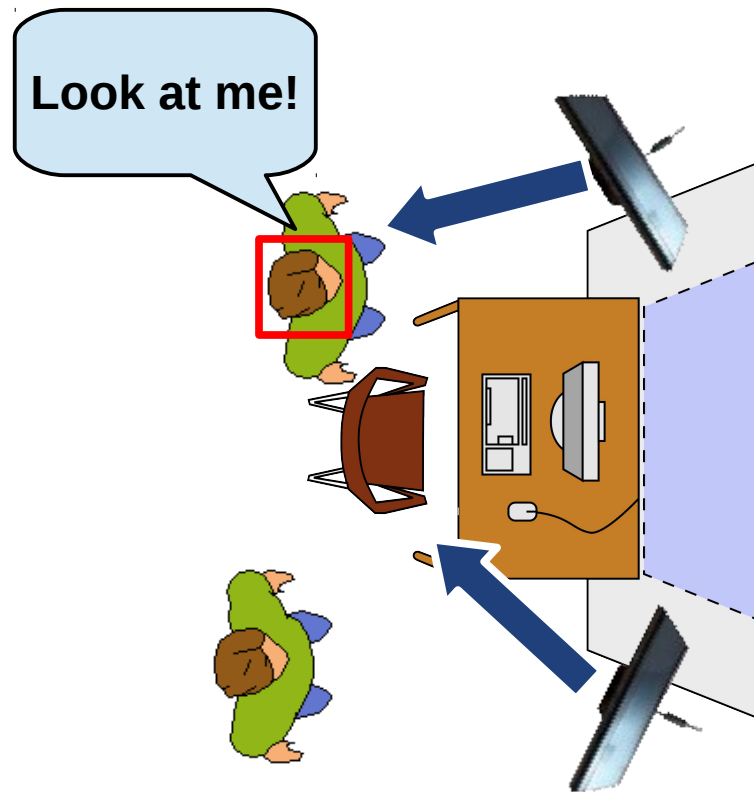
Rendering – multiple users



Rendering – multiple users



Rendering – multiple users



Projection



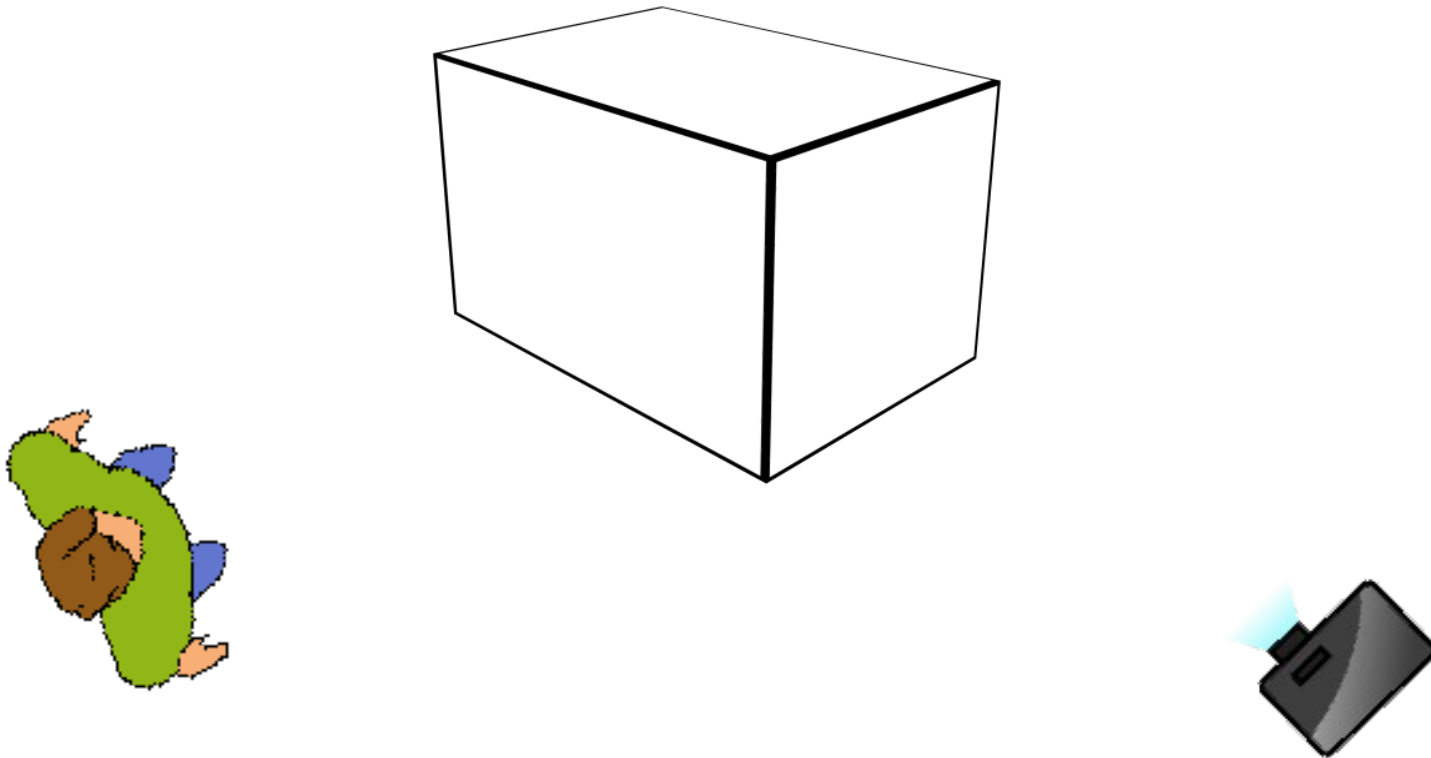
Projection



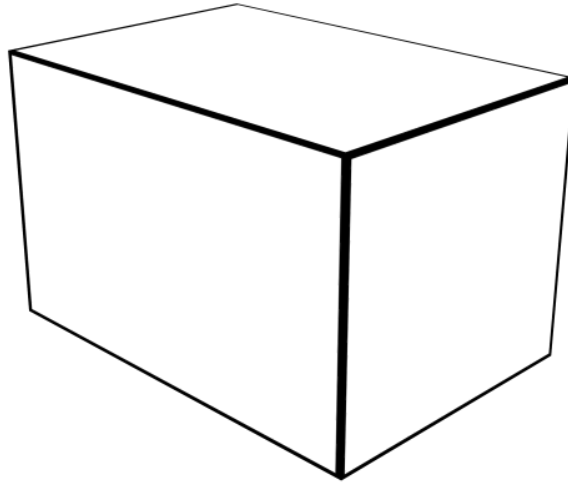
Projection



Projection – adapting to surface



Projection – adapting to surface



Projection – adapting to surface



Projection – adapting to surface



Projection – adapting to surface



Projection – adapting to surface



Implementations – MirageTable



[Benko2012]; image from <http://www.engadget.com/>

Implementations – Beamatron



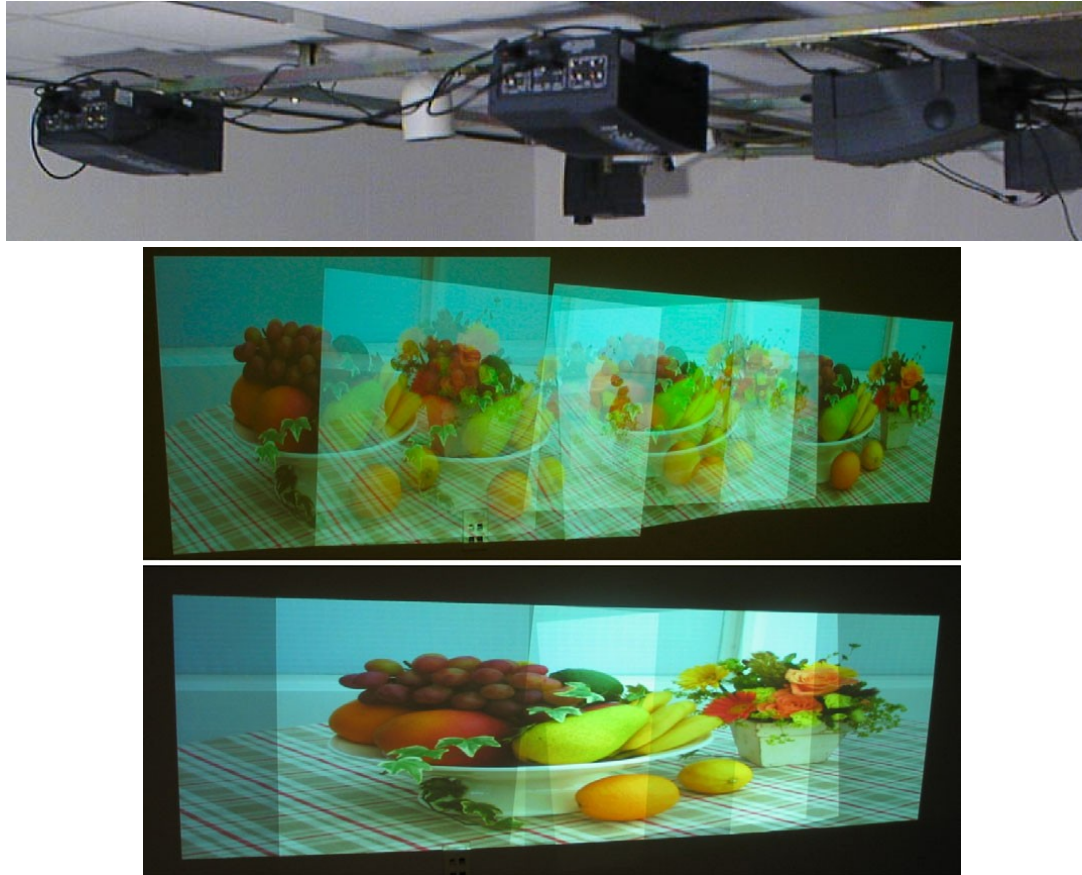
Projector

Pan-Tilt Platform

Kinect Sensor

[Wilson2012]

Implementations – multiple projectors



[Raskar1998, Raskar2003]

Implementations – autostereoscopic display



[Maimone2012a]; image from <http://www.shortcourses.com/>

Conclusion



[Raskar1998]

Thank you!

