Human-Computer Interaction

Interactive Environments

Mobile Technologies

Desktop Environments
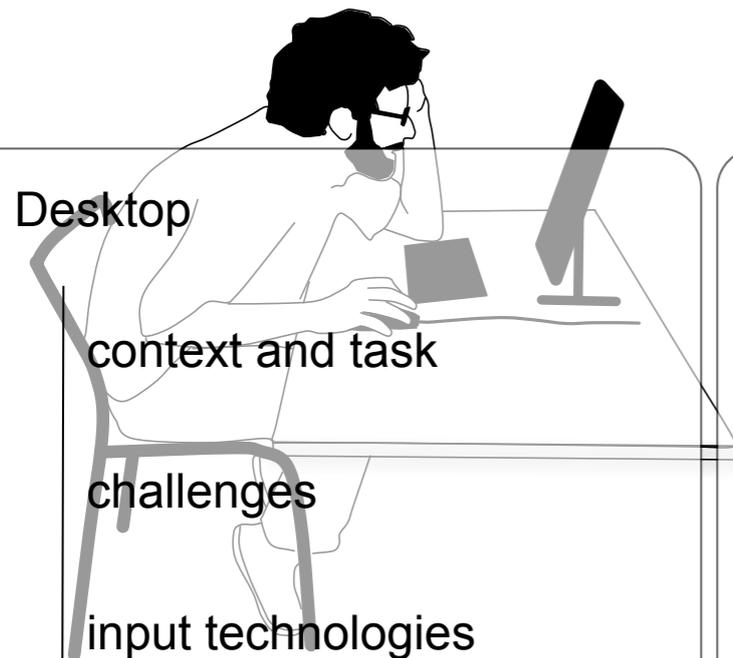
Desktop	Mobile	Interactive Environments
context and task	context and task	context and task
challenges	challenges	challenges
input technologies	input technologies	input technologies
challenges in interaction design	challenges in interaction design	challenges in interaction design
output technologies	output technologies	output technologies

Interactive Environments

context and task

theory

interaction techniques

in/output technologies

Post-PC Era or Ubiquitous Computing

|	
Mainframe:	1 computer, many users
Personal Computer:	1 computer, 1 user
Ubiquitous Comp.:	many computers, 1 user
...or rather:	many computers, many users
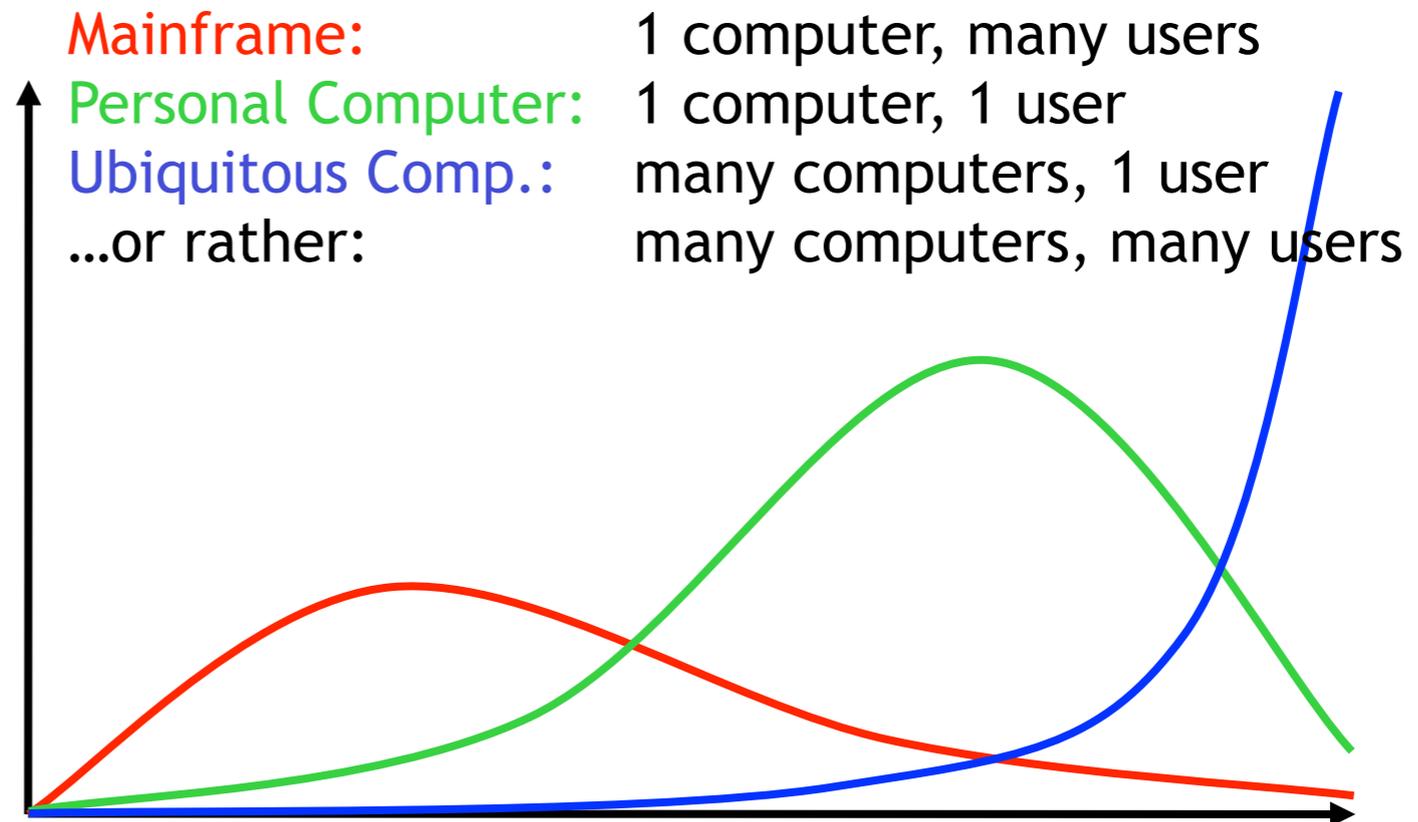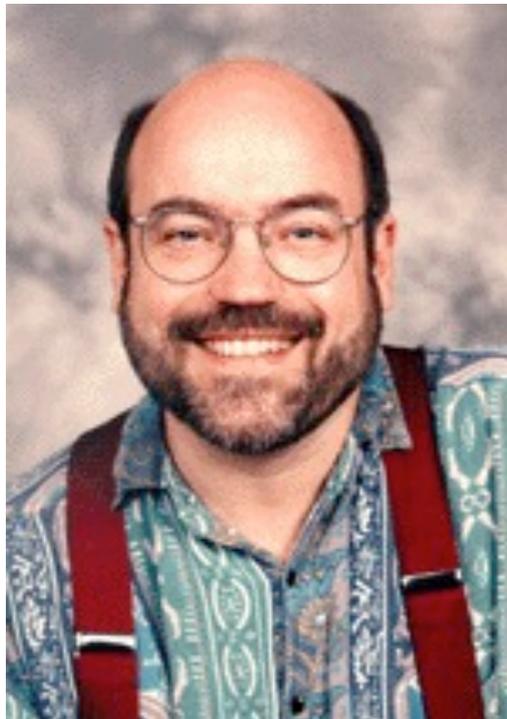
Mark Weiser: What Ubiquitous Computing Isn't
Ubiquitous computing is roughly the opposite of virtual reality. Where virtual reality puts people inside a computer-generated world, ubiquitous computing forces the computer to live out here in the world with people.
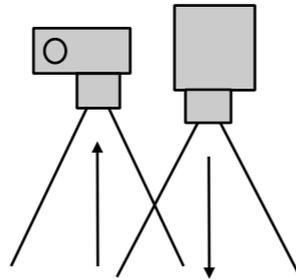
Computer out here in the world: Instrumented Environments

Instrumented Environments
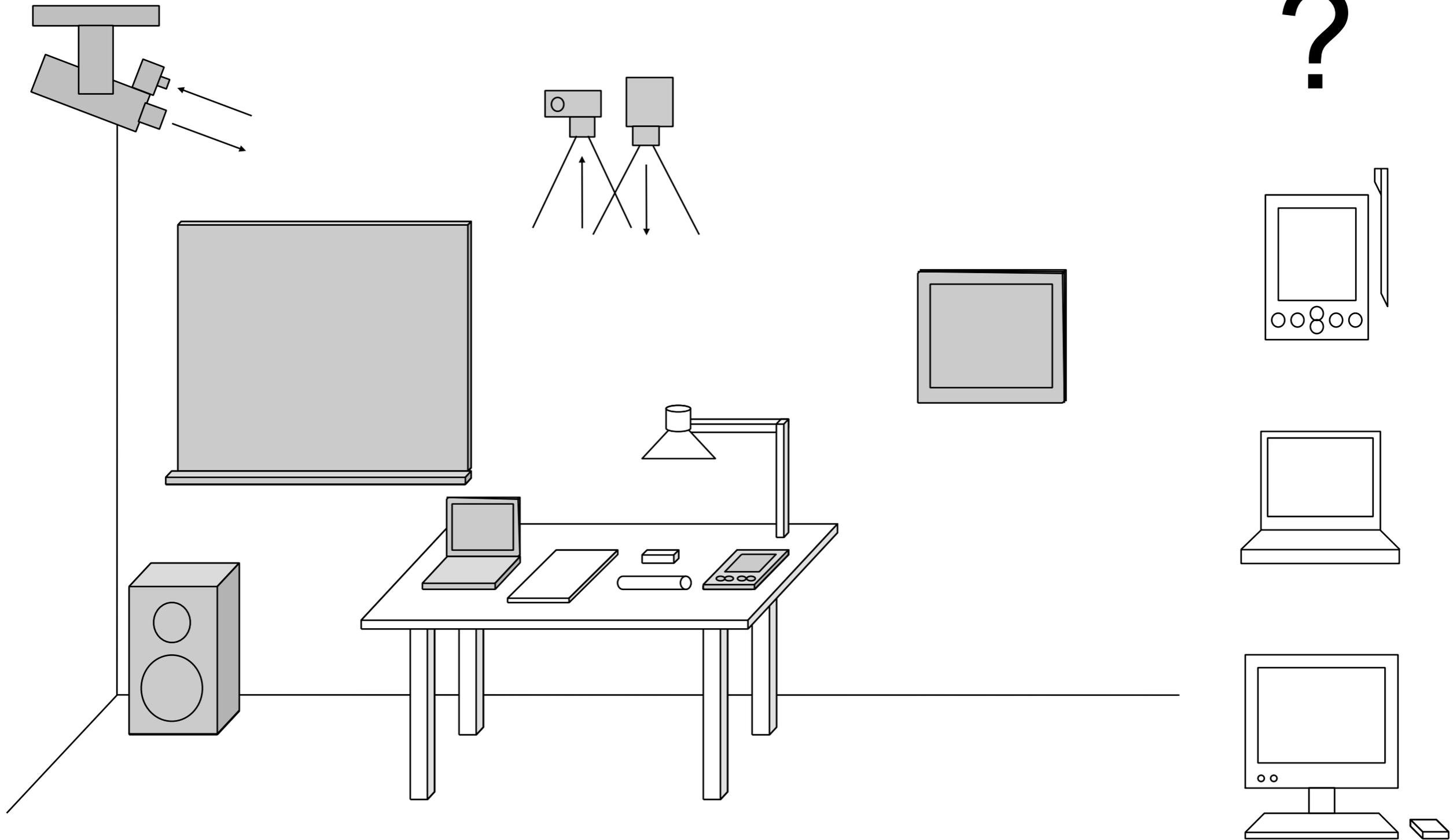
Instrumented desk

Research Topics:

- Borders between phys. and virtual world

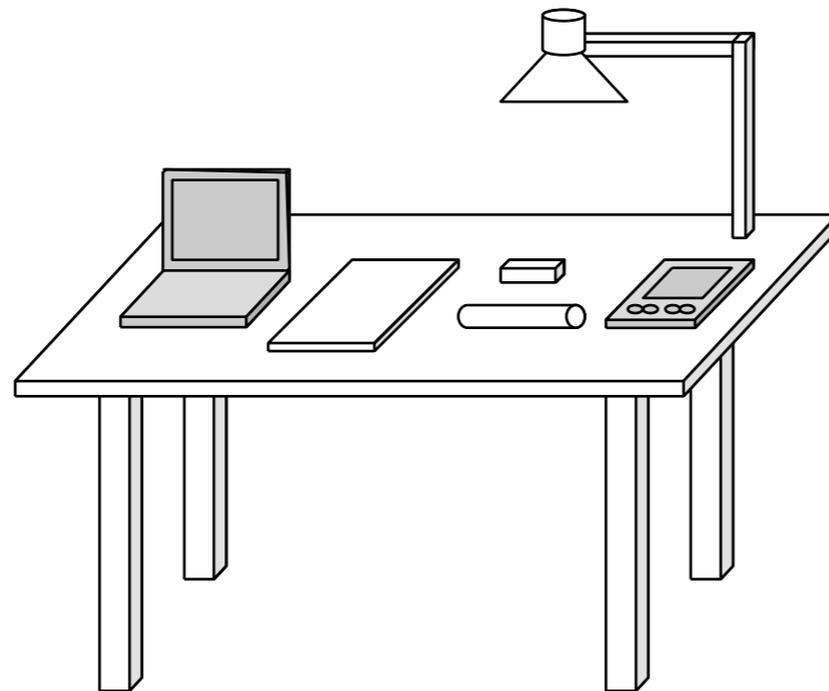- Interaction objects

- Physical tools for virtual media

Instrumented room
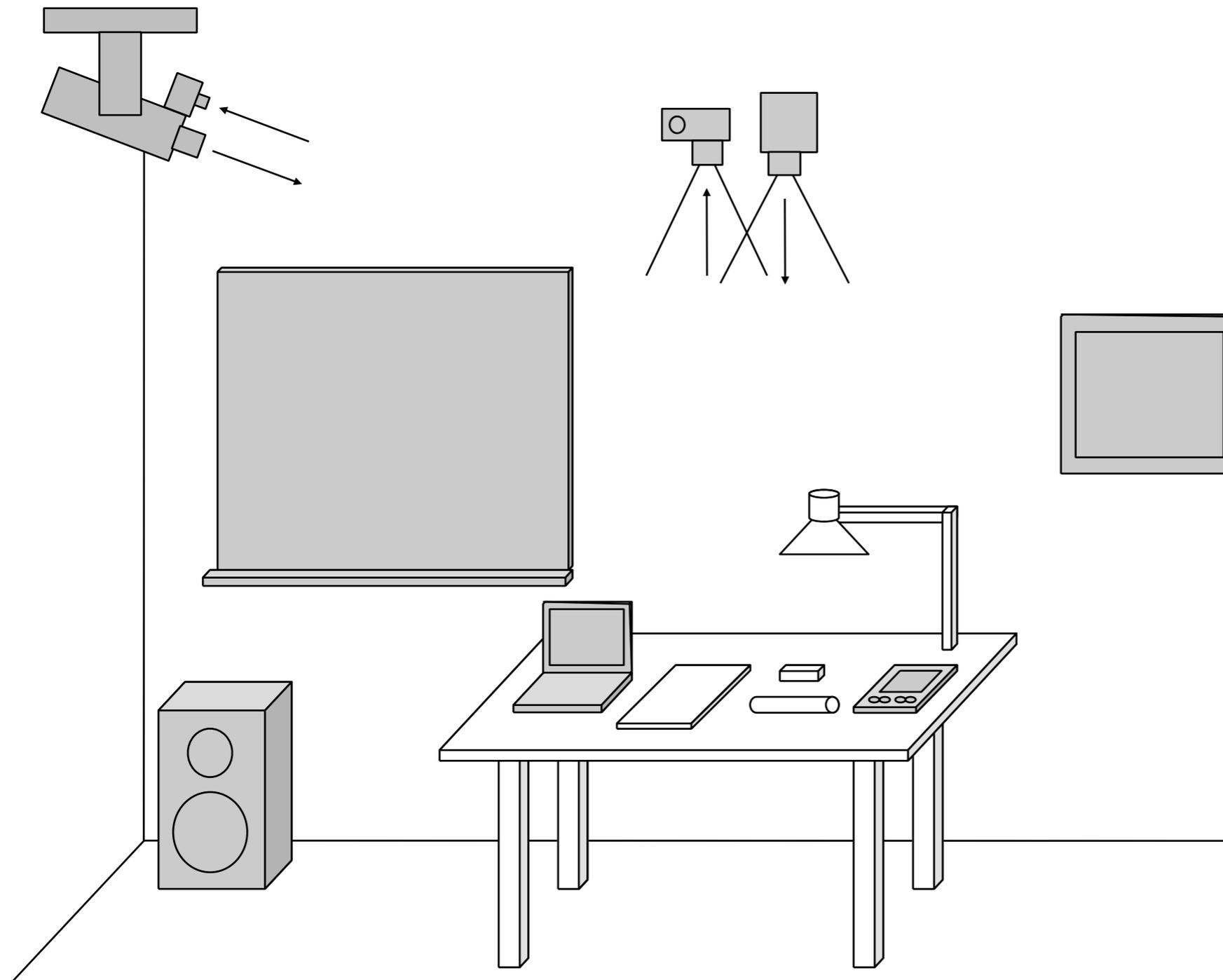
Research Topics:

- Borders between phys. and virtual world

- Interaction objects

- Physical tools for virtual media

- Environment as display continuum (+ audio)

- Interaction with large displays

- Interaction with many different displays

- Ambient displays

Instrumented building
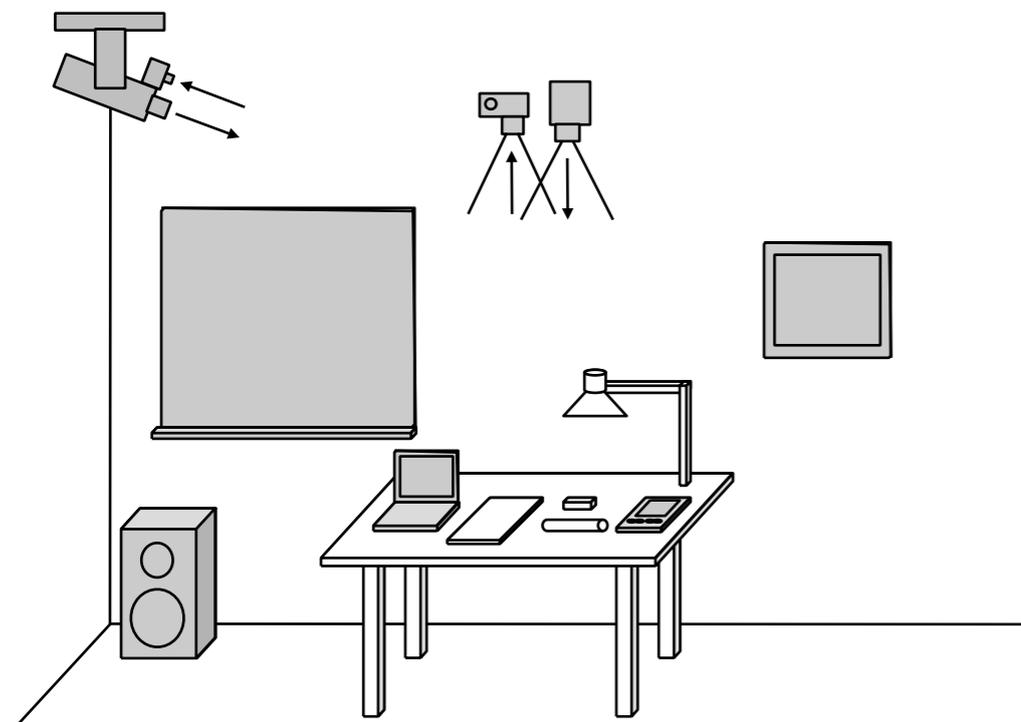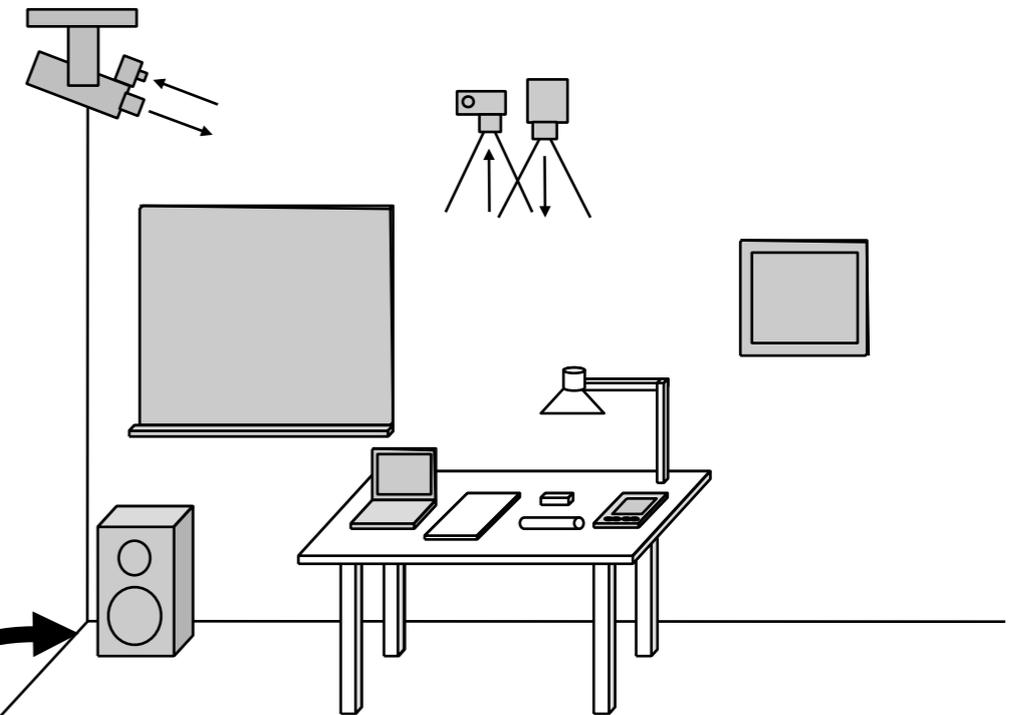
- Interaction between different displays without line of sight

- place holder objects, transport metaphors

- interaction over distance

Instrumented city

Sci-Fi version of Instrumented Environments

Interactive Environments

Interactive Environments

supported by a fixed installed environment

interaction between people

http://joergmueller.info/lookingglass/ipd_files/glass_fig1.png

Interactive Environments

- **support social activities**
- smart home environments
- control center and work places

context and
task

social

theory

interaction
techniques

in/output
technologies

Supporting social activities with technology

- community work
- citizen activism
- entertainment

context and
task

social

theory

interaction
techniques

in/output
technologies

Community work in rural India

- goal: support health workers employed in villages to persuade pregnant women to utilize health services

- problem:
  - resistance to change in the village
  - heath workers have limited education and training for their task

- suggestion:
  - deploy short videos on mobile phones for motivation and persuasion
  - health workers record their own videos

- result: creation and use of videos help
  - engage village women in dialogue
  - health worker were more motivated and learning
  - motivate key community influencers to participate in promoting the health workers

Literature: Ramachandran et al.: *Mobile-izing Health Workers in Rural India*. CHI 2010

Citizen Activism

- Goal: understand what burglars look for when deciding to burglarize a home.

- Findings:
  - existing technologies such as security systems, alarms, and cameras do not dissuade burglars
  - "noisy neighbors" was named the strongest deterrent.

Literature: Sheena Lewis Errete: *Protecting the Home: Exploring the Roles of Technology and Citizen Activism from a Burglar's Perspective*. CHI 2013

Citizen Activism

context and
task

social

theory

interaction
techniques

in/output
technologies

- Burglar's process:
  - choose a quiet suburban neighborhood
  - choose target: dress up as electricians, handymen, construction workers... etc. (1 burglar uses google earth)
  - choose entry point: "I'd just kick in the front door", no concern about witnesses.

- High risk deterrents:
  - noisy neighbors: neighbors who talk to each other, ask how the burglar questions because they have not seen him before.
  - "I prefer when neighbors don't communicate and don't call the police."

Literature: Sheena Lewis Errete: *Protecting the Home: Exploring the Roles of Technology and Citizen Activism from a Burglar's Perspective*. CHI 2013

Environments

context and task

social

theory

interaction techniques

in/output technologies

Citizen Activism

- most effort to stop burglars have focused on the physical area of the domestic space.

- findings suggest that technology should enhance interaction amongst neighbors and encourage citizen activism

Sometimes we focus on instrumenting our environment where an alternative solution might be to create a social cohesion and to support citizen engagement instead.

Literature: Sheena Lewis Errete: *Protecting the Home: Exploring the Roles of Technology and Citizen Activism from a Burglar's Perspective*. CHI 2013

Community-sourcing Vending Machine

context and task

social

theory

interaction techniques

in/output technologies

- goal: get community to do expert work
  - grade Computer Science exams

- use touchscreen attached to a vending machine.
  - get physical reward from the machine
  - placed machine one week in a university building, 328 unique users completed 7771 tasks.
  - compared it to single expert grading
    - graded exams with 2% higher accuracy (at same price)
    - in comparison, Mechanical Turk workers had no success grading the same exams

see chapter Crowdsourcing

Literature: Heimerl. K. et al.: *Communitysourcing: Engaging Local Crowds to Perform Expert Work Via Physical Kiosks*. CHI 2012

Entertainment - hole in space (Galloway, 1980)

context and task

social

theory

interaction techniques

in/output technologies

http://www.medienkunstnetz.de/assets/img/data/2665/bild.jpg

Entertainment/Work - Media Spaces

- # Results show that video links:
  - – are effective for problem solving
  - – enhance cooperation
  - – enhance mutual trust and confidence
  - – support new forms of communication in the virtual shared office

Literature: Pagani and Mackay. (1993): *Bring media spaces into the real world.* ECSCW'93

Entertainment- Manhattan Story Mashup

Environments

context and task

social

theory

interaction techniques

in/output technologies

http://www.youtube.com/watch?v=3ozUNUTNMT4

Interactive Environments

- support social activities
- **smart home environments**
- control center and work places

Possible interaction models

- strictly tool-based --> appliances
  - Human is the cause of all action
  - Tools just facilitate these actions
- automation, assisted living
  - Things happen magically by themselves
  - Controlled by machine intelligence in the background
- proactivity, intelligent agents
  - Environment takes the initiative
  - Manifestation through a conversational agent

Xerox ParcTab (1995)

https://www.parc.com/publication/583/overview-of-the-parctab-ubiquitous-computing-experiment.html

- Infrared network

  – Base stations in the ceiling

- Each base station was controlled by a IR gateway

- Each tab represented by a SW agent (tab agent)

- Applications written in

  – modula-3

  – Tcl/TK

  – Using MacTabit (~VNC)

- various types of interaction:

  – across multiple displays

  – context-dependent interaction

  – voting in presentations
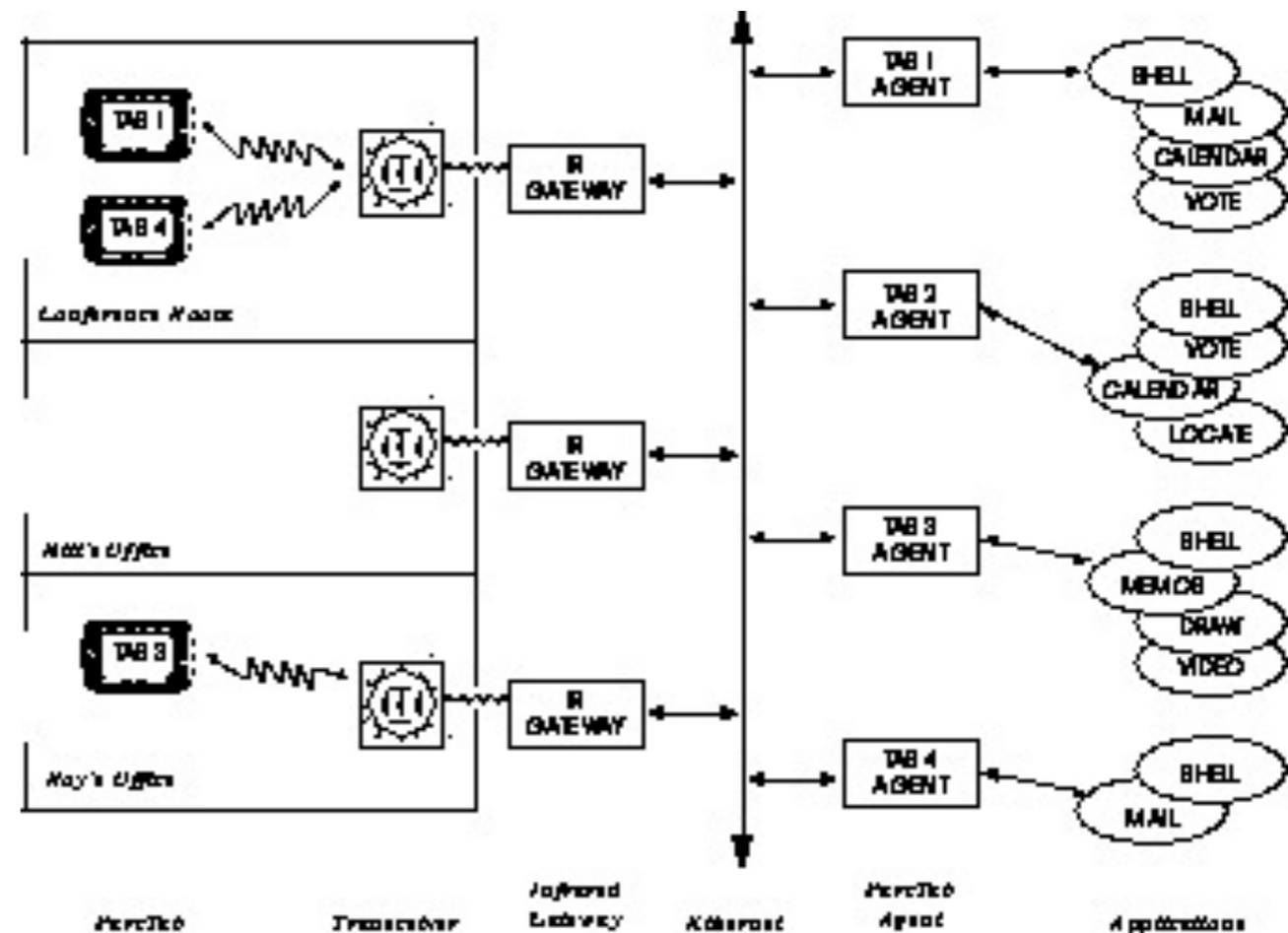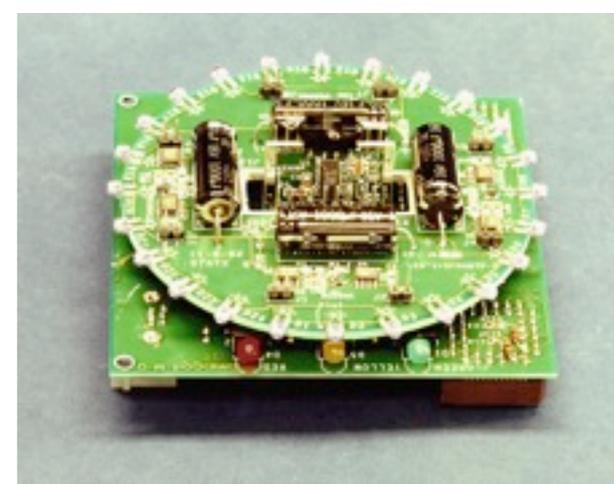
Tabs, pads and boards
(the Xerox ParcTab project)

Tabs

Pads

Boards

Tabs, pads...

- Tabs, inch-sized (1 Inch = 2.54 cm)
  - small handheld networked devices
- See also Active badges
  - specialized tabs, enable localization
- Pads, foot-sized (1 Foot = 30.47 cm)
  - mixture of laptop, palmtop, sheet of paper

- Introduced the concept of a disposable computer, no identity, impersonal
- Provide a solution to the lack of space on windows based systems

...and boards

- Boards, yard-sized (1 Yard = 0.914 m)
  - used as chalk boards, TVs, display boards

- Power of Ubicomp stems from the interaction of all devices.

- Ubicomp can „awake" lifeless things (books, overhead slides, etc.)

- Problem: today it's easier to read a book than to sit down at a complicated Personal Computer

- Transition will happen in small steps

Georgia Tech: Aware Home
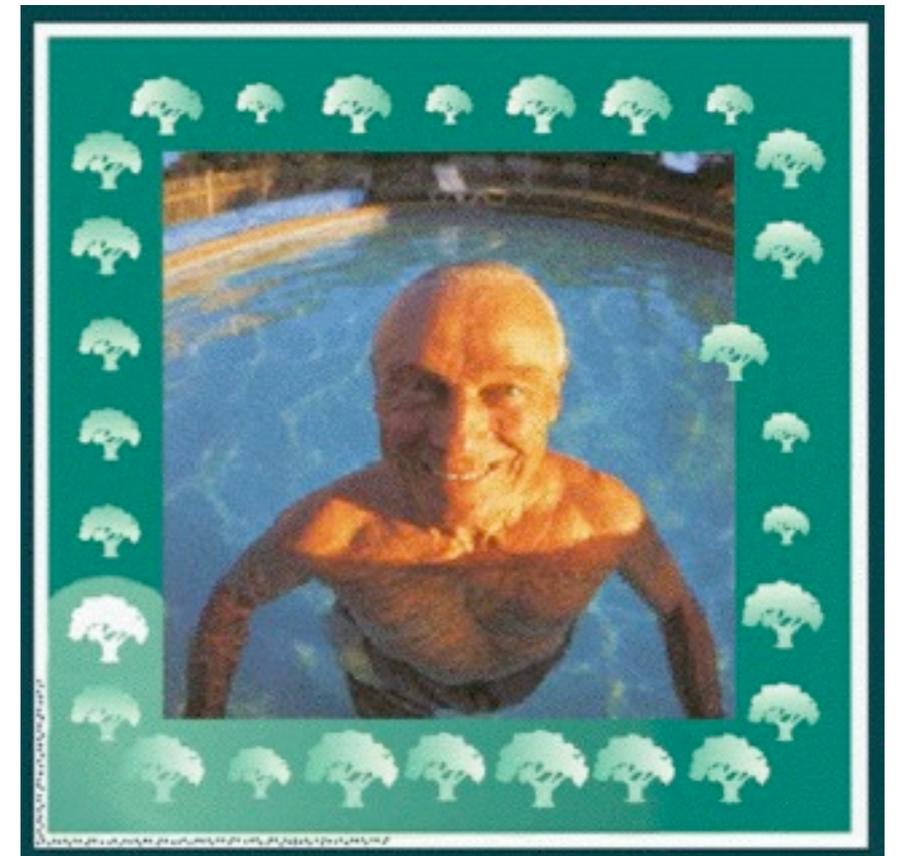
- ...a classic. https://www.youtube.com/watch?v=aeAWrA5fajk

Digital Family Portrait
(Mynatt et al. CHI 01)

- In the "Aware home"

- Lets people "keep an eye" on others

- Balance betw. privacy and contact

- Icons around the frame indicate health, activity or relationships

- 28 icons on 4 sides = 4 weeks

- Position and size carry a meaning

Mediacup (1999) http://mediacup.teco.edu

- Cup sensing temperature, weight and movement

- Location of cups detected

- Detected interaction:
  - Presence of multiple people in a room, all cups warm → mark room as occupied for a meeting

The Virtual Room Inhabitant (2005)

http://w5.cs.uni-sb.de/staff/show/mkruppa

- personalized interface to an instrumented environment
- animated figure „inhabitating" the room
  - can appear on screens
  - can jump out of screens and run along walls
  - can explain the environment and point out functionality
- prototype implemented
  - scripted animations
  - synthesized speech
  - gestures & speech
  - using a steerable projector

HWRS at KAIST: Instrumented Bedroom

- ## Support for elderly and disabled people
  - Robot person lift
  - Robot wheelchair
  - Robot bed
  - Fridge/oven combi
  - Sensing mattress

- ## Interface:
  - Control via voice input
  - Feedback via talking head („yes, master..")
  - Gesture input (e.g., for TV for spastic patients)

http://koasas.kaist.ac.kr/m/items-by-publisher?publisher=HWRS

Instrumented Bedroom (2)

http://hwrs.kaist.ac.kr/

- Patient can move between bed and wheelchair
  - Wheelchair will come automatically
  - Lift will act on commands
  - Bed will adapt shape on command
  - Fridge will heat up meal
- Sensing mattress can tell whether…
  - patient is in right position
  - patient has fallen off
- Safety + self-determined life
  - Nurse not constantly needed
  - Environment can call if there seems to be a problem
  - Sense of Mastery („yes, master..")

RWTH Aachen: eHealth

context and task

social

home

theory

interaction techniques

in/output technologies

http://www.youtube.com/watch?v=IAnmpswTCa0

context and task
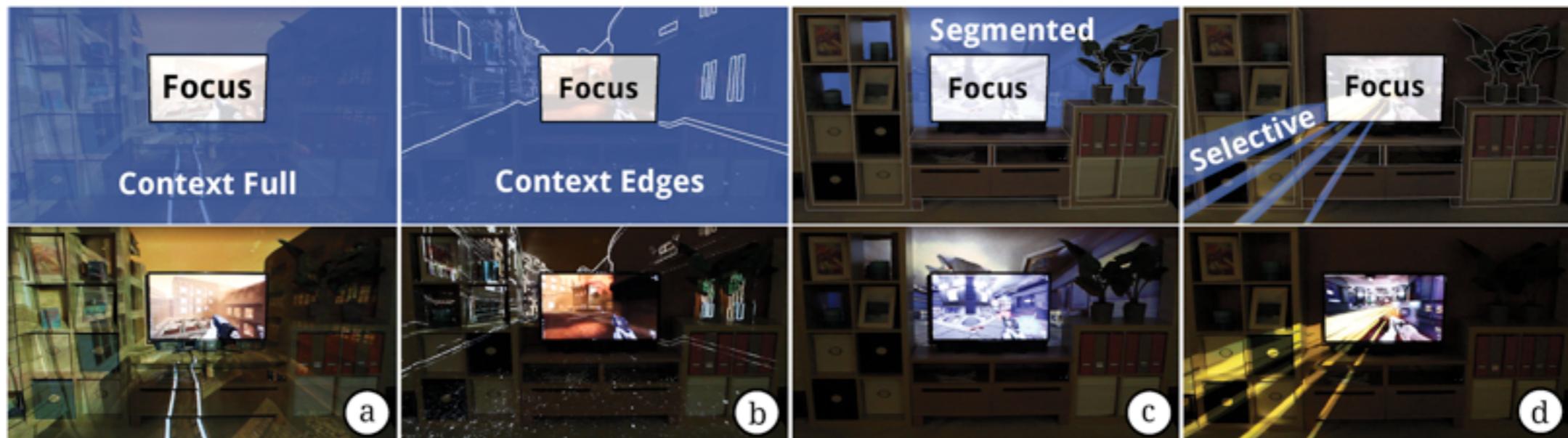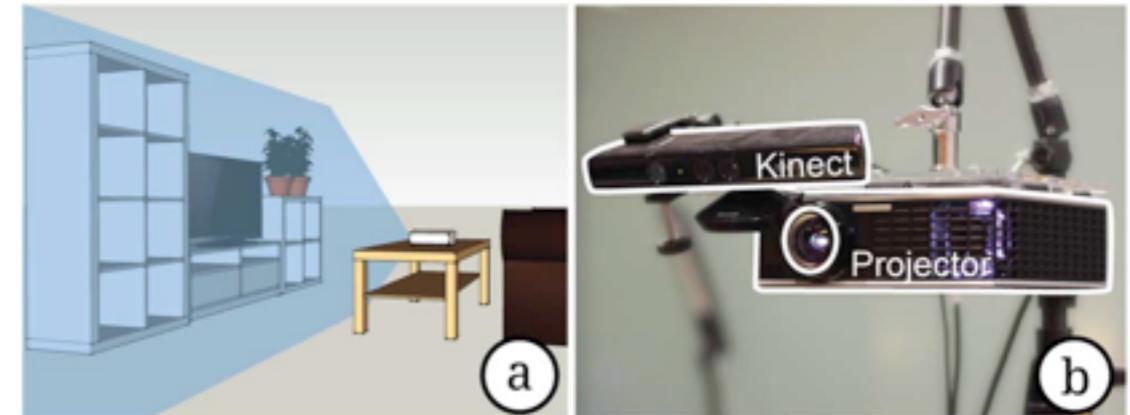
social

home

theory

interaction techniques

in/output technologies

IllumiRoom

- augment the area surrounding a television
- enhance game experience
  - peripheral projected illusions
  - include apparent motion
  - extend field of view

see spatial augmented reality chapter

Literature: Jones B. et al.: *IllumniRoom: Peripheral Projected Illusions for Interactive Experiences,* CHI 2013

Interactive Environments

- support social activities
- smart home environments
- **control center and work places**

http://images.kino.de/flbilder/max04/auto04/auto43/04430351/b640x600.jpg

context and task

social

home

work

theory

interaction techniques

in/output technologies

Challenges

- large data sets:
  - visualization
  - manipulation
- collaboration

Interactive Work Environments - vision and reality

- NASA
- ALMA - largest astronomical project
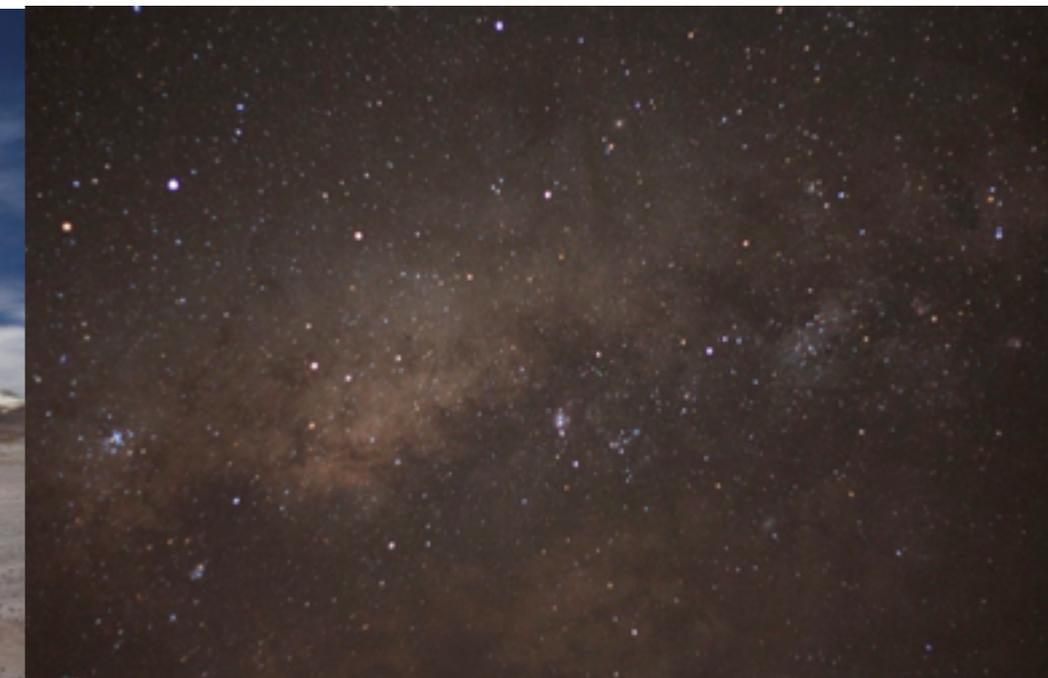

0124-0609-2010-0605_monitor_data_at_the_shuttle_flight_control_room_m.jpg

http://pages.saclay.inria.fr/emmanuel.pietriga/pictures/alma2012/

Interactive Walls in Research

context and task

social

home

work

theory

interaction techniques

in/output technologies

- HyperWall at UCSD
- WILD in Paris

see chapter mid-air pointing on large displays

https://www.lri.fr/~mbl/WILD/

Environments

context and
task

social

home

work

theory

interaction
techniques

in/output
technologies

Interactive Walls in Research

https://www.lri.fr/~mbl/WILD/

Roomware (1999)

another classic...

Streitz et al. http://www.smart-future.net/13.html

Connectable Displays

Streitz et al., FhG

Single usage

Connected usage

**context and
task**

social

home

work

theory

interaction
techniques

in/output
technologies

Take-home points

- Instrumented environments...
  - ...have been a vision for a long time
    - smart homes
    - smart work environments
  - ...have partially become everyday reality
    - supporting people by technology
  - ...can involve multiple...
    - ...displays, devices, sensors
    - ...people, objects, spaces
    - ...senses, modalities

- They provide a large potential, but also new challenges!

Environments

context and
task

social

home

work

theory

interaction
techniques

in/output
technologies

Outlook on the rest of the semester

- 3.12.   Environment 1: context and tasks
- 10.12. Environment 2: theory
- 17.12. Christmas lecture
  -         bring snacks, have fun! ;-)
- 7.1.   Environment 3: Interaction techniques
- 14.1.   Environment 4: I/O Technologies

- 21.1. Guest lecture by Dr. Martin Knobel (BMW):
  - User Experience Design

- 28.1.   Time buffer
  - remaining open topics
  - questions about exam