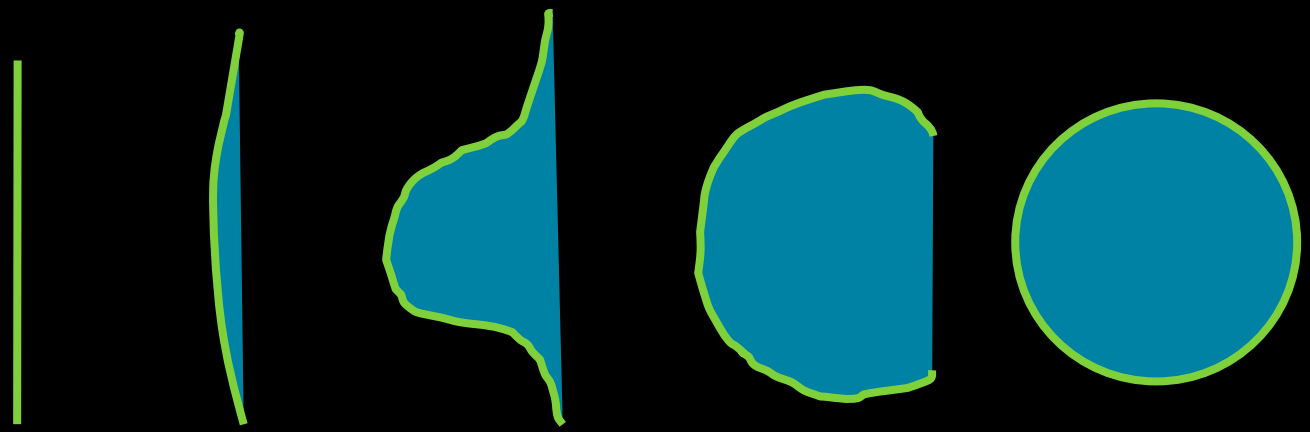


BEYOND FLAT SURFACE COMPUTING

Hrvoje Benko

Microsoft© Research

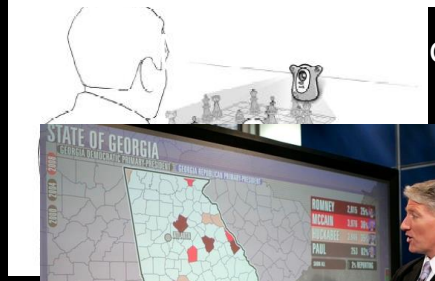
ACM MultiMedia 2009 – Beijing, China

Surface Computing

Holowall, ‘97

Apple iPhone

DiamondTouch, ‘01

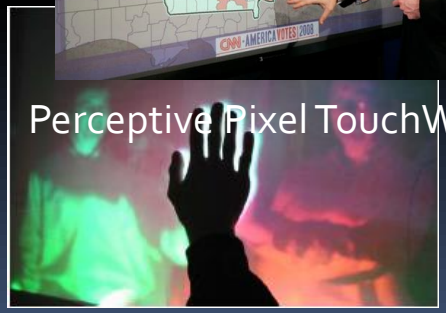


ce

Perceptive Pixel TouchWall

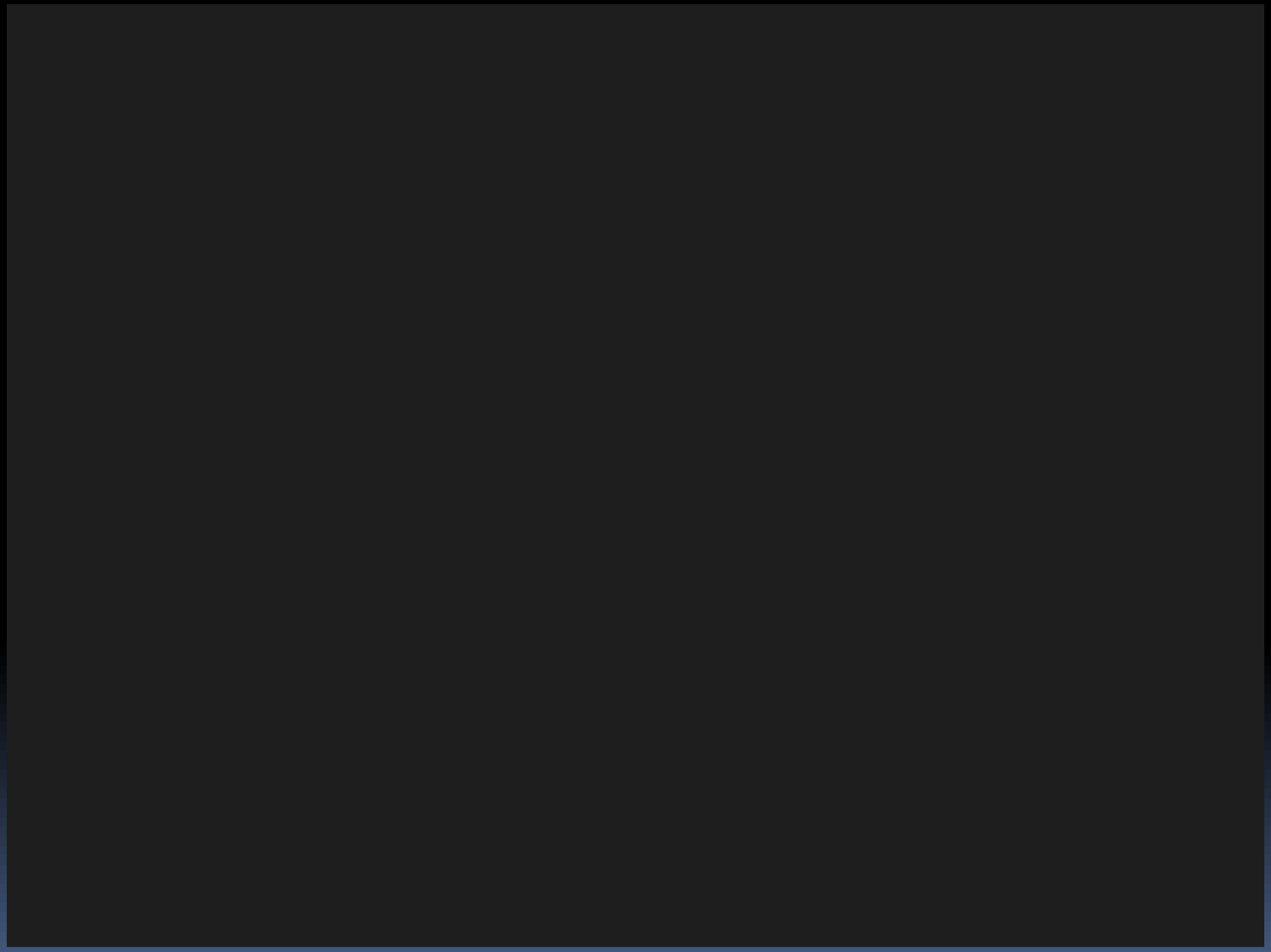
Smart Table

FTIR Display, ‘06



TouchLight, ‘06

Microsoft Surface



Surface Computing

An interface where instead of through indirect input devices (mice and keyboard) the user is interacting directly with the content on the screen's surface.

Direct un-instrumented interaction!

Surface Computing

"Surface computing is the term for the use of a specialized computer GUI in which traditional GUI elements are replaced by intuitive, everyday objects."

Wikipedia

Content is the interface!

Digital vs. Real

Microsoft© Research

Beyond Flat Surface Computing

Transcend the flat two-dimensional surface and typical 2D media associated with it

and

explore the curved, three-dimensional interfaces that cross the boundary between the digital and physical world.

- Direct un-instrumented interaction
- Content is the interface

Two Approaches

1. Non-flat interactive surfaces
2. Depth-aware interactions above the surface

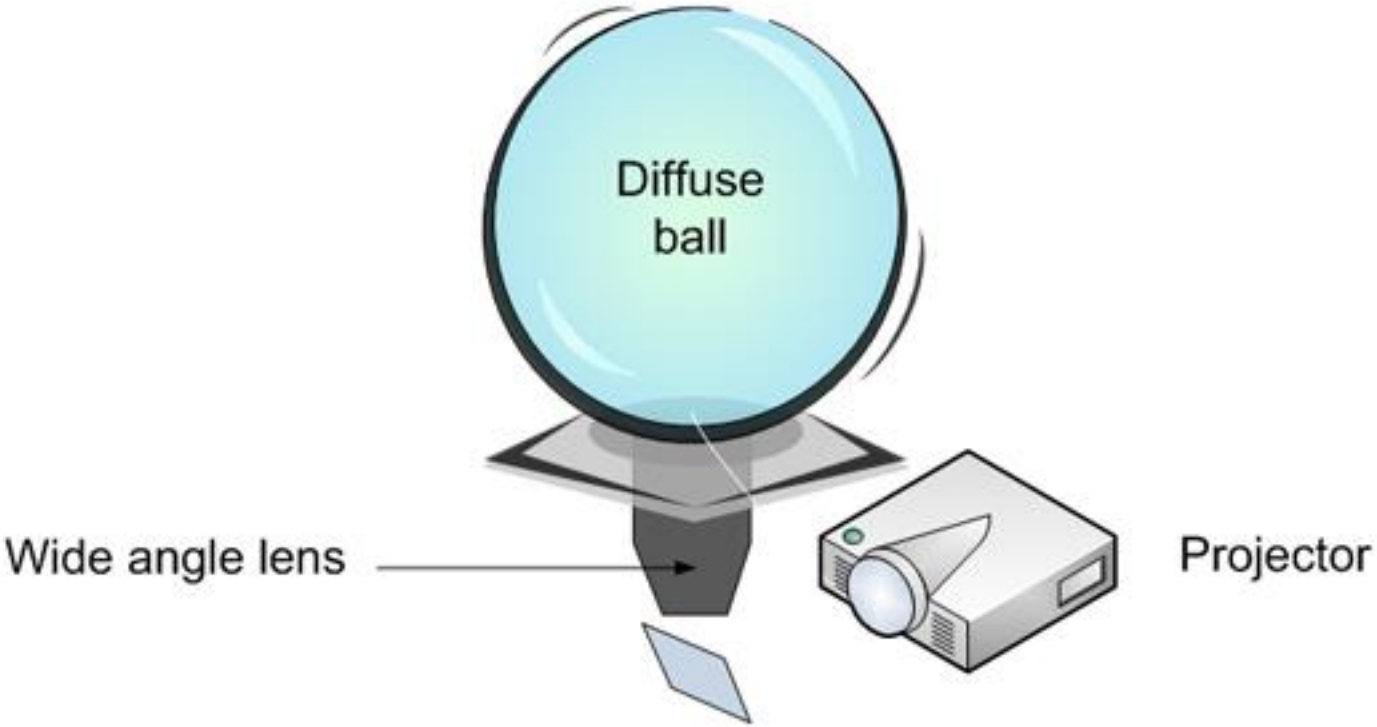
Approach #1

Enable touch and gesture interactions
on non-flat surfaces.

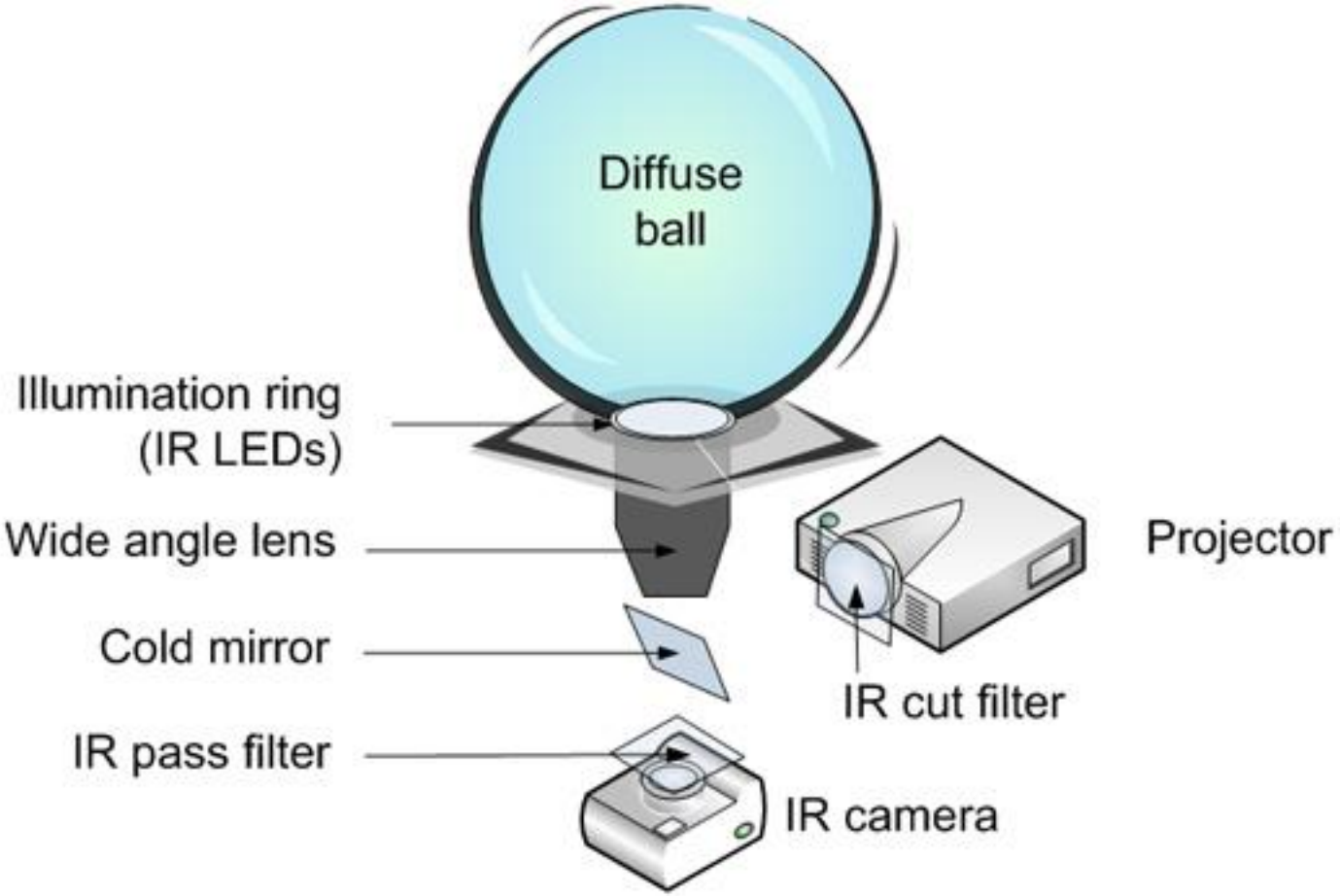
Sphere

Benko, Wilson, & Balakrishnan, ACM UIST 2008

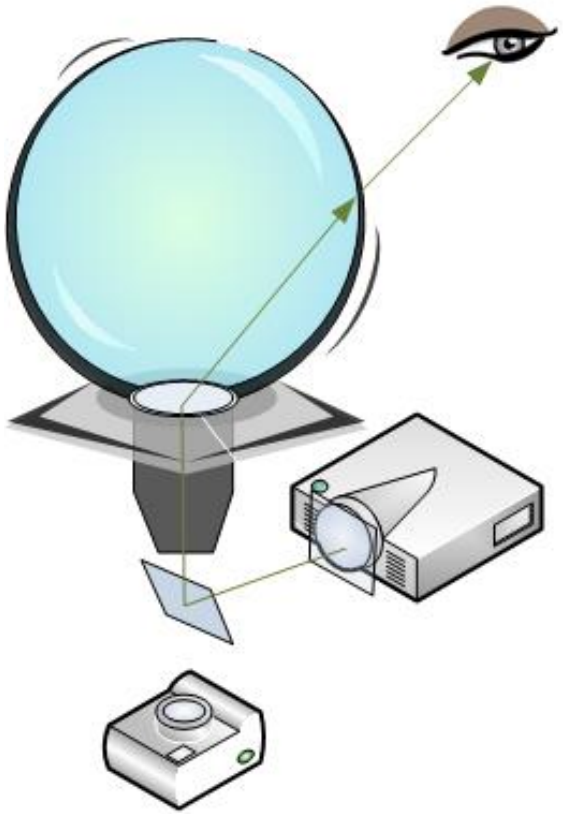
Projection



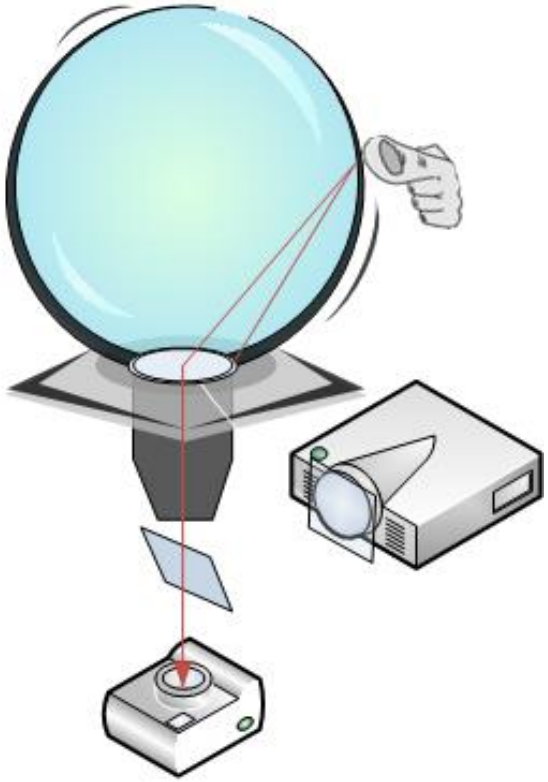
Projection + Sensing



Reusing the Optical Path



Projection path
(Visible)



Tracking path
(IR)

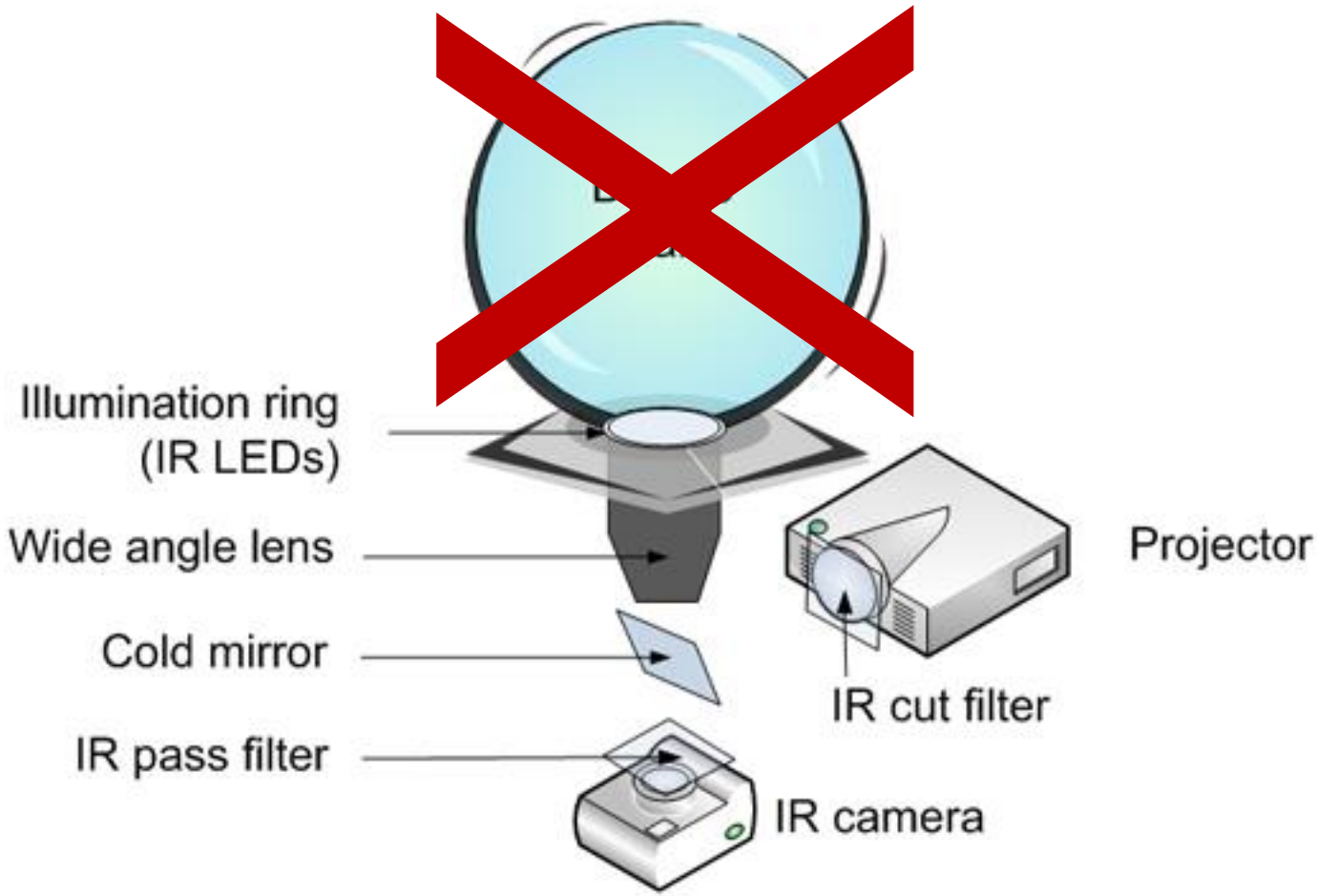
Sensing & Projection Distortions

Unique Properties = Opportunities

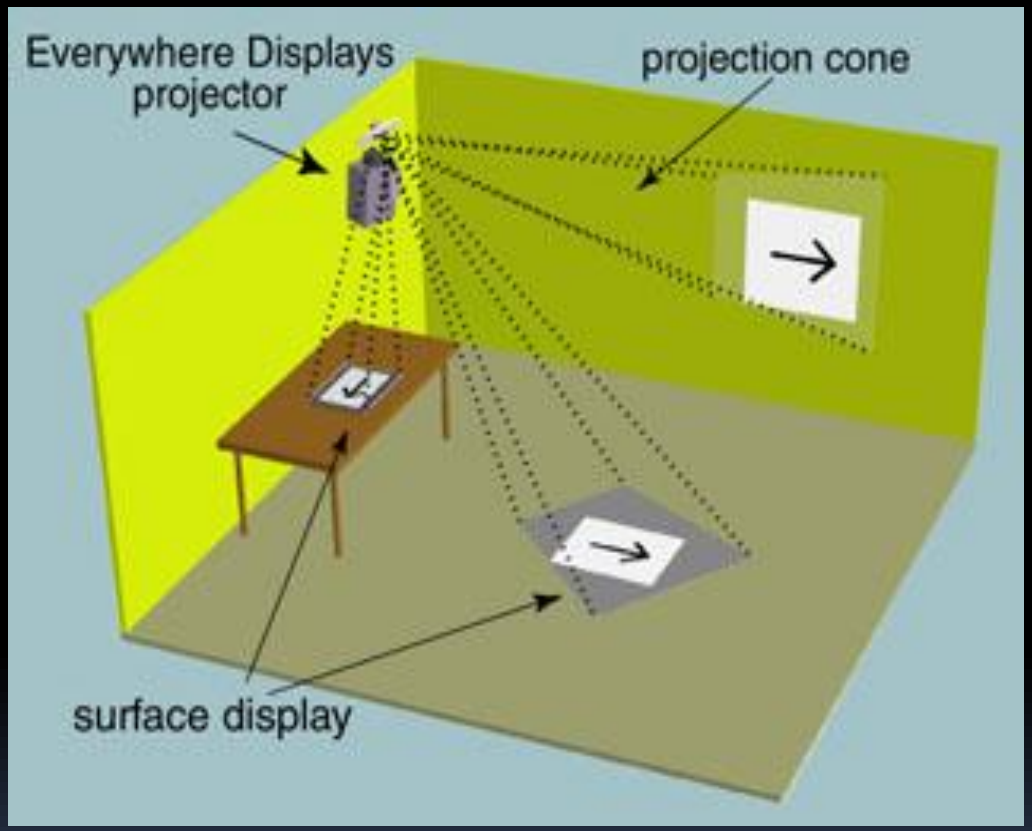
- Borderless, but finite display
- Non-visible hemisphere
- No master user position/orientation
- Smooth transitions between
  - Vertical and horizontal
  - Near and far
  - Shared and private

Sphere Interactions

Spherical Projector



Everywhere Displays



Pinhanez et al. '01

Pinch-the-Sky Dome

Microsoft© Research

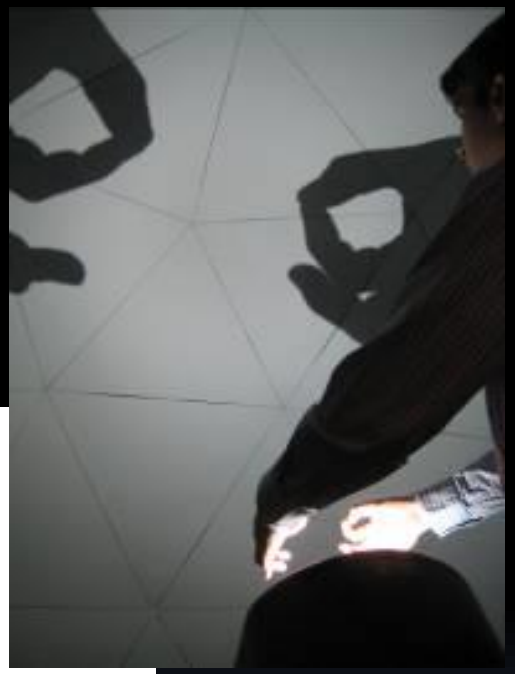
Benko, Wilson, and Fay, 2009

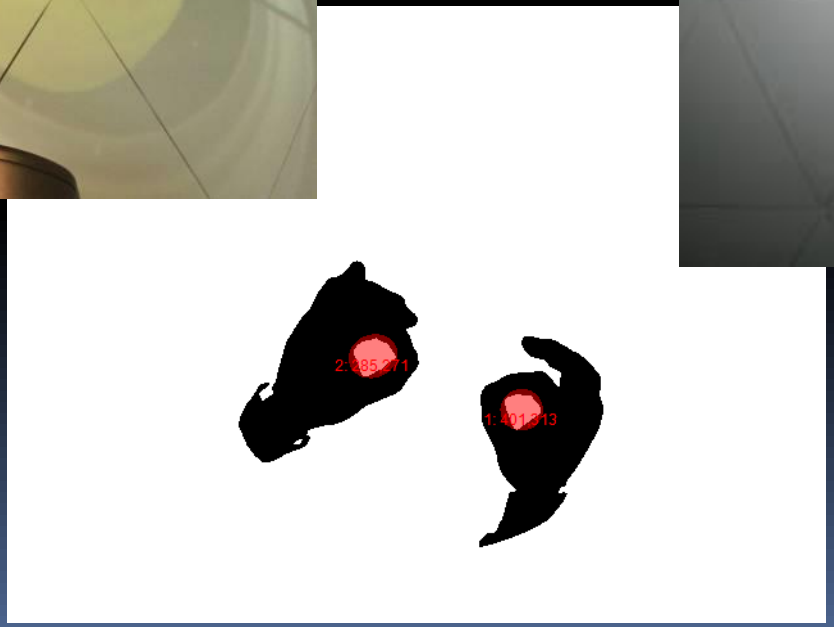
Omni-Directional Content

- WorldWide Telescope
- Graph visualizations
- Panoramic images
- Immersive animations

Pinch-the-Sky Dome

Gesture Delimiter Problem





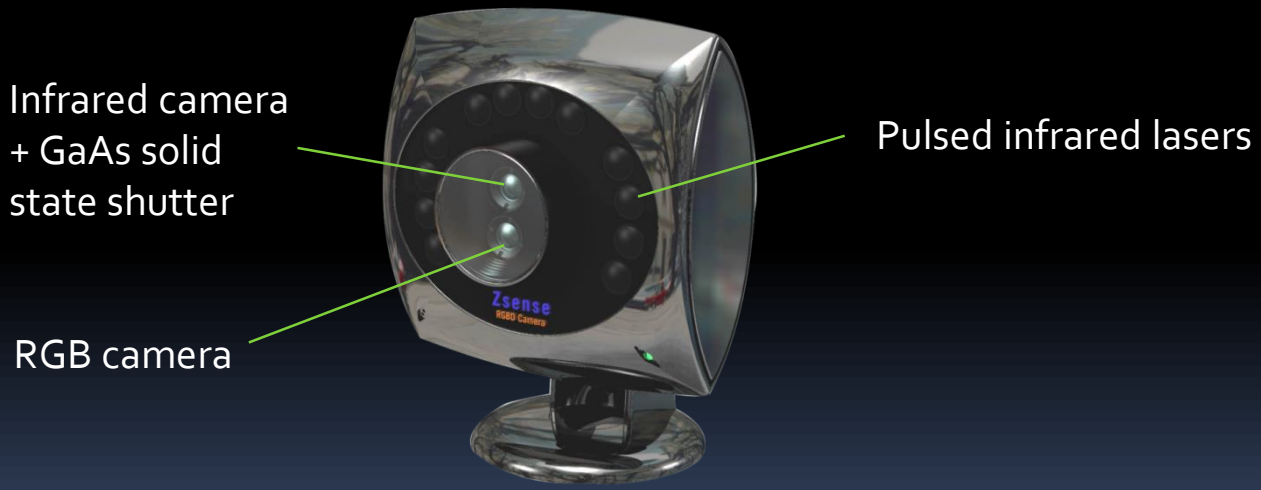
Freehand Interactions

Approach #2

Enable freehand gesture interactivity
in mid-air above the display.

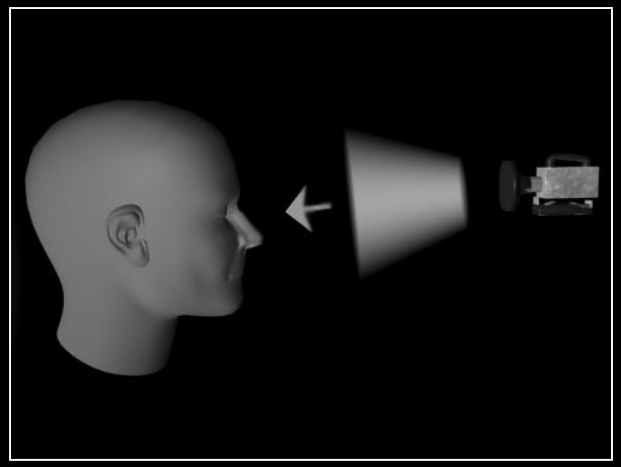
Depth Sensing Camera

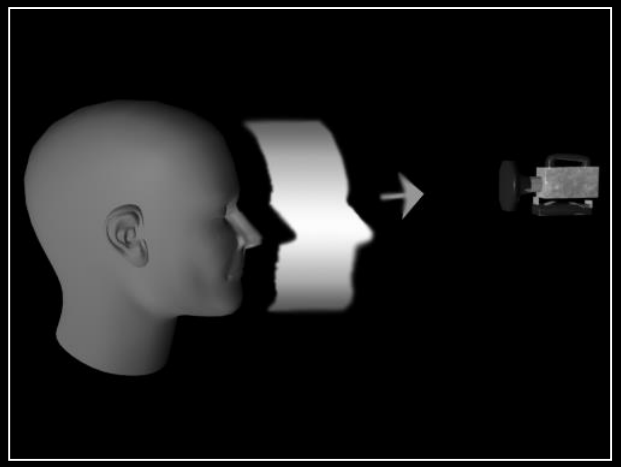
- Gives depth map + color
- RGBZ pixels

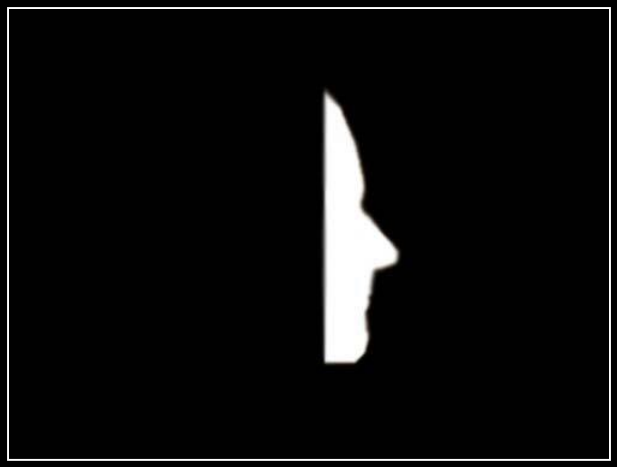


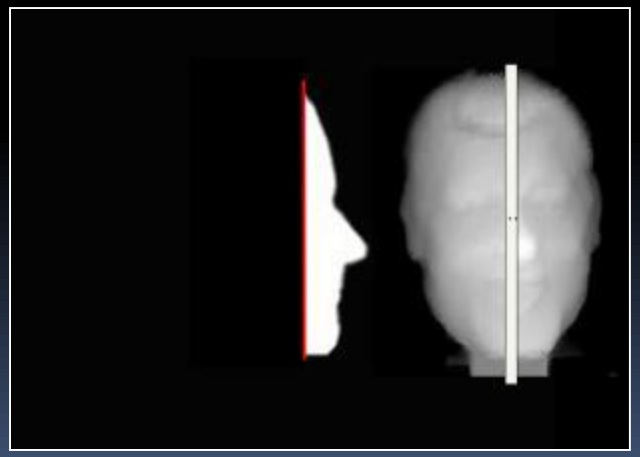
3DV ZSense Camera

How does it work?









DepthTouch

Benko & Wilson, Tabletop 2008

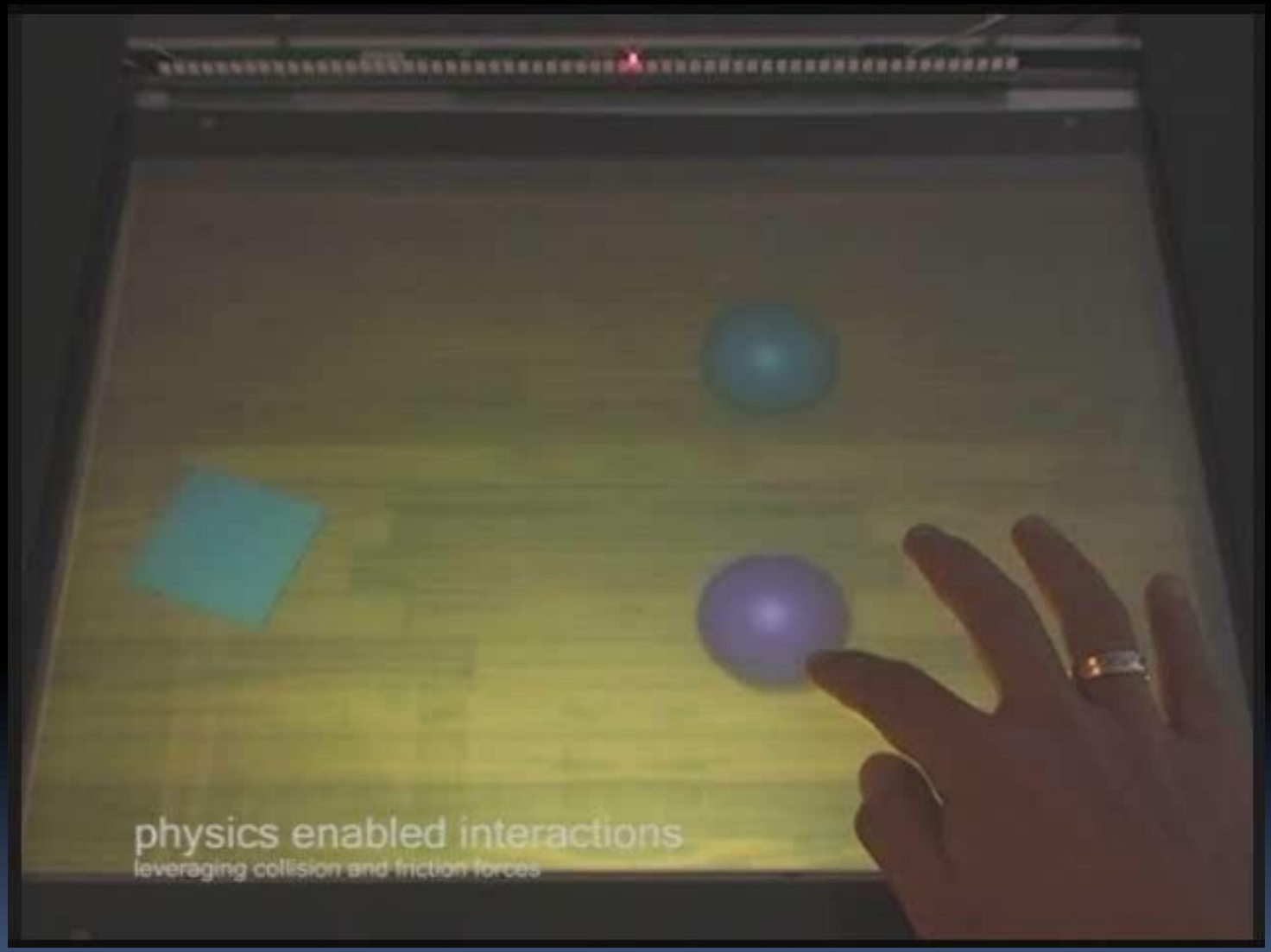
Beach Volleyball

Wilson, 2008

MicroMotoCross

Wilson, Tabletop 2007

Above the Surface Interactions



Hilliges, Izadi, Wilson, Hodges, Butz, & Garcia-Mendoza, ACM UIST2009

Project Natal for Xbox

Microsoft© Research

Project Natal

Microsoft© Research

GOING FORWARD

Challenges

- Preserving the direct experience
  - The only experience the user needs is *life experience*
- Finding applications and appropriate content
- Facilitating the ecosystem of heterogeneous devices

Heterogeneous Ecosystem of Devices?

Trends That Will Help

- Mobile pico projectors
- Displays with sensor in pixel
- Flexible eInk or OLEDs
- “Cheap” computation

Vision

We live in the non-flat world.

Our computer interfaces will become non-flat too.

This is NOT the end of 2D interfaces. They will continue to be very useful.

But, the standard computer interface is changing: *Content is the new interface*.

Challenges are in finding and adapting the content and the interactions to the new form factors.

Contact

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Collaborators

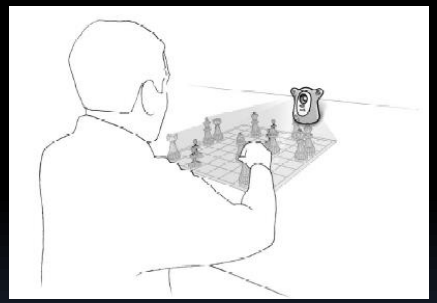
- Andy Wilson
- Ravin Balakrishanan
- Jonathan Fay

Surface Computing Research

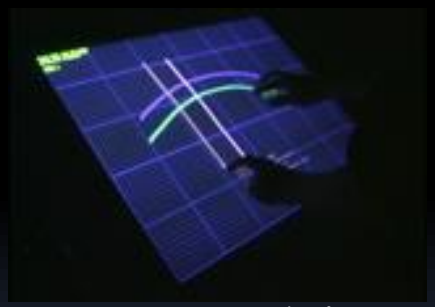
Holowall, ‘97

Augmented Surfaces, ‘99

DiamondTouch, ‘01



PlayAnywhere, ‘05



FTIR Display, ‘06

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Microsoft Surface

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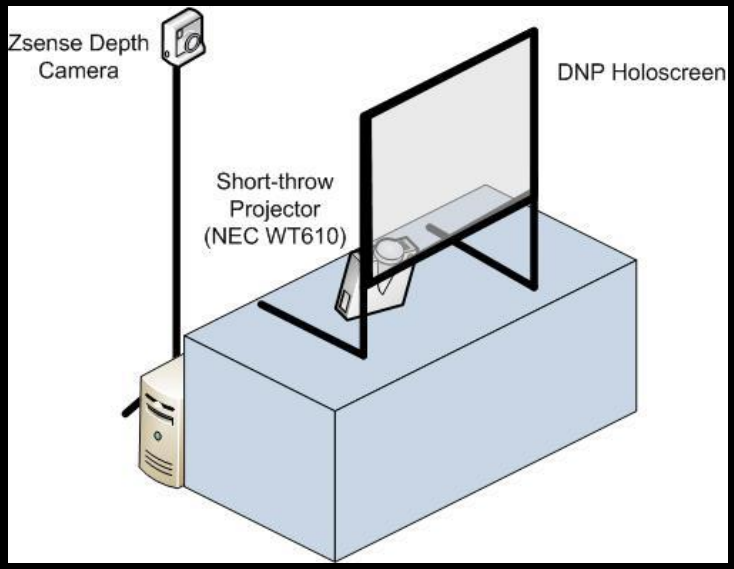
Smart Table

Surface Computing

Microsoft© Research

DepthTouch


Zsense Depth Camera
DNP Holoscreen
Short-throw Projector (NEC WT610)

Contact

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