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
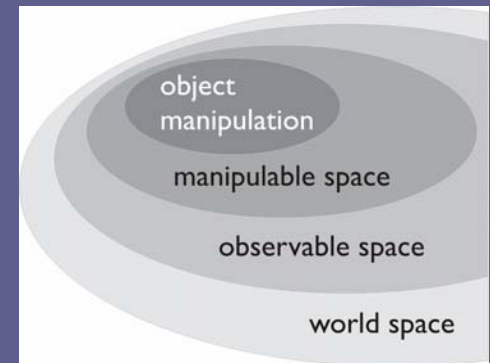
"Egocentric Interaction"

- 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.