Special Needs & Contexts:

Using Tangible User Interfaces to Improve Accessibility of Technologies

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Special Needs

- Special needs encapsulates many different types of disabilities, including:
  - Physical problems
    - e.g. mobility, fine motor control, vision, hearing
  - Cognitive limitations
    - e.g. progressive memory loss (Alzheimer’s), brain injury, mental impairment

- May also want to consider “normal” users acting under difficult circumstances
Example Problems with GUIs

- Hard to see small visual elements on screen
- “Out of sight, out of mind” – navigation difficult with short-term memory deficits
- Mouse is difficult to...
  - grasp and click, if you have arthritis
  - point with, if you have Parkinson’s
  - intuit what it does, if you have mental impairment
Potential Benefits of TUIs

- Flexibility in how TUIs are manipulated and spatially arranged
  - arrangement can provide memory cues
  - visibility of physical objects means all options are always available, not hidden in menus

- Physicality can be tailored to the user
  - size, shape & weight designed for ease of use

- Ease of collaborative use
  - offers ways of receiving assistance from others, while still retaining some control & dignity
Position Papers

- Designing for the narrowest part of the population often renders interfaces more usable by the general populace.

- Considering users with special needs is valuable in TUI research, whether we are...
  - developing new frameworks for design
  - exploring the potential of new technologies within particular environments
  - exploiting current market trends
Developing a Framework

Can Tangible User Interface concepts be used for describing everyday object manipulation?, Pederson, Umeå University

“Egocentric Interaction”: Situative framework explicitly ignoring I/O devices

- Centres activity modelling around a specific human agent & the space surrounding them
- Physical & virtual objects treated as being located in same space
“Egocentric Interaction”

- A framework focusing on the individual lends nicely to designing for special needs
- Developing system to help those with mild dementia perform routine household tasks
  - Activity recognition system which analyzes object translation patterns within the spaces
  - Will provide constructive suggestions when problem performing an activity is likely to have happened
Points for discussion...

- To do this, must formalize what happens in the “object manipulation” space, preferably without hard-coding meaning into objects... but how?

- Can the simple object ontologies & models of object relationships used in TUIs assist?
  - eg “blocks”, “tokens”, “tools”, “domain objects”

- Is it enough to be able to detect that correct activities are being performed? What about detecting when activities are being performed correctly?
Designing for the Home

Reflecting on Tangible User Interfaces: Three Issues Concerning Domestic Technology, Zigelbaum & Csikszentmihályi, MIT Media Lab

- Suggest technology should be designed specifically for the domestic environment
  - Rather than being ported from the workplace

- Hard to predict what the effects of a new domestic technology will be, but three main issues have been identified
Domestic Environments

Issues for domestic technology design:

1. Context & the differentiation of constraints
   - Understand context of use within a particular environment

2. Privatization of space
   - TUIs may offer ways to increase socialization and connection, both within the household & remotely

3. Perception of control
   - If no perceived control over functioning of an interface, and it fails, users feel helpless
Points for discussion...

- People with disabilities may spend more time at home (due to various physical & cognitive problems)
  - How wide-ranging might context of use (and constraints) be within a household?
  - Can TUIs offer new ways of adapting to multiple contexts and constraint sets?

- How might the use of TUIs in the home instill a greater sense of control for users?
Market Trend – Personalization

Personalization for Tangible Interfaces, Chang & Ishii, MIT Media Lab

- Growing trend towards personalization
  - Inspired a framework for designing TUIs

- Features of personalization can be split into 2 design categories of interface control
  - Scale: personalize at different levels of detail
  - Metamorphosis: transition over time & space
Personalization

- Easing customization & distribution could increase commercial viability of TUIs

- Accessibility of TUIs by those with special needs could be catered for, while still being useful for the general population, through incorporating:
  - Shape change
  - Changes in material properties
  - Different levels of control
  - etc.
Points for Discussion...

- Can an interface be “too personalizable”?
- Spatial and tactile personalization are two obvious attributes of TUIs to exploit; which others would be useful?
- Are there particular contexts in which personalization becomes most desirable?
- When evaluating an interface using CD’s, tradeoffs are acknowledged. By increasing personalization, what tradeoffs might occur?
General Discussion Points...

- Can TUIs provide additional benefits over current interfaces for those with special needs?
- How might we go about measuring these benefits?
- Which disabilities might most be helped through the use of TUIs?

Discuss.