TUI’s: design challenges

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2004
Our Research Approach

Validated Design Knowledge

- statistics
- requirements
- empirical validation
- assessment criteria

Interactive systems
Trends in Interactive System Technology

Mobile computing

Transport

Ambient rooms and Cooperative buildings
Interaction Models
Ullmer & Ishii, 2000
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)
Architecture of a Natural User Interface (NUI)

Communication & Working Area

Electronic documents

Paper document

Working Area

Tognazzini B: Tog on Software Design. (1996)
Tangible User Interfaces (TUI)…

The Build-It System
M. Bichsel, M. Fjeld & M. Rauterberg 1997
Interaction Props: user study

18th Century: tool production

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.
The Build-It System: tangible props

2D

[design by Fred Voorhorst]

3D

[design by Fred Voorhorst]

2D Interaction Props

VIP-3 Drawing board
Reflecting material
Sheet of paper
Real pen combined with Drawing Board pen

3D Interaction Props

RISP:
Rigid Intersection Selection Prop

Different Prop Designs…

Ref: Napier (1956) classified grips into 2 different categories ‘precision grip’ and ‘power grip’.

RISP := Rigid Inter-Section Prop

RISP Thumb  RISP Power  RISP Round
The Next Steps

• full-duplex audio connection
• additional interaction techniques, e.g. speech, handwritten input
• more 2 and 3D interaction possibilities
• video conferencing functionality for distributed cooperation
Future Directions…

Further research questions:
? gaze/eye contact with remote partner
? variation of interface prop designs
? additional input technologies
? presence supported by full-duplex audio connection

And how to analyze human behavior in 2/3D space & time over a longer period?
Thank you for your attention.