Tangible Bits

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MS Windows 95
- MS Windows 95
- Pentium Pro with 150 – 200 MHz
Large variety of Scientific Instruments
(Lost) Advantages

**physical**
- familiarity
- haptic feedback
- remembrance
- efficiency
- aesthetic aspect

**digital**
- All in One (smaller, universal)
- possibilities (computation, larger memory...)

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**physical**

**digital**
Idea:

- Look at old instruments and find lost advantages
- Connect virtual world and physical world
- Take the best from both worlds
Goal: Connect virtual world and physical world

Concepts:
- Interactive Surfaces
- Connecting Bits and Atoms
- Ambient Media
Prototypes

Tangible Media Group, MIT, 1997

metaDESK
ambientROOM
transBOARD
The Prototype: Tangible Geospace

Scenario: Navigate through MIT campus
Great Dome Model

- triggers application
- translates map
- rotates map
continuous 3D view of map through Active Lens
2D scaled part of the map accessible with Passive Lens
two models allow scaling and rotation but can be ambiguous
Rotation Constraint Instrument solves problem of ambiguity
physical form to parts of *graphical user interface* (GUI), the *tangible user interface* (TUI)
metaDESK – setup

- phicon / phandle
- 2D graphical surface
- passive lens
- active lens: 3D graphical display
- mirror
- tray
- 6D position sensing device
- infrared camera
- video camera
- desk display
- sensors
- active lens
- PC
- SGI
- PC
- easier to use, more intuitive than normal PCs
- more efficient, fast control of map transformations
- good support for multiple users
- great potential

- only useful for one application yet
- complexity and price
ambientROOM

Integrating Ambient Media with Architectural Space
Humans have awareness for foreground and background

Concentrate on foreground while monitoring the background

Bring background to foreground
ambientROOM focuses on background awareness of humans to interact with them
use of ambient media
water ripple shadow on a ceiling
ambient sound
abstract light spots on a side wall
air flow

ambient lights
clock for time navigation
bottles as containers of bits
water ripples on ceiling
- this physical icon uses vibration for output
- *here*: vibrates when hamster at MIT has activity
- vibrating sound can be distracting
transferring output medium from vibrating phicon to ceiling
light spots represent activity around the room
bottles serve as containers for digital information
navigation through „history“ via rotating the hands of the clock
ambientROOM – conclusions

- various ambient displays for background information
- interactive surfaces
- connected physical objects with its digital information

- problem of fuzzy boundary between foreground and background
- not usable without knowledge (what does the light spots mean?)
transBOARD
- transBOARD absorbs information of a whiteboard and distributes it (over the internet)
- barcode tagged cards as containers
Conclusions

- bridge between virtual world and physical world
- new interfaces to the virtual world
  - interactive surfaces (metaDESK)
  - connecting bits and atoms (Great Dome phicon, bottle)
  - ambient media (background audio)
- parts of graphical user interface became tangible
- efficient and innovative navigation through MIT campus
- use of human background perception
Thank you for your attention
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Discussion

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