Chapter 6: Interfaces and interactions
Overview

• Introduce the notion of a paradigm
• Provide an overview of the many different kinds of interfaces
  – highlight the main design and research issues for each of the different interfaces
• Consider which interface is best for a given application or activity
Paradigms

- Refers to a particular approach that has been adopted by a community in terms of shared assumptions, concepts, values and practices
  - Questions to be asked and how they should be framed
  - Phenomena to be observed
  - How findings from experiments are to be analyzed and interpreted
Paradigms in HCI

- The predominant 80s paradigm was to design user-centred applications for the single user on the desktop
- Shift in thinking occurred in the mid 90s
- Many technological advances led to a new generation of user–computer environments – e.g., virtual reality, multimedia, agent interfaces, ubiquitous computing
- Effect of moving interaction design ‘beyond the desktop’ resulted in many new challenges, questions, and phenomena being considered
Ubicomp

• Would radically change the way people think about and interact with computers
• Computers would be designed to be embedded in the environment
• Major rethink of what HCI is in this context
New thinking

• How to enable people to access and interact with information in their work, social, and everyday lives
• Designing user experiences for people using interfaces that are part of the environment with no controlling devices
• What form to provide contextually-relevant information to people at appropriate times and places
• Ensuring that information, that is passed around via interconnected displays, devices, and objects, is secure and trustworthy
Interface types

• Many, many kinds now

1980s interfaces
  - Command
  - WIMP/GUI

1990s interfaces
  - Advanced graphical (multimedia, virtual reality, information visualization)
  - Web
  - Speech (voice)
  - Pen, gesture, and touch
  - Appliance

2000s interfaces
  - Mobile
  - Multimodal
  - Shareable
  - Tangible
  - Augmented and mixed reality
  - Wearable
  - Robotic
Command interfaces

- Commands such as abbreviations (e.g., `ls`) typed in at the prompt to which the system responds (e.g., listing current files)
- Some are hard wired at keyboard, e.g., delete
- Efficient, precise, and fast
- Large overhead to learning set of commands
Research and design issues

- Form, name types and structure are key research questions
- Consistency is most important design principle
  - e.g., always use first letter of command
- Command interfaces popular for web scripting

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.
WIMP/GUI interfaces

• Xerox Star first WIMP -> rise to GUIs

• Windows
  – could be scrolled, stretched, overlapped, opened, closed, and moved around the screen using the mouse

• Icons
  – represented applications, objects, commands, and tools that were opened when clicked on

• Menus
  – offering lists of options that could be scrolled through and selected

• Pointing device
  – a mouse controlling the cursor as a point of entry to the windows, menus, and icons on the screen
GUIs

- Same basic building blocks as WIMP but more varied
  - Color, 3D, sound, animation,
  - Many types of menus, icons, windows
- New graphical elements, e.g.,
  - toolbars, docks, rollovers
Windows

- Windows were invented to overcome physical constraints of a computer display, enabling more information to be viewed and tasks to be performed.
- Scroll bars within windows also enable more information to be.
- Multiple windows can make it difficult to find desired one, so techniques used
  - Listing, iconising, shrinking
Apple’s shrinking windows
Selecting a country from a scrolling window
Is this method any better?

### International Flower Delivery

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Research and design issues

• Window management
  – enabling users to move fluidly between different windows (and monitors)
• How to switch attention between them to find information needed without getting distracted
• Design principles of spacing, grouping, and simplicity should be used
Menus

• A number of menu interface styles
  – flat lists, drop-down, pop-up, contextual, and expanding ones, e.g., scrolling and cascading

• Flat menus
  – good at displaying a small number of options at the same time and where the size of the display is small, e.g., iPods
  – but have to nest the lists of options within each other, requiring several steps to get to the list with the desired option
  – moving through previous screens can be tedious
iPod flat menu structure
Expanding menus

• Enables more options to be shown on a single screen than is possible with a single flat menu

• More flexible navigation, allowing for selection of options to be done in the same window

• Most popular are cascading ones
  – primary, secondary and even tertiary menus
  – downside is that they require precise mouse control
  – can result in overshooting or selecting wrong options
Cascading menu
Contextual menus

• Provide access to often-used commands that make sense in the context of a current task

• Appear when the user presses the Control key while clicking on an interface element
  - e.g., clicking on a photo in a website together with holding down the Control key results in options ‘open it in a new window,’ ‘save it,’ or ‘copy it’

• Helps overcome some of the navigation problems associated with cascading menus
Research and design issues

• What are best names/labels/phrases to use?
• Placement in list is critical
  – Quit and save need to be far apart
• Many international guidelines exist emphasizing depth/breadth, structure and navigation
  – e.g. ISO 9241
Icon design

- Icons are assumed to be easier to learn and remember than commands
- Can be designed to be compact and variably positioned on a screen
- Now populate every application and operating system
  - represent desktop objects, tools (e.g., paintbrush), applications (e.g., web browser), and operations (e.g., cut, paste, next, accept, change
Icons

• Since the Xerox Star days icons have changed in their look and feel:
  - black and white -> color, shadowing, photorealistic images, 3D rendering, and animation
• Many designed to be very detailed and animated making them both visually attractive and informative
• GUIs now highly inviting, emotionally appealing, and feel alive
Icon forms

• The mapping between the representation and underlying referent can be:
  – similar (e.g., a picture of a file to represent the object file),
  – analogical (e.g., a picture of a pair of scissors to represent ‘cut’)
  – arbitrary (e.g., the use of an X to represent ‘delete’)

• Most effective icons are similar ones

• Many operations are actions making it more difficult to represent them
  – use a combination of objects and symbols that capture the salient part of an action
Early icons

(a) 

(b) Talk 
Hangup

(c) 

(d)
Newer icons
Simple icons plus labels

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<th>Label</th>
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Activity

• Sketch simple icons to represent the operations to appear on a digital camera LCD screen:
  – Delete last picture taken
  – Delete all pictures stored
  – Format memory card
Toshiba’s icons

- Which is which?
- Are they easy to understand?
- Are they distinguishable?
- What representation forms are used?
- How do yours compare?
Research and design issues

• There is a wealth of resources now so do not have to draw or invent icons from scratch
  – guidelines, style guides, icon builders, libraries

• Text labels can be used alongside icons to help identification for small icon sets

• For large icon sets (e.g., photo editing or word processing) use rollovers
Advanced graphical interfaces

- Advanced graphical interfaces exist now that extend how users can access, explore, and visualize information
  - e.g. interactive animations, multimedia, virtual environments, and visualizations
- Some designed to be viewed and used by individuals
- Others by users who are collocated or at a distance
Multimedia

• Combines different media within a single interface with various forms of interactivity
  – graphics, text, video, sound, and animations
• Users click on links in an image or text
  -> another part of the program
  -> an animation or a video clip is played
  -> can return to where they were or move on to another place
BioBlast multimedia learning environment
Pros and cons

- Facilitates rapid access to multiple representations of information
- Can provide better ways of presenting information than can either one alone
- Can enable easier learning, better understanding, more engagement, and more pleasure
- Can encourage users to explore different parts of a game or story
- Tendency to play video clips and animations, while skimming through accompanying text or diagrams
Research and design issues

• How to design multimedia to help users explore, keep track of, and integrate the multiple representations
  – provide hands-on interactivities and simulations that the user has to complete to solve a task
  – Use ‘dynalinking,’ where information depicted in one window explicitly changes in relation to what happens in another (Scaife and Rogers, 1996).

• Several guidelines around that recommend how to combine multiple media for different kinds of task
Virtual reality and virtual environments

- Computer-generated graphical simulations providing:
  - “the illusion of participation in a synthetic environment rather than external observation of such an environment” (Gigante, 1993)
- provide new kinds of experience, enabling users to interact with objects and navigate in 3D space
- Create highly engaging user experiences
Pros and cons

• Can have a higher level of fidelity with the objects they represent, c.f. multimedia
• Induces a sense of presence where someone is totally engrossed by the experience
  – “a state of consciousness, the (psychological) sense of being in the virtual environment” (Slater and Wilbur, 1999)
• Provides different viewpoints: 1st and 3rd person
• Head-mounted displays are uncomfortable to wear, and can cause motion sickness and disorientation
Research and design issues

• Much research on how to design safe and realistic VRs to facilitate training
  – e.g., flying simulators
  – help people overcome phobias (e.g., spiders, talking in public)

• Design issues
  – how best to navigate through them (e.g., first versus third person)
  – how to control interactions and movements (e.g., use of head and body movements)
  – how best to interact with information (e.g., use of keypads, pointing, joystick buttons);
  – level of realism to aim for to engender a sense of presence
Which is the most engaging game of Snake?