

Lab 1, Friday 29/10
2 sessions: [9-12] & [13-16]
Lab halls: Vit & Karmosin

- 1) Get Windows data account from Delphi
 - Osquars Backe 2, ground floor
- 2) Preparation assignment: before the lab!



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mixed reality

course notes

Alex Olwal
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videos & material from lecture (+ more):
www.csc.kth.se/~alx

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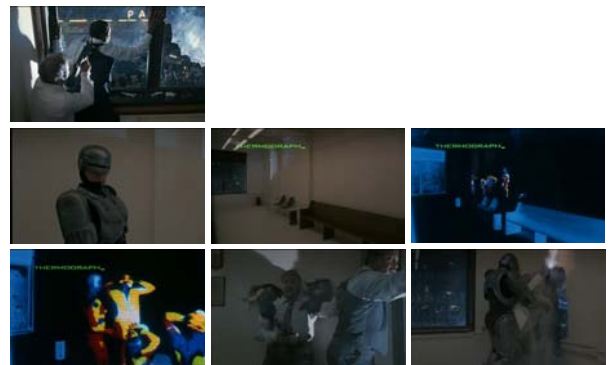
mixed reality

- blend real + virtual (digital/synthesized/...)
- seamlessly combine virtual data with real
- supplement real
- ease & improve understanding

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robocop (1987)



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terminator 3 (2003)



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mixed reality

- blend real + virtual (digital/synthesized/...)
- seamlessly combine virtual data with real
- supplement real
- ease & improve understanding

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head-up-displays



Boeing Next-Generation 737 (2003)
 visibility_{min} w/o HUD: 182 m
 visibility_{min} with HUD: 91 m

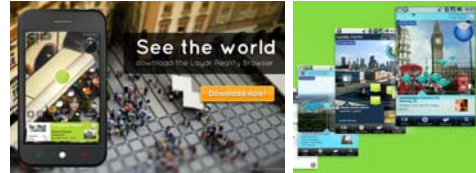


NASA's Gulfstream GV

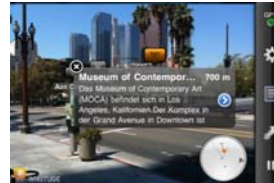


C-130J Hercules

new mobile platforms



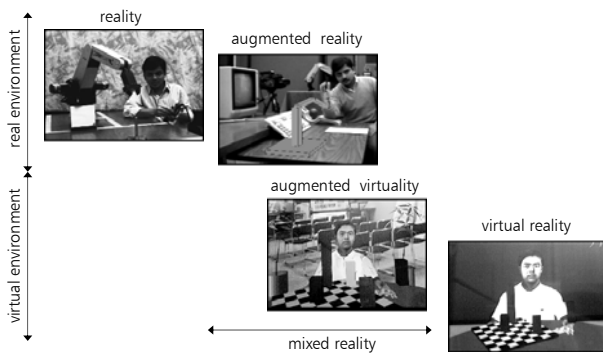
Layer



WIKITUDE

continuum

[Milgram & Kishino 1994]



augmented reality: definition

[Azuma 1997; Azuma, Bailiot, Behringer, Feiner, Julier & MacIntyre 2001]

- 1) real + virtual objects in real environment
- 2) runs interactively and in realtime
- 3) registers real + virtual objects with each other



issues

display technology

- visually combine computer graphics with view of real world

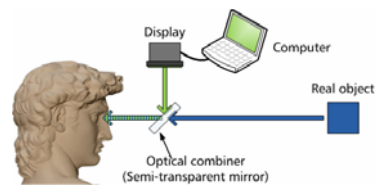
tracking/registration

- accurately combine computer graphics with real world objects in 3D

see-through displays

optical see-through

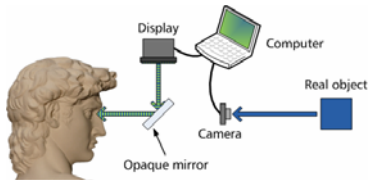
- semi-transparent displays
- optical combiners



see-through displays

video see-through

- opaque displays
- video cameras



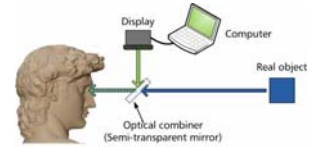
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see-through displays

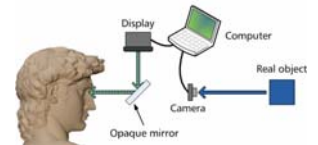
optical see-through

- lower cost
- no downsampling
- no delay of real
- no offset



video see-through

- flexible composition
- sync real/virtual
- simpler calibration



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issues

display technology

- visually combine computer graphics with view of real world

tracking/registration

- accurately combine computer graphics with real world objects in 3D

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tracking/registration

ultrasonic

- Intersense IS-600, IS-900

electromagnetic

- Ascension Flock of Birds
- Polhemus LIBERTY LATUS, FASTRAK

optical/camera-based

- marker-based (e.g., ARToolKit, ARToolKitPlus, ARTag)
- 3rdTech HiBall tracker
- A.R.T.
- WorldViz PPT

hybrid

- Intersense IS-1200 VisTracker

natural feature tracking

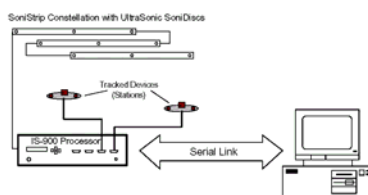
- Computer vision techniques

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ultrasonic

- IS-900



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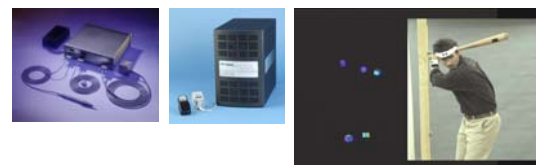
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electromagnetic

- Ascension Flock of Birds (DC)



- Polhemus LIBERTY LATUS/FASTRAK (AC)

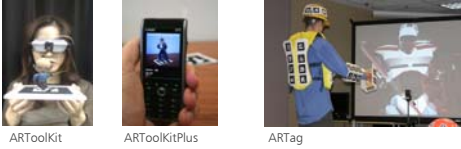


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optical/camera-based

- ARToolKit / ARToolKitPlus / ARTag



- 3rdTech HiBall tracker

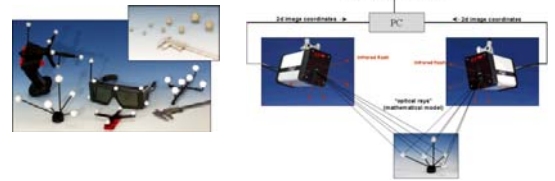


optical/camera-based

- WorldViz PPT



- A.R.T.

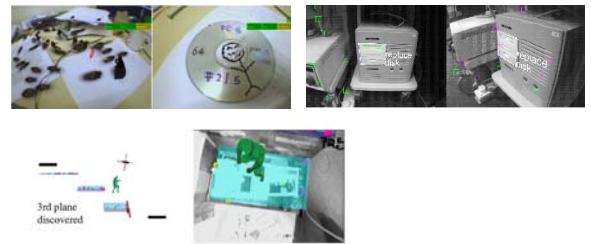


hybrid

- InterSense IS-1200

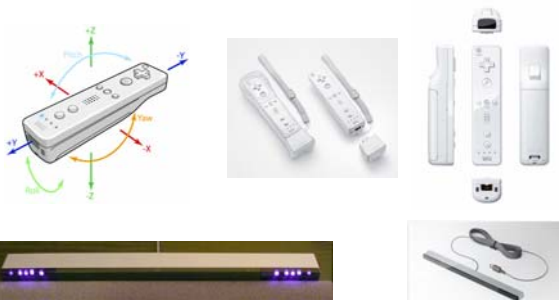


natural feature tracking



advanced sensing in consumer electronics

- Nintendo Wiimote + "sensor" bar + MotionPlus



advanced sensing in consumer electronics

- Microsoft Kinect



advanced sensing in consumer electronics

- PlayStation Move



display types

- > head-mounted-displays (HMDs)
- handheld
- spatial

HMD

[Sutherland 1968]



annotation

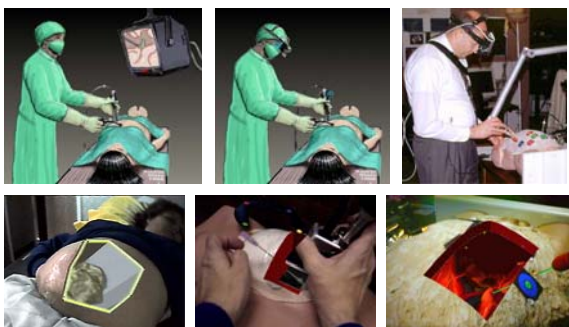
[Feiner, MacIntyre, Haupt & Solomon 1993], [Feiner, MacIntyre, and Seligmann 1993], [Bell, Feiner & Höllerer 2001], [Bell, Höllerer & Feiner 2002]



medical augmented reality

[State, Livingston, Garrett, Hirota, Whitton, Pisano & Fuchs 1996]

[Fuchs, Livingston, Raskar, Colucci, Keller, State, Crawford, Rademacher, Drake, & Meyer 1998]



situated documentaries

[Höllerer, Feiner & Pavlik 1999]



MagicBook

[Billinghurst, Kato & Poupyrev 2001]

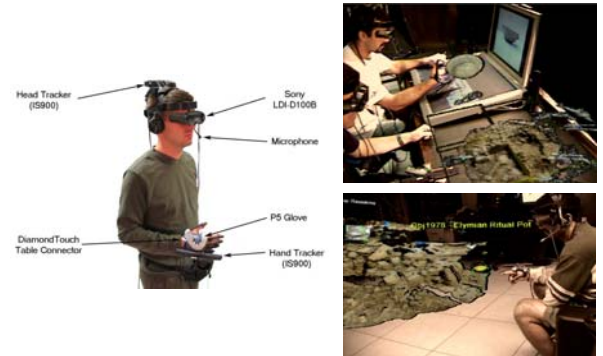


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archeology

[Benko, Ishak & Feiner 2004]



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display types

head-mounted-displays (HMDs)

> handheld

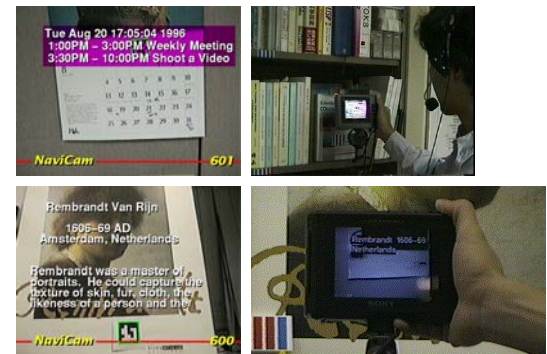
spatial

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handheld: NaviCam

[Rekimoto 1995]



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handheld: PDA

[Wagner, Pintaric & Schmalstieg 2003]



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handheld: cell phone

[Möhring, Lessig & Bimber 2004]



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handheld: ARToolKitPlus & StudierStube ES

[StudierStube augmented reality project]

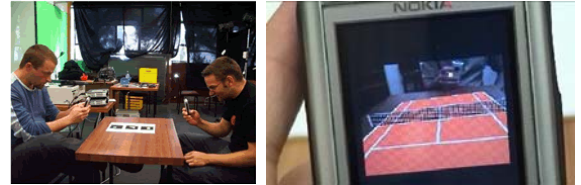


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handheld: ARToolKit

[Henrysson 2006]



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handheld: lightsense

[Olwal 2006]

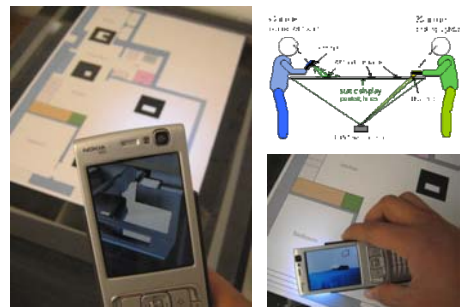


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handheld: LUMAR – Hybrid 2D & 3D

[Olwal & Henrysson 2007]



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display types

head-mounted-displays (HMDs)

handheld

> spatial

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spatial: everywhere displays

[Pinhanez 2001]



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spatial: on-board MR projector

[Karitsuka & Sato 2003]



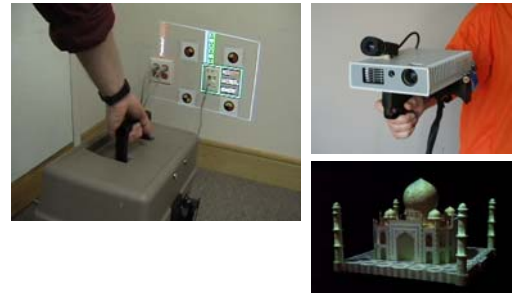
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spatial: iLamps, Shader Lamps

[Raskar, vanBaar, Beardsley, Willwacher & Rao 2003]

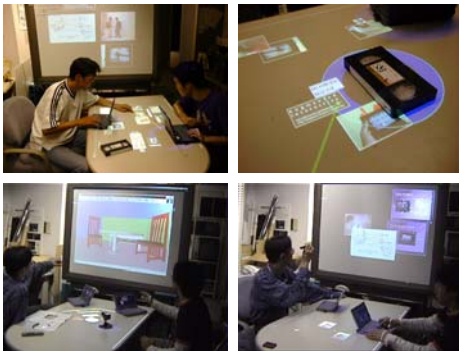
[Bandyopadhyay, Raskar & Fuchs 2001]



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spatial: augmented surfaces [Rekimoto & Saitoh 1999]



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spatial: SurfaceFusion [Olwal & Wilson 2008]

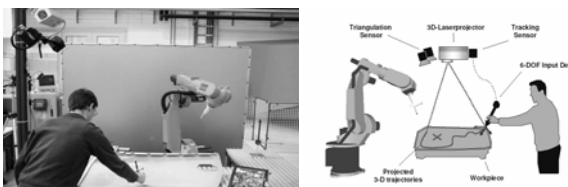


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spatial: interactive laser projection

[Zaeh & Vogl 2006]

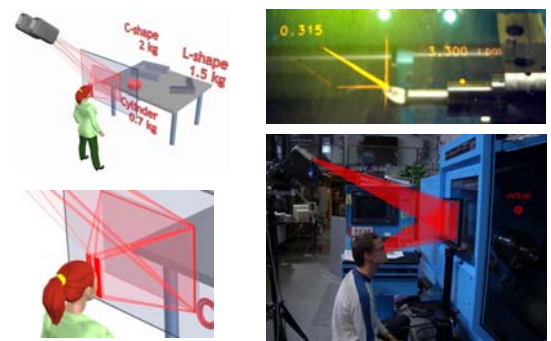


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spatial: ASTOR

[Olwal, Lindfors, Gustafsson, Kjellberg & Mattsson 2005]



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spatial: immaterial, dual-sided

[Olwal, DiVerdi, Rakkolainen & Höllerer 2007]
[DiVerdi, Rakkolainen, Höllerer & Olwal 2006]



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spatial: handheld projectors

[Cao, Forlines & Balakrishnan 2007]

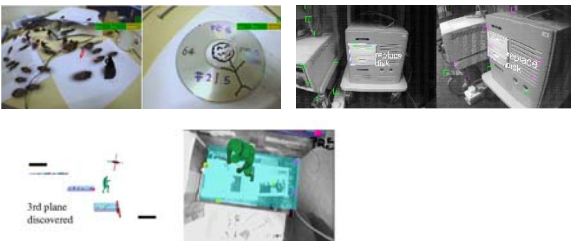


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SLAM: simultaneous location & mapping

[Klein & Murray 2007]
[Reitmayr et al. 2007]
[Chekov et al. 2007]



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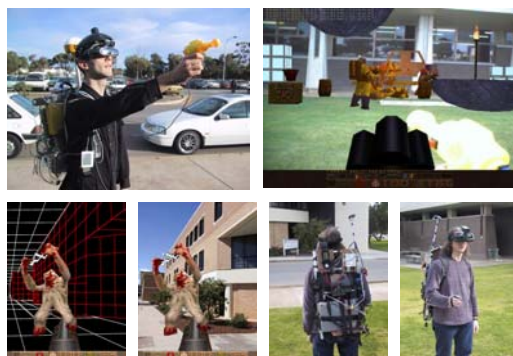
augmented & mixed reality entertainment

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ARQuake

[Piekarski & Thomas 2002]

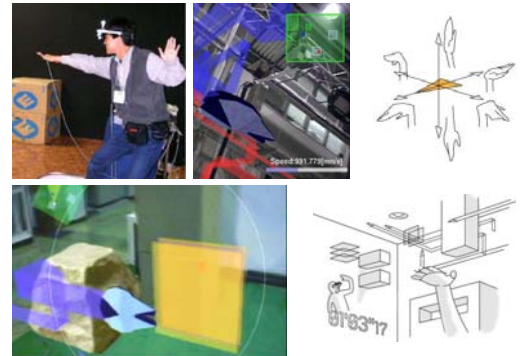


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BLADESHIPS

[Takemura, Haraguchi & Ohtarski 2004]



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Human Pacman

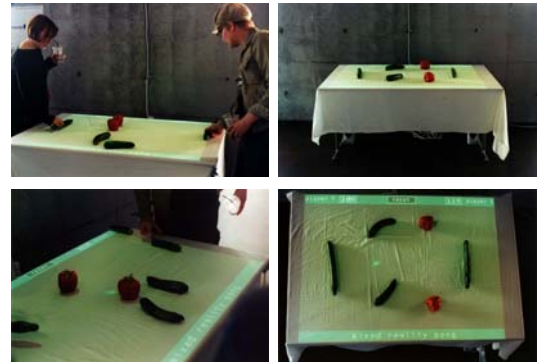
[Cheok, Goh, Farbiz, Liu, Li, Fong, Yang & Teo 2004]



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Mixed Reality Pong [Kallio 2001]

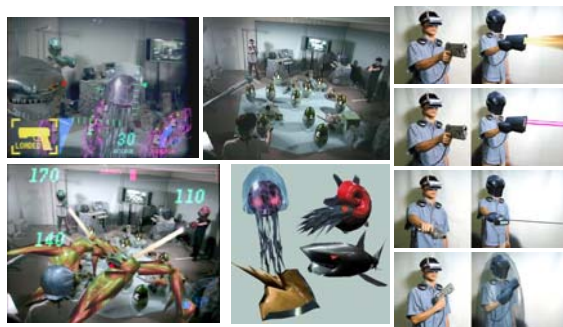


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AquaGauntlet

[Ohshima, Satoh, Yamamoto & Tamura 2000]



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RV-Border Guards

[Ohshima, Satoh, Yamamoto & Tamura 1999]

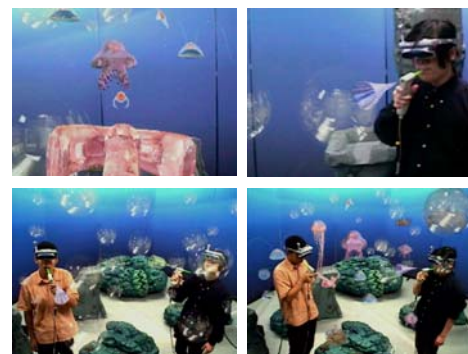


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Jellyfish Party

[Okuno, Kakuta, Takayama & Asai 2003]



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augmented & mixed reality summary

definition

- real + virtual in real environment
- interactive & real-time
- register virtual w/ real



realities

- reality – augmented reality – augmented virtuality – virtual reality



issues

- display technology (HMD, handheld, projector)
- tracking/registration



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augmented & mixed reality

videos & material from lecture (+ more):
www.csc.kth.se/~alx

Individual projects in interactive computer graphics (can start anytime): 3D graphics, augmented/virtual reality, touch screens, or anything else you might be interested in...

- > DD2465, advanced individual course in computer science, 6 hp
- > DD2464, bigger advanced individual course in computer science, 9 hp
- > DH2466, advanced individual course in human-computer interaction, 6 hp

- > DM2904, individual course in media technology, 6 hp
- > DM2905, individual course in media technology, 7.5 p

> Master's thesis project