Übung zur Vorlesung Mensch-Maschine-Interaktion

Otmar Hilliges

Ludwig-Maximilians-Universität München

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Advanced Interface Technologies - Introduction

- What's wrong with mice and keyboards?
- What are advanced interface technologies?
- When can we benefit from their usage?
- How can we classify them?
- What is important when designing with and for such devices?

Advanced Interface Technologies – Introduction II

- The lecture focuses on WIMP (**W**indows **I**cons **M**enus **P**ointers) user interfaces.
- WIMP user interfaces use standardized controls (since the 80s)
  - Mouse
  - Keyboard
  - Monitor
  - Speakers/Headphones
- In real live we use a magnitude of tools and controls that have evolved over much longer time.
  - Screwdriver, pliers, saw
  - Knobs, levers, buttons
  - …
- These tools serve a specific need and are often highly specialized.

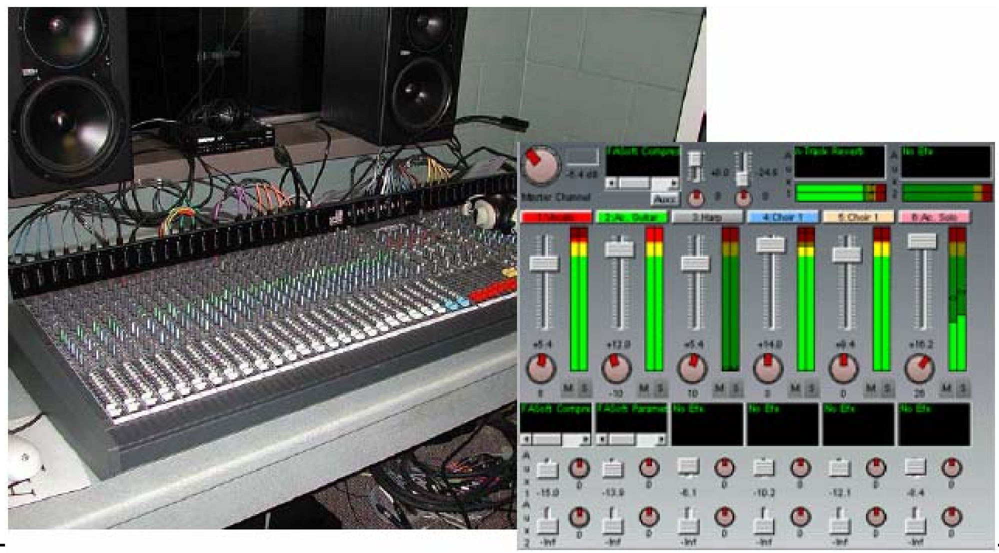
Advanced Interface Technologies – Introduction III

- Are mice and keyboards the ultimate interface devices?

Video

What’s wrong with mice and keyboards?

- Through interactive graphics we can metaphorically rebuild (almost) every real device (or its controls) in software.
  – Trash bin on desktops
  – Phone dialing pads in VoIP software
  – Calculator
  – Volume controls
  – Professional audio/video editing (e.g., Cubase/Premiere)
- Are there any limitations/drawbacks?



Basic Problem with Single Pointing Device

- With mice (and keyboard) some sort of multiplexing is required for complex interactions
  - Input multiplexing (key combination + point’n’click)
  - Time multiplexing (several click operations after each other)

Basic Problems – Cont'd

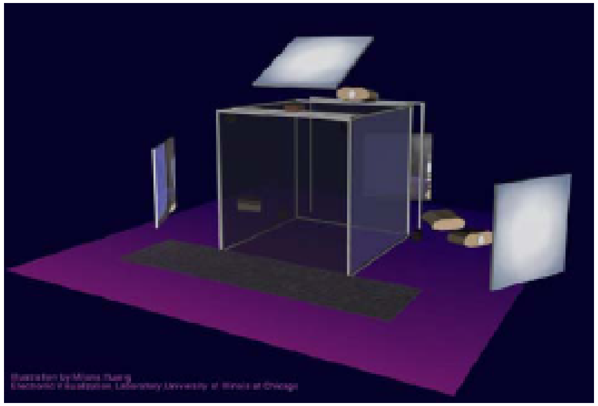
- Several application domains have properties that are hard to match with standardized input/output technologies. Which?
  - Complex machinery (e.g., music instruments, planes)
  - 3D modeling/manipulation (e.g., CAD)
  - 3D navigation (e.g., games, high dimensional data sets)
  - Playful applications (e.g., exertion interfaces)
  - Mobile applications (e.g., navigation, maintenance, field studies)
  - Special experience (e.g., museum, exhibitions, trade fare)
  - Integrated communication / collaboration

Controller

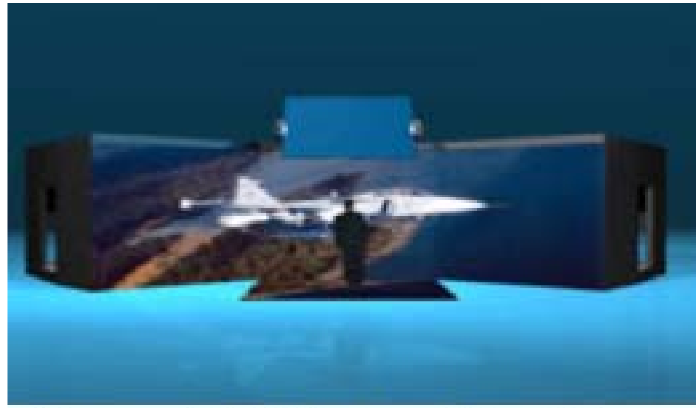
3D Input

VRLOGIC, haptic workstation

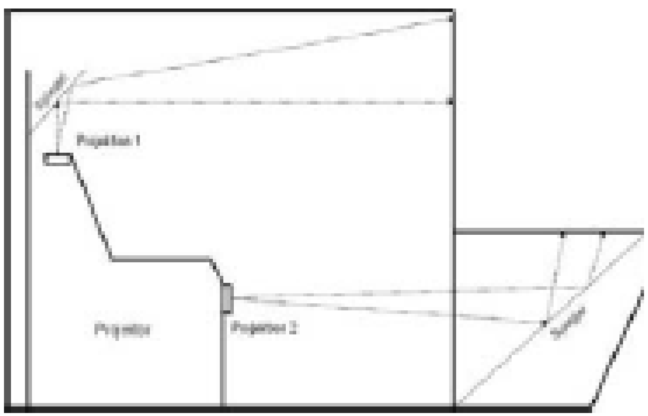
3D Output I

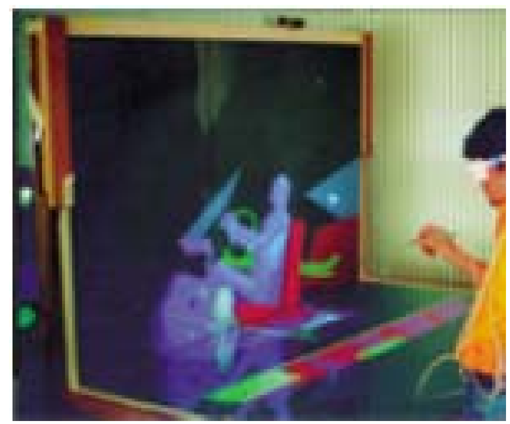


NCSA-EVL CAVE™



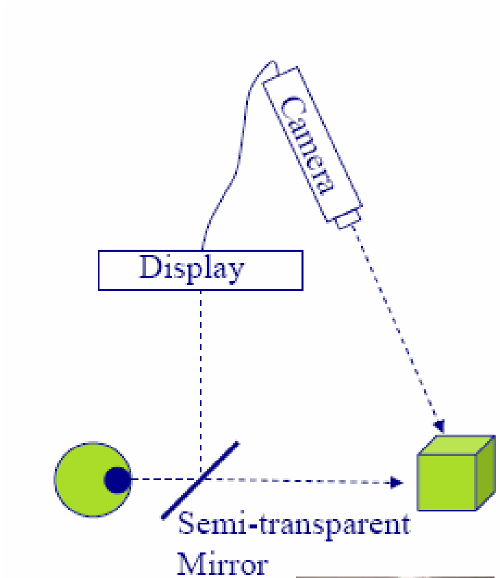
Fakespace RAVE (Jackson University)



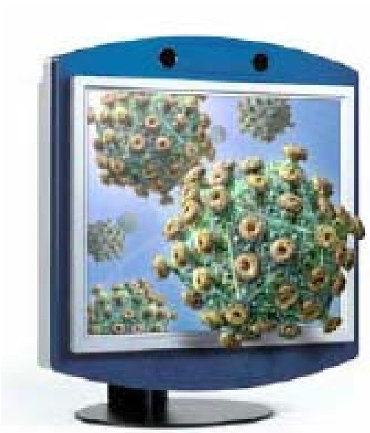


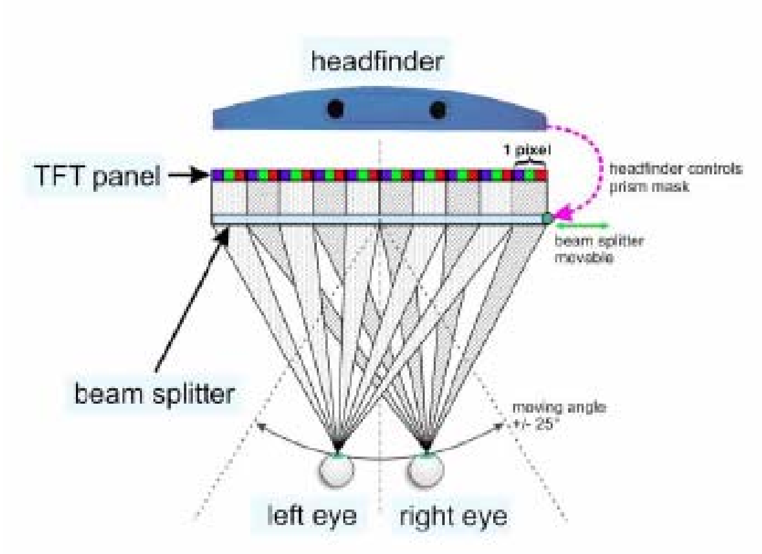
3D Output II

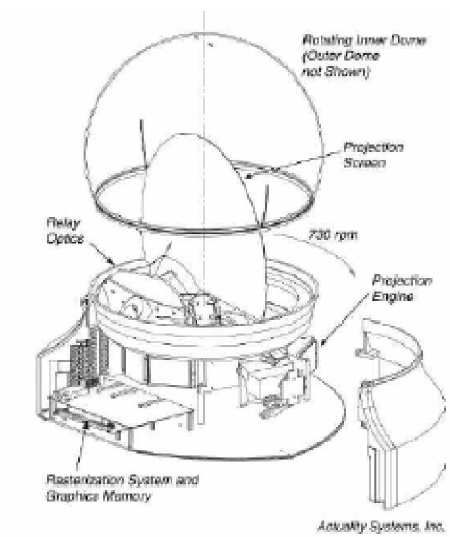
3D Output III



3D Output IV



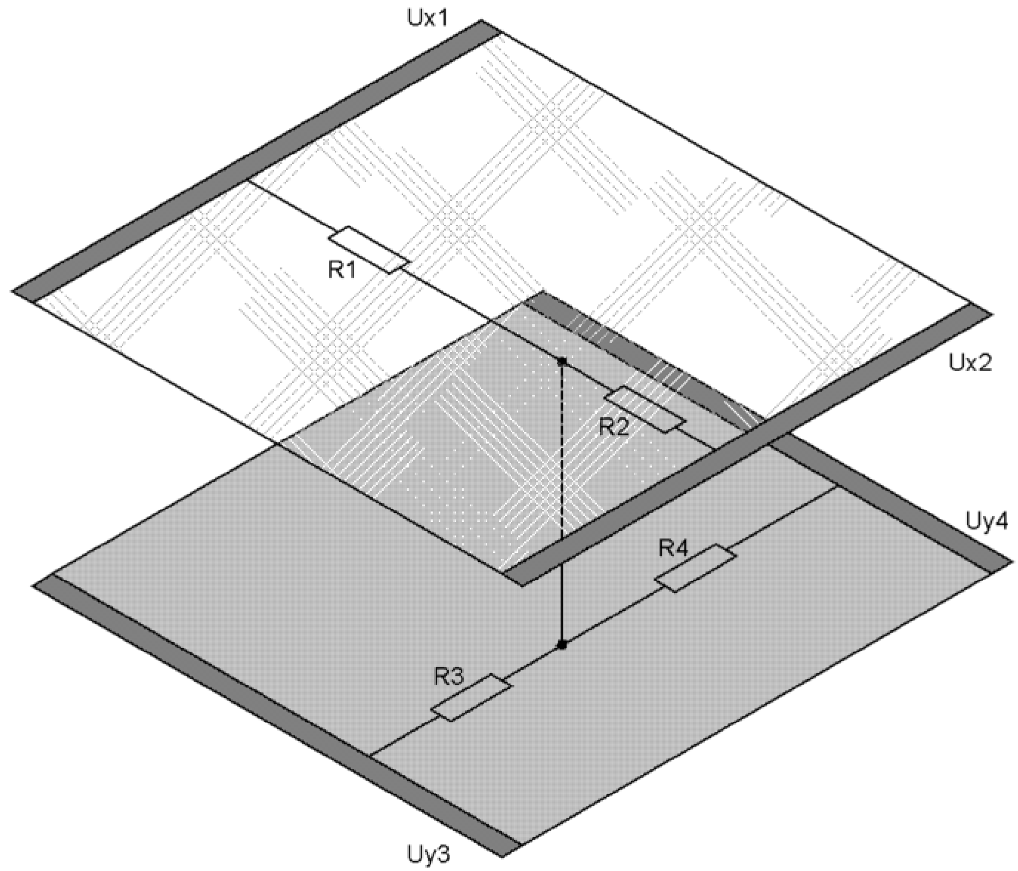

headfinder
TFT panel
1 pixel
headfinder controls prism mask
beam splitter movable
beam splitter
moving angle +/- 25°
left eye
right eye


Rotating Inner Dome (Outer Dome not Shown)
Projection Screen
Relay Optics
730 rpm
Projection Engine
Rasterization System and Graphics Memory
Actuality Systems, Inc.

Continuous Information Spaces

Interactive Surfaces I

- Standard touch screens
- Two sheets of conductive, transparent material
- Connected by finger or pen pressure
- Resistance measurements
  - Between X electrodes
  - Between Y electrodes
- Cheap and robust technology
- Only one point can be tracked
  - Direct manipulation equivalent standard mouse.



Interactive Surfaces II

- Mitsubishi DiamondTouch
  [P. Dietz, D. Leigh, UIST 2002]
- www.merl.com/projects/diamondtouch

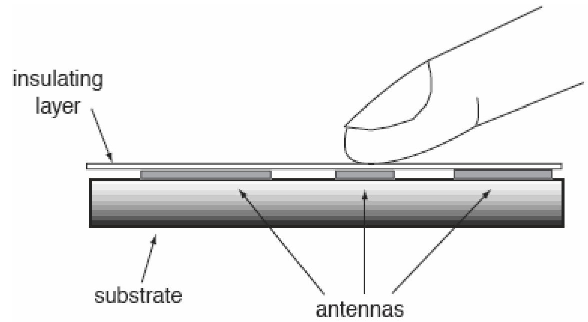


Figure 3: A set of antennas is embedded in the table-top. The antennas are insulated from each other and from the users.

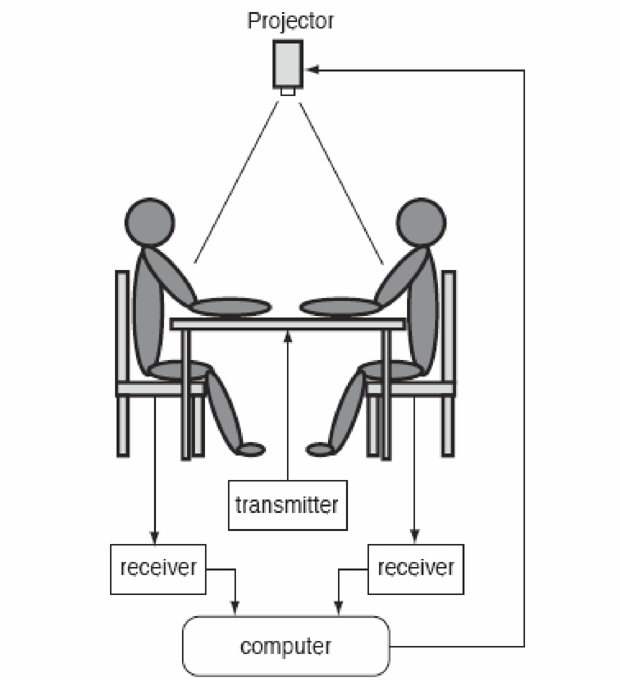
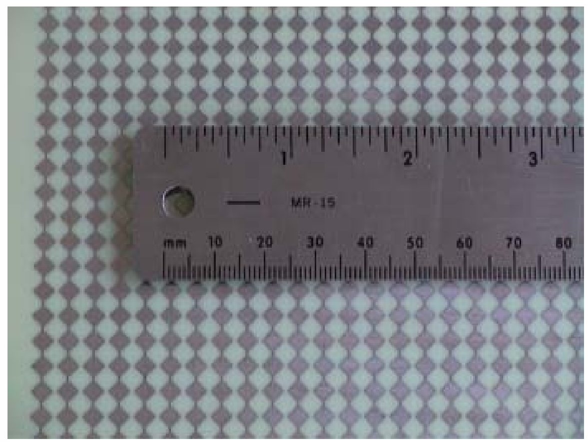
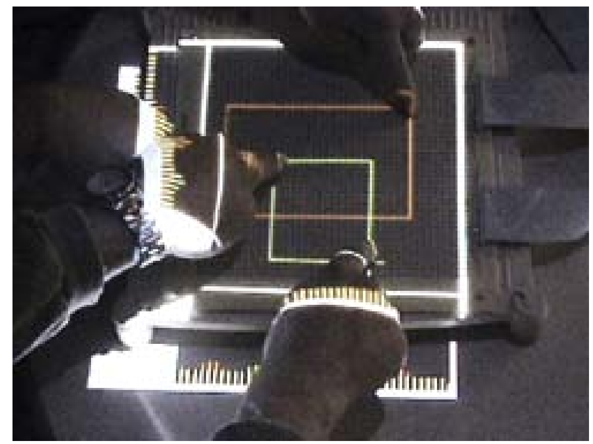


Figure 2: DiamondTouch works by transmitting signals through antennas in the table. These signals are capacitively coupled through the users and chairs to receivers, which identify the parts of the table each user is touching. This information can then be used by a computer in the same way as mouse or tablet data.





Interactive Surfaces III

- Sony SmartSkin
  [Jun Rekimoto, CHI 2002]

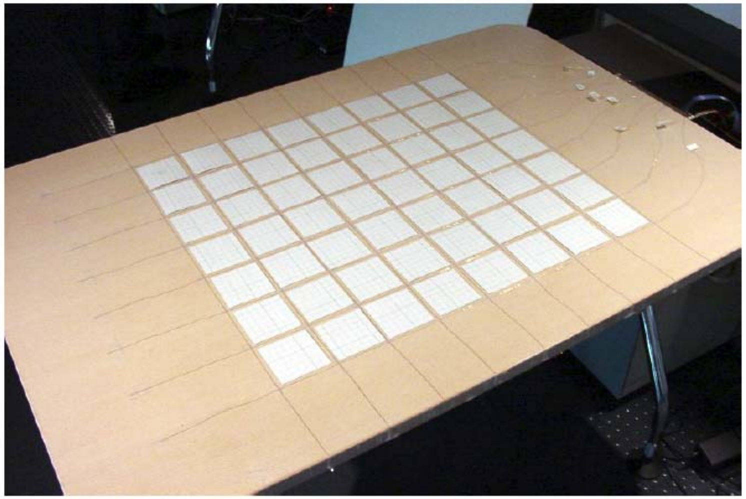
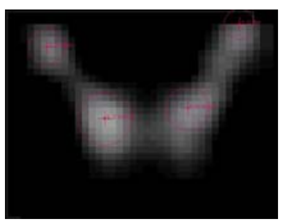


Figure 3: Interactive table with an 8 × 9 SmartSkin sensor: A sheet of plywood covers the antennas. The white squares are spacers to protect the wires from the weight of the plywood cover.



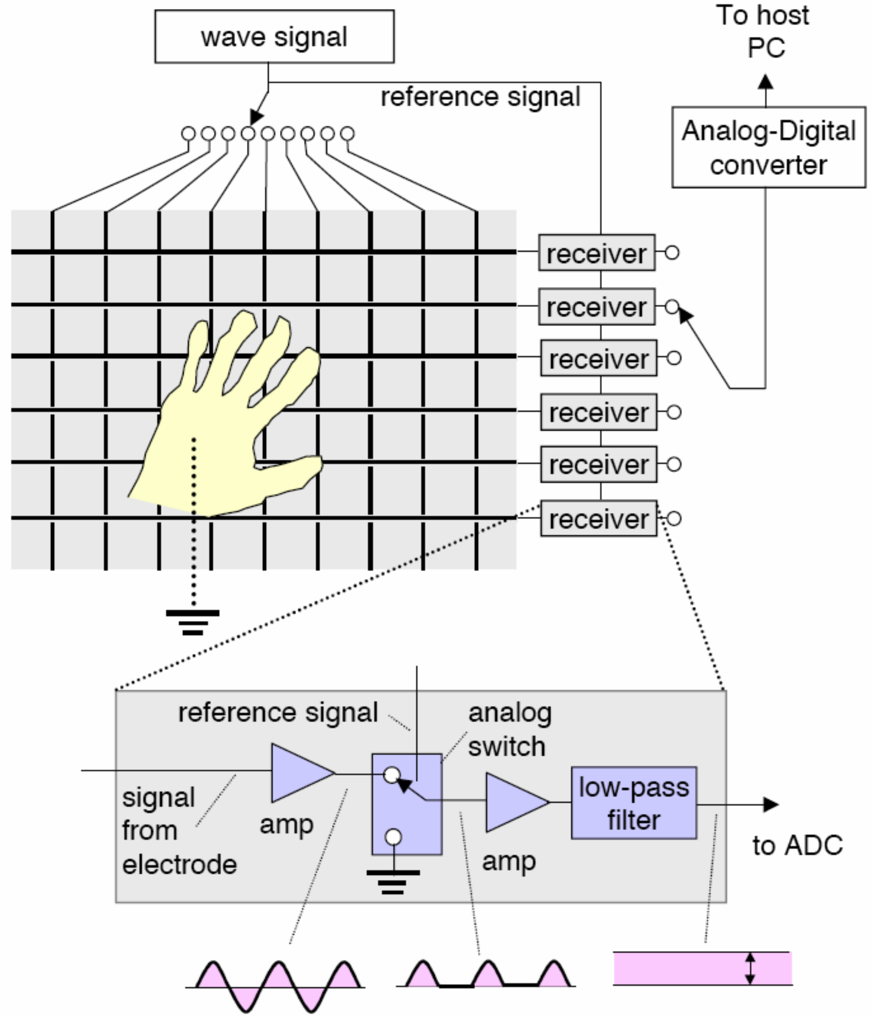


Figure 2: The SmartSkin sensor configuration: A mesh-shaped sensor grid is used to determine the hand's position and shape.

Interactive Surfaces IV

- SmartTech SmartBoard DViT
- Vision based, 4 cameras, 100FPS
- Nearly on any surface
- More than one pointers
- http://www.smarttech.com/dvit/index.asp

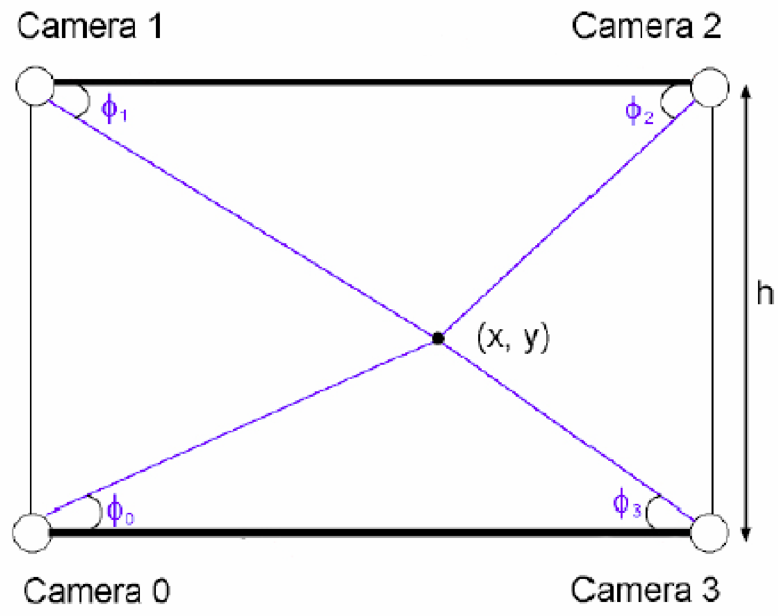
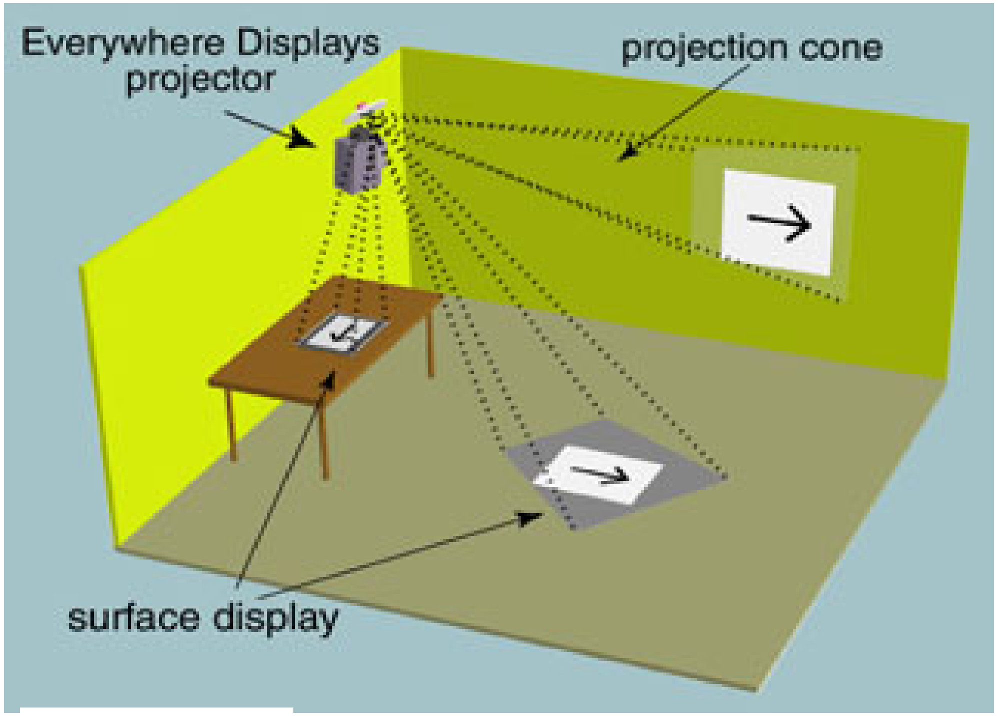


Figure 2: Camera Identification of a Contact Point

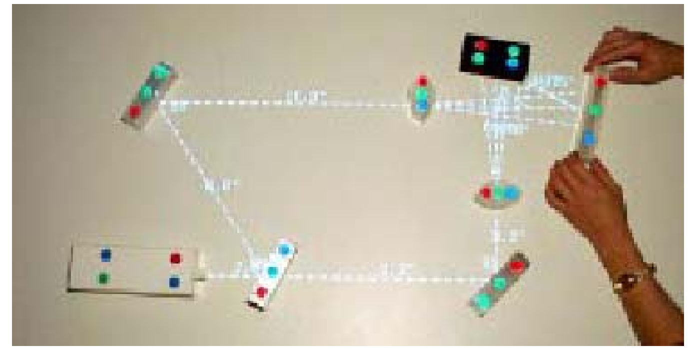
Figure 1: DViT Technology Camera

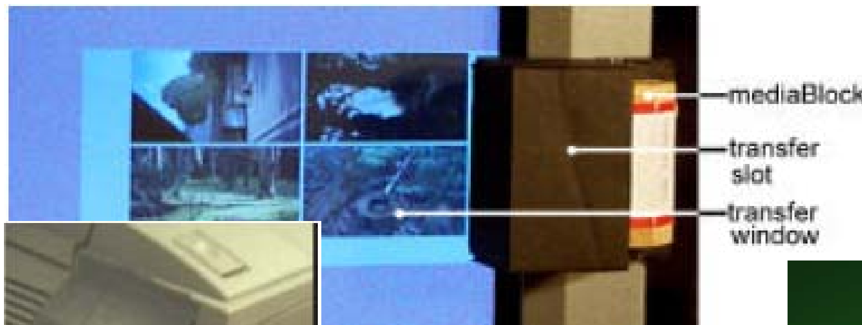
Everywhere Display

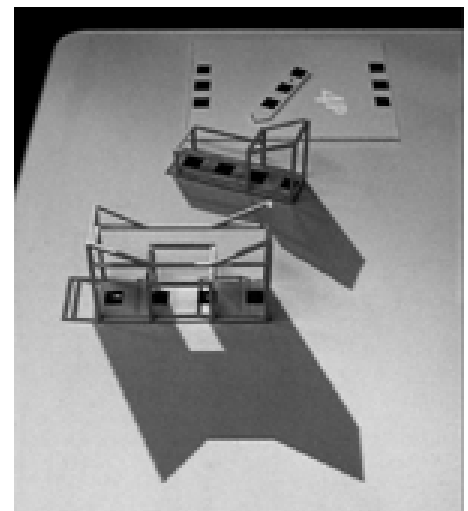


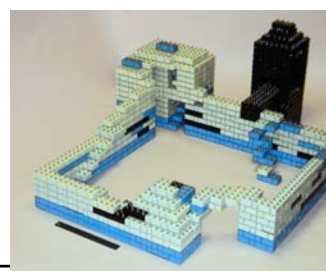
Tangible User Interfaces

- “Augment the real physical world by coupling digital information to everyday physical objects and information “ [Ishii H, Ullmer B, CHI’97]
- Manipulating specialized physical objects alters system state.
- Different types of TUIs. [Holmquist et al., HUC’99]
  - Tools
  - Tokens
  - Containers









Device Taxonomy

- Can we deal with all these devices systematically?
- What are the dimensions of a possible taxonomy?
  – Input vs. output
  – Continuous vs. discrete?
  – Parameters measured? (e.g., position, pressure, temperature)
  – Number of dimensions?
  – Agent of control (e.g., hand, foot, voice, eyes)
- Several taxonomies (for input devices) exist.
- Often incomplete because of new devices being developed

Semantic Input taxonomy

- Instead of classifying every possible device one can classify the data emitted.
- Thus application programming becomes independent from the actual device.

Taxonomy for Output Devices

- Can we do the same thing for Output devices?
- How can expressiveness of output signals be classified?
- Which devices can be exchanged which can’t?
  - Laptop monitor vs. power wall?
  - Spoken text vs. written text?
  - Dynamic vs. static behavior?
  - 3D vs. 2D capabilities?
- The receiver of information is human
  - Perceptive and cognitive system is very complex.
  - This makes it very hard to predict how information is decoded.
  - Almost impossible to come up with equivalency relations between different modalities.

Output Taxonomy for Unimodal Output