Lecture 4 – Models and Metaphors

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CS147 - Introduction to Human-Computer Interaction Design
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Learning Goals

• Understand the use of metaphors in designing interfaces and be able to choose them appropriately
• Understand the need for a clear conceptual model in interface design and be able to analyze and create appropriate models for specific applications
Conceptual Models

• In interacting with any system (software or others), a person has a concept of what the system is: what its components are, what properties they have, and what interactions they can enter into. This conceptual model underlies the more specific aspects of interface, such as screen representations and command structures.
Metaphors

• A key issue in software design is to make the model as clear and comprehensible as possible, and to relate it appropriately to the person's models based on prior experience with other systems and aspects of ordinary life.

• Metaphors can help the designer communicate the mental model based on the user’s prior understanding.
Three Paradigms [Cooper]

- **Technology paradigm**
  - To use the device (or program) you need to understand the mechanism

- **Metaphor paradigm**
  - Let users apply what they know from some familiar part of life in understanding the interface

- **Idiomatic Paradigm**
  - Design simple interactions and imbue them with meaning
The Desktop Metaphor – Xerox Star, 1981
Icons for Familiar Office Objects
Notebook Metaphor – Penpoint, 1991

Dear Ms. Huerta:

This is our agreement for a new bottle design for the Chili Mixes.

1. You agree to supply design services and technical drawings to New World.

2. If your design proves to be inadequate to withstand the stresses, heat, and shock for which you have guaranteed it, you will complete a new design at no charge.

3. Your cost estimates must be submitted in advance every week and approved by Richard Hopkins before you continue work.

4. New World will pay each invoice from an approved estimate within thirty (30) days.

Please sign a copy of this agreement and fax it back to me.
Good evening.
Click on the door to sign in...
Setting up your e-mail address...

The first step is to subscribe to the Bob E-Mail service.

- How to subscribe to the service

The second step is to tell me your account info and e-mail address so I can pick up and deliver your e-mail.

- Tell me your e-mail information

Finally, if you have trouble sending or receiving e-mail messages, I can help you fix any problems.

- Troubleshoot e-mail problems

[Cancel]
Lava Lamp

Note: This is a decorative object. It does not start any programs or do anything special.

- [ ] Change it
- [x] Cancel
House for a PDA – Magic Cap 1994
Virtual World metaphor

There.com
Secondlife.com
Bookshelf Metaphor
Web Book – Xerox PARC
Physical Device Metaphors

Figure 2-3: IBM's RealPhone Application Interface

Apple Quicktime 4.0
Conversational Agents
Clippy - Microsoft

Memo to File

SUBJECT: CYA

1. Staudt has obviously pressed lodges more about interference

It looks like you're crafting a crude forgery.

Would you like help?
- Get Dan Rather's phone number
- See fonts that were available in 1973
- Grab a beer and some popcorn and watch the festivities on Democratic Underground.
Three basic physical interaction metaphors

• **Manipulation:**
  – Desktop, notebook,…

• **Navigation:**
  – WWW, virtual spaces…

• **Conversation:**
  – Speech, agents…
Transporting metaphor vs. Familiarizing metaphor [Heckel and Clanton]

• Provide a structure that can be learned and that enables new kinds of applications
# The Spreadsheet – Visicalc, 1979

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</table>
Timeline Metaphor - Lifestreams, 1997
Map Metaphor(s)
Map Metaphor(s)
Collaborative Tagging

<table>
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<th>All time most popular tags</th>
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</thead>
<tbody>
<tr>
<td>amsterdam, animal, animals, april, architecture, art, australia, baby, barcelo...</td>
</tr>
</tbody>
</table>
Three design aspects [Liddle]

- Conceptual model
- Information display
- Control mechanism
Conceptual Model

• User’s concept of (software) system she interacts with
  – Components, properties, interactions

• Goal in interaction design
  – Clear, comprehensible model
Three models of the same system

- Designer’s model
- User's model
- System image
How do conceptual models present themselves to the user of a system?

- Implied by the interface metaphor
- Design of affordances
  - (e.g., how much lights up when you do a selection)
- Responses to actions
- Use of natural language terms
  - (e.g., "page, kill, trash") which have prior understandings.
  - In documentation, help, tutorials, etc.
  - In menus, dialog boxes, etc.
Example: Word processing

• Uses metaphors from many worlds
  – language, direct manipulation, typewriter, teletype, typography & printing

• Many conceptual model differences between alternative applications
Example: Formatting a Paper

• What kinds of page elements are manipulable as distinct objects?
• What aspects of their layout can you control?
• What happens when you make changes?
• What is the overall conceptual model for how things are laid out onto pages?
• For that matter, what is a "page"
Barehands:
Implement-Free Interaction with a Wall-Mounted Display

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Abstract

We describe Barehands, a technique for emerging technologies, in which the user can control the orientation of virtual commands and objects on a large screen by making simple hand gestures. Using infrared-sensitive infrared (IR)殊政 and a camera mounted on a TiltScope, we enable a hands-friendly S440i Touch (a commercially available 41” x 41” digital-touch-screen display) to identify and respond to natural human hand gestures. Barehands supports a general, unified, implementation of commanding with large, wall-mounted interactive surfaces.

Keywords:
interaction, user interface, hand gestures, orientation, image processing, optical tracking, S440i Touch, Barehands, virtual reality, augmented reality, and TiltScope.

Introduction

As part of our project to develop a generic command-based system, we have created an interactive interface which recognizes a variety of devices, including paper, PDAs, and large displays, both virtual (remote-remote) and physical (physical). Our research focus is on generating interfaces which the system's own software can understand and interact with, and which enable the user to utilize a variety of devices.

Barehands allows the user to control virtual commands with large, wall-mounted displays using just hand gestures, and it employs hand-gesture recognition techniques.

The Commons

A key design concern in any command system is a general approach to command entry.

Figure 1: Projector, camera, and lighting setup. The infrared LED array is guided in association with the camera so that it illuminates the rear of the board, including objects that reflect light back near to its front side. The camera records the images for analysis.
Microsoft Word

Implement-Free Interaction with a Wall-Mounted Display

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ABSTRACT

We describe Barehands, a featureless, resource-constrained device, in which the user can control the movements of a computer mouse and use a wall-mounted board. Given hand gestures and a wall-mounted display, a user can draw simple shapes and make text entries. The device is implemented using a standard video camera and a frame-grabbing card. The video images are transmitted to a PC using a wireless network. The images are processed to detect and track hand gestures, and the resulting data is transmitted over the network to the PC. The PC then sends the appropriate commands to the user's computer.

Some paragraphs

Section with 1 column

Section with 2 columns

Page and column margins
Barehands: Implement-Free Interaction with a Wall-Mounted Display

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ABSTRACT
We describe Barehands, a hand-held interaction technique, in which the user can control the interaction of system commands and tools on a touch screen by touching it with distinct hand postures. Using a hand-held, infrared (IR) screen and a video camera with an IR filter, we enable a back-projected SMARTboard (a commercially available, 61" x 47" touch-screen display) to identify and respond to several distinct hand postures. Barehands provides a natural, quick, implement-free method of interacting with large, wall-mounted interactive surfaces.

Keywords
Interaction techniques, user interface, hand posture, infrared, image processing, human gesture, SMARTboard, interactive workspaces, touch interaction, interaction tool.

INTRODUCTION
As part of our project to develop a pervasive computing environment [1], we have created an interactive workspace which integrates a variety of devices, including laptops, PDAs, and large displays, both vertical (white-board) and horizontal (tabletop). Our research framework is on providing integration at both the system and interaction levels, so that information presented by different devices can be linked directly to each other.

Barehands addresses the issue of effective interaction with large touch-sensitive surfaces by employing hand-specific recognition techniques.

The Design:
A key design objective for our environment is to provide support on a variety of devices for existing modes of interaction with applications and standard GUI interfaces (e.g., Windows, Mac OS). We cannot expect real applications to be developed if they require special re-coding for use in our environment. At the same time, we want to support additional interactions that are not in current systems. These include:

- device augmentation (such as providing the equivalent of keyboard shortcuts for a non-keyboard touch screen)
- multi-device actions (such as dragging up a web page to applications on a screen other than the one on which the interaction occurs, or using a pointing device on a laptop to control the mouse on a SMARTboard)
- display screen actions (such as making up the desktop display)

FIGURE 1: Projection, camera, and lighting setup, side view. The infrared LED arrays are placed in coordination with the camera shutter to illuminate the rear of the board, including objects that reflect light by being near to its front side. The camera records the image for analysis.
Barehands: Implement-Free Interaction with a Wall-Mounted Display

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ABSTRACT
We describe Barehands, an interactive surfaces.

Keywords
Interaction technique, low-Skill interaction tool.

INTRODUCTION
As part of our project, we have been investigating...techniques.

The Overface
A key design criterion for our environment is to provide support on a variety of devices for existing modes of interaction. These include:

- device augmentation
- multi-device wall-screen
- meta-screen

FIGURE 1: Projection, 2D analysis.
Barehands: Implement-Free Interaction with a Wall-Mounted Display

We demonstrate Barehands, a first-hand experience where users can control the layout of menus and menus with gestures on a wall-mounted display or on a desktop computer. Using the same intuitive, natural (R) gestures and menus, users can easily organize menus, execute commands, and interact with the display.

Key terms:
- Barehands
- First-hand
- Gesture
- Menu
- Desktop
- Interactive

INTRODUCTION
As part of our project to develop a pervasive computing environment, we have created an interactive system that supports a variety of devices, including hapas, TVs, and large displays, both wirebound (walled) and wireless (unbound). Our research focuses on providing seamless interaction across different environments and interfaces. Barehands can be used to control menus and menus on a wall-mounted display or on a desktop computer.

The Question
A key design decision in the Barehands system is to provide seamless interaction across devices in a wall-mounted display environment.
The Concept of “Paragraph”

- **Non-computer**: Semantic unit
  - One thought, start on new indented line with topic sentence
- **Word**: “the” building block of a document
  - Carries formatting, even used for figures, headers
- **HTML**: One building block of a document
  - Forces whitespace -> often misused for layout
- **PowerPoint**: not part of natural model (visuals+bulleted lists), added later from Word
The Concept of “Layout”

- Non-computer: Typographical-physical
  - Cut & Paste anywhere
- Word: Mostly typographical
  - Sections [with attributes like #columns], paragraphs [with attributes like indent.], inconsistent pictures model (added late), tables
- HTML: Sequential, but gone bad
  - Intended for simple sequential “scroll” rendering
  - But: tables used to create page layouts
  - “Don’t let HTML become the DOS of the WWW!” [Alan Kay, WWW3, 1995]
- PowerPoint: Graphical
  - Overlapping objects, no flow beyond page
Back to Metaphor

• A metaphor implies many elements of the model to a user who is familiar with the metaphorical object (e.g., a physical desktop)

• In general a model requires more learning without metaphors to which users can anchor it to their previous experience.

• There is a fine line between metaphor and non-metaphor (e.g., in natural language "The stock market is up today").
Problems with metaphors

- Don’t scale well
- Too constraining
- Conflict with design principles
- Makes true functionality invisible
- Overly literal translations
- Can limit the designer's imagination
The Myth of Metaphor [Cooper]

• … basing a user interface design on a metaphor is not only unhelpful but can often be quite harmful. The idea that good user interface design is based on metaphors is one of the most insidious of the many myths that permeate the software community.

• Use 'em if you find 'em, but don't bend your interface to fit some arbitrary metaphoric standard. [Cooper]