CPE/CSC 486: Human-Computer Interaction

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Course Overview

- Introduction
- Cognitive Foundations
- Input-Output Devices
- Interaction Spaces
- Interaction Styles
- Interaction with Mobile Devices
- Speech-Based Interaction
- User Assistance
- Natural User Interfaces
- Case Studies
- Project Presentations

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Chapter Overview
Interaction with Mobile Devices

- Motivation
- Objectives

- Key Terms
- Summary

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Sources

- **Pen Lister: Mobile and Emerging Devices, 2009**
  - see http://www.slideboom.com/presentations/115954/Mobile-Devices
- **Stephen Brewster: Multimodal Interaction, 2009**
  - http://www.ukinit.org/sites/default/files/Steve%20Brewster.pdf

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Logistics

- **Term Project**
  - mid-quarter project displays Thu, May 3
  - possibility of external visitors
- **Research Activity**
  - status update

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Motivation

Objectives

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Mobile Devices

Usage
Capabilities
Advantages
Limitations

Mobile Devices - Usage

- **often closer proximity to users**
  - with the user most of the time
  - easy to carry
- **often multi-purpose devices**
  - mobile phone, music player, camera, hand-held computer
- **essential professional or personal device**
  - connectivity (phone, text messaging, email, Web)
  - organization (calendar, to do list, contacts, directions)
  - pleasure (music, photos, videos, e-books)

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Mobile Devices - Capabilities

- **I/O capabilities**
  - input
    - control and navigation (buttons; no mouse; cursor keys or limited pointing device; touch screen; gyroscope or accelerometer)
    - text (keyboard missing or small)
    - speech (microphone/head set)
  - output
    - visual: small screen
    - audio: small speaker, headphones
    - haptic: vibration
- **computational capabilities**
  - limited memory, processing
- **connectivity**
  - wired (USB)
  - wireless (cellular, Wi-Fi, Bluetooth, Infrared)

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Mobile Devices - Advantages

- quick & easy access
- multiple functions in one device

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Mobile Devices - Limitations

- **input and output constraints**
  - buttons, keyboard, navigation
  - screen size
- **functional constraints**
  - available functions are often not very sophisticated
- **proprietary or unusual interaction methods**
  - touch gestures, (virtual) keyboard arrangement
- **synchronization with other devices**
  - computer, home phone, car, ...

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Device Categories

- Electronic Organizers
- PDAs
- Mobile Phones
- Smartphones
- Tablets

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Functionality Overlap

- **Phones**
  - directory
- **PDAs**
  - calendar
  - address book
  - notes
  - apps

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Universal Device vs. Specialized Tools

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Survival of Specialized Devices

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Interaction with Mobile Devices

user needs and requirements
task analysis
interaction flow
screen design
prototyping
evaluation

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Mobile Interaction Design Factors

context
interaction method
format
content source
simplicity

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Context

- **mobile interaction is embedded in the real world**
  - users move
  - may be involved in other tasks
    - possibly involving hands
    - may require attention by the user
      - e.g. driving
- **more challenging interaction experience**
  - users are less focused on the interaction with the device
  - devices have more interaction constraints
- **“head down” interaction**

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Content Source

- original server
- intermediate server with specific mobile formats

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Interaction Method

- **content transmission**
  - push
  - pull
  - prefetch

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Format

- Web-generic
- mobile Web page
- mobile app

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Simplicity

- **Occam's Razor**
  - the law of parsimony, economy or succinctness
  - among competing hypotheses, select the one with the fewest assumptions
    - offers the simplest explanation
      - may not be the most accurate one
- **Einstein on Simplicity**
  - "Everything should be made as simple as possible, but not one bit simpler."

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Designing for Mobile Devices

Users
Usage Scenarios
Purpose
Constraints

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Output Constraints

Small Screen

- **visibility constraints**
  - less display space (“screen estate”)
- **interaction constraints**
  - number and size of buttons, menus, and other interaction elements
  - more scrolling and paging
  - visual cues to indicate more content
- **mobility advantages**
  - device can be carried around
  - device can be placed in a convenient position for interaction
    - reading
    - phone call

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Readability

- Which text display is easier to read? The one in a few wide lines with a primarily horizontal arrangement, or the one arranged vertically?

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Single Window Mode

- **most mobile devices do not allow the display of multiple windows**
  - screen size constraints
  - performance constraints
  - interaction constraints
- **consequences**
  - switching within or between applications is more cumbersome
  - no simultaneous viewing
    - comparisons
    - correlations
    - information transfer

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Input Constraints

keyboard

size, number of keys, arrangement of keys

limited haptic feedback

requires visual attention

touch typing is much more challenging

screen navigation

simple for touch-based devices

limited for others

cursor keys, 4-way rocker switches

pen

inconvenient

hand-writing recognition still somewhat problematic

Touch-Based Interaction

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Input Constraints

keyboard
screen navigation
pen
voice

Keyboard Constraints

- size, number of keys, arrangement of keys
- limited haptic feedback
- requires visual attention
  - touch typing is much more challenging

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Screen Navigation Constraints

- **simple for touch-based devices**
- **limited for others**
  - cursor keys, 4-way rocker switches

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Pen Constraints

- inconvenient
- hand-writing recognition still somewhat problematic

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Voice Constraints

- audibility range
- background noise
- disturbance of others
- speech recognition

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Design Guidelines for Mobile Devices

1. **Reduce the amount of content.**
2. **Single column layout works best.**
3. **Adjust the navigation method.**
   - bread crumbs vs. menu
   - top or bottom placement
4. **Minimize text entry.**
5. **Consider multiple mobile versions.**
   - iPhone vs. iPad; touch vs. keyboard; computing power
6. **Touchscreen or not?**
7. **Utilize built-in functionality.**
   - phone calls, localization, QR codes

http://www.webcredible.co.uk/user-friendly-resources/web-usability/mobile-guidelines.shtml

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Outlook: "Head Up" Interaction

- **"hands-free" input**
  - gestures
  - voice
- **"eyes free" output**
  - sound and tactile feedback
    - auditory widgets ("audicons")
      - alerts, meaningful sounds
      - may be annoying for others
        - unless ear/head phones are used
    - tactile widgets ("tacticons", "tactons")
      - vibrations
      - surface variations
      - requires direct contact with the user

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Important Concepts and Terms

- batch system
- command-line interface
- contextual task analysis
- desktop
- direct manipulation
- forms
- full-screen interface
- goal
- graphical user interface (GUI)
- heuristic evaluation
- hierarchical menu
- human-machine interface
- intelligent agent
- interaction style
- menu
- mouse
- natural language
- networked menu
- system language
- task
- task analysis
- usability
- user-centered design
- user interface design
- user language
- user requirements
- What You See Is What You Get" (WYSIWYG)
- WIMP
- window

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Chapter Summary

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