The Next Generation of Interactive Systems

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What are Interactive Systems?

Goal:
Actual Performance => Desired Performance
Trends in Interactive System Technology

Mobile computing

Transport

Ambient rooms and Cooperative buildings
The Digital Desk
from Pierre Wellner in 1991

[vide 8.1 min]
SUN Starfire Vision 1995

Starfire, the Movie, showing a day in the life of a knowledge worker in the year 2004...
Natural User Interfaces (NUI)

1. design requirement
   Perception space and action space must coincide!

2. design requirement
   No technical equipment inside the body space of the user!
Perception Space and Action Space

- **Perception Space**
  - The physical space where the user’s attention is.

- **Action Space**
  - The physical space where the user acts in.

- **Design Principle:**
  - perception space and action space must coincide! \( \delta = 0 \)
  - “Interlacing the display and manipulation space”
    (Djajadiningrat, 1998, TU Delft)

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Empirical Results: game playing time per dialog technique

Cell Line Chart for "playing time"
Grouping Variable(s): Interface type
Error Bars: ± 1 Standard Deviation(s)

CI MI TI DPD

P<.001 P<.01 P<.001 P<.001

P<.001 P<.01 P<.001

P<.001
Empirical Results: winning chance per dialog technique

Cell Line Chart for "winning chance"
Grouping Variable(s): Interface type
Error Bars: ± 1 Standard Deviation(s)

User win

Remis

Computer win

CI MI TI DPD

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The Build-It System

Fjeld, Bichsel & Rauterberg 2001

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Morten Fjeld

[video 6.2 min]

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The Build-It tangible props

18th Century: tool production

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NUI Interaction Props: user study

Props design factors:
form, size, material and metaphor:

•An experiment was carried out to explore different design strategies.

•Tasks were based on initial planning of an interior architecture.

•Focus of the experiment was subjective opinion (n=12) about the bricks.

•The bricks were ranked by user performance before (first number) and after (second number) task solving activity.
Build-It: Spin-offs in Europe

ETH → TELLWARE

IPO → TU/e

VIP-3 → Visual Interaction Platform

Fraunhofer IPA

Institut Produktionstechnik und Automatisierung

vonRoll GROUP

Mikron Technology Group

IMAB

Technische Universität Clausthal

Technische Universität Chemnitz

Technische Universität Carolus-Wilhelmina zu Braunschweig
VIP-3: Tangible Interaction Props

Aliakseyeu, Subramaniam, Martens & Rauterberg 2002

[video 2.6 min]

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The Next Steps

- Empirical validation
- Additional interaction techniques, e.g. speech input
- Full 3D interaction possibilities
- Video conferencing functionality for distributed cooperation
Sensor Based Home Technology

Bill and Melinda Gates' $97 million house

- **Main characteristics:**
  - Home automation is defined as a process or system which provides the ability to enhance one's lifestyle, and make a home more **comfortable, safe and efficient**.
  - Home automation can link lighting, entertainment, security, **tele-communications**, **office automation**, heating and air conditioning into one centrally controlled system.

[video 11.4 min]
PHILIPS Ambient Home 1999

Ambient Intelligent environments combine ubiquity, awareness, intelligence and natural interaction.

- Awareness refers to the ability of the system to locate and recognize objects and people, and their intentions.
- Intelligence allows the system to analyze the context, adapt to the people that live in it, learn from their behavior, and eventually to recognize as well as show emotion.

[video 0.5 min]

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HomeLab: The Memory Browser
E. van den Hoven, B. Eggen & M. Rauterberg, 2003

[video 2.6 min]
GUI versus NUI/TUI: interaction models
Ullmer & Ishii, 2000

INPUT    OUTPUT

physical
digital

control view

INPUT / OUTPUT

control

graspable representation

Non graspable representation

model

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Design Metaphors

Tool

Channel

Substitute

long time ago 2000

history
Trend in Interface Design
Design Styles

- Mechanical style
- Electronic style
- Mechatronic style

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Design Forms

mechanical style
- dedicated form (e.g. typewriter, etc)

mechatronic style
- active forms (smart memory alloys)
- connected forms (ambient intelligence)
- given forms (ubiquitous computing)

electronic style
- channel forms (e.g. PC, TV, Radio, etc)

time

1900  2000

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Interaction Props with Active Form

unloaded state  Nitinol tubes  loaded state

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Conclusions

- multi-modal sensors will monitor user behavior
- interactive systems will become embedded systems
- appropriate user feedback goes via active forms
- the interface will disappear into the background