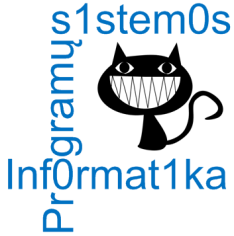


Interfaces, part 2

Lecture 7

Dr. Kristina Lapin

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

Interface type	See also
1. Command-based	
2. WIMP and GUI	
3. Multimedia	WIMP and web
4. Virtual reality	Augmented and mixed reality
5. Information visualization	Multimedia
6. Web	Mobile and multimedia
7. Consumer electronics and appliances	Mobile
8. Mobile	Augmented and mixed reality
9. Speech	
10. Pen	Shareable, touch
11. Touch	Shareable, air-based gesture
12. Air-based gesture	Tangible
13. Haptic	Multimodal
14. Multimodal	Speech, pen, touch, gesture, and haptic
15. Shareable	Touch
16. Tangible	
17. Augmented and mixed reality	Virtual reality
18. Wearable	
19. Robotic	
20. Brain–computer	

Table 6.1 The types of interfaces covered in this chapter

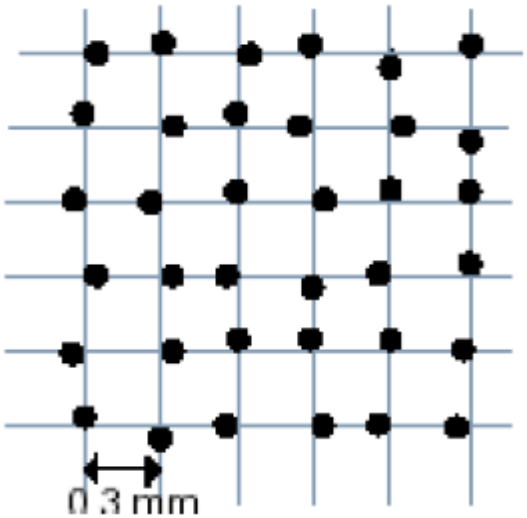
10. Digital pen

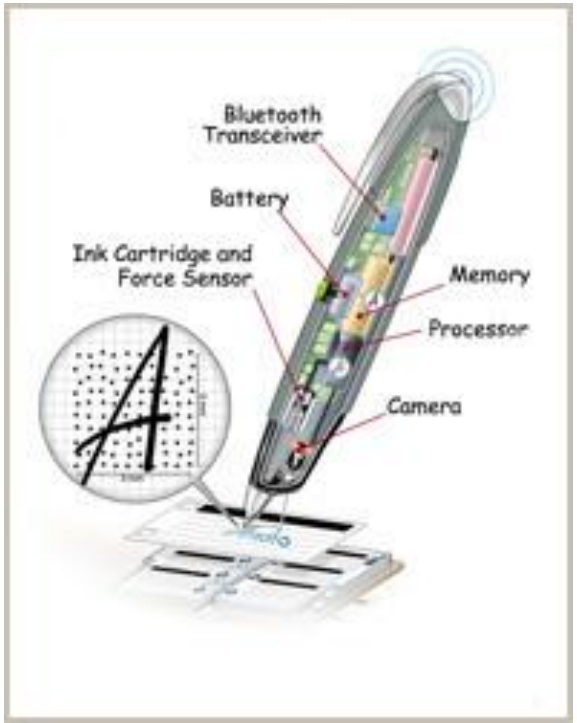
- Enable people to write, draw, select, and move objects at an interface using lightens or styluses
  - capitalize on the well-honed drawing skills developed from childhood
- Digital pens, e.g. Anoto, use a combination of ordinary ink pen with digital camera that digitally records everything written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

IRISnotes digital pen and a mobile note taker

Anoto digital pen

- Pen with integrated digital camera
- Paper with non-repeating patterns
- The pen decodes the dot pattern as pen moves across paper and stores the data temporarily in pen.





Livescribe Pulse Smartpen

- A little thicker than most pens, but comfortable.
- You can record and sound - the quality is good.
- Playful configuration process.
- Very easy to fill out forms
  - There is no need to rewritei
- Security?

A comparison

Pen with mobile note taker	**Anoto digital pen**
Need to carry an additional device.	No need to carry an additional device.
You can write on any paper.	You can write on special paper.
No need to print paper.	Paper printing takes a long time.

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

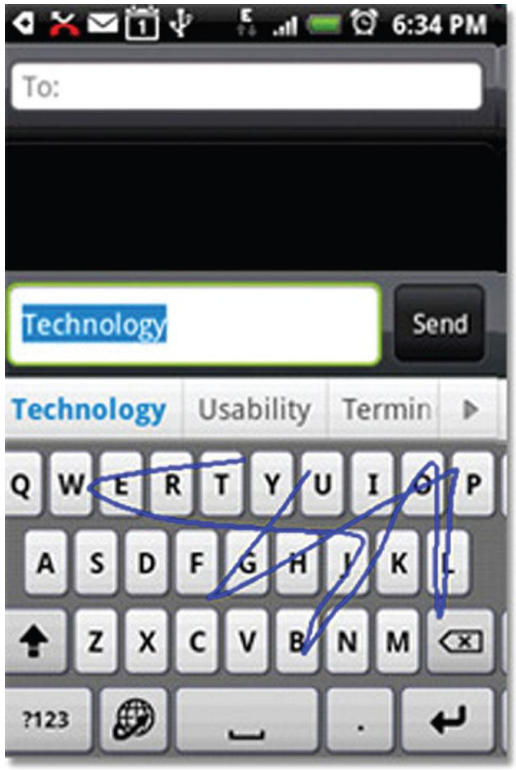
- Touch screens, such as walk-up kiosks, detect the presence and location of a person's touch on the display
- Multi-touch support a range of more dynamic finger tip actions, e.g. swiping, flicking, pinching, pushing and tapping
- Now used for many kinds of displays, such as Smartphones, iPods, tablets 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, stroking and touching a screen result in new ways of consuming, reading, creating and searching digital content?

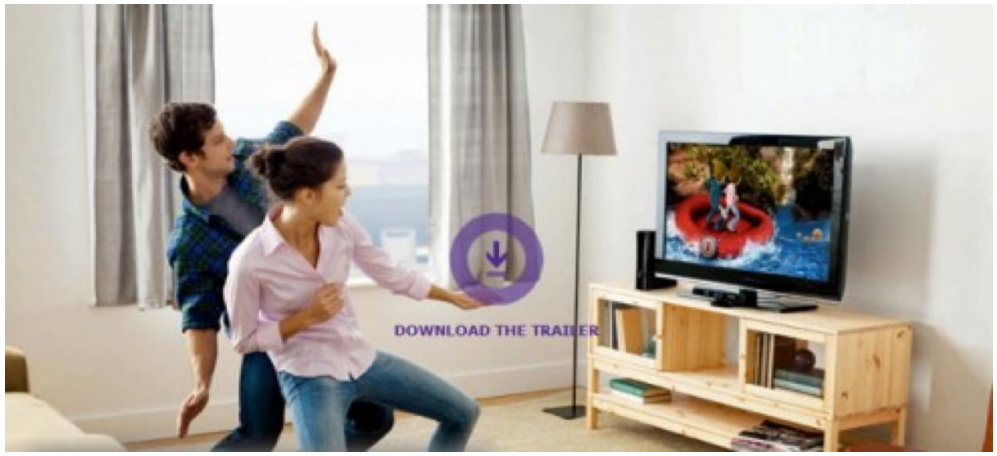


12. Air-based gestures

- Uses camera recognition, sensor and computer vision techniques
  - can recognize people's body, arm and hand gestures in a room
  - systems include Kinect and EyeToy
- 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



Research and design issues

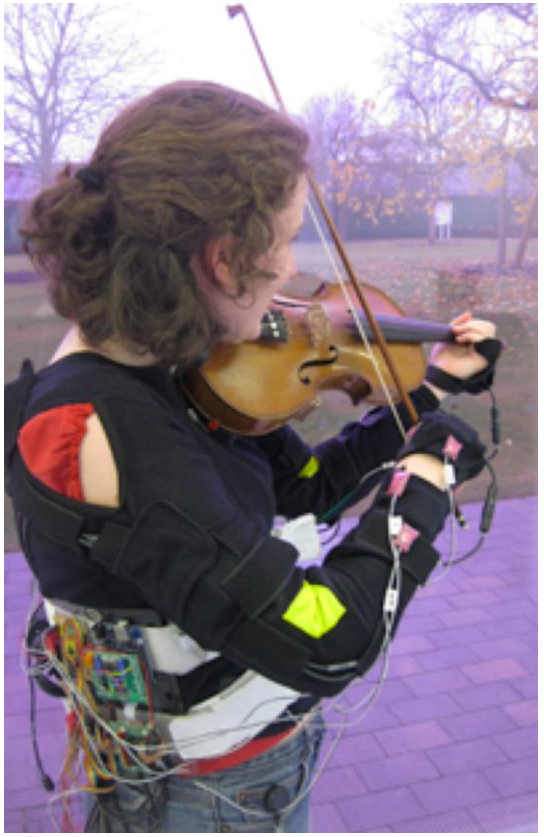
- How does computer recognize and delineate players' gestures?
  - Deictic and hand waving
- Does holding a control device feel more intuitive than controller free gestures?
  - For gaming, exercising, dancing

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 cell phone
- 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



Telefonai specialių poreikių naudotojams

ALVA MPO telefonas
- 8 įvesties mugtukai
- sintetinės kalbos išvestis
- 20 langelių antnaujinamas Brailio įšvesties ekranas
- 2 mygtukai garsui valdyti

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?

14. Multi-modal

- Meant to provide enriched and complex user experiences
  - multiplying how information is experienced 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

DiamondTouch Tabletop

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

The Drift Table

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

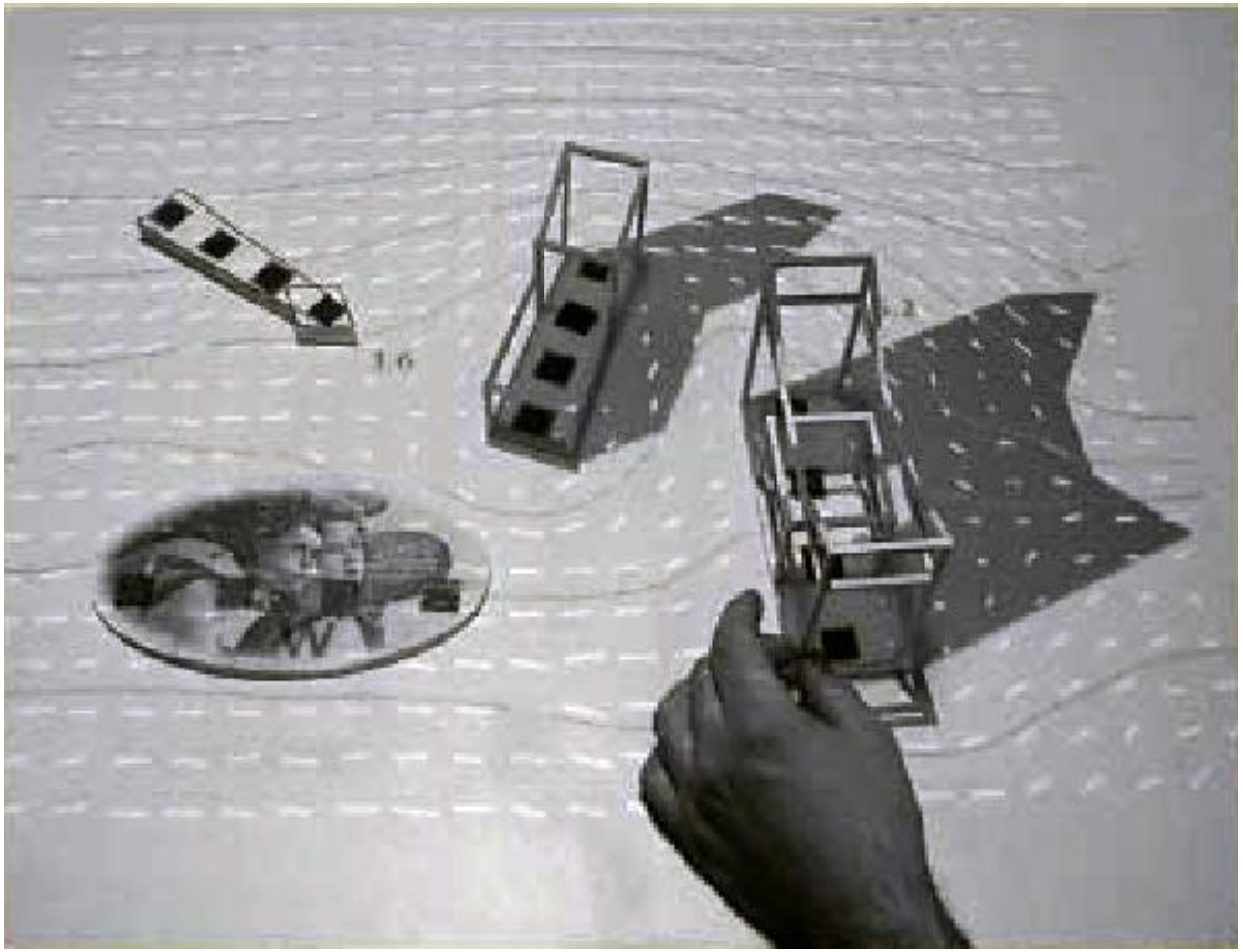
- Type of sensor-based interaction, where physical objects, e.g., bricks, are coupled with digital representations
- When a person manipulates the physical object/s it causes a digital effect to occur, e.g. an animation
- Digital effects can take place in a number of media and places or can be embedded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

Flow blocks

Urp



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

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 artefact 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

‘Smart’ augmented reality?

- Smartphone apps intended to guide people walking in a city
  - arrows and local information (e.g. nearest McDonalds) are overlaid on a picture of the street the person is walking in
  - Will this mean people spending most of their time glued to their smartphone rather than looking at the sites?

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

Steve Mann - pioneer of wearables

Steve Mann's "wearable computer" and "reality mediator" inventions of the 1970s have evolved into what looks like ordinary eyeglasses.

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

- Four types
  - 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, being able to reduce stress and loneliness
- Remote robots can be controlled to investigate bombs and other dangerous materials

Research and design issues

- How do humans react to physical robots designed to exhibit behaviours (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)?

20. Brain-computer

- 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

Brainball game

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
- Many design and research questions need to be considered to decide which to use
- An important concern that underlies the design of any kind of interface is how information is represented to the user so they can carry out ongoing activity or task