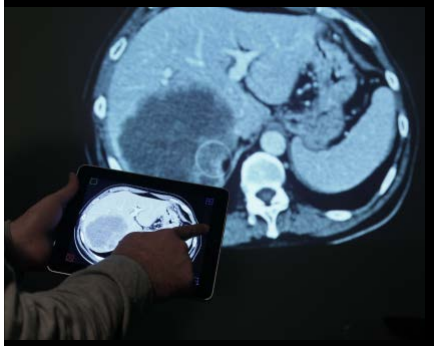
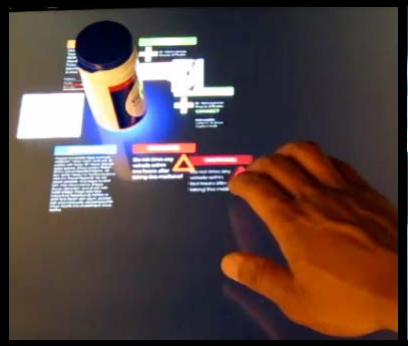
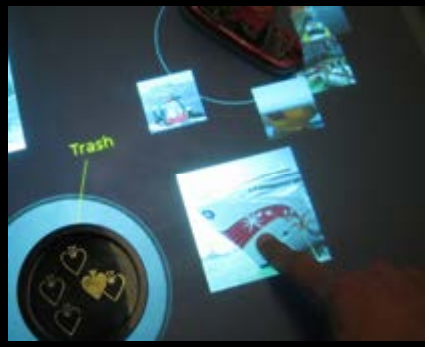
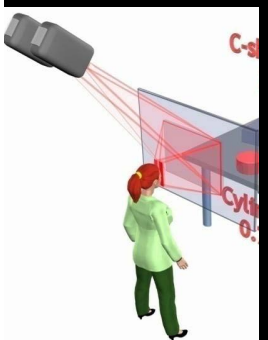
Alex Olwal, Ph.D.
www.olwal.com

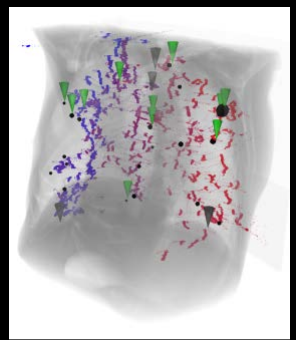
Interaction Technology, Interfaces and The End of Reality

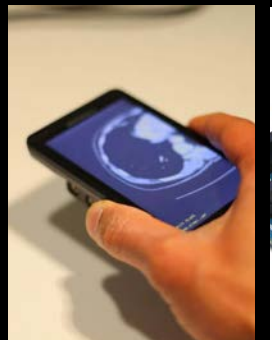
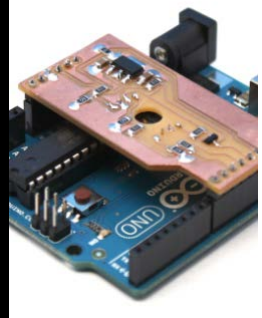






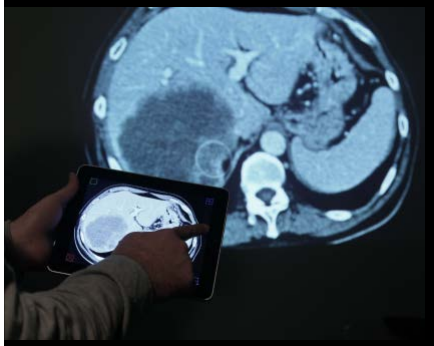



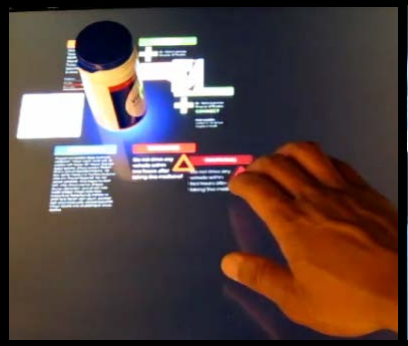
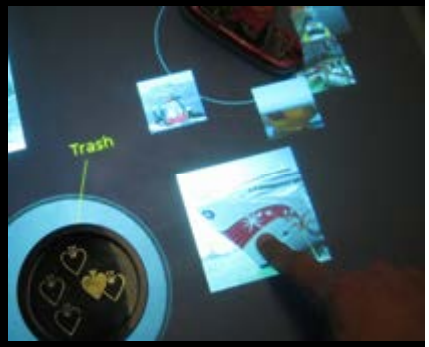
Alex Olwal, Ph.D.

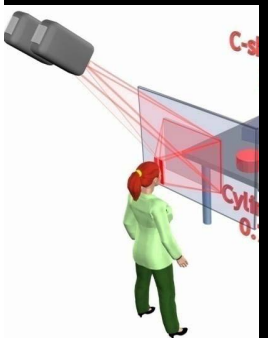
www.olwal.com

Human — computer interaction

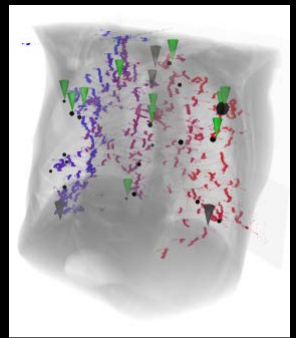
- Interaction technologies & techniques
- Augmented reality
- Medical & health applications

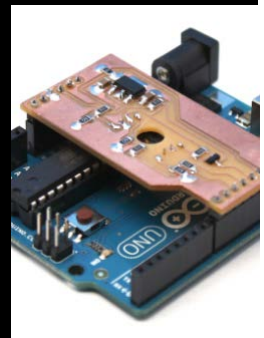






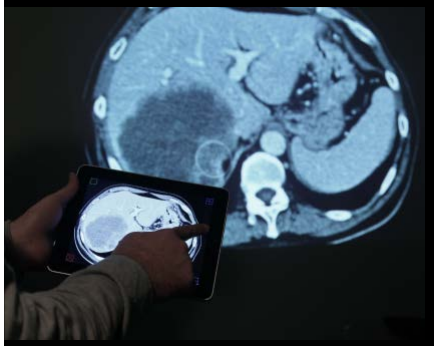



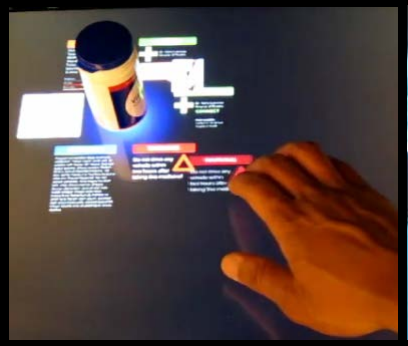
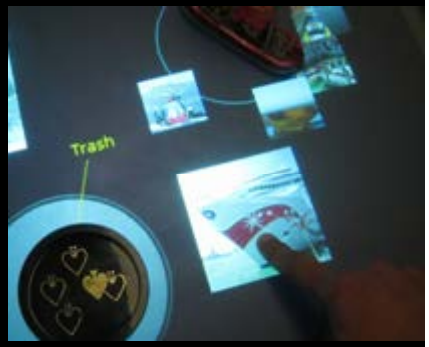



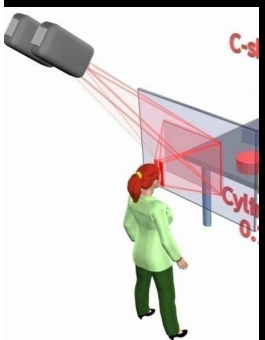
Alex Olwal, Ph.D.

www.olwal.com

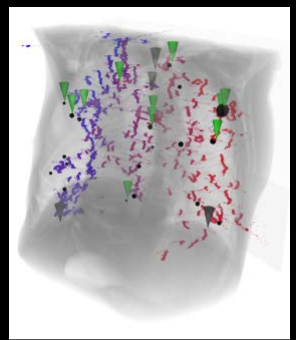
• MIT Media Lab	Cambridge, MA
• Columbia University	New York, NY
• Royal Institute of Technology	Stockholm, Sweden
• Microsoft Research	Redmond, WA
• University of California	Santa Barbara, CA
• Rhode Island School of Design	Providence, RI








HE STRIPPED SOULS AS BARE AS BODIES!

AMERICAN INTERNATIONAL presents

RAY MILLAND

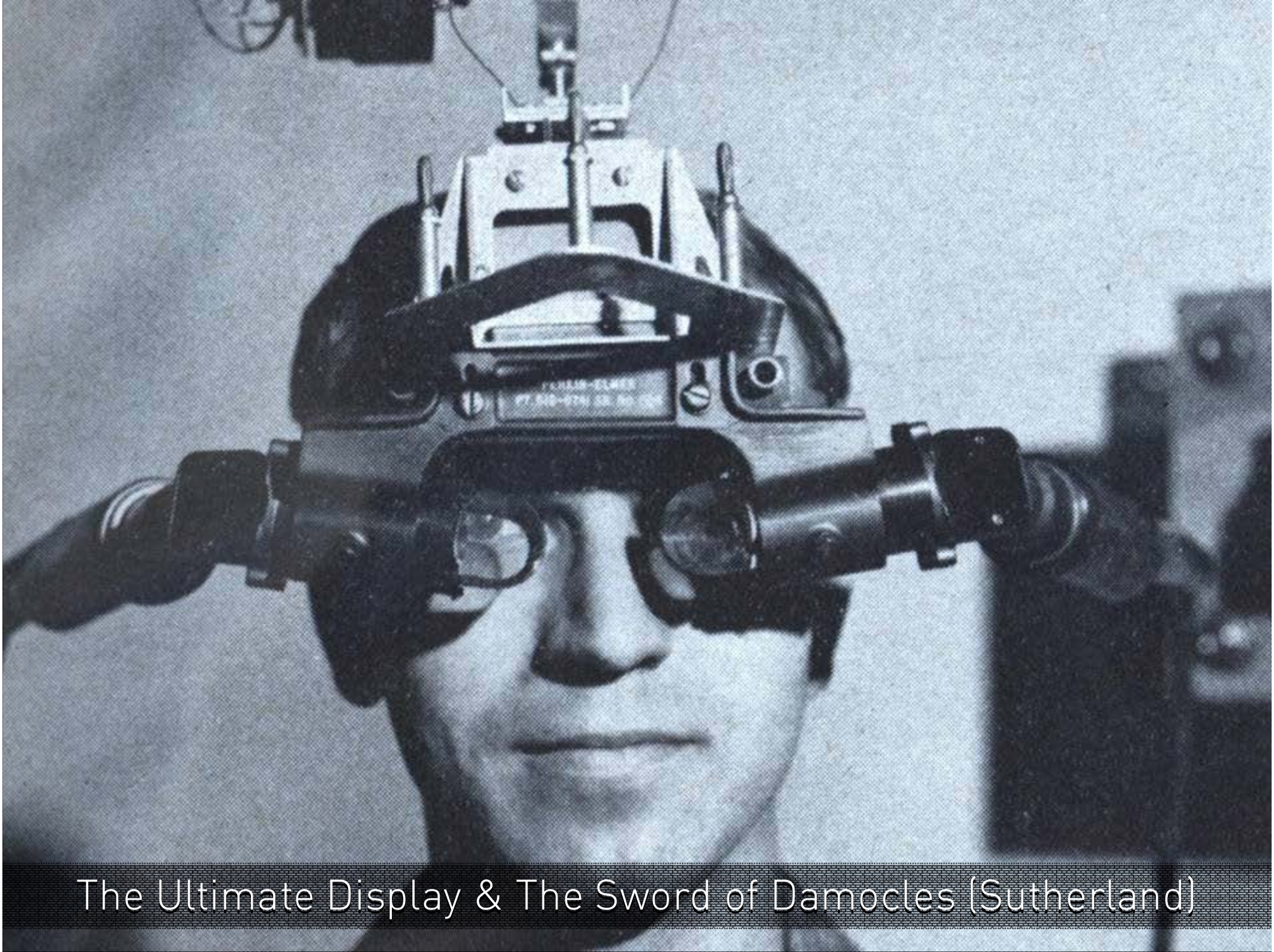
STARRING AS

"X"

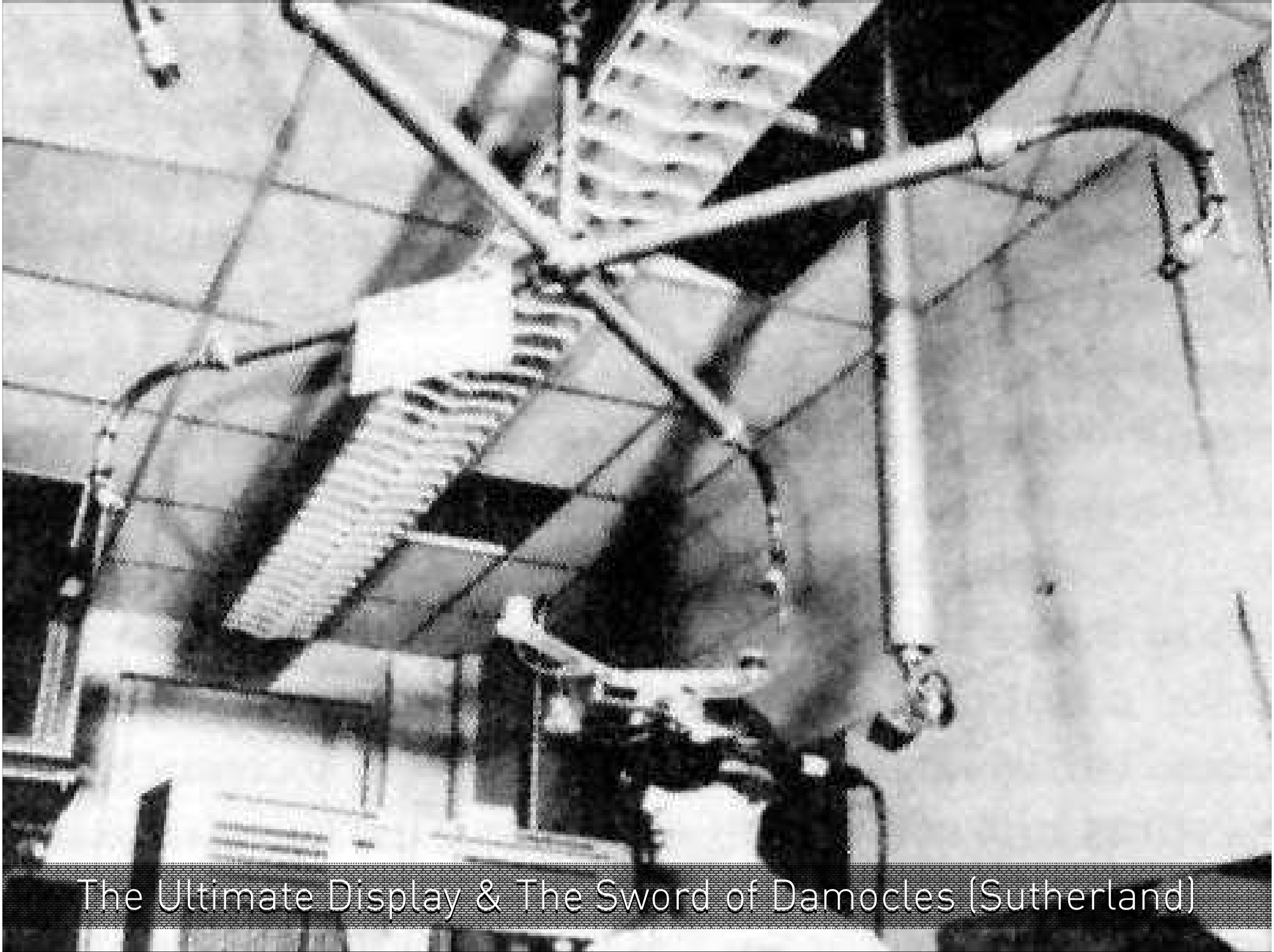
THE MAN WITH THE X-RAY EYES

IN PATHÉCOLOR AND SPECTARAMA

WINNER OF THE INTERNATIONAL SCIENCE-FICTION FILM FESTIVAL



The Ultimate Display & The Sword of Damocles (Sutherland)



The Ultimate Display & The Sword of Damocles (Sutherland)

UX = SENSING × DISPLAY × INTERACTION

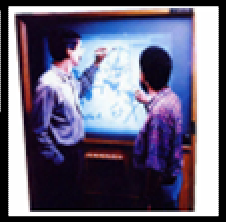
1 Unobtrusive

2 Seamless display

3 Embedded sensing

4 Hybrid & symbiotic

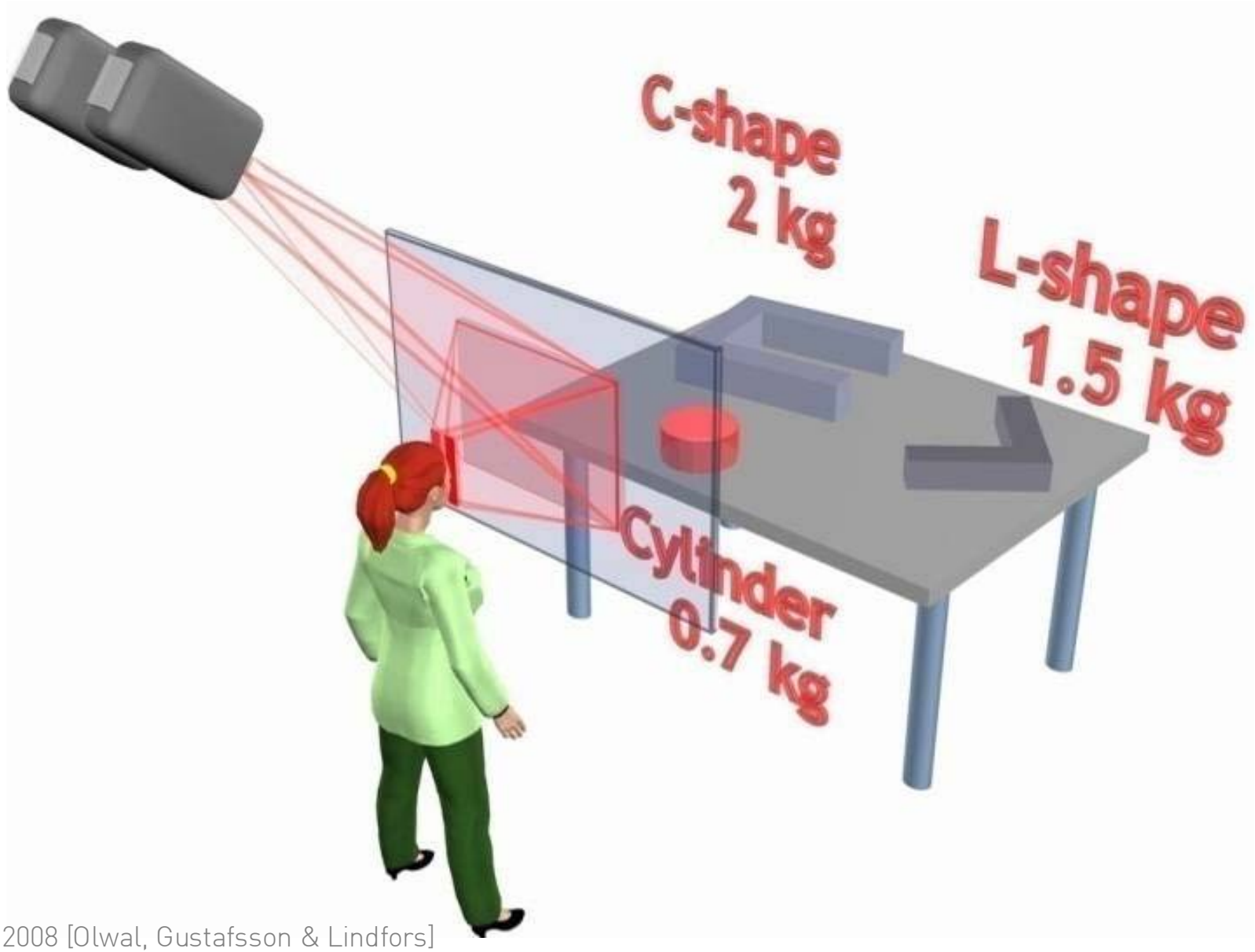





Augmented Reality, Ubiquitous Computing, Spatially Aware Handhelds, Interactive Surfaces, ...

ASTOR

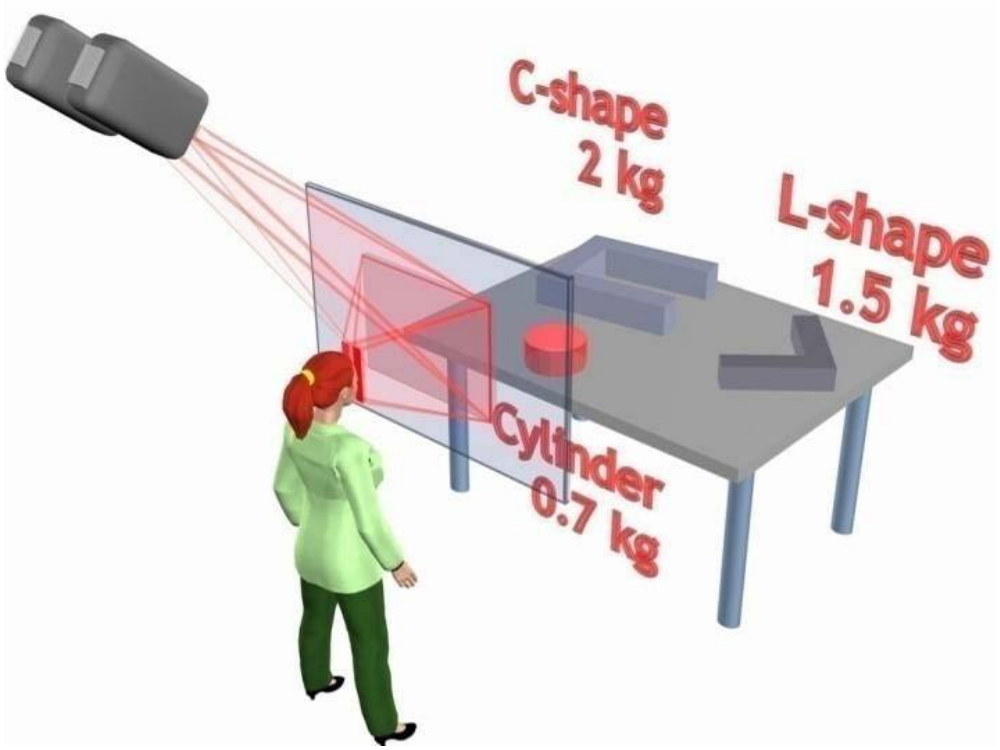
Transparent window with autostereoscopic 3D overlays

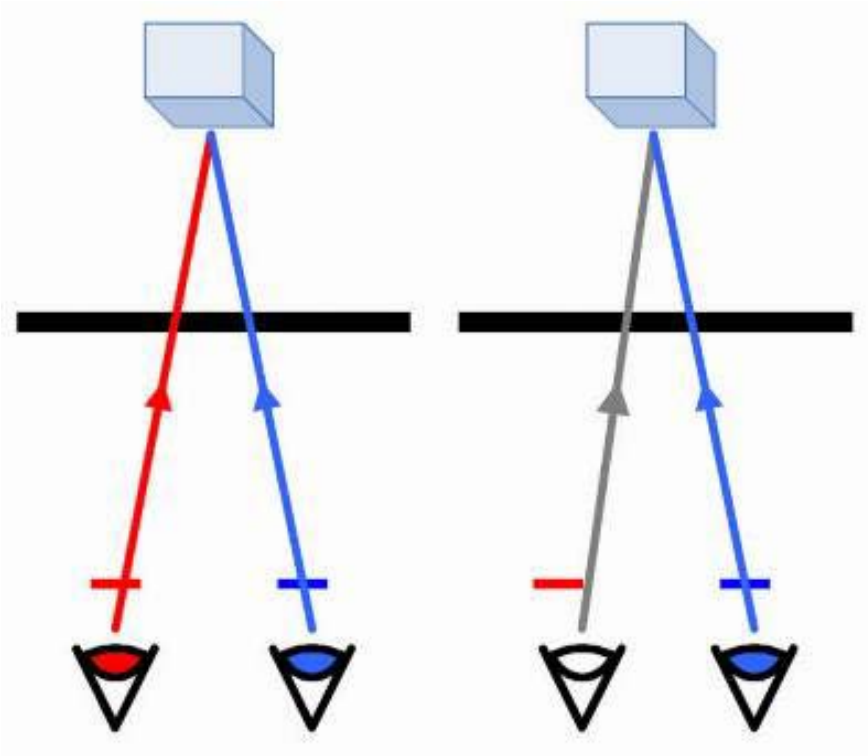


SPIE 2008 [Olwal, Gustafsson & Lindfors]
ISMAR 2005 [Olwal, Lindfors, Gustafsson, Kjellberg & Mattson]
SIGGRAPH 2004 Sketches [Olwal, Lindfors & Gustafsson]

ASTOR

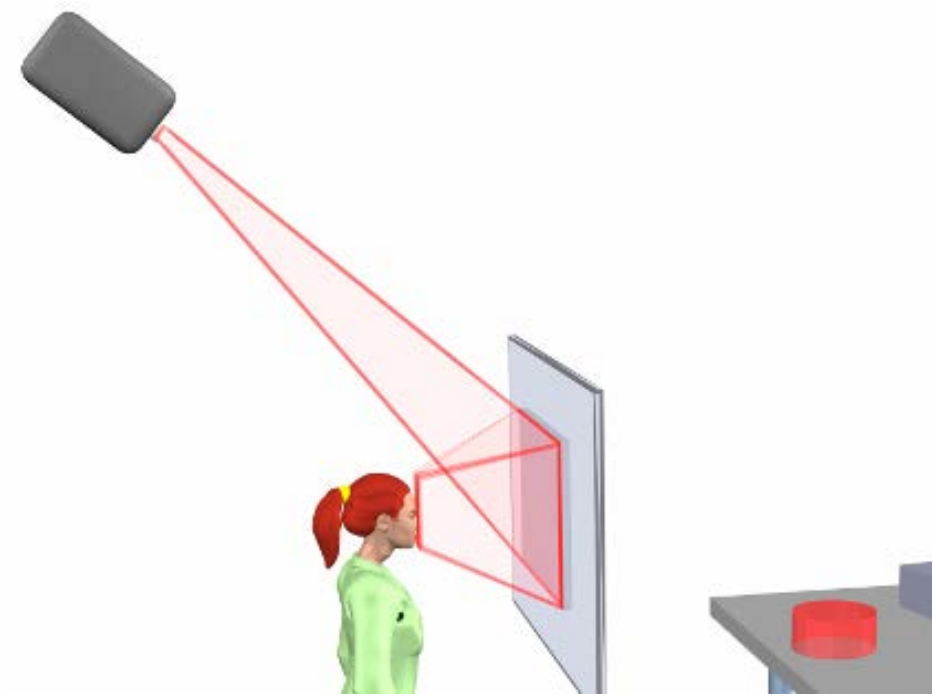
Multi-view display through HOE

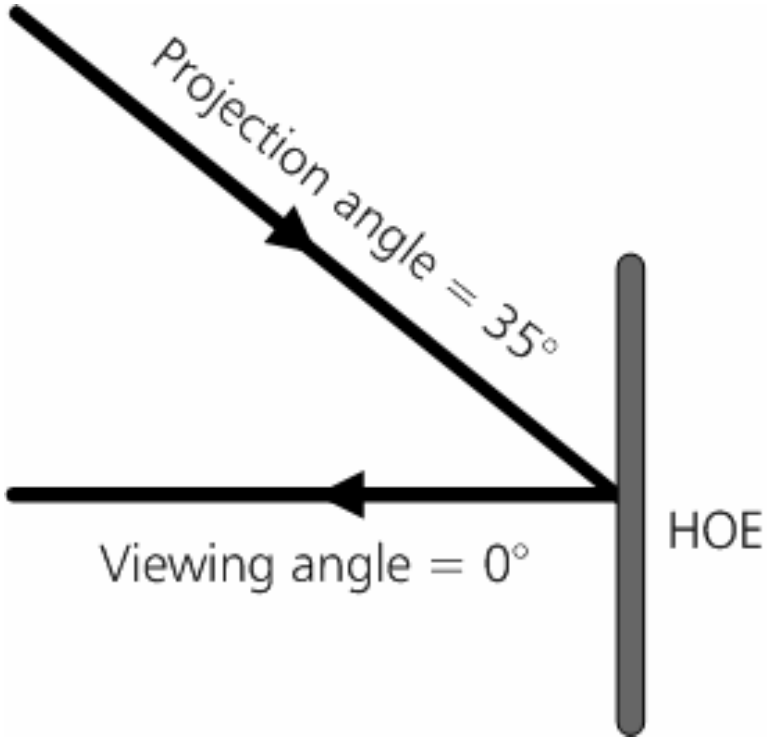


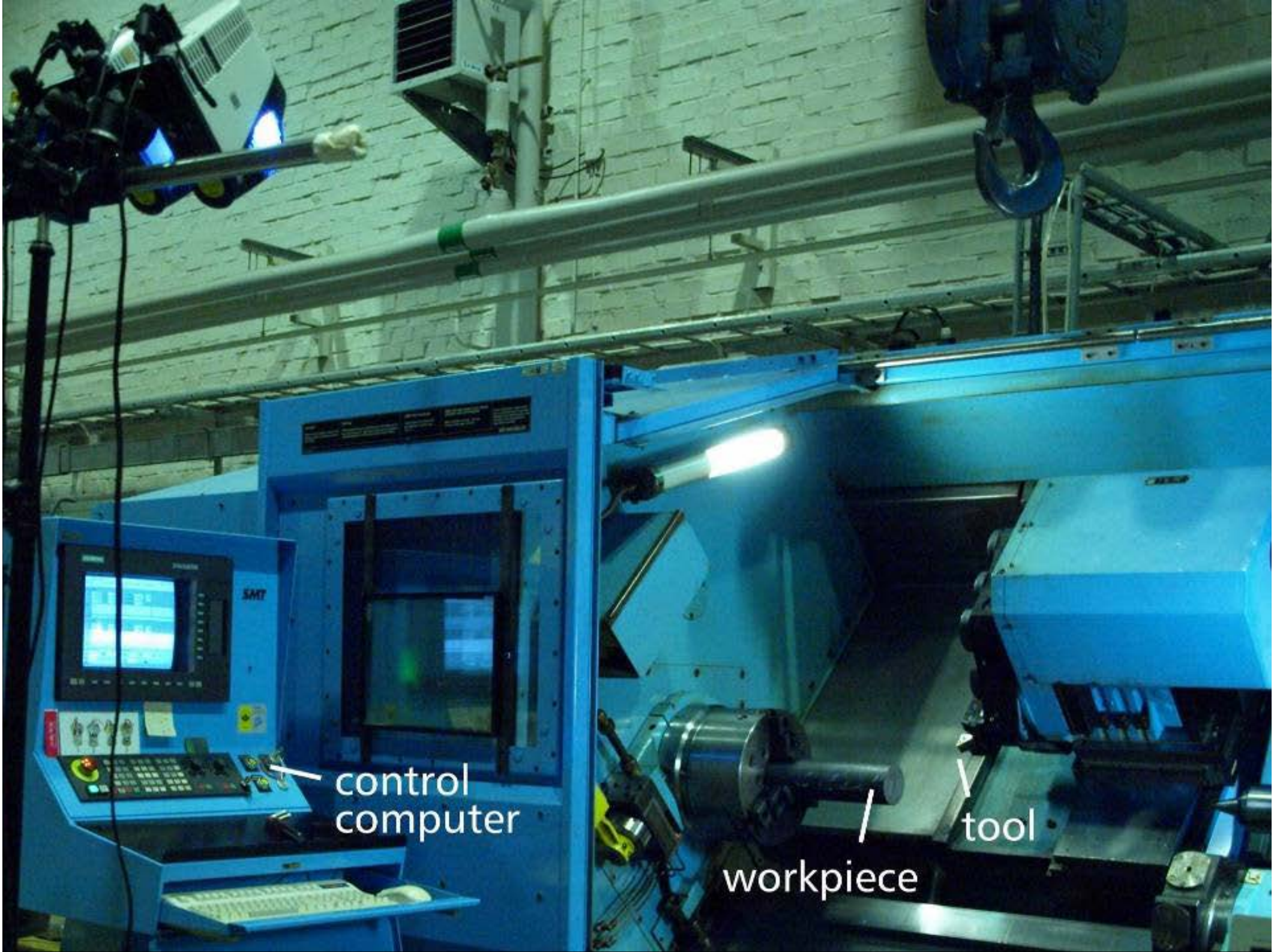


ASTOR

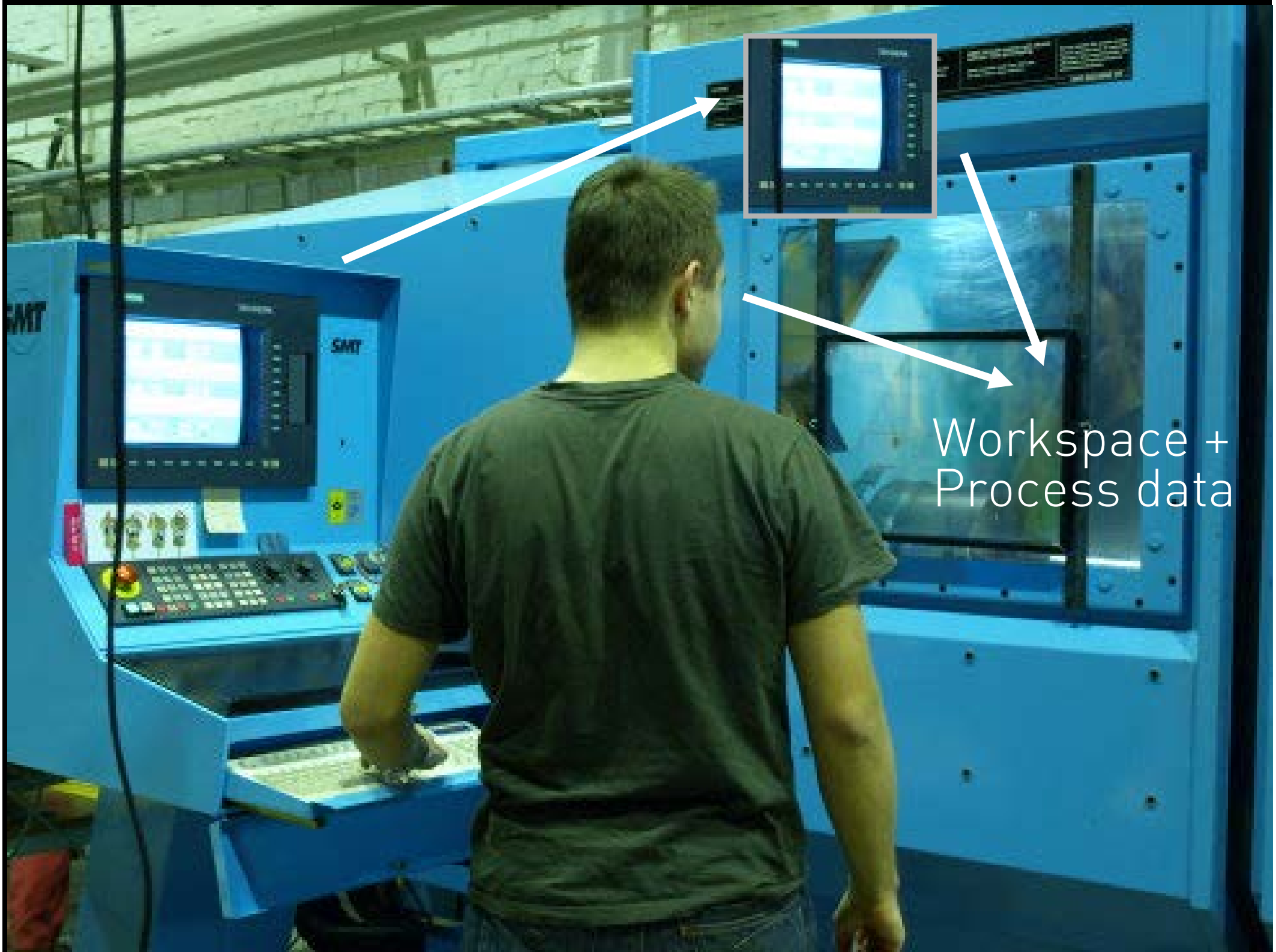
Flexible configuration






control
computer
workpiece
tool


Process data
Workspace


Workspace +
Process data

SpaceTop

Hybrid 2D + 3D workspaces

CHI 2013 [Lee, Olwal, Boulanger & Ishii]

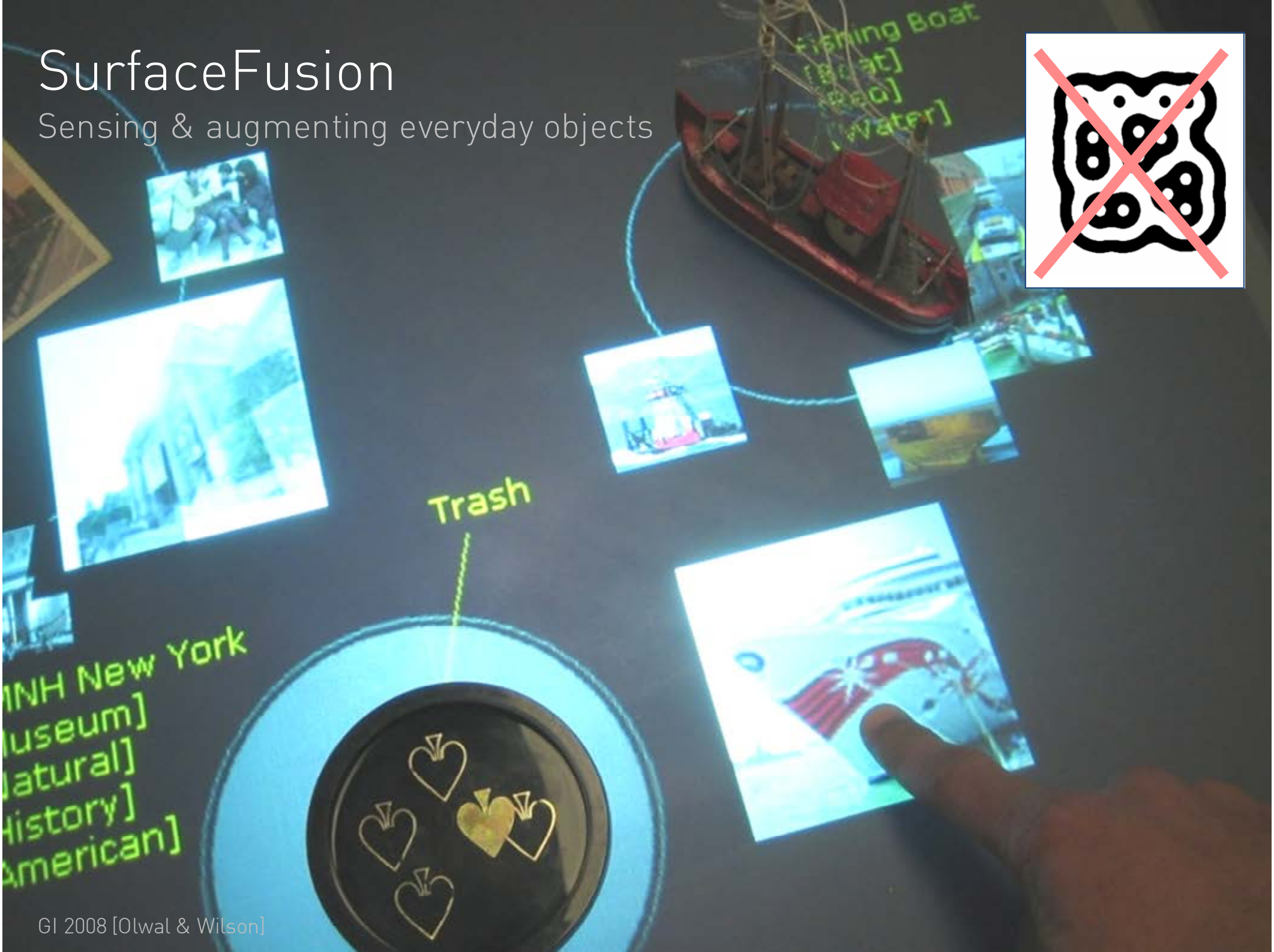
Immaterial displays

Face-to-face, reach-through & walk-through interaction

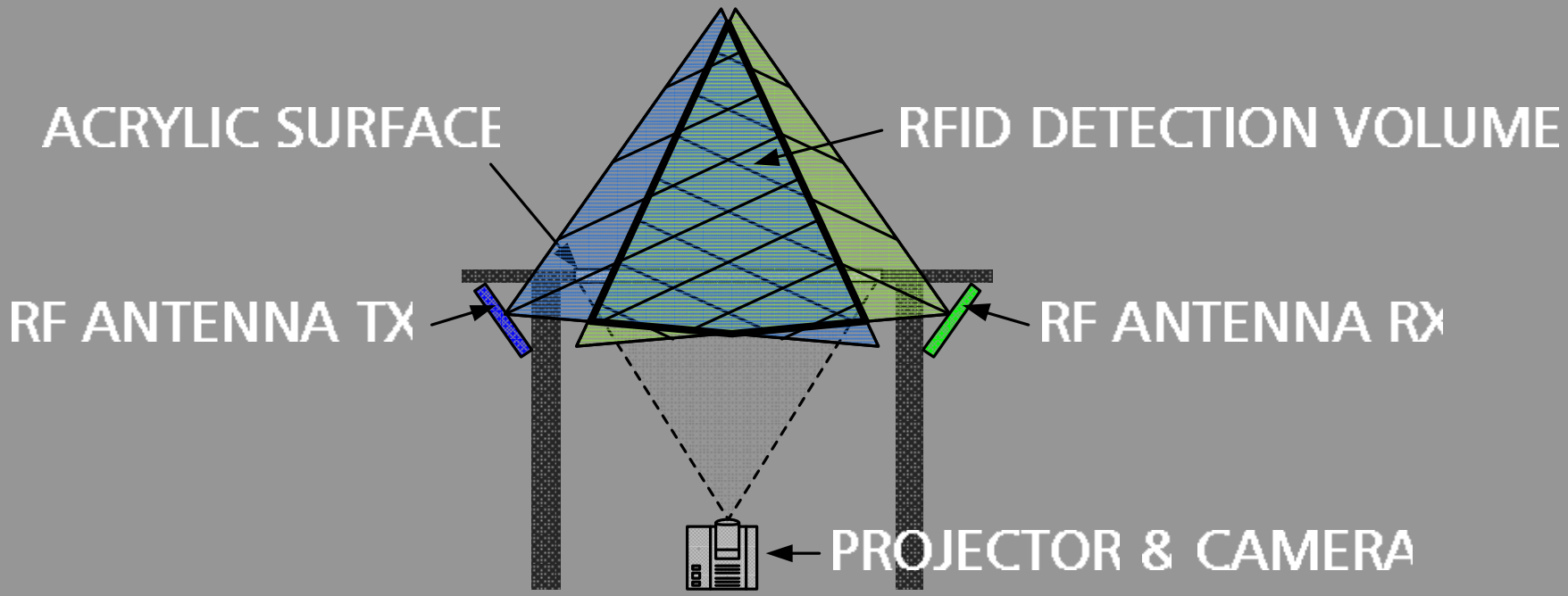
3DTV Book 2008 [DiVerdi, Olwal, Rakkolainen & Höllerer]
VR 2006 [Olwal, DiVerdi, Rakkolainen & Höllerer]
SIGGRAPH 2005 Emerging Technologies [Rakkolainen, DiVerdi, Olwal, Candussi & Höllerer]

SurfaceFusion

Sensing & augmenting everyday objects

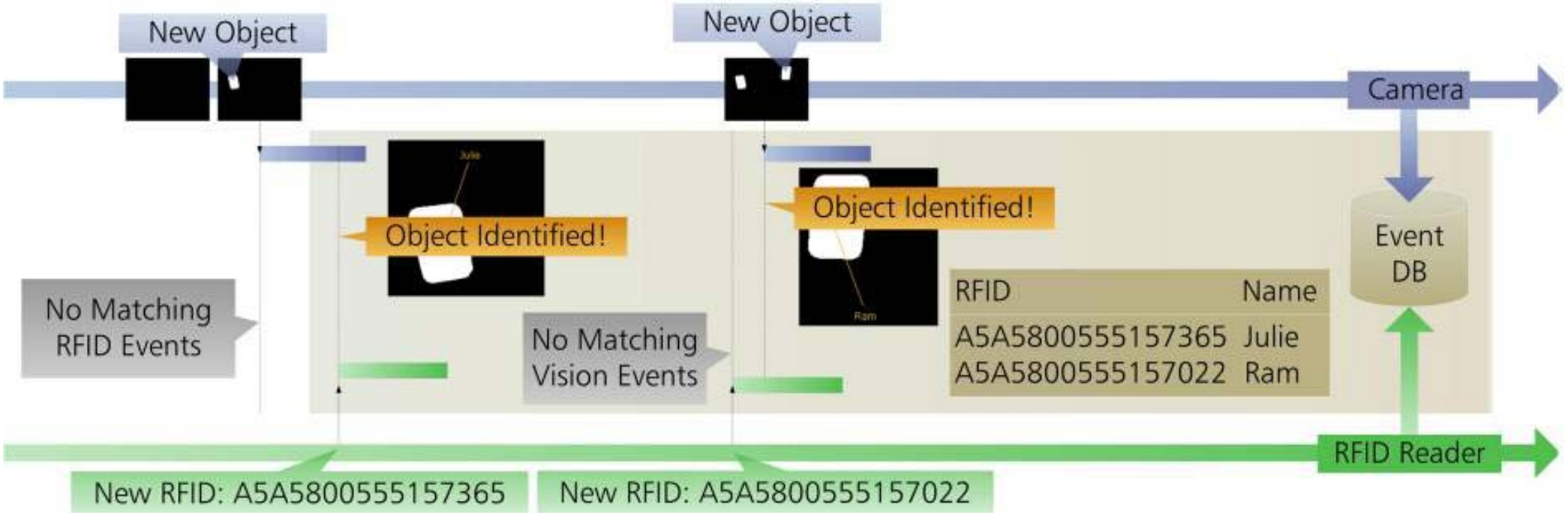


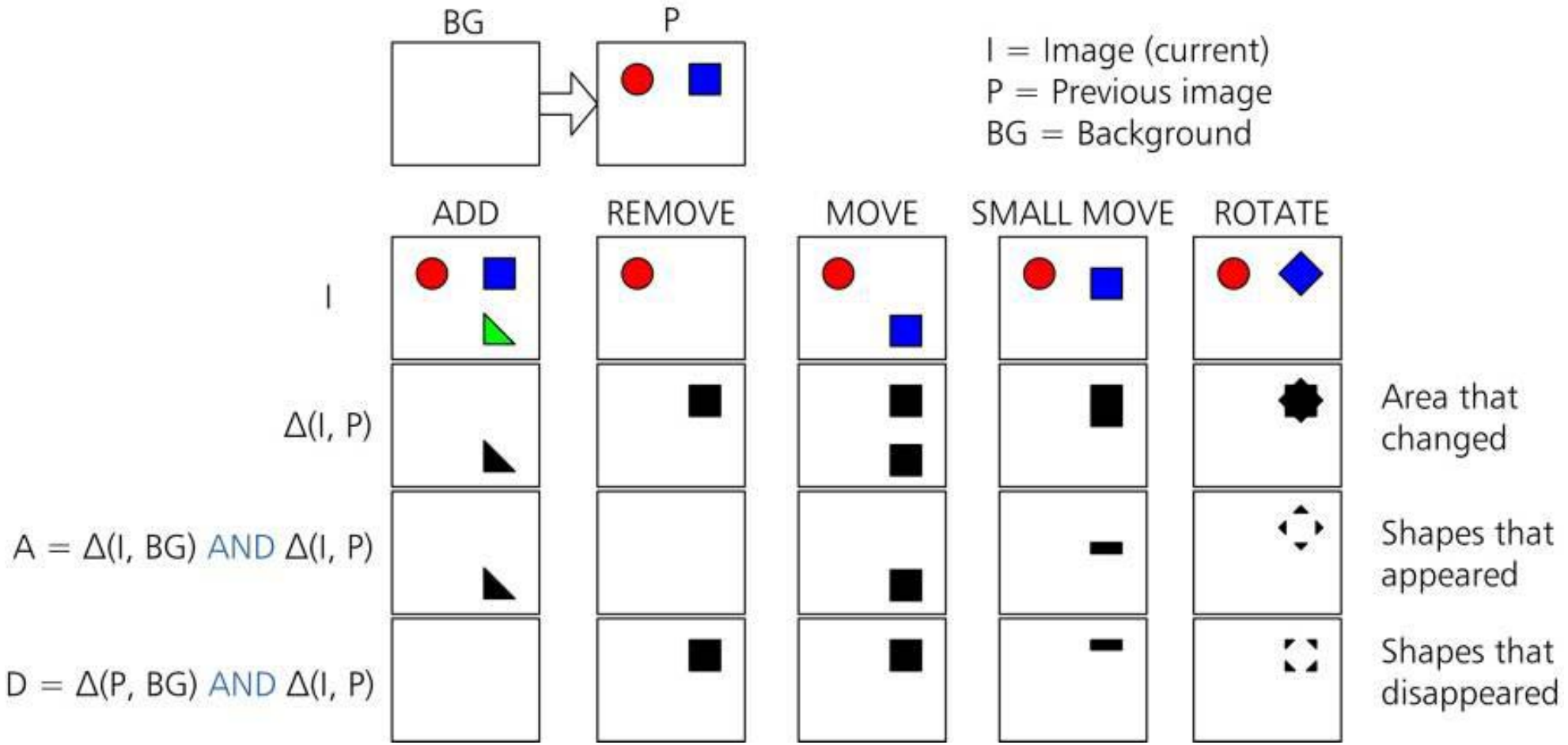
GI 2008 [Olwal & Wilson]


ACRYLIC SURFACE
RFID DETECTION VOLUME
RF ANTENNA TX
RF ANTENNA RX
PROJECTOR & CAMERA

Temporal fusion

Computer vision + RFID





sum(A) >> sum(D) → added

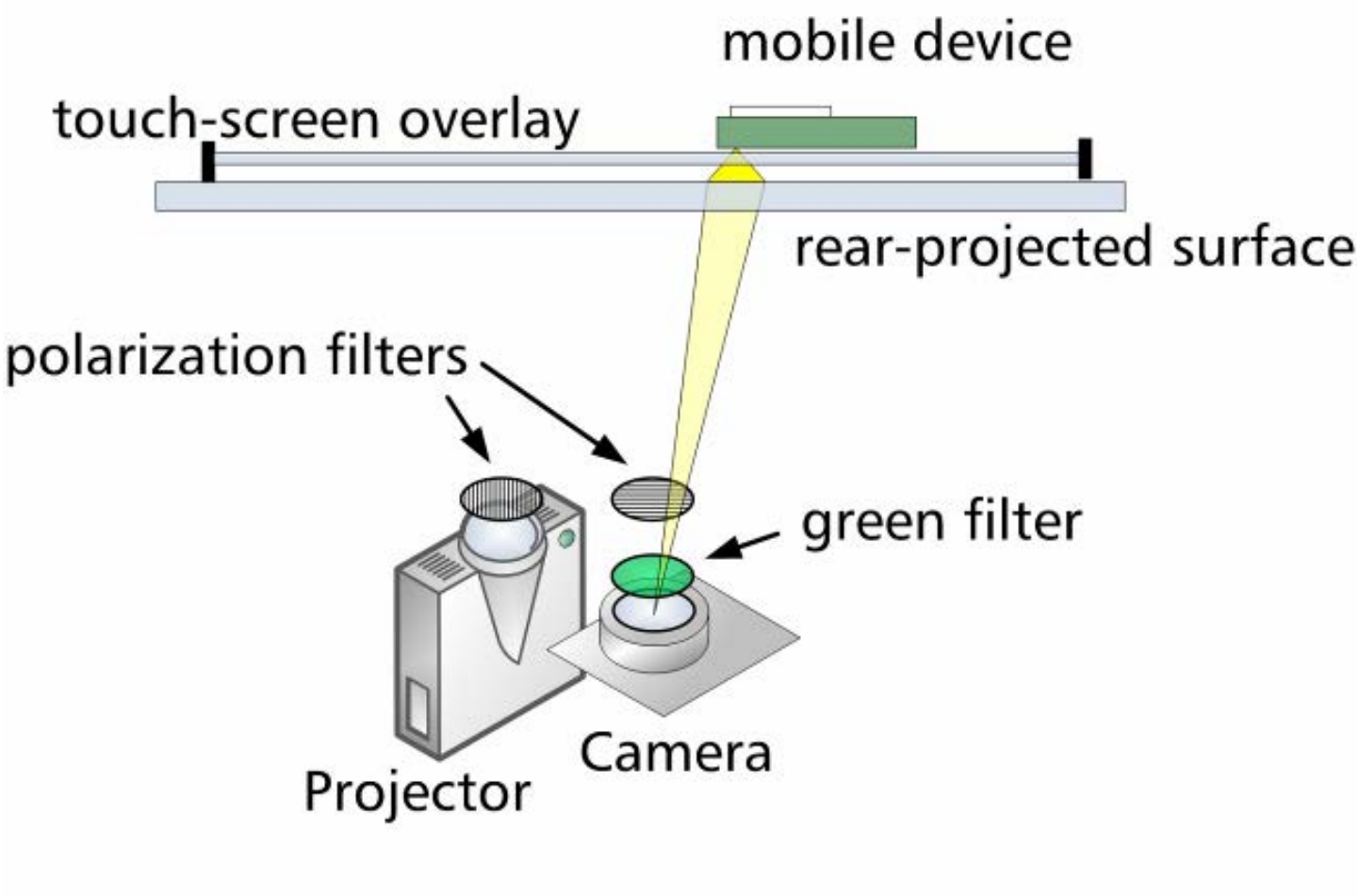
sum(D) >> sum(A) → removed

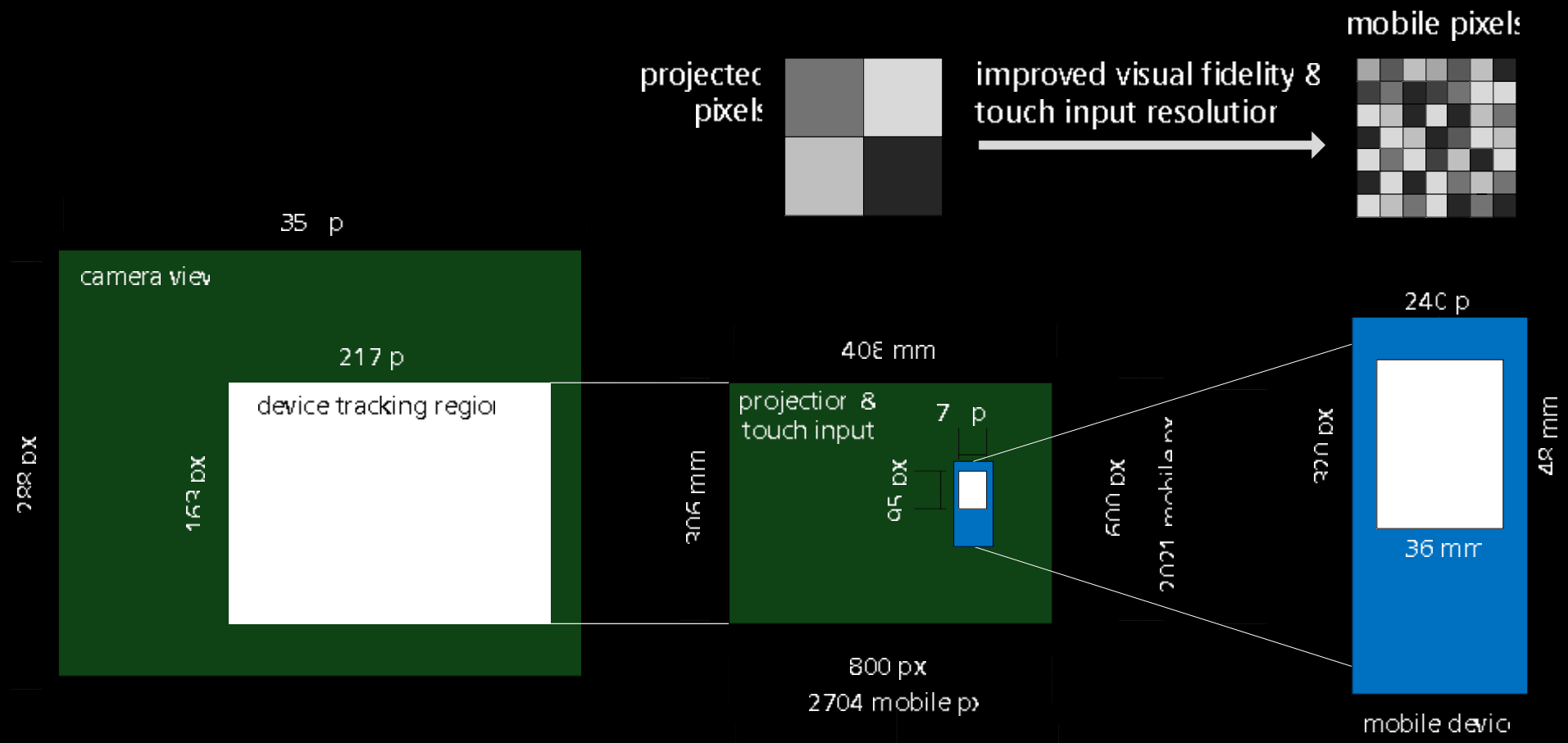
sum(A) ≈ sum(D) → move

Spatially aware handhelds

Enhancing interaction with large displays

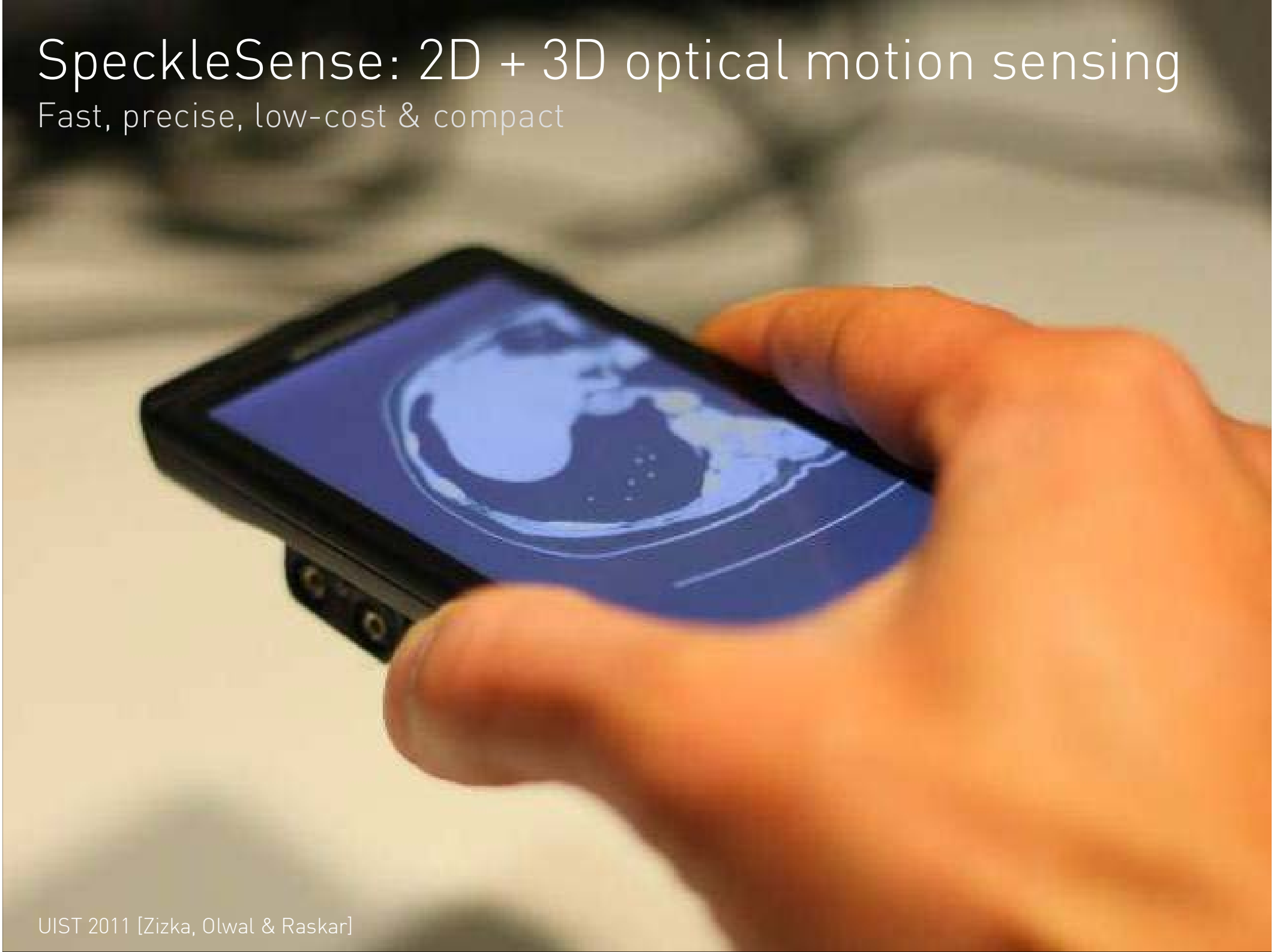
TEI 2009 [Olwal & Feiner]
INTERACT 2009 [Olwal]


mobile device
touch-screen overlay
rear-projected surface
polarization filters
green filter
Camera
Projector


mobile pixels
projected pixels
improved visual fidelity & touch input resolution
35 p
camera view
217 p
device tracking region
408 mm
projection & touch input
7 p
95 px
800 px
2704 mobile px
240 p
320 px
36 mm
48 mm
mobile device

SpeckleSense: 2D + 3D optical motion sensing

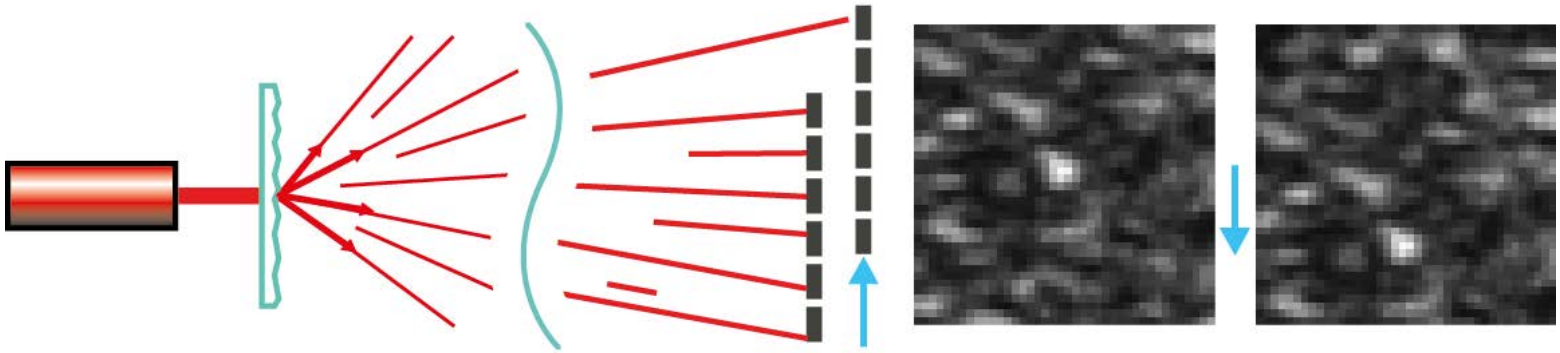
Fast, precise, low-cost & compact



UIST 2011 [Zizka, Olwal & Raskar]

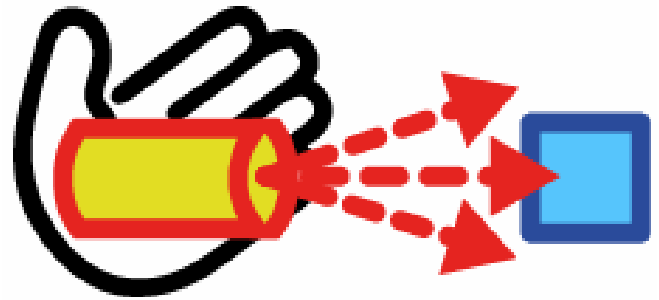
SpeckleSense: Optical motion sensing

- Fast (10 000 fps)
- Precise (50 μm)
- Lensless → Tiny (1 × 2 mm)
- Low power
- Minimal computation → minimal latency

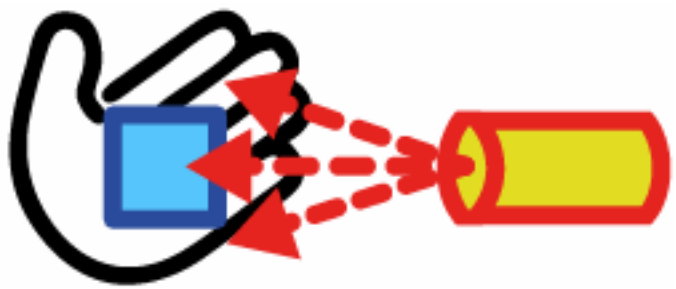


Diffuser

Handheld Speckle Projector



Handheld Speckle Sensor



Reflection

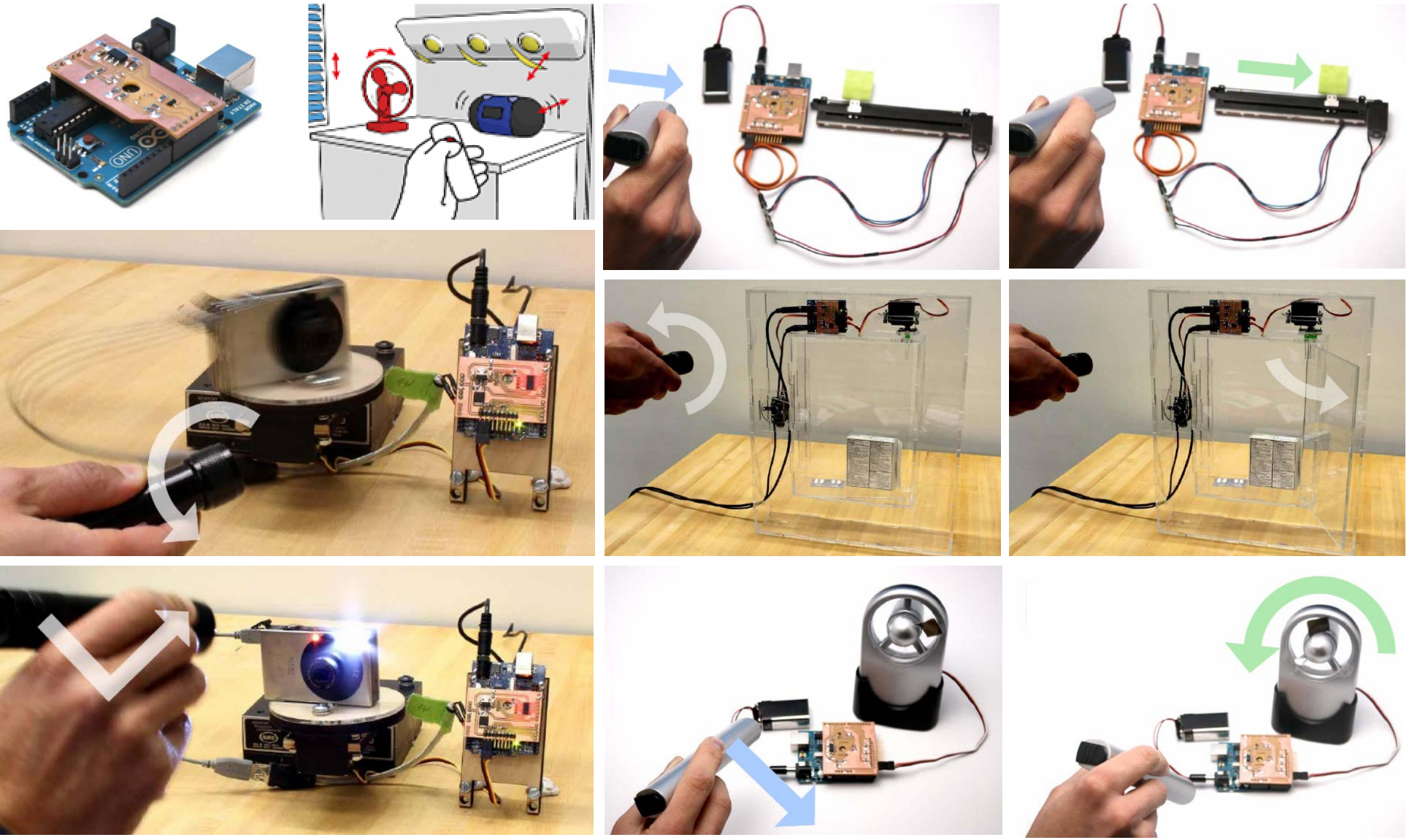
Self-tracked Device

Speckle Tracking of Hands

SpeckleEye: Gestural interaction for Ubicomp

Open source software + hardware platform for embedded electronics

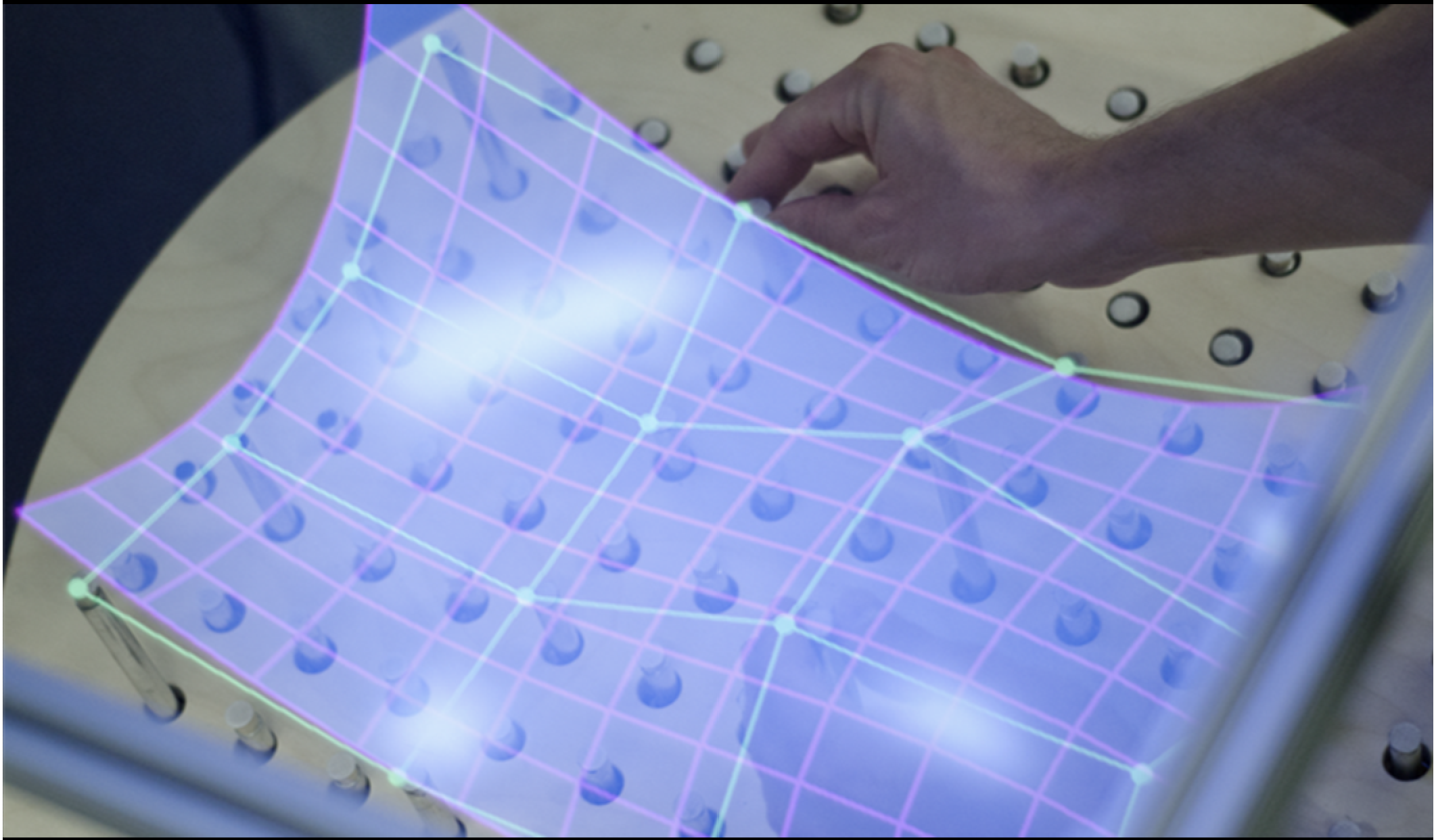
www.specklesense.org



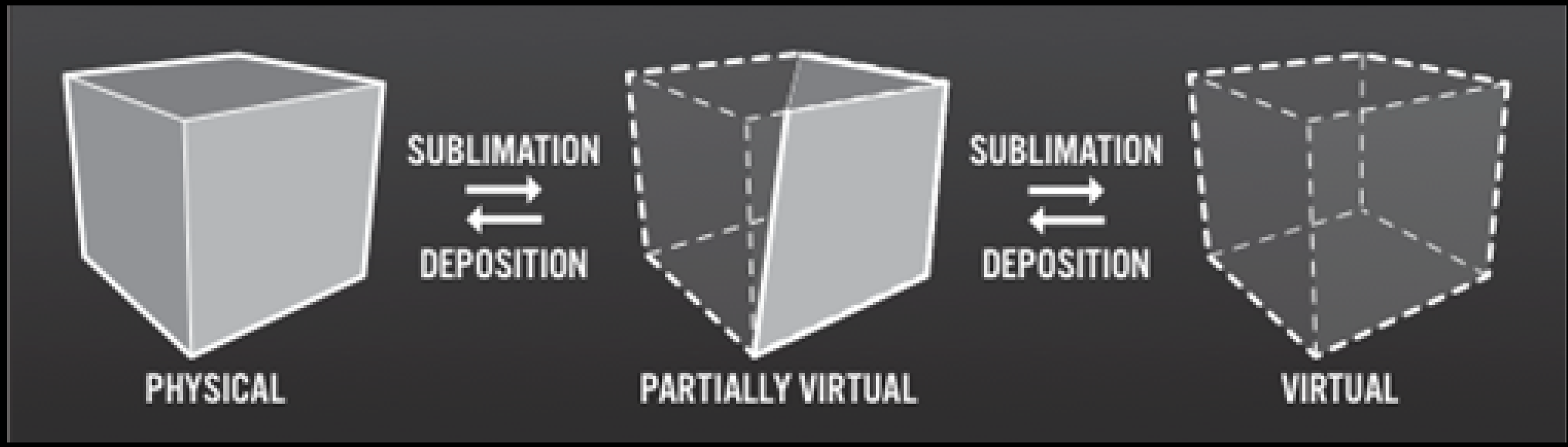
CHI 2012 Extended Abstracts [Olwal, Bardagjy, Zizka & Raskar]

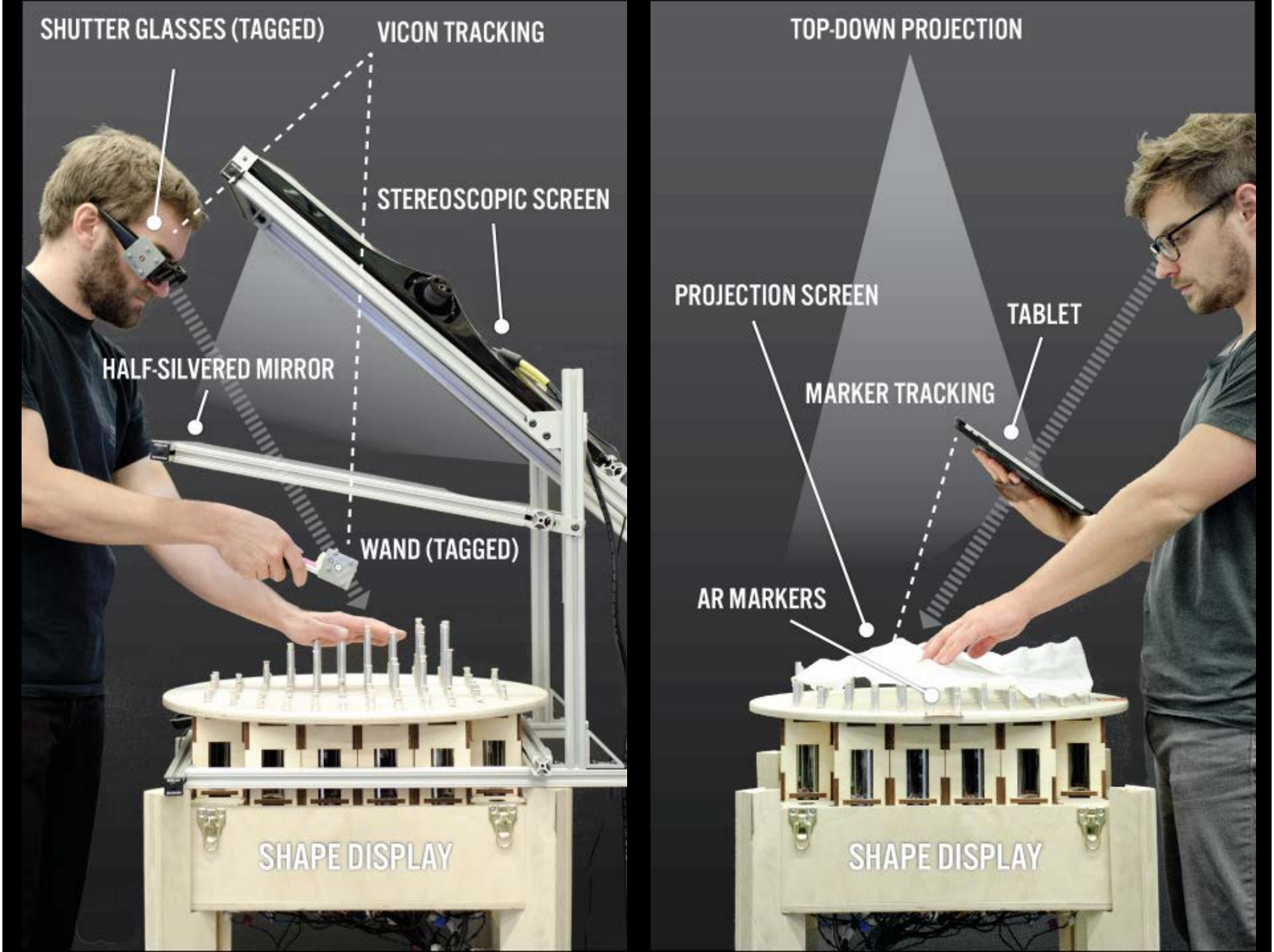
Sublimate

Switchable physical / virtual rendering



CHI 2013 [Leithinger, Follmer, Olwal, Luescher, Hogge, Lee & Ishii]


SUBLIMATION
DEPOSITION
SUBLIMATION
DEPOSITION
PHYSICAL
PARTIALLY VIRTUAL
VIRTUAL

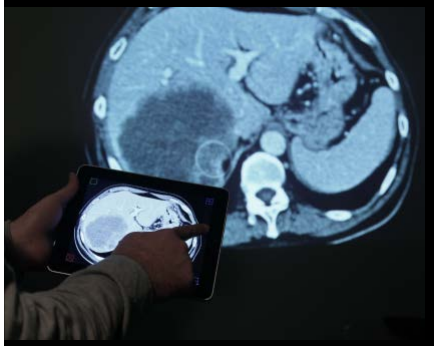

SHUTTER GLASSES (TAGGED)
VICON TRACKING
STEREOSCOPIC SCREEN
HALF-SILVERED MIRROR
WAND (TAGGED)
SHAPE DISPLAY
TOP-DOWN PROJECTION
PROJECTION SCREEN
TABLET
MARKER TRACKING
AR MARKERS
SHAPE DISPLAY

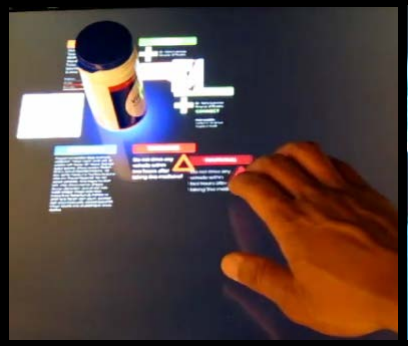
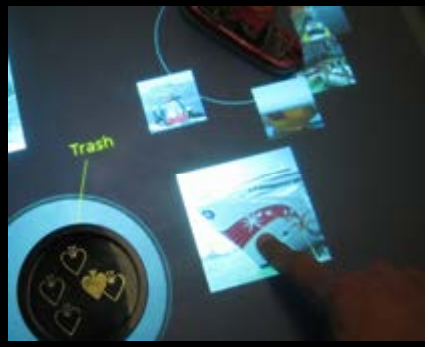
Alex Olwal, Ph.D.

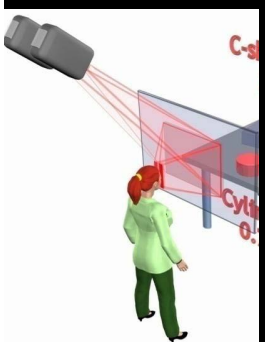
www.olwal.com

UX = Sensing × display × interaction

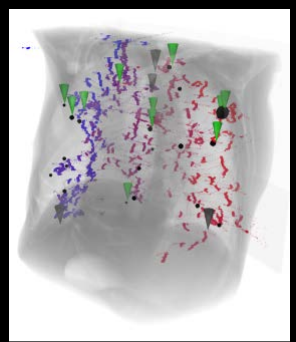
- Unobtrusive
- Embedded sensing
- Seamless display
- Hybrid & symbiotic

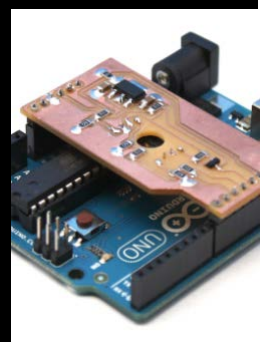






The End of Reality (?)

Alex Olwal
olwal.com

Jamie Zigelbaum
jamiezigelbaum.com

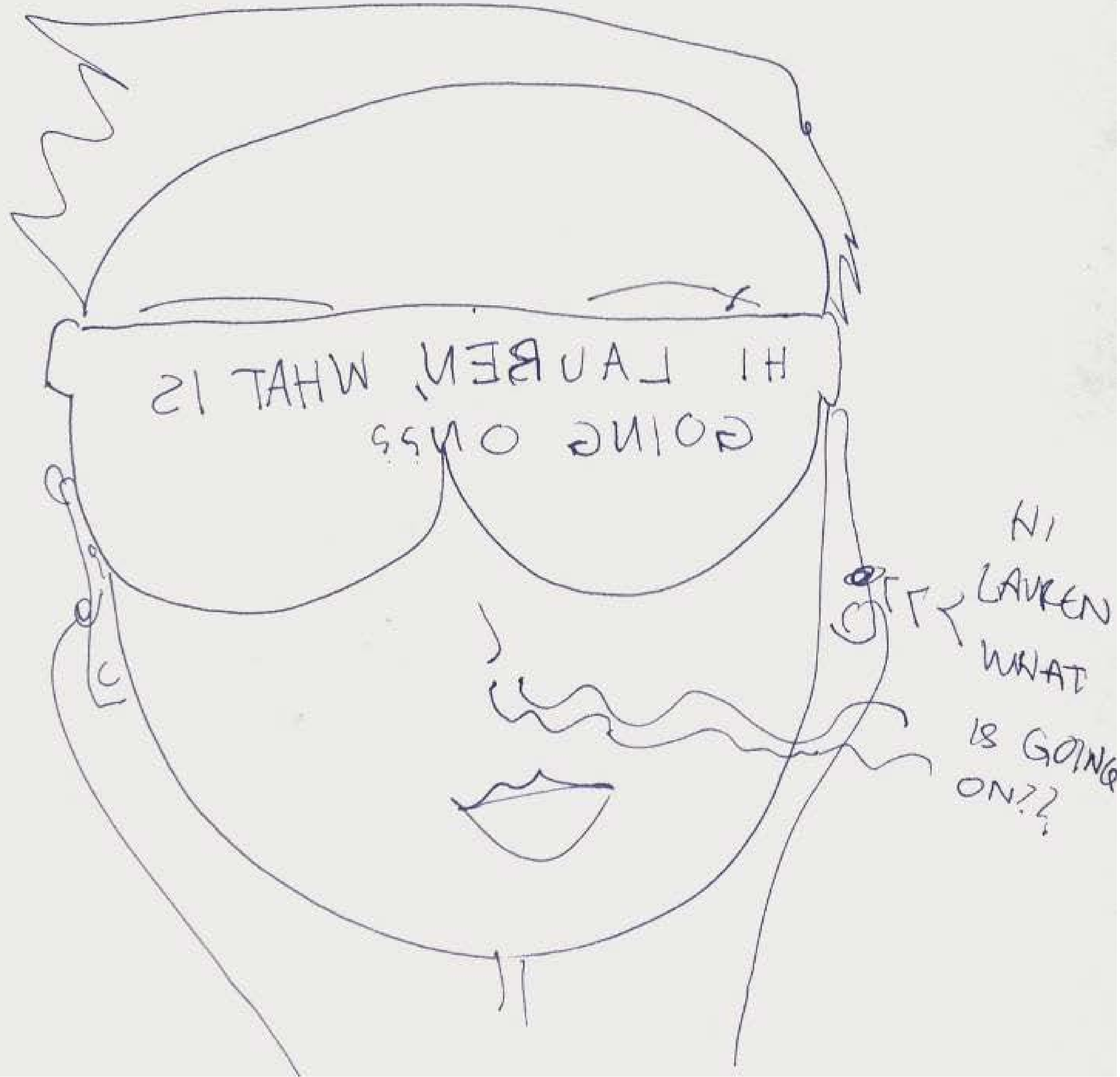

STEVEN SPIELBERG PRESENTS
BACK TO THE FUTURE
PG
A ROBERT ZEMECKIS FILM
"BACK TO THE FUTURE" STARRING MICHAEL J. FOX CHRISTOPHER LLOYD LEA THOMPSON CRISPIN GLOVER WRITTEN BY ROBERT ZEMECKIS & BOB GALE MUSIC BY ALAN SILVESTRI PRODUCED BY BOB GALE AND NEIL CANTON
AMBLIN
A UNIVERSAL PICTURE
EXECUTIVE PRODUCERS STEVEN SPIELBERG KATHLEEN KENNEDY AND FRANK MARSHALL DIRECTED BY ROBERT ZEMECKIS
UNIVERSAL
WWW.UNIVERSALPICTURES.CO.UK

Cambridge

Jake Bernstein: Ph.D. candidate, MIT Media Lab
Eric Gunther: Founder, Sosolimited
Lauren McCarthy: Designer, programmer, artist
Dan Paluska: Artist, roboticist
Nadya Peek: Ph.D. candidate, MIT Center for Bits and Atoms
David Robert: Ph.D. candidate, MIT Media Lab

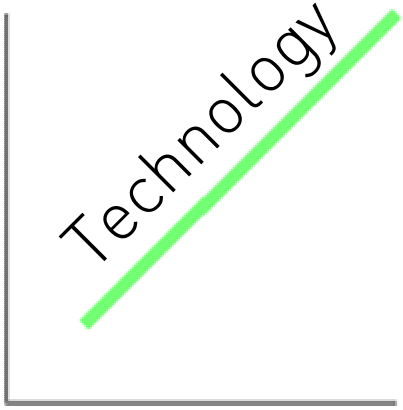
New York

Christine Creamer: Product developer
Amanda Parks: Media designer & technologist
James Patten: Founder, Patten Studio
Marko Tandefelt: Director of technology & research, Eyebeam
Richard The: Senior designer, Google Creative Lab

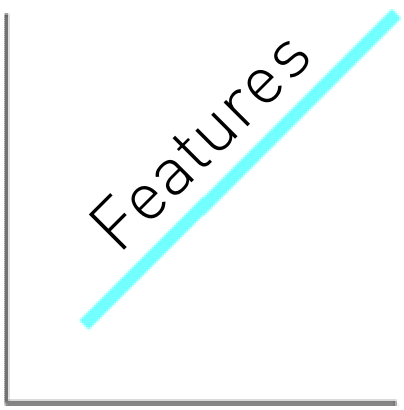

HI
LAUREN
WHAT
IS GOING
ON??

Expectations of cognitive capabilities

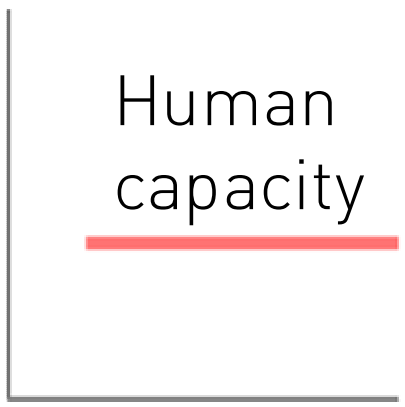
Moore's law



Buxton's law



Man's law



infinite choice paralysis (~~watcher~~ wormhole syndrome)

mind switches to vegetative state from repeated exposure to endless choices of ~~information~~ ~~sensory input~~ ~~augmented~~ feeds. reality augmentations when subject leaves augmented environments

Symptoms can persist. Subject appears to be "pulled into" that reality

brain scans indicate cortical areas associated with visual + audio reception ~~become to~~ larger blood flow + alternate sensory areas become oxygen starved. even after augmented reality is removed.

Subject is paralyzed by - - - - - -

puppet interface

?

Cognitive control in media multitaskers

Eyal Ophir[a], Clifford Nass[b,1], and Anthony D. Wagner[c]

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Edited by Michael I. Posner, University of Oregon, Eugene, OR, and approved July 20, 2009 (received for review April 1, 2009)

Chronic media multitasking is quickly becoming ubiquitous, although processing multiple incoming streams of information is considered a challenge for human cognition. A series of experiments addressed whether there are systematic differences in information processing styles between chronically heavy and light media multitaskers. A trait media multitasking index was developed to identify groups of heavy and light media multitaskers. These two groups were then compared along established cognitive control dimensions. Results showed that heavy media multitaskers are more susceptible to interference from irrelevant environmental stimuli and from irrelevant representations in memory. This led to the surprising result that heavy media multitaskers performed worse on a test of task-switching ability, likely due to reduced ability to filter out interference from the irrelevant task set. These results demonstrate that media multitasking, a rapidly growing societal trend, is associated with a distinct approach to fundamental information processing.

attention | cognition | executive function | multitasking | working memory

In an ever-more saturated media environment, media multitasking—a person's consumption of more than one item or stream of content at the same time—is becoming an increasingly prevalent phenomenon, especially among the young (1). Researchers have examined the immediate effects of multitasking, and of media multitasking in particular, on memory, learning, and cognitive functioning (2–4). However, it is unknown whether and how chronic heavy multitaskers process information differently than individuals who do not frequently multitask (viewing multitasking as a trait, not simply a state). This issue seems especially pertinent in light of evidence that human

media multitasking index to determine the mean number of media a person simultaneously consumes when consuming media and selected those individuals who were heavy media multitaskers (HMMs were one standard deviation or more above the mean) or light media multitaskers (LMMs were one standard deviation or more below the mean) on this index. We then examined these groups' abilities on cognitive control dimensions that could indicate a breadth-bias in cognitive control at different control loci: the allocation of attention to environmental stimuli and their entry into working memory, the holding and manipulation of stimulus and task set representations in working memory, and the control of responses to stimuli and tasks.

Filtering Environmental Distractions: Filter and AX-CPT Tasks. In a test of filtering ability (10)—an ability that can point to a breadth orientation in allowing stimuli into working memory—participants viewed two consecutive exposures of an array of rectangles and had to indicate whether or not a target (red) rectangle had changed orientation from the first exposure to the second, while ignoring distractor (blue) rectangles (Fig. 1*A*). We measured performance for arrays with two targets and 0, 2, 4, or 6 distractors. Repeated-measures ANOVA revealed a group*distractor level interaction (Fig. 1*B*), $F(1, 39) = 4.61$, $P < 0.04$: HMMs' performance was linearly negatively affected by distractors, $F(1, 18) = 9.09$, $P < 0.01$, whereas LMMs were unaffected by distractors, demonstrating that LMMs have the ability to successfully filter out irrelevant stimuli, $F(1, 21) = 0.18$, $P > 0.68$.

Further evidence for HMMs' tendency to allow irrelevant stimuli into working memory emerged on the AX-CPT variant (11, 12) of the Continuous Performance Task (13). This task

Why are remote people so much more important?

the most real disorder

characterised by constantly obsessing over how to get to the 'real' reality, a la existenz, the matrix or inception.

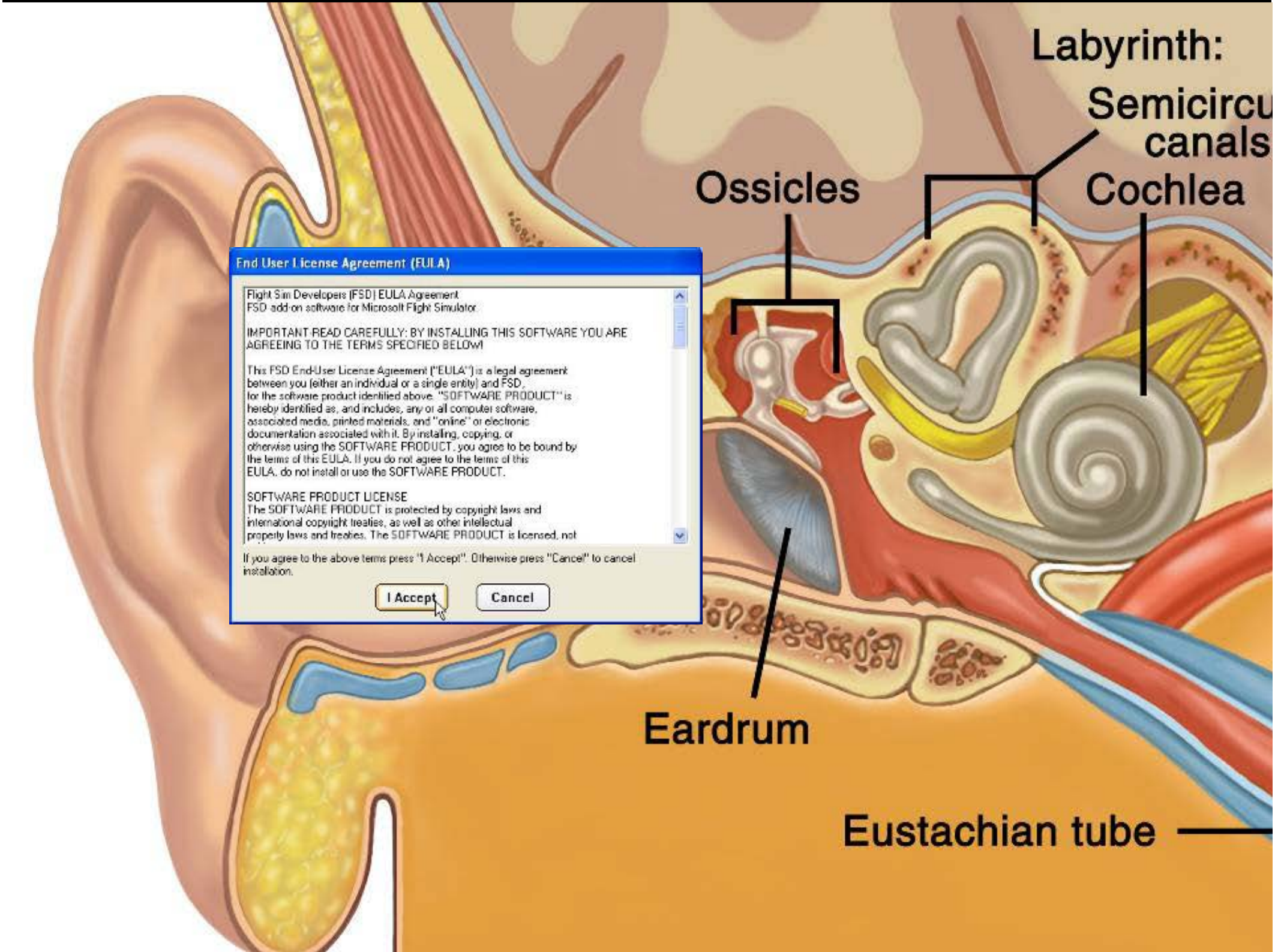
Light cases may be characterized by a withdrawn approach to life and a disregard for every day events.

More severe cases might suffer from ~~self-mutilating tendencies or~~ a lack of empathy or concern for others or the self, extending to self-mutilating or homicidal tendencies

~~Cases~~ Therapeutic cures available include withdrawing from all augmented forms of life in secluded therapy areas. With more serious cases medication to suppress the imagination might be prescribed.

Illusory Consensual Partnering (ICP)

The common manifestation of ICP is observed as two people in a long-term partnership where all or nearly all communication between the partners is passes through two separate consensual reality filters. Each person is involved in a deeper community of reality replacement and 'believes their partner to be in the same reality although they are not. After years of misperception they realize their error after system upgrade outages and generally choose to ignore it.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I Accept
Cancel
Eardrum
Eustachian tube


PART MAN,
PART MACHINE,
ALL COP.

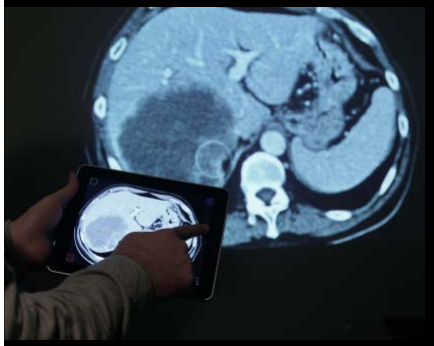
Now	vs.	Later
Local	vs.	Remote
Present	vs.	Absent
Focused	vs.	Distracted
Unified	vs.	Fractured

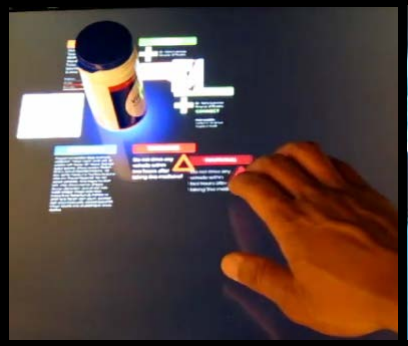
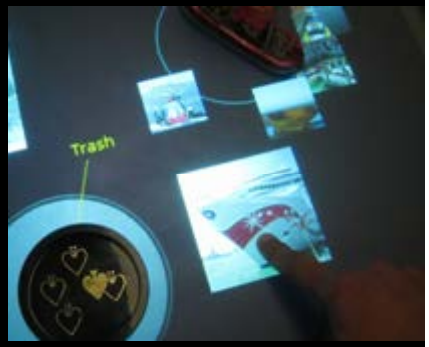
Alex Olwal, Ph.D.

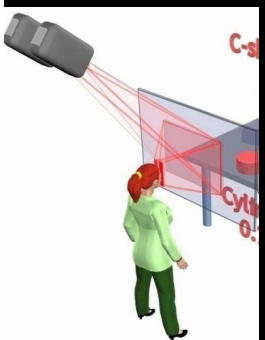
www.olwal.com

UX = Sensing × display × interaction × human

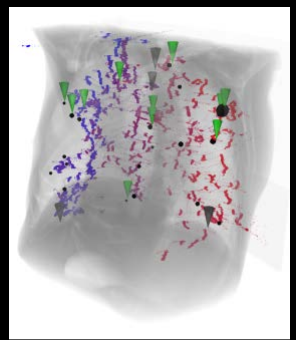
- Unobtrusive
- Embedded sensing
- Seamless display
- Hybrid & symbiotic








olwal.com

Shape, Actuation and Deformation

SWITCHABLE PHYSICAL/VIRTUAL RENDERING

Sublimate explores rapid and fluid transitions between physical and visual representations of dynamic digital content.

Sublimate: State-Changing Virtual and Physical Rendering to Augment Interaction with Shape Displays
Leithinger, D., Follmer, S., Olwal, A., Luescher, S., Hogge, A., Lee, J., and Ishii, H.
CHI 2013

CONTROLLING SOFTNESS + SENSING SHAPE

Jamming User Interfaces enable programmable stiffness, haptic feedback and deformation, for new types of flexible and shape-changing interactions.

Jamming User Interfaces: Programmable Particle Stiffness and Sensing for Malleable and Shape-Changing Devices
Follmer, S., Leithinger, D., Olwal, A., Cheng, N., and Ishii, H.
UIST 2012 - Best Paper Award

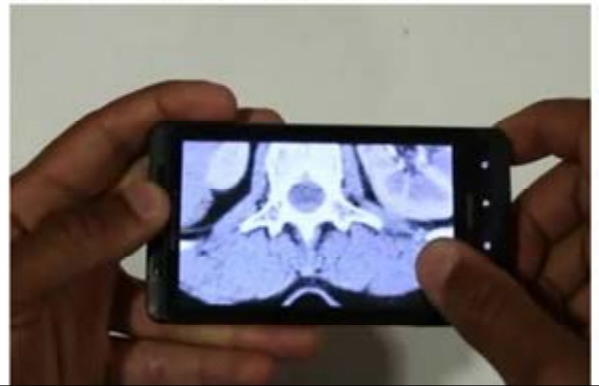
TACTILE FEEDBACK FOR MOTION GUIDANCE

Motion guidance for position, direction and continuous velocities, is provided to tracked users using visual, vibrotactile and pneumatic feedback.

Multimodal Motion Guidance: Techniques for Adaptive Dynamic Feedback
Schönauer, C., Fukushi, K., Olwal, A., Kaufmann, H., and Raskar, R.
ICMI 2012

Sensing for Embedded Devices and Tangible User Interfaces

LASER SPECKLE FOR MOTION SENSING



RFID + COMPUTER VISION FOR TRACKING

OPTICAL SENSING FOR SPATIAL AWARENESS

Alex Olwal, Ph.D.

www.olwal.com

UX = Sensing × display × interaction × human

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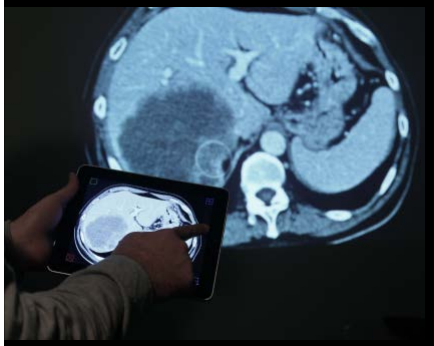
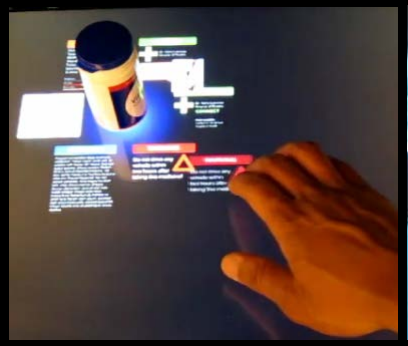
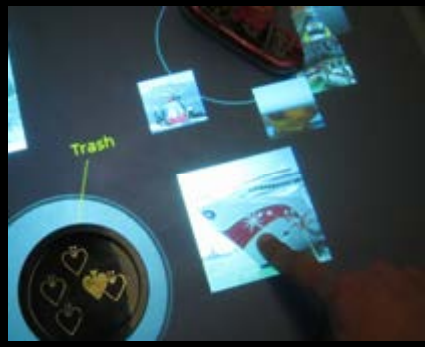
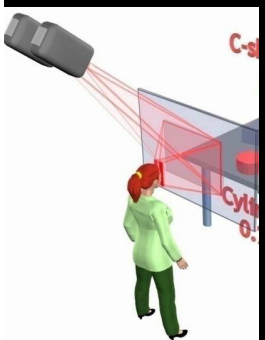
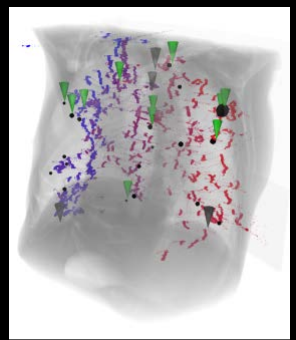







SurfaceFusion

RFID + vision → ID + track everyday objects

GI 2008 [Olwal & Wilson]

LightSense

Dynamic augmentation of printed media

ISMAR 2006 [Olwal]

LUMAR

Hybrid 2D + 3D handheld AR

ICAT 2007 [Olwal & Henrysson]

Hybrid surface interaction

Distributed interaction with large displays

INTERACT 2009 [Olwal]

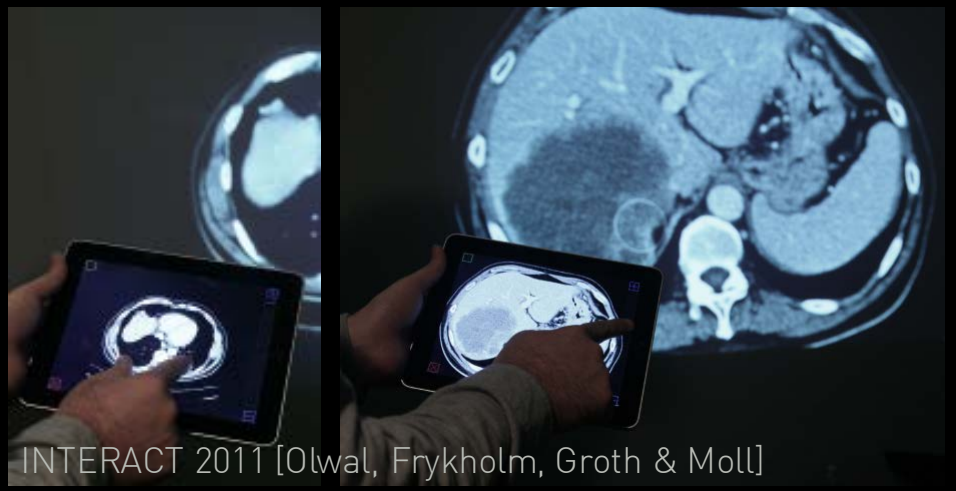
Spatially aware handhelds

Mobile devices → expanded capabilities

TEI 2009 [Olwal & Feiner]

Collaborative interfaces

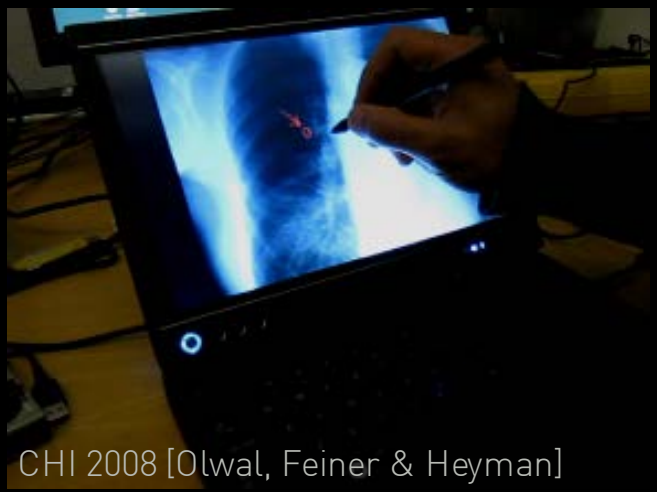
Multiple users, devices & locations



INTERACT 2011 [Olwal, Frykholm, Groth & Moll]

Touch-screen techniques

Minimal gestures for precise interaction



CHI 2008 [Olwal, Feiner & Heyman]

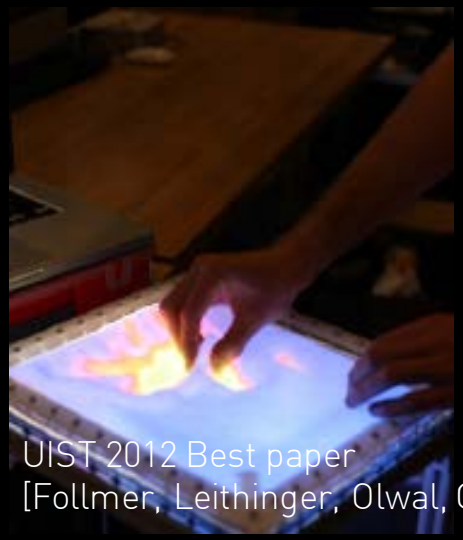
3D interaction

Mobile, gestures, touch, eye tracking, ...

NordiCHI 2008 [Olwal]

Jamming user interfaces

Stiffness & sensing for malleable devices



UIST 2012 Best paper
[Follmer, Leithinger, Olwal, Cheng & Ishii]

Multimodal motion guidance

Dynamic tactile feedback for motor training

ICMI 2012 [Schönauer, Fukushi, Olwal, Kaufmann, & Raskar]

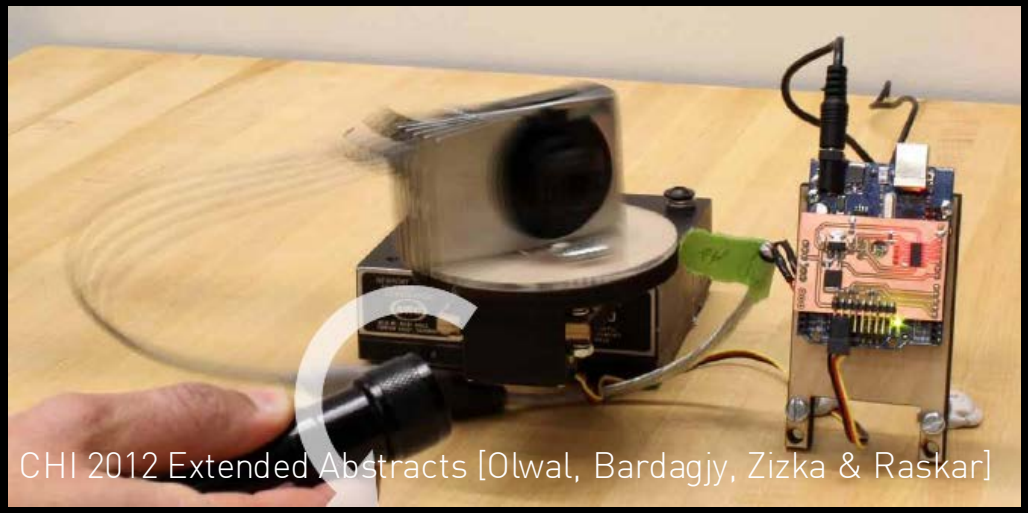
SpeckleSense

2D + 3D optical motion sensing

UIST 2011 [Zizka, Olwal & Raskar]

SpeckleSense / SpeckleEye

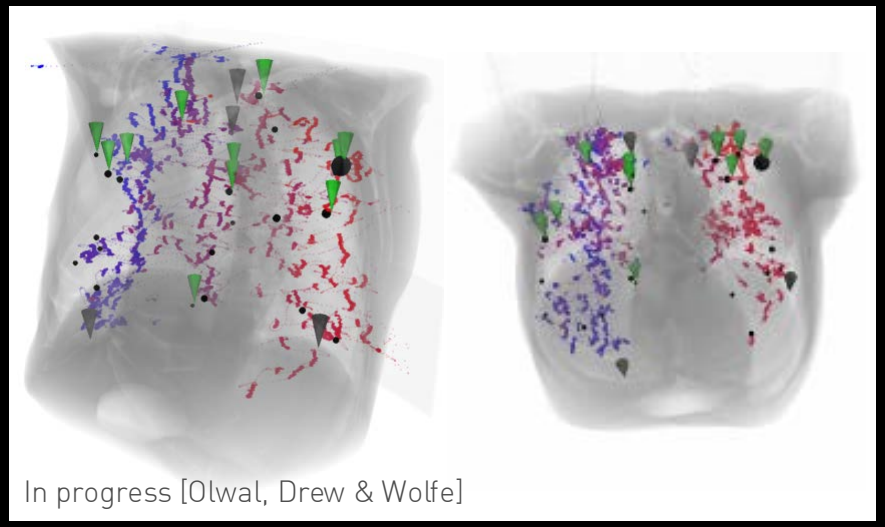
Embedded motion sensing & gestural interaction



CHI 2012 Extended Abstracts [Olwal, Bardagjy, Zizka & Raskar]

Eye tracking for radiology

2D tracking → 3D visualization



In progress [Olwal, Drew & Wolfe]

3D interaction with 2D X-ray imagery

Spatiotemporal visualizations to minimize radiation

CBMS 2011 [Ioakeimidou, Olwal, Nordberg & Holst]

Mobile eye exams

Portable cataract screening & retinal imaging

SIGGRAPH 2012 Talks
[Lawson, Boggess, Khullar, Olwal, Wetzstein & Raskar]

Low-cost telemedicine for prosthetics

Real-time collaboration for remote advice

MobileHCI workshop 2011 [Sengeh & Olwal]

Exhibit Surface

Multi-touch + RFID

Museum of Naval History, Stockholm

Hybrid Surface

Sensing & interaction for objects & mobile devices

Ericsson: HQ, Mobile World Congress, Volvo Ocean Race, ...

Expressive weather

Robotic façade display with weather sayings

Tom Tits Experiment

PeopleBandit

Oversized slot machine → remixes 1000 locals

Lunagallerian