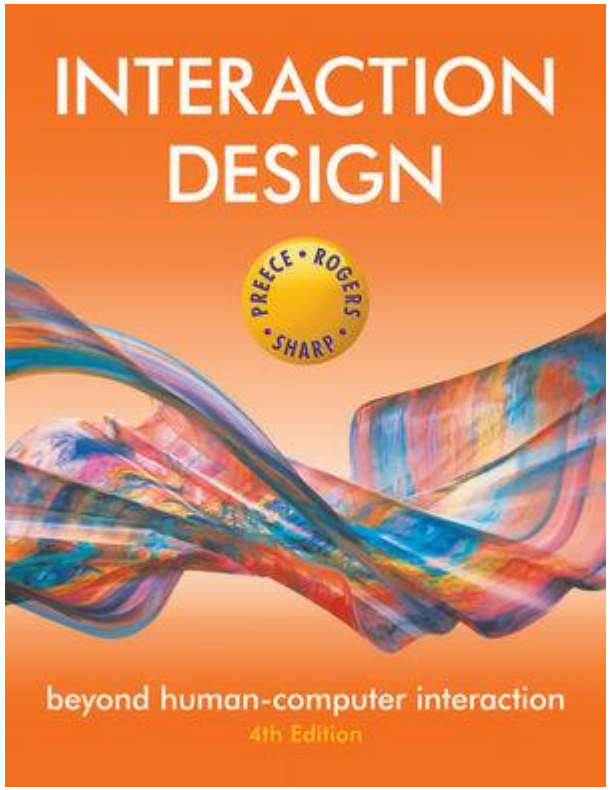


Lecture 04 (Part A)
UNDERSTANDING HOW INTERFACES AFFECT USERS

Overview

- Emotions and the user experience
- Expressive interfaces
  - how the ‘appearance’ of an interface can affect users
- Frustrating interfaces
  - what are they and how to reduce them
- Persuasive technologies and behavioral change
  - how technologies can be designed to change people’s attitudes and behavior
- Anthropomorphism
  - The pros and cons
- Models of emotion

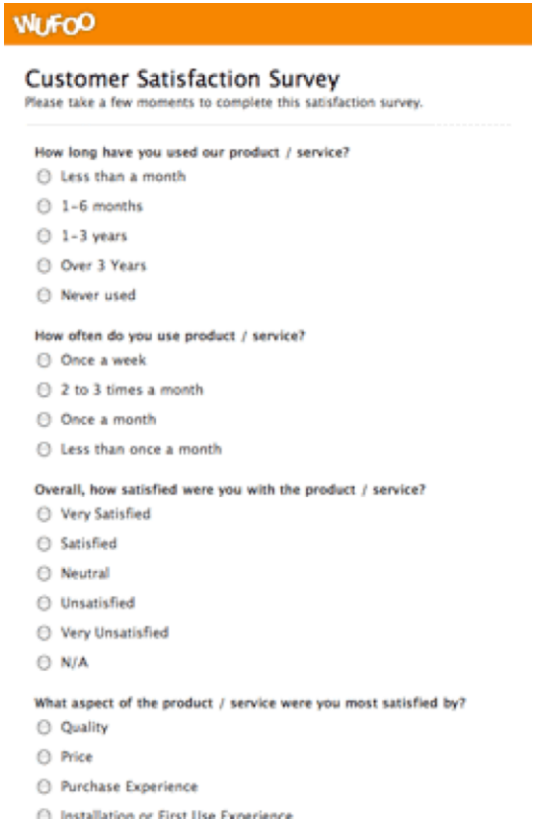
Emotions and the user experience

- HCI has traditionally been about designing efficient and effective systems
- Now more about how to design interactive systems that make people respond in certain ways
  - e.g. to be happy, to be trusting, to learn, to be motivated
- Emotional interaction is concerned with how we feel and react when interacting with technologies

Is this form fun to fill in?

"My goal was to design Wufoo to feel like something Fisher-Price would make."

Kevin Hale, Wufoo director



Emotional interaction

- What makes us happy, sad, annoyed, anxious, frustrated, motivated, delirious and so on
  - translating this into different aspects of the user experience
- Why people become emotionally attached to certain products (e.g. virtual pets)
- Can social robots help reduce loneliness and improve wellbeing?
- How to change human behavior through the use of emotive feedback

Activity

- Try to remember the emotions you went through when buying a big ticket item online (e.g. a fridge, a vacation, a computer)
- How many different emotions did you go through?

Expressive interfaces

- Provide reassuring feedback that can be both informative and fun
- But can also be intrusive, causing people to get annoyed and even angry
- Color, icons, sounds, graphical elements and animations are used to make the 'look and feel' of an interface appealing
  - conveys an emotional state
- In turn this can affect the usability of an interface
  - people are prepared to put up with certain aspects of an interface (e.g. slow download rate) if the end result is appealing and aesthetic

User-created expressiveness

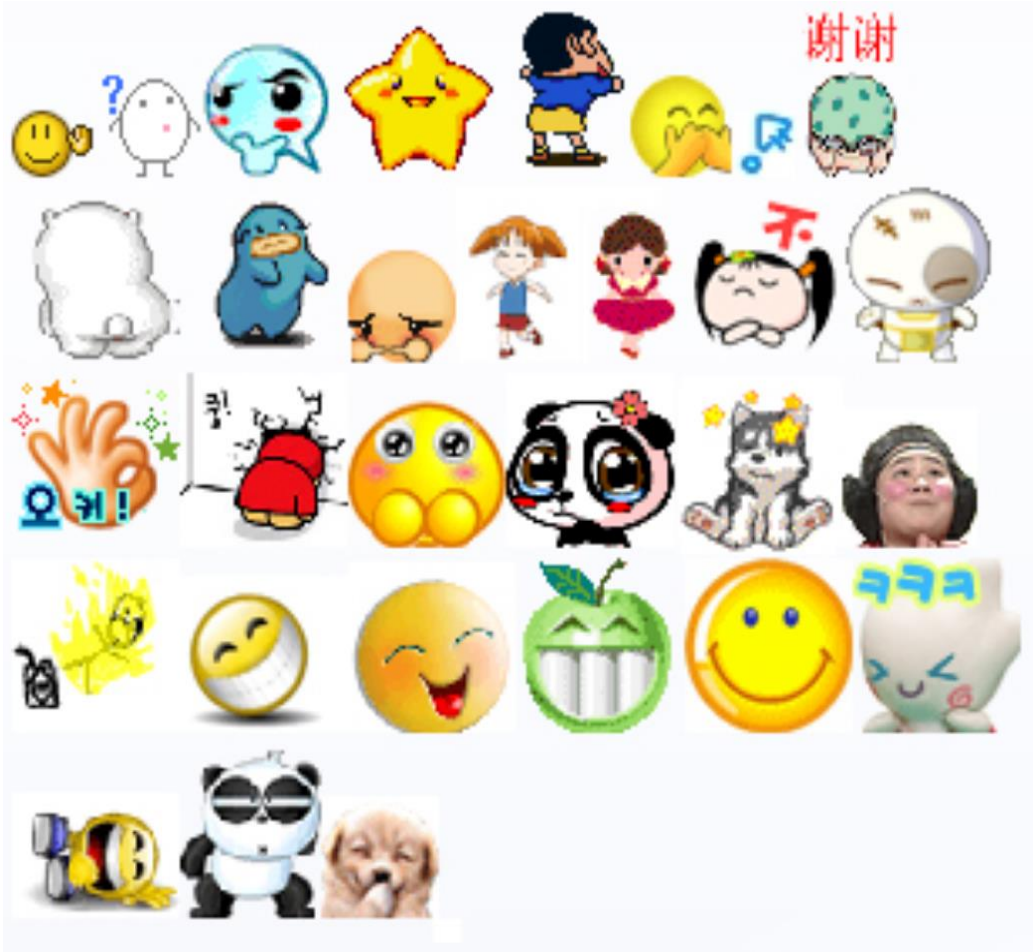
- Users have created a range of *emoticons* - compensate for lack of expressiveness in text communication:

  Happy :)
  Sad :<
  Sick :X
  Mad >:
  Very angry >:-(

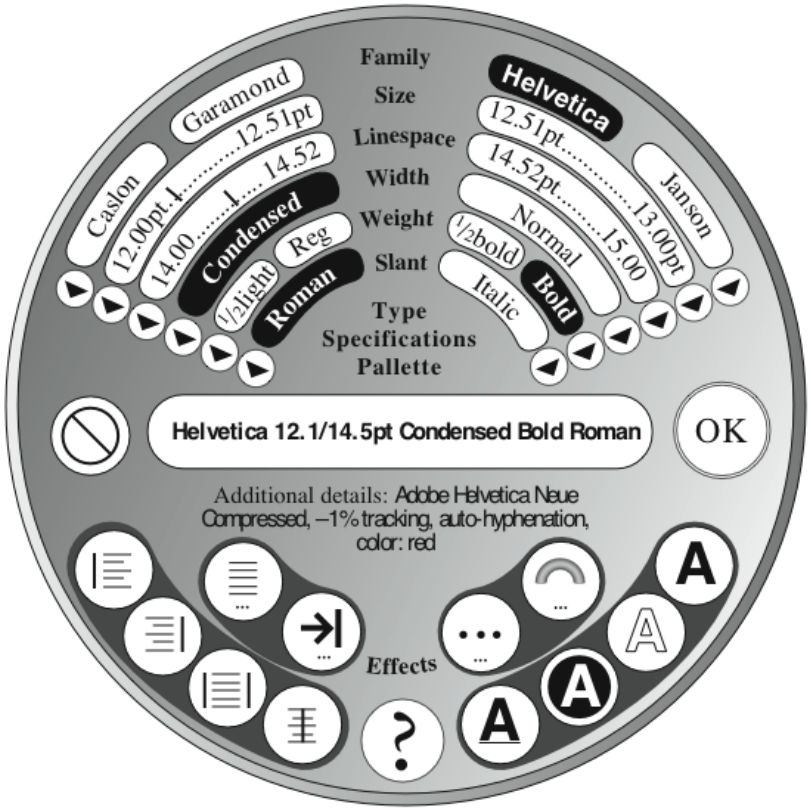
- Also use of icons and shorthand in texting and instant messaging has emotional connotations, e.g.

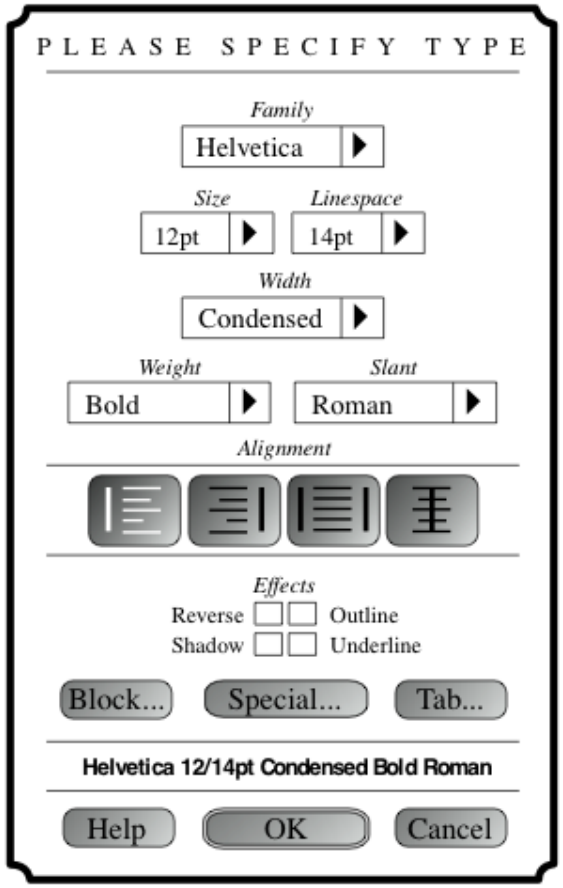
  LOL, I 12 CU 2NITE

Would you use any of these? What for?



Which one do you prefer?





Marcus and Teasley study

- Marcus (1992) proposed interfaces for different user groups
  - Left dialog box was designed for white American females
  - Who “prefer a more detailed presentation, curvilinear shapes and the absence of some of the more brutal terms ... favored by male software engineers.”
  - Right dialog box was designed for European adult male intellectuals
  - who like “suave prose, a restrained treatment of information density, and a classical approach to font selection”
- Teasley et al (1994) found this not to be true
  - the European dialog box was preferred by all and was considered most appropriate for all users
  - round dialog box was strongly disliked by everyone

Friendly interfaces

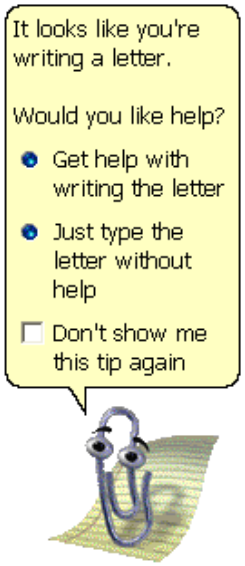
- Microsoft pioneered friendly interfaces for technophobes - ‘At home with Bob’ software
- 3D metaphors based on familiar places (e.g. living rooms)
- Agents in the guise of pets (e.g. bunny, dog) were included to talk to the user
  - Make users feel more at ease and comfortable

Bob


Microsoft BOB - Microsoft Virtual PC 2004
Action Edit CD Floppy Help
Nov 3
Bob Household Manager
Start program
Change it
Cancel
EXIT

Clippy

- Why was Clippy disliked by so many?
- Was it annoying, distracting, patronising or other?
- What sort of user liked Clippy?

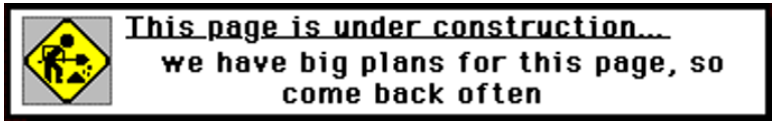


Frustrating interfaces

- Many causes:
  - When an application doesn't work properly or crashes
  - When a system doesn't do what the user wants it to do
  - When a user's expectations are not met
  - When a system does not provide sufficient information to enable the user to know what to do
  - When error messages pop up that are vague, obtuse or condemning
  - When the appearance of an interface is garish, noisy, gimmicky or patronizing
  - When a system requires users to carry out too many steps to perform a task, only to discover a mistake was made earlier and they need to start all over again

Gimmicks

- Amusing to the designer but not the user, e.g.
  - Clicking on a link to a website only to discover that it is still ‘under construction’



Error messages

"The application Word Wonder has unexpectedly quit due to a type 2 error."

Why not instead:

"the application has *expectedly* quit due to poor coding in the operating system"

- Shneiderman's guidelines for error messages include:
  - avoid using terms like FATAL, INVALID, BAD
  - Audio warnings
  - Avoid UPPERCASE and long code numbers
  - Messages should be precise rather than vague
  - Provide context-sensitive help

Website error messages

More helpful error message

"The requested page **/helpme** is not available on the web server.

If you followed a link or bookmark to get to this page, please let us know, so that we can fix the problem. Please include the URL of the referring page as well as the URL of the missing page.

Otherwise check that you have typed the address of the web page correctly.

The Web site you seek
Cannot be located, but
Countless more exist."

Should computers say they're sorry?

- Reeves and Naas (1996) argue that computers should be made to apologize
- Should emulate human etiquette
- Would users be as forgiving of computers saying sorry as people are of each other when saying sorry?
- How sincere would they think the computer was being? For example, after a system crash:
  - "I'm really sorry I crashed. I'll try not to do it again"
- How else should computers communicate with users?

Persuasive technologies and behavioral change

- Interacive computing systems deliberately designed to change people's attitudes and behaviors (Fogg, 2003)
- A diversity of techniques now used to change what they do or think
  - Pop-up ads, warning messages, reminders, prompts, personalized messages, recommendations, Amazon 1-click
  - Commonly referred to as nudging

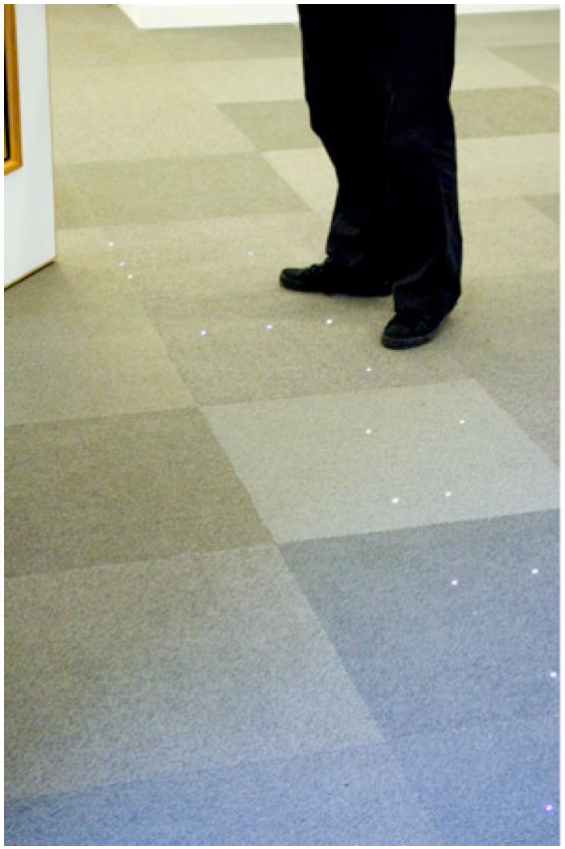
Nintendo's Pocket Pikachu

- Changing bad habits and improving well being
  - Designed to motivate children to be more physically active on a regular basis
  - owner of the digital pet that 'lives' in the device is required to walk, run, or jump
  - If owner does not exercise the virtual pet becomes angry and refuses to play anymore

How effective?

- Is the use of novel forms of interactive technologies (e.g., the combination of sensors and dynamically updated information) that monitor, nag, or send personalized messages intermittently to a person more effective at changing a person's behavior than non-interactive methods, such as the placement of warning signs, labels, or ads in prominent positions?

Which is most effective?



Energy reduction

Phishing and trust

- Web used to deceive people into parting with personal details
  - e.g. Paypal, eBay and won the lottery letters
- Allows Internet fraudsters to access their bank accounts and draw money from them
- Many vulnerable people fall for it
- The art of deception is centuries old but internet allows ever more ingeniuos ways to trick people

Anthropomorphism

- Attributing human-like qualities to inanimate objects (e.g. cars, computers)
- Well known phenomenon in advertising
  - Dancing butter, drinks, breakfast cereals
- Much exploited in human-computer interaction
  - Make user experience more enjoyable, more motivating, make people feel at ease, reduce anxiety

Which do you prefer?

1. As a welcome message

- “Hello Chris! Nice to see you again. Welcome back. Now what were we doing last time? Oh yes, exercise 5. Let’s start again.”

- “User 24, commence exercise 5.”

Which do you prefer?

2. Feedback when get something wrong

1. *"Now Chris, that's not right. You can do better than that. Try again."*
2. *"Incorrect. Try again."*

Is there a difference as to what you prefer depending on type of message? Why?

Evidence to support anthropomorphism

- Reeves and Naas (1996) found that computers that flatter and praise users in education software programs -> positive impact on them

"Your question makes an important and useful distinction. Great job!"

- Students were more willing to continue with exercises with this kind of feedback

Criticism of anthropomorphism

- Deceptive, make people feel anxious, inferior or stupid
- People tend not to like screen characters that wave their fingers at the user and say:
  - Now Chris, that's not right. You can do better than that.Try again."
- Many prefer the more impersonal:
  - "Incorrect. Try again."
- Studies have shown that personalized feedback is considered to be less honest and makes users feel less responsible for their actions (e.g. Quintanar, 1982)

Virtual characters

- Appearing on our screens in the form of:
  - Sales agents, characters in videogames, learning companions, wizards, pets, newsreaders
- Provides a persona that is welcoming, has personality and makes user feel involved with them

Disadvantages

- Can lead people into false sense of belief, enticing them to confide personal secrets with chatterbots
- Annoying and frustrating
  - e.g. Clippy
- May not be trustworthy
  - virtual shop assistants?

Rea the realtor

- Rea showing user an apartment
- Human-like body
- Uses gesture, non-verbal communication (facial expressions, winks) while talking
- Sophisticated AI techniques used to enable this form of interaction

Cassell, 2000, MIT

Conversation with Rea

- *Mike approaches screen and Rea turns to face him and says:*
- Hello. How can I help you?
- Mike: I'm looking to buy a place near MIT.
- *Rea nods, indicating she is following.*
- Rea: I have a house to show you. (picture of a house appears on the screen)
- Rea: it is in Somerville.
- Mike: Tell me about it.
- *Rea looks up and away while she plans what to say.*
- Rea: It's big.
- *Rea makes an expansive gesture with her hands.*
- *Mike brings his hands up as if to speak, so Rea does not continue, waiting for him to speak.*
- Mike: Tell me more about it.
- Rea: Sure thing. It has a nice garden...

- Would you buy a house from her?

Virtual agents

- What do the virtual agents do?
- Do they elicit an emotional response in you?
- Do you trust them?
- What is the style of interaction?
- What facial expression do they have?
- Are they believable, pushy, helpful?
- Would it be different if they were male? If so, how?

What makes a virtual agent believable?

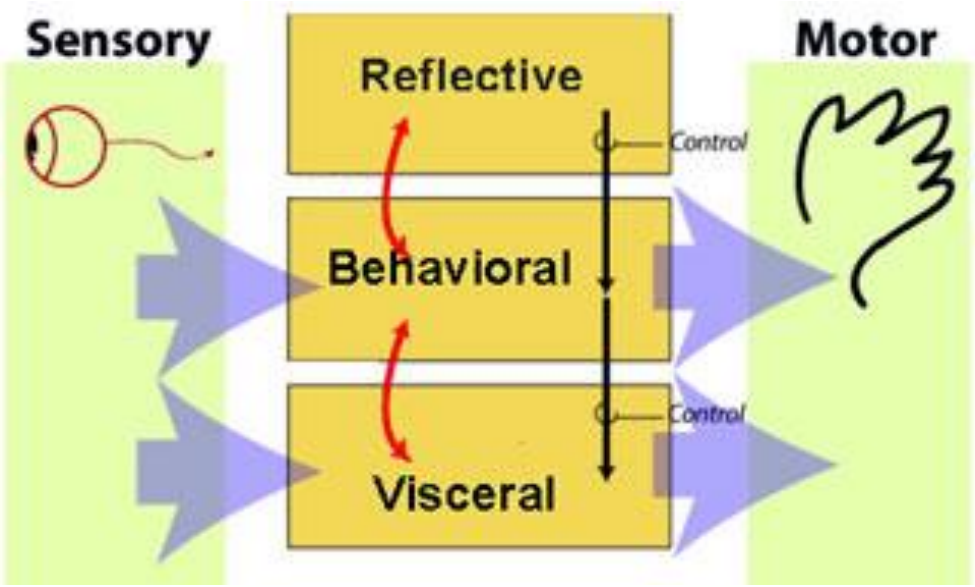
- Believability refers to the extent to which users come to believe an agent's intentions and personality
- Appearance is very important
  - Are simple cartoon-like characters or more realistic characters, resembling the human form more believable?
- Behavior is very important
  - How an agent moves, gestures and refers to objects on the screen
  - Exaggeration of facial expressions and gestures to show underlying emotions (c.f. animation industry)

Robot-like or cuddly?

- Which do you prefer and why?

Emotional design model

- Norman, Ortony and Revelle (2004) model of emotion



Claims from model

- Our emotional state changes how we think
  - when frightened or angry we focus narrowly and body responds by tensing muscles and sweating
    - more likely to be less tolerant
  - when happy we are less focused and the body relaxes
    - more likely to overlook minor problems and be more creative

Implications

- Should we, therefore, create products that adapt according to people's different emotional states?
  - When people are feeling angry should an interface be more attentive and informative than when they are happy?
- Is Norman right?
  - designers "can get away with more" for products intended to be used during leisure time than those designed for serious tasks

Pleasure model

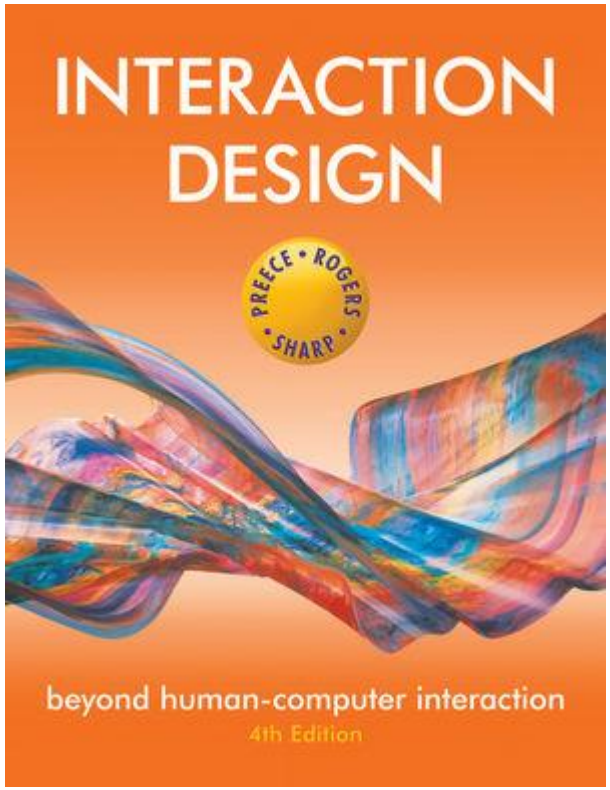
- Jordon (2000) based on Tiger's (1992) framework of pleasure
- Focuses on the pleasurable aspects of our interactions with products
  - (i) physio-pleasure
  - (ii) socio-pleasure
  - (iii) psycho-pleasure
  - (iv) ideo-pleasure (cognitive)
- Means of framing a designer's thinking about pleasure, highlighting that there are different kinds

Technology as Experience

- McCarthy and Wright (2004) framework of the user experience in terms of how it is 'felt' by the user
- Draws from Pragmatism, which focus on the sense-making aspects of human experience
- Made up of 4 core threads
  - compositional,
  - sensual,
  - emotional
  - spatio-temporal

Summary

- Emotional interaction is concerned with how interactive systems make people respond in emotional ways
- Well-designed interfaces can elicit good feelings in users
- Expressive interfaces can provide reassuring feedback
- Badly designed interfaces make people angry and frustrated
- Anthropomorphism is the attribution of human qualities to objects
- An increasingly popular form of anthropomorphism is to create interface agents and robot pets
- Models of affect provide a way of conceptualizing emotional and pleasurable aspects of interaction design



Lecture 04 (Part B)
INTERFACES

Overview

- Interface types
  - highlight the main design and research issues for each of the different interfaces
- Consider which interface is best for a given application or activity

1. Command-based

- 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, others can be assigned to keys
- Efficient, precise, and fast
- Large overhead to learning set of commands

Second Life command-based interface for visually impaired users

Figure 6.1 Second Life command-based interface for visually impaired users

Source: Reproduced with permission from http://www.eelke.com/images/textsl.jpg.

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

2. WIMP and GUI

- 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 WIMPs but more varied
  - Color, 3D, sound, animation,
  - Many types of menus, icons, windows
- New graphical elements, e.g.
  - toolbars, docks, rollovers
- Challenge now is to design GUIs that are best suited for tablet, smartphone and smartwatch interfaces

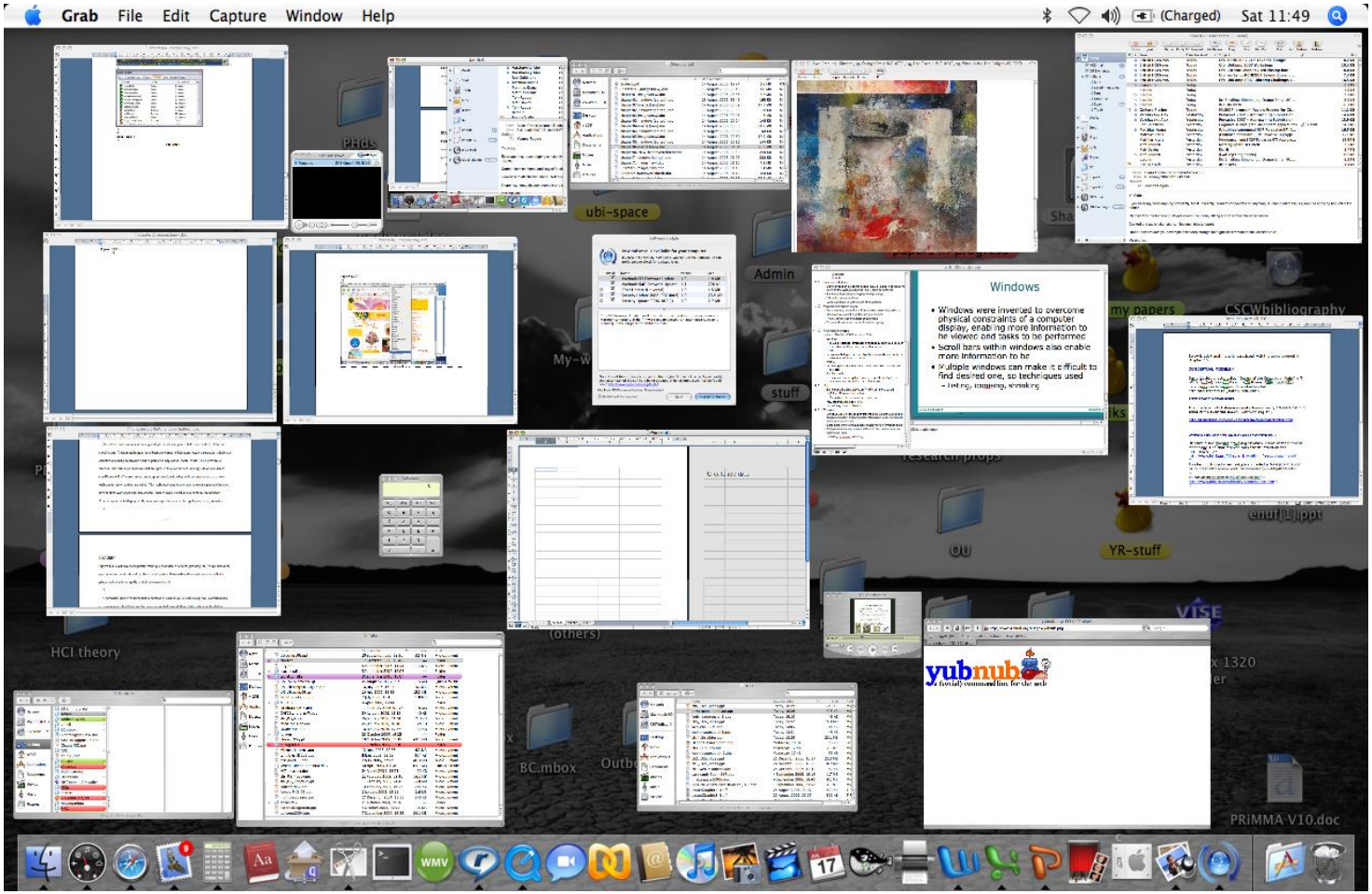
Windows

- Windows were invented to overcome physical constraints of a computer display
  - enable more information to be viewed and tasks to be performed
- Scroll bars within windows also enable more information to be viewed
- Multiple windows can make it difficult to find desired one
  - listing, iconising, shrinking are techniques that help

Figure 6.2 The boxy look of the first generation of GUIs. The window presents several check boxes, notes boxes, and options as square buttons

Source: Mullet, Kevin; Sano, Darrell, *Designing Visual Interfaces: Communication Oriented Techniques*, 1st, © 1995. Reproduced by permission of Pearson Education, Inc., Upper Saddle River, New Jersey.

Apple's shrinking windows



Safari panorama window view

Figure 6.3 A window management technique provided in Safari: pressing the 4×3 icon in the top left corner of the bookmarks bar displays the 12 top sites visited, by shrinking them and placing them side by side. This enables the user to see them all at a glance and be able to rapidly switch between them

Selecting a country from a scrolling window

Figure 6.4 A scrolling menu

Source: Screenshot of Camino browser, ©The Camino Project.

Is this method any better?

F	G	H	I	J
Fiji	Gabon	Haiti	Iceland	Jamaica
Finland	Germany	Holland	India	Japan
France	Gibraltar	Honduras	Indonesia	Jordan
French Guyana	Greece	Hong Kong	Iran	
French Polynesia	Greenland	Hungary	Ireland	
	Guadeloupe		Israel	
	Guam		Italy	
	Guatemala		Ivory Coast	

Figure 6.5 An excerpt of the listing of countries in alphabetical order from interflora.co.uk

Source: www.interflora.co.uk. Reproduced with permission.

Research and design issues

- Window management
  - enables users to move fluidly between different windows (and monitors)
- How to switch attention between windows 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

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

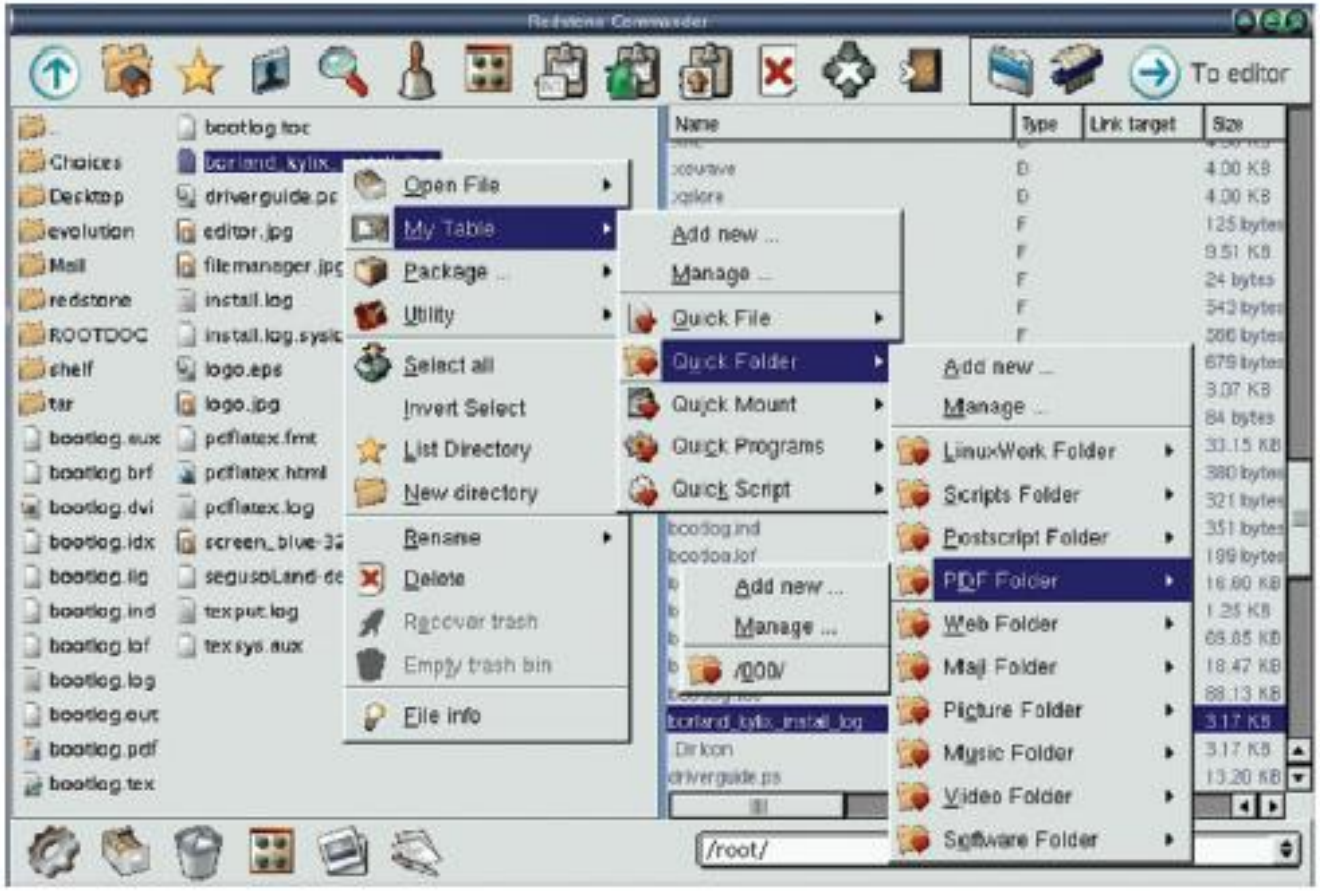


Figure 6.7 A cascading menu

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

Windows Jump List Menu

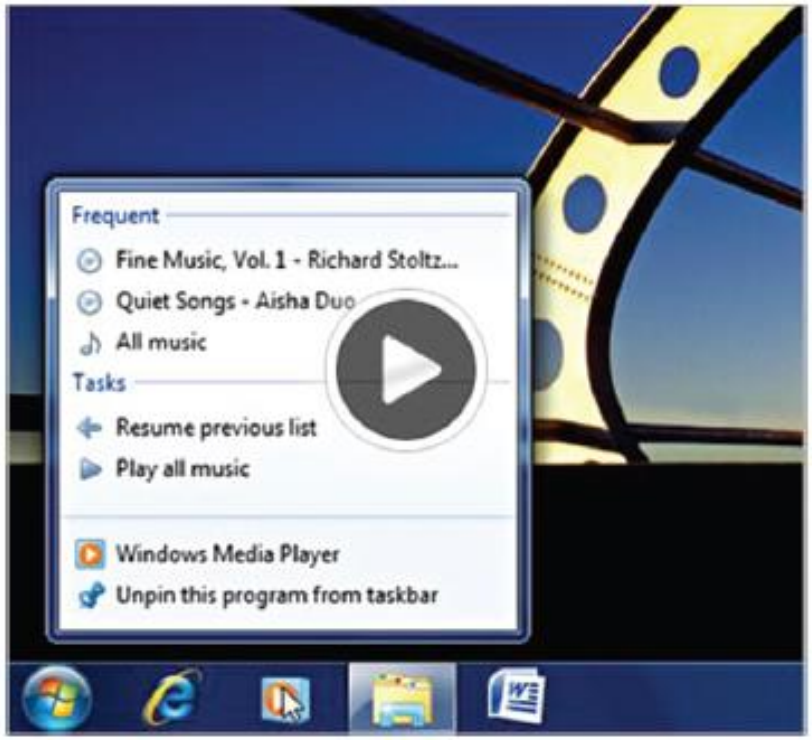


Figure 6.8 Windows jump list

Source: http://windows.microsoft.com/en-US/windows7/products/features/jump-lists.

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
- Choice of menu to use determined by application and type of system
  - flat menus are best for displaying a small number of options at one time
  - expanding menus are good for showing a large number of options

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 pervasive in every interface
  - e.g. 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

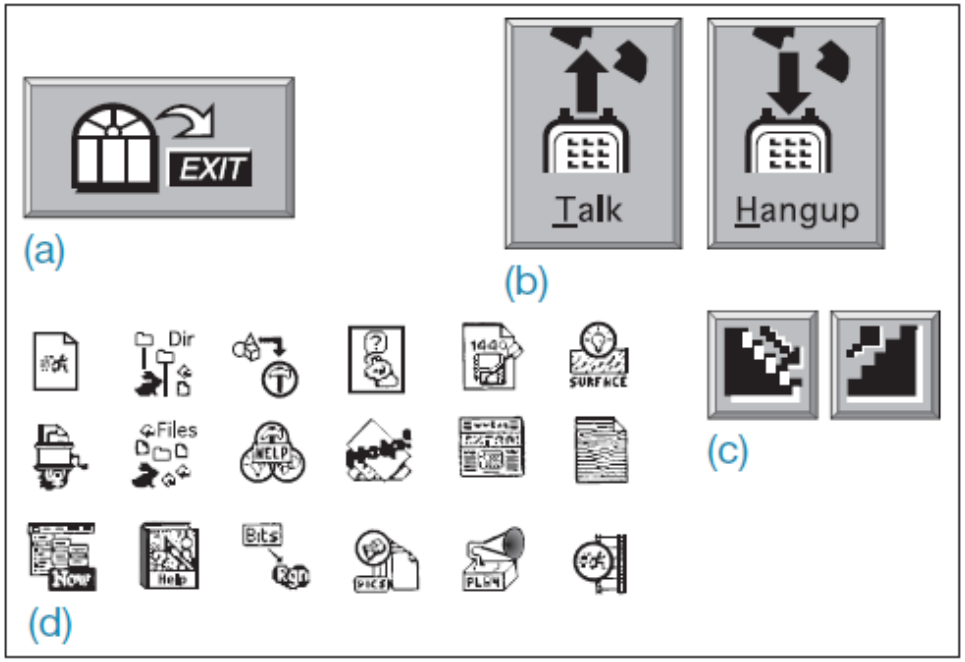


Figure 6.9 Poor icon set from the early 1990s. What do you think they mean and why are they so bad?

Source: K. Mullet and D. Sano: "Designing Visual Interfaces" Pearson 1995, reproduced with permission of Pearson Education.

Newer icons

Figure 6.11 Contrasting genres of Aqua icons used for the Mac. The top row of icons have been designed for user applications and the bottom row for utility applications

Simple flat 2D icons

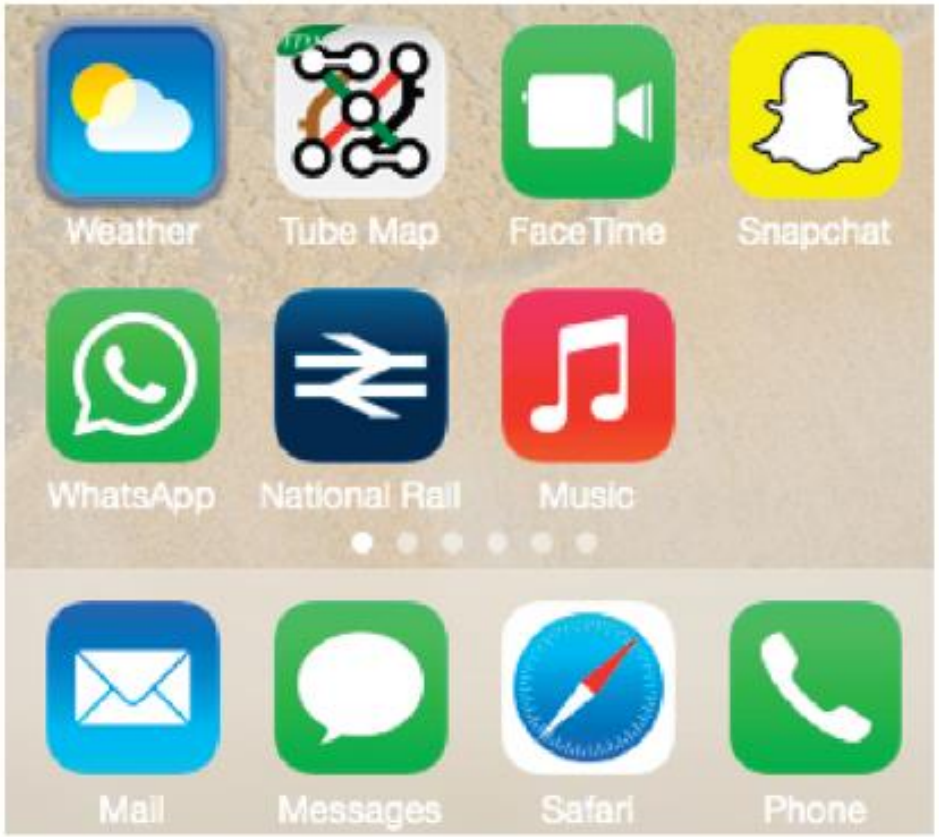


Figure 6.12 Flat 2D icons designed for smartphone apps

Activity

- Sketch simple icons to represent the following operations to appear on a digital camera screen:
  - Turn image 90 degrees sideways
  - Auto-enhance the image
  - Fix red-eye
  - Crop the image
- Show them to someone else and see if they can understand what each represents

Basic edit icons on iPhone

- 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 new 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

3. 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

Figure 6.14 Screen dump from the multimedia environment BioBLAST

Source: Screenshot from BioBlast, ©Wheeling Jesuit University.

Pros and cons

- Facilitates rapid access to multiple representations of information
- Can provide better ways of presenting information than can any media 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 that recommend how to combine multiple media for different kinds of task

4. Virtual reality

- 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 objects they represent compared to 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?

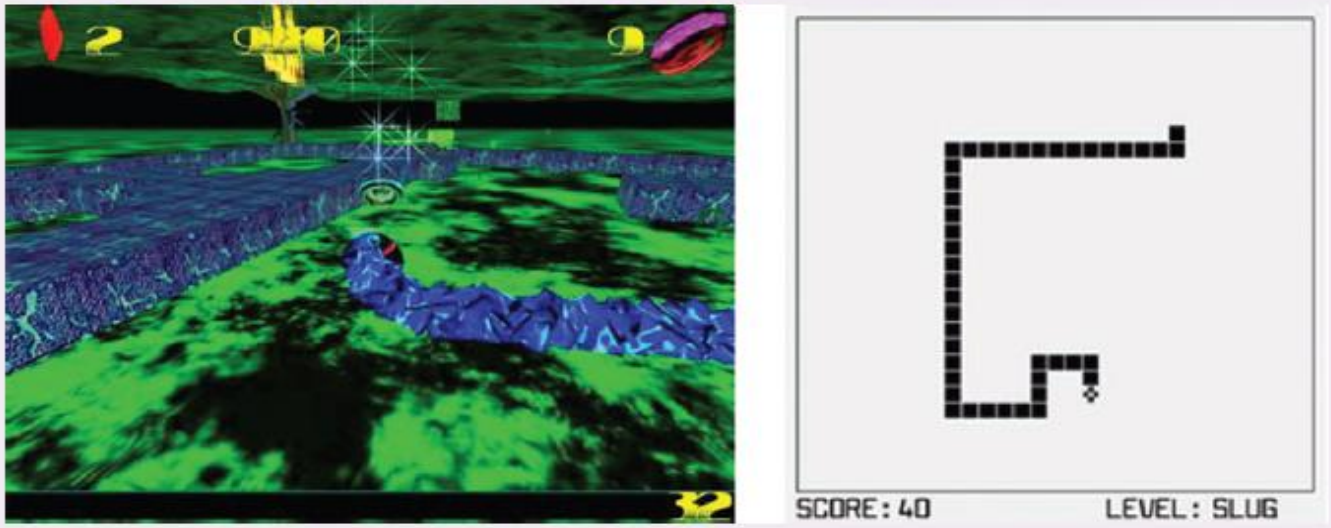


Figure 6.16 Two screenshots from the game Snake – the one on the left is played on a PC and the one on the right on a cell phone. In both games, the goal is to move the snake (the blue thing and the black squares, respectively) towards targets that pop up on the screen (e.g. the bridge, the star) and to avoid obstacles (e.g. a flower, the end of the snake's tail). When a player successfully moves his snake head over or under a target, the snake increases its length by one blob or block. The longer the snake gets, the harder it is to avoid obstacles. If the snake hits an obstacle, the game is over. On the PC version there are lots of extra features that make the game more complicated, including more obstacles and ways of moving. The cell phone version has a simple 2D bird's eye representation, whereas the PC version adopts a 3D third-person avatar perspective

5. Information visualization and dashboards

- Computer-generated interactive graphics of complex data
- Amplify human cognition, enabling users to see patterns, trends, and anomalies in the visualization (Card *et al,* 1999)
- Aim is to enhance discovery, decision-making, and explanation of phenomena
- Techniques include:
  - 3D interactive maps that can be zoomed in and out of and which present data via webs, trees, clusters, scatterplot diagrams, and interconnected nodes

Dashboards

- Show screenshots of data updated over periods of time - to be read at a glance
- Usually not interactive - slices of data that depict current state of a system or process
- Need to provide digestible and legible information for users
  - design its spatial layout so intuitive to read when first looking at it
  - should also direct a user's attention to anomalies or unexpected deviations

Which dashboard is best?

(a)

Figure 6.18 Screenshots from two dashboards: (a) British Airways frequent flier club that shows how much a member has flown since joining them, and (b) London City that provides various information feeds. Which is the easier to read and most informative?

Which dashboard is best?

(b)

Figure 6.18 Screenshots from two dashboards: (a) British Airways frequent flier club that shows how much a member has flown since joining them, and (b) London City that provides various information feeds. Which is the easier to read and most informative?

Research and design issues

- Whether to use animation and/or interactivity
- What form of coding to use, e.g. color or text labels
- Whether to use a 2D or 3D representational format
- What forms of navigation, e.g. zooming or panning,
- What kinds and how much additional information to provide, e.g. rollovers or tables of text
- What navigational metaphor to use

6. Web

- Early websites were largely text-based, providing hyperlinks
- Concern was with how best to structure information to enable users to navigate and access it easily and quickly
- Nowadays, more emphasis on making pages distinctive, striking, and pleasurable
- Need to think of how to design information for multi-platforms - keyboard or touch?
  - e.g. smartphones, tablets, PCs

Usability versus attractive?

- Vanilla or multi-flavor design?
  - Ease of finding something versus aesthetic and enjoyable experience
- Web designers are:
  - "thinking great literature"
- Users read the web like a:
  - "billboard going by at 60 miles an hour" (Krug, 2000)
- Need to determine how to brand a web page to catch and keep 'eyeballs'

In your face ads

- Web advertising is often intrusive and pervasive
- Flashing, aggressive, persistent, annoying
- Often need to be ‘actioned’ to get rid of
- What is the alternative?

Research and design issues

- Need to consider how best to design, present, and structure information and system behavior
- But also content and navigation are central
- Veen's (2001) design principles

(1)Where am I?

(2)Where can I go?

(3) What's here?

Activity

- Look at the Nike.com website
- What kind of website is it?
- How does it contravene the design principles outlined by Veen?
- Does it matter?
- What kind of user experience is it providing for?
- What was your experience of engaging with it?

7. Consumer electronics and appliances

- Everyday devices in home, public place, or car
  - e.g. washing machines, remotes, photocopiers, printers and navigation systems)
- And personal devices
  - e.g. MP3 player, digital clock and digital camera
- Used for short periods
  - e.g. putting the washing on, watching a program, buying a ticket, changing the time, taking a snapshot
- Need to be usable with minimal, if any, learning

A toaster

Figure 6.19 A typical toaster with basic physical controls

Research and design issues

- Need to design as transient interfaces with short interactions
- Simple interfaces
- Consider trade-off between soft and hard controls
  - e.g. buttons or keys, dials or scrolling

8. Mobile

- Handheld devices intended to be used while on the move
- Have become pervasive, increasingly used in all aspects of everyday and working life
- Apps running on mobiles have greatly expanded, e.g.
  - used in restaurants to take orders
  - car rentals to check in car returns
  - supermarkets for checking stock
  - in the streets for multi-user gaming
  - in education to support life-long learning

The advent of the iPhone app

- A whole new user experience that was designed primarily for people to enjoy
  - many apps not designed for any need, want or use but purely for idle moments to have some fun
  - e.g. iBeer developed by magician Steve Sheraton
  - ingenious use of the accelerometer that is inside the phone

iBeer app

Figure 6.20 The iBeer smartphone app

Source: iBeer™ Photo ©2010 HOTTRIX® Reproduced with permission.

QR codes and cell phones

Figure 6.21 QR code appearing on a magazine page

Mobile challenges

- Smaller screens, small number of physical keys and restricted number of controls
- Innovative physical designs including:
  - roller wheels, rocker dials, up/down ‘lips’ on the face of phones, 2-way and 4-way directional keypads, softkeys, silk-screened buttons
- Usability and preference varies
  - depends on the dexterity and commitment of the user
- Smartphones overcome mobile physical constraints through using multi-touch displays

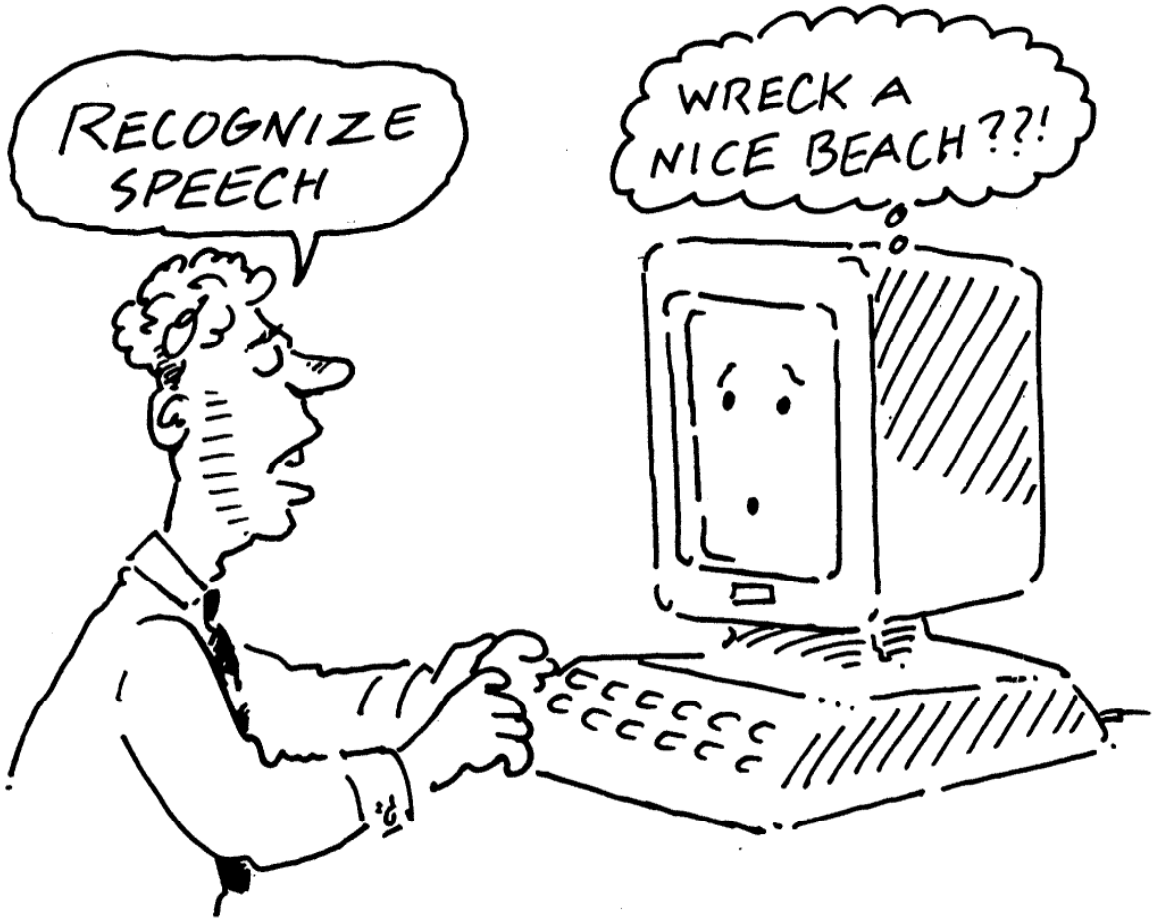
Research and design issues

- Mobile interfaces can be tricky and cumbersome to use for those with poor manual dexterity or ‘fat’ fingers
- Key concern is hit area
  - area on the phone display that the user touches to make something happen, such as a key, an icon, a button or an app
  - space needs to be big enough for fat fingers to accurately press
  - if too small the user may accidentally press the wrong key

9. Speech

- Where a person talks with a system that has a spoken language application, e.g. timetable, travel planner
- Used most for inquiring about very specific information, e.g. flight times or to perform a transaction, e.g. buy a ticket
- Also used by people with disabilities
  - e.g. speech recognition word processors, page scanners, web readers, home control systems

Have speech interfaces come of age?



Get me a human operator!

- Most popular use of speech interfaces currently is for call routing
- Caller-led speech where users state their needs in their own words
  - e.g. "I'm having problems with my voice mail"
- Idea is they are automatically forwarded to the appropriate service
- What is your experience of speech systems?

Format

- Directed dialogs are where the system is in control of the conversation
- Ask specific questions and require specific responses
- More flexible systems allow the user to take the initiative:
  - e.g. “I’ d like to go to Paris next Monday for two weeks.”
- More chance of error, since caller might assume that the system is like a human
- Guided prompts can help callers back on track
  - e.g. “Sorry I did not get all that. Did you say you wanted to fly next Monday?”

Research and design issues

- How to design systems that can keep conversation on track
  - help people navigate efficiently through a menu system
  - enable them to easily recover from errors
  - guide those who are vague or ambiguous in their requests for information or services
- Type of voice actor (e.g. male, female, neutral, or dialect)
  - do people prefer to listen to and are more patient with a female or male voice, a northern or southern accent?

10. Pen

- Enable people to write, draw, select, and move objects at an interface using lightpens or styluses
  - capitalize on the well-honed drawing skills developed from childhood
- Digital pens, e.g. Anoto, use a combination of ordinary ink pen with digital camera that digitally records everything written with the pen on special paper

Pros and cons

- Allows users to quickly and easily annotate existing documents
- Can be difficult to see options on the screen because a user's hand can occlude part of it when writing
- Can have lag and feel clunky

11. Touch

- Touch screens, such as walk-up kiosks, detect the presence and location of a person's touch on the display
- Multi-touch support a range of more dynamic finger tip actions, e.g. swiping, flicking, pinching, pushing and tapping
- Now used for many kinds of displays, such as Smartphones, iPods, tablets and tabletops

Research and design issues

- More fluid and direct styles of interaction involving freehand and pen-based gestures
- Core design concerns include whether size, orientation, and shape of touch displays effect collaboration
- Much faster to scroll through wheels, carousels and bars of thumbnail images or lists of options by finger flicking
- More cumbersome, error-prone and slower to type using a virtual keyboard on a touch display than using a physical keyboard

Research and design issues

- Will finger-flicking, swiping, stroking and touching a screen result in new ways of consuming, reading, creating and searching digital content?

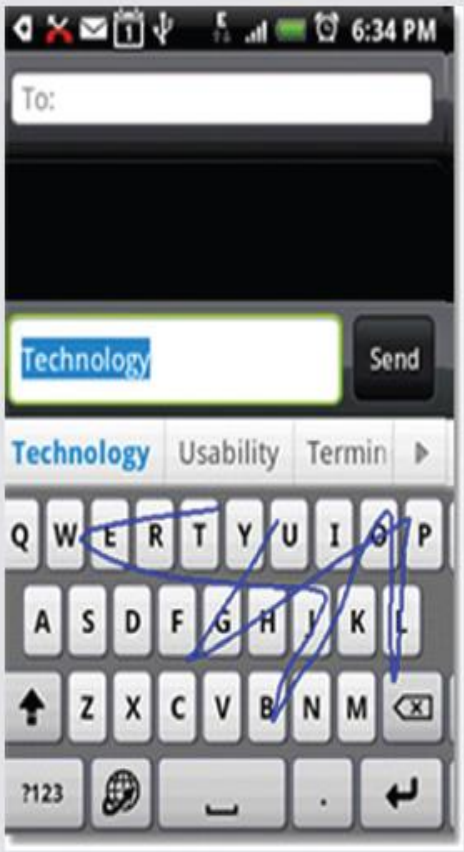


Figure 6.23 The Swype interface developed for mobile touch displays

Source: Reproduced from http://www.geek.com/articles/mobile/nuances-t9-trace-virtual-keyboard-allows-you-to-swipe-rather-than-type-20100323/technology/.

12. Air-based gestures

- Uses camera recognition, sensor and computer vision techniques
  - can recognize people's body, arm and hand gestures in a room
  - systems include Kinect
- Movements are mapped onto a variety of gaming motions, such as swinging, bowling, hitting and punching
- Players represented on the screen as avatars doing same actions

Home entertainment

- Universal appeal
  - young children, grandparents, professional gamers, technophobes

Figure 6.25 Touchless gesturing in the operating theater
Source: Courtesy of Kenton O'Hara, Microsoft.

Gestures in the operating theatre

- A touchless system that recognizes gestures
- surgeons can interact with and manipulate MRI or CT images
  - e.g. two-handed gestures for zooming and panning

Figure 6.26 The MusicJacket prototype with embedded actuators that nudge the player

Research and design issues

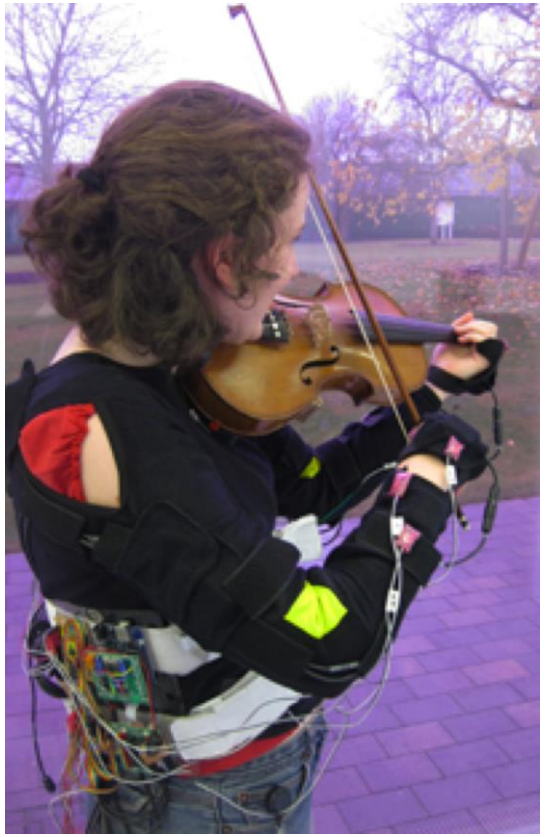
- How does computer recognize and delineate user's gestures?
  - Deictic and hand waving
- Does holding a control device feel more intuitive than controller free gestures?
  - For gaming, exercising, dancing

13. Haptic

- Tactile feedback
  - applying vibration and forces to a person's body, using actuators that are embedded in their clothing or a device they are carrying, such as a smartphone
- Can enrich user experience or nudge them to correct error
- Can also be used to simulate the sense of touch between remote people who want to communicate

Realtime vibrotactile feedback

- Provides nudges when playing incorrectly
- Uses motion capture
- Nudges are vibrations on arms and hands



Research and design issues

- Where best to place actuators on body
- Whether to use single or sequence of ‘touches’
- When to buzz and how intense
- How does the wearer feel it in different contexts?
- What kind of new smartphones/smart-watches apps can use vibrotactile creatively?
  - e.g. slow tapping to feel like water dropping that is meant to indicate it is about to rain and heavy tapping to indicate a thunderstorm is looming

14. Multi-modal

- Meant to provide enriched and complex user experiences
  - multiplying how information is experienced and detected using different modalities, i.e. touch, sight, sound, speech
  - support more flexible, efficient, and expressive means of human–computer interaction
  - Most common is speech and vision

Research and design issues

- Need to recognize and analyse speech, gesture, and eye gaze
- What is gained from combining different input and outputs
- Is talking and gesturing, as humans do with other humans, a natural way of interacting with a computer?

15. Shareable

- Shareable interfaces are designed for more than one person to use
  - provide multiple inputs and sometimes allow simultaneous input by co-located groups
  - large wall displays where people use their own pens or gestures
  - interactive tabletops where small groups interact with information using their fingertips
  - e.g. DiamondTouch, Smart Table and Surface

A smartboard

(a)

Figure 6.27 (a) A SmartBoard in use during a meeting and (b) Mitsubishi's interactive tabletop interface, where collocated users can interact simultaneously with digital content using their fingertips

Source: (a) ©2006 SMART Technologies Inc. Used with permission. (b) Image courtesy of Mitsubishi Electric Research Labs.

DiamondTouch Tabletop

(b)

Figure 6.27 (a) A SmartBoard in use during a meeting and (b) Mitsubishi's interactive tabletop interface, where collocated users can interact simultaneously with digital content using their fingertips

Source: (a) ©2006 SMART Technologies Inc. Used with permission. (b) Image courtesy of Mitsubishi Electric Research Labs.

Advantages

- Provide a large interactional space that can support flexible group working
- Can be used by multiple users
  - Can point to and touch information being displayed
  - Simultaneously view the interactions and have same shared point of reference as others
- Can support more equitable participation compared with groups using single PC

Research and design issues

- More fluid and direct styles of interaction involving freehand and pen-based gestures
- Core design concerns include whether size, orientation, and shape of the display have an effect on collaboration
- Horizontal surfaces compared with vertical ones support more turn-taking and collaborative working in co-located groups
- Providing larger-sized tabletops does not improve group working but encourages more division of labor

16. Tangible

- Type of sensor-based interaction, where physical objects, e.g., bricks, are coupled with digital representations
- When a person manipulates the physical object/s it causes a digital effect to occur, e.g. an animation
- Digital effects can take place in a number of media and places or can be embedded in the physical object

Examples

- Chromarium cubes
  - when turned over digital animations of color are mixed on an adjacent wall
  - faciliates creativity and collaborative exploration
- Flow Blocks
  - depict changing numbers and lights embedded in the blocks
  - vary depending on how they are connected together
- Urp
  - physical models of buildings moved around on tabletop
  - used in combination with tokens for wind and shadows -> digital shadows surrounding them to change over time

Benefits

- Can be held in both hands and combined and manipulated in ways not possible using other interfaces
  - allows for more than one person to explore the interface together
  - objects can be placed on top of each other, beside each other, and inside each other
  - encourages different ways of representing and exploring a problem space
- People are able to see and understand situations differently
  - can lead to greater insight, learning, and problem-solving than with other kinds of interfaces
  - can facilitate creativity and reflection

VoxBox

- A tangible system that gathers opinions at events through playful and engaging interaction (Goldsteijn et al, 2015)

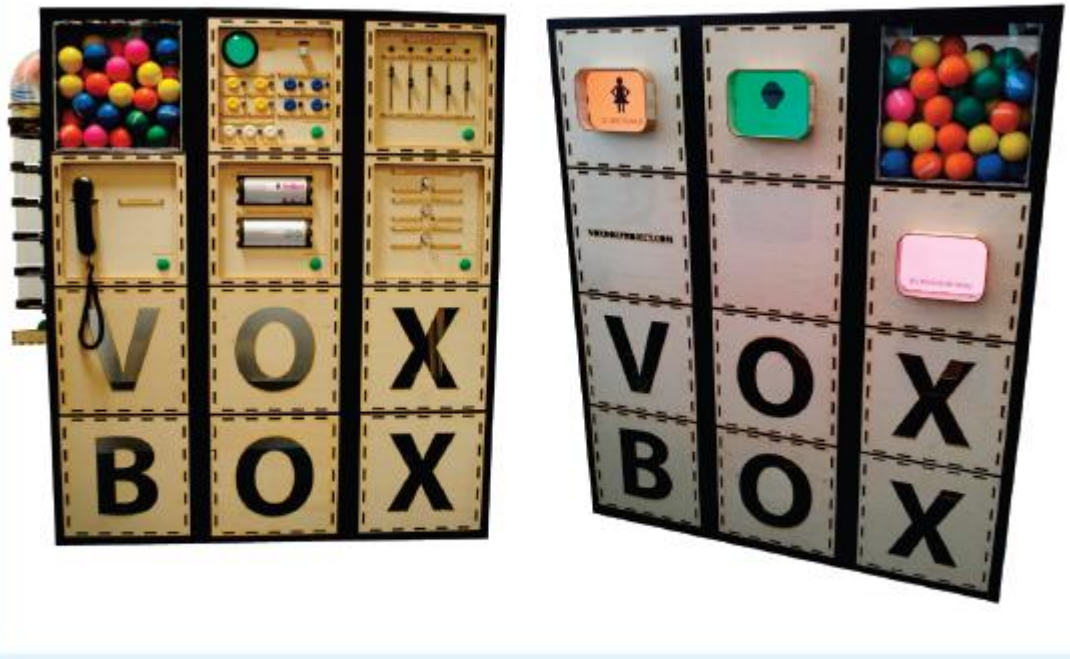


Figure 6.29 VoxBox – Front and back of the tangible machine questionnaire

Source: Golsteijn, C., Gallacher, S., Koeman, L., Wall, L., Andberg, S., Rogers, Y. and Capra, L. (2015) VoxBox: a Tangible Machine that Gathers Opinions from the Public at Events. In *Proc. of TEI' 2015*. ACM.

Research and design issues

- Develop new conceptual frameworks that identify novel and specific features
- The kind of coupling to use between the physical action and digital effect
  - If it is to support learning then an explicit mapping between action and effect is critical
  - If it is for entertainment then can be better to design it to be more implicit and unexpected
- What kind of physical artifact to use
  - Bricks, cubes, and other component sets are most commonly used because of flexibility and simplicity
  - Stickies and cardboard tokens can also be used for placing material onto a surface

17. Augmented and mixed reality

- Augmented reality - virtual representations are superimposed on physical devices and objects
- Mixed reality - views of the real world are combined with views of a virtual environment
- Many applications including medicine, games, flying, and everyday exploring

Examples

- In medicine
  - virtual objects, e.g. X-rays and scans, are overlaid on part of a patient's body
  - aid the physician's understanding of what is being examined or operated
- In air traffic control
  - dynamic information about aircraft overlaid on a video screen showing the real planes, etc. landing, taking off, and taxiing
  - Helps identify planes difficult to make out

An augmented map

Figure 6.30 An augmented map showing the flooded areas at high water level overlaid on the paper map. The handheld device is used to interact with entities referenced on the map

Source: Reproduced with permission.

Top Gear James May in AR

- Appears as a 3D character to act as personal tour guide at Science Museum

Figure 6.31 James May appearing in 3D Augmented Reality

Source: http://www.wired.com/2012/04/top-gear-host-narrates-museum-exhibits-as-augmented-reality-avatar/. Roberto Baldwin/Wired/©Conde Nast

Research and design issues

- What kind of digital augmentation?
  - When and where in physical environment?
  - Needs to stand out but not distract from ongoing task
  - Need to be able to align with real world objects
- What kind of device?
  - Smartphone, head up display or other?

18.Wearables

- First developments were head- and eyewear-mounted cameras that enabled user to record what was seen and to access digital information
- Since, jewellery, head-mounted caps, smart fabrics, glasses, shoes, and jackets have all been used
  - provide the user with a means of interacting with digital information while on the move
- Applications include automatic diaries, tour guides, cycle indicators and fashion clothing

Google Glass: short-lived

Figure 6.32 Google Glass

Source: https://www.google.co.uk/intl/en/glass/start/.
Google and the Google logo are registered trademarks of Google Inc., used with permission.

- What were the pros and cons?

Research and design issues

- Comfort
  - needs to be light, small, not get in the way, fashionable, and preferably hidden in the clothing
- Hygiene
  - is it possible to wash or clean the clothing once worn?
- Ease of wear
  - how easy is it to remove the electronic gadgetry and replace it?
- Usability
  - how does the user control the devices that are embedded in the clothing?

19. Robots and drones

- Four types of robot
  - remote robots used in hazardous settings
  - domestic robots helping around the house
  - pet robots as human companions
  - sociable robots that work collaboratively with humans, and communicate and socialize with them – as if they were our peers

Advantages

- Pet robots are assumed to have therapeutic qualities, helping to reduce stress and loneliness
- Remote robots can be controlled to investigate bombs and other dangerous materials

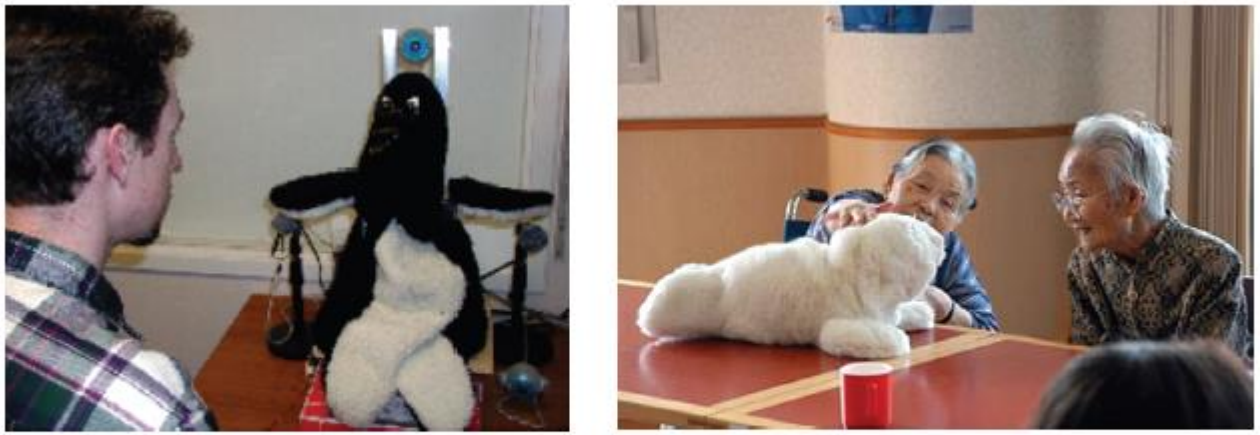


Figure 6.33 Left: Mel, the penguin robot, designed to host activities; right: Japan's Paro, an interactive seal, designed as a companion, primarily for the elderly and sick children

Source: (left) Image courtesy of Mitsubishi Electric Research Labs. (right) Courtesy of Parorobots.com.

Drones

- Unmanned aircraft that are controlled remotely and used in a number of contexts
  - e.g. entertainment, such as carrying drinks and food to people at festivals and parties;
  - agricultural applications, such as flying them over vineyards and fields to collect data that is useful to farmers
  - helping to track poachers in wildlife parks in Africa
- Can fly low and and stream photos to a ground station, where images can be stitched together into maps
- Can be used to determine the health of a crop or when it is the best time to harvest the crop

Drone in vineyard

Figure 6.34 A drone being used to survey the state of a vineyard

Source: Courtesy of Discover Sonoma County Wine
http://www.latimes.com/business/la-fi-drones-agriculture-20140913-story.html#page=1.

Research and design issues

- How do humans react to physical robots designed to exhibit behaviors (e.g. making facial expressions) compared with virtual ones?
- Should robots be designed to be human-like or look like and behave like robots that serve a clearly defined purpose?
- Should the interaction be designed to enable people to interact with the robot as if it was another human being or more human-computer-like (e.g. pressing buttons to issue commands)?
- Is it acceptable to use unmanned drones to take a series of images or videos of fields, towns, and private property without permission or people knowing what is happening?

20. Brain-computer interfaces

- Brain–computer interfaces (BCI) provide a communication pathway between a person's brain waves and an external device, such as a cursor on a screen
- Person is trained to concentrate on the task, e.g. moving the cursor
- BCIs work through detecting changes in the neural functioning in the brain
- BCIs apps:
  - Games
  - enable people who are paralysed to control robots

Brainball game

Figure 6.35 The Brainball game using a brain–computer interface

Source: "Brainball" from The Interactive Institute. Reproduced with permission.

Which interface?

- Is multimedia better than tangible interfaces for learning?
- Is speech as effective as a command-based interface?
- Is a multimodal interface more effective than a monomodal interface?
- Will wearable interfaces be better than mobile interfaces for helping people find information in foreign cities?
- Are virtual environments the ultimate interface for playing games?
- Will shareable interfaces be better at supporting communication and collaboration compared with using networked desktop PCs?

Which interface?

- Will depend on task, users, context, cost, robustness, etc.
- Mobile platforms taking over from PCs
- Speech interfaces also being used much more for a variety of commercial services
- Appliance and vehicle interfaces becoming more important
- Shareable and tangible interfaces entering our homes, schools, public places, and workplaces

Summary

- Many innovative interfaces have emerged post the WIMP/GUI era, including speech, wearable, mobile, brain and tangible
- Raises many design and research questions to decide which to use
  - e.g. how best to represent information to the user so they can carry out ongoing activity or task
- New interfaces that are context-aware or monitor raise ethical issues concerned with what data is being collected and what it is used for