

Chapter 6

Interfaces

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Overview

- Interface types
 - Main design and research issues
- 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

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Interfaces

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1. Command-based

- What is it?
 - Commands typed in at the prompt
 - Or key combo pressed
 - Or key pressed
 - System responds
- Ex:
 - MS-DOS
 - PowerShell
- Popular for
 - Web scripting
 - CS in general

```
Windows PowerShell
Copyright (C) 2009 Microsoft Corporation. All rights reserved.

PS C:\Users\Anna> dir

Directory: C:\Users\Anna

Mode                LastWriteTime         Length Name
----                -
d-----         10/24/2012    7:52 PM             .eclipse
d-----         1/15/2013    3:10 PM             .gimp-2.8
d-----         8/26/2012   11:36 PM             .thumbnails
d-r-----         8/10/2012    1:55 PM             Contacts
d-r-----         1/21/2013    4:58 PM             Desktop
d-r-----         1/20/2013   12:45 PM             Documents
```

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Pros and Cons

- The Good
 - Efficient
 - Low-level control
- The Bad
 - Low visibility
 - Large overhead to learning set of commands

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Research and design issues

- Form of commands
 - Full name, abbrev., etc.
- Syntax
 - How combine commands
- Structure
 - How organize options
- Key principle
 - Consistency

2. WIMP and GUI

- WIMP
 - Stands for
 - Windows
 - Icons
 - Menus
 - Pointing device
 - Boxy
 - Limited by standard widgets

2. WIMP and GUI

- GUI
 - Stands for
 - Graphical
 - User
 - Interface
 - More modern term
 - Non-standard widgets
 - New elements
 - Toolbars
 - Docks
 - Rollovers
- Popular for
 - Personal computers

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Pros and Cons

- The Good
 - Can convey information in more ways
 - Can have affordances
 - Better visibility
 - Better feedback
- The Bad
 - Less efficient
 - Fix: Add shortcuts
- Skipping over design issues for now

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3. Multimedia

- Combine media within single interface
 - Various forms of interactivity
 - Graphics, text, video, sound, and animations
 - Differs from GUI because includes web
- Ex: BioBlast
- Popular for
 - Education/Training
 - General Browsing



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Pros and cons

- The Good
 - Rapid access to multiple representations of info
 - Whole can be better than the parts
 - Can enable
 - Easier learning/understanding
 - More engagement/pleasure
 - Encourage exploration
 - Tendency to explore multiple elements at once
- The Bad
 - Promotes fragmented interactions
 - Fix: Require text to be read before continuing

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Research and design issues

- How to help explore, keep track of, and integrate the multiple representations
 - Require hands-on interactivities and simulations
 - 'dynalinking,' – change in window affects other(s)
 - Scaife and Rogers, 1996
- How best to combine for given task
 - Audio to stimulate imagination
 - Movies for action info
 - Text for details
 - Diagrams for ideas

Aside

- NUI = Natural User Interface
- Based on natural interactions

4. Virtual reality

- Immersive virtual simulation
 - Feeling of being there
- Can interact and navigate in 3D
- Highly engaging user experiences
- Different viewpoints: 1st and 3rd person
- Ex: Second Life
- Popular for
 - Learning
 - Training
 - Overcoming phobias



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Virtual Gorilla Project



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Pros and cons

- The Good
 - Lack of danger/cost
 - Feels more realistic
 - Sense of 'presence' – act as if real
- The Bad
 - Head-mounted displays
 - Uncomfortable to wear
 - Cause motion sickness and disorientation
 - Fix: Use desktop display
 - Less real

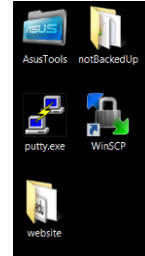
Research and design issues

- Prevent nausea
- How best to navigate
- How to control
- How best to interact with information
- How best to collaboration/communicate
- Level of realism

Abstraction vs Realism

• Abstraction

- Simplification
- More efficient
 - More popular with experienced users



• Realism

- Feel more comfortable on first encounter
- Very detailed
 - Can overwhelm
- Games
 - Sometimes good for novice and expert
 - Sometimes better only for expert



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<http://x7.fi/2010/01/18/lost-tech-put-on-your-magic-cap/>

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Abstraction vs Realism

• Ex:

- Drag and drop vs. ctrl+x and ctrl+v
- Large icons vs text
- Games:



<http://susanpolgar.blogspot.com/2012/04/chess-grand-final-starts-tanauan-city.html>



<http://newbreview.com/review-starcraft-ii/>

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Types of Software

5. Information visualization

- Interactive graphics of complex data
- Help users see
 - Patterns
 - Trends
 - Anomalies
 - (Card *et al*, 1999)
- Enhance
 - Discovery
 - Decision-making
 - Explanation of phenomena

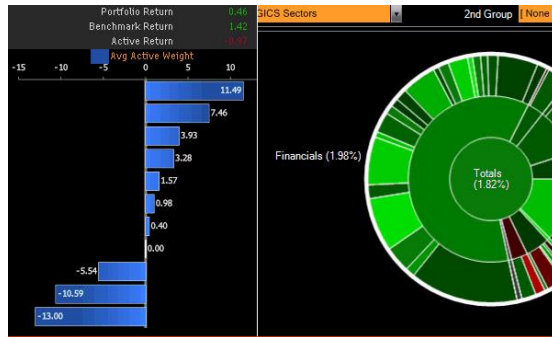
5. Information visualization

- Popular for 'big data'

- Maps
- Finance

- Ex:

- Google Maps
- Bloomberg



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http://origin-www.bloomberg.com/professional/portfolio_risk_management/

Research and design issues

- Use animation and/or interactivity?
- Type of grouping
- 2D or 3D representation
- Forms of navigation
- How much additional info to provide
- Simplicity

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6. Web

- Set of interlinked docs
- Vs. GUI, web has more emphasis on
 - Content
 - Use of links for navigation
- Popular for
 - Information exchange
 - Advertising
 - Storage
 - Social networking
 - Etc.
- CSC 170

6. Web

- Before 90s
 - Text based
 - Focus on
 - Ease and efficiency of navigation
 - Simplicity
 - Feedback
 - Legibility
 - Usability
 - Download speed a major factor

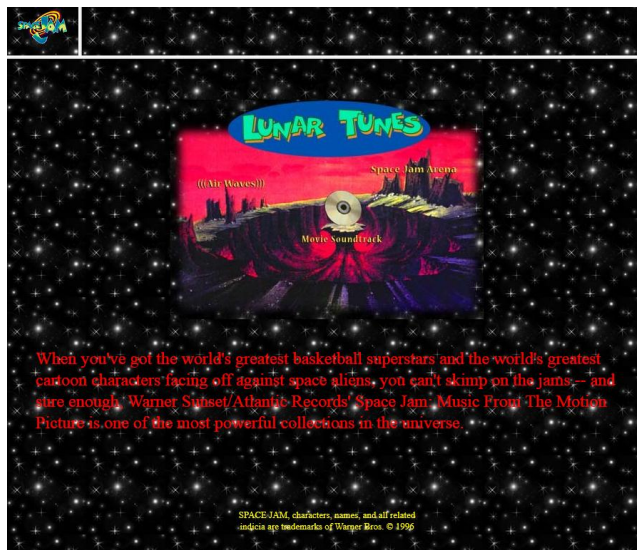
6. Web

- 90s
 - Images
 - Graphic design
 - Distinctive, striking, pleasurable
 - Focus on
 - Aesthetic appeal
 - Usability
 - Ease of maintenance

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<http://www2.warnerbros.com/spacejam/movie/cmp/tunes/tunesframes.html>

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6. Web



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<http://www2.warnerbros.com/spacejam/movie/cmp/tunes/tunesframes.html>

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Usability versus attractive?

- Ease of discovery vs. aesthetics/pleasure
- Web designers are:
 - “thinking great literature”
- Users read the web like a:
 - “billboard going by at 60 miles an hour” (Krug, 2000)

6. Web

- 00s and beyond
 - Video
 - User-centered editing tools
 - Programming languages
 - Wikis, forums, blogs, etc.
 - PC -> Web
 - Email
 - Photo sharing
 - Smart phones
 - Listlink instead of hyperlink



Research and design issues

- **Issues similar to GUIs**
 - How best to design, present, and structure information
 - System behavior
- **Broad audience**
- **Key principles**
 - Visibility
 - Utilize conventions
 - Simplicity

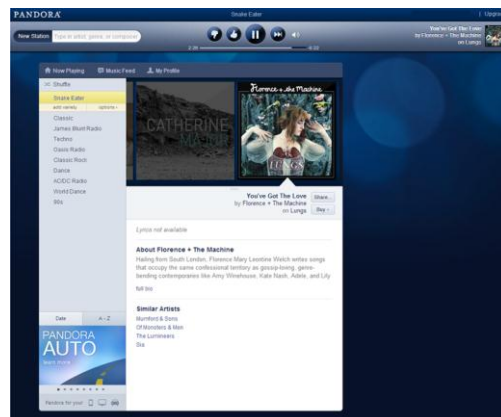
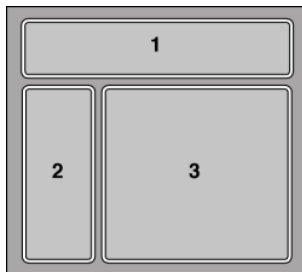
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Research and design issues

- **Veen's design principles**
 1. Where am I?
 2. Where can I go?
 3. What's here?



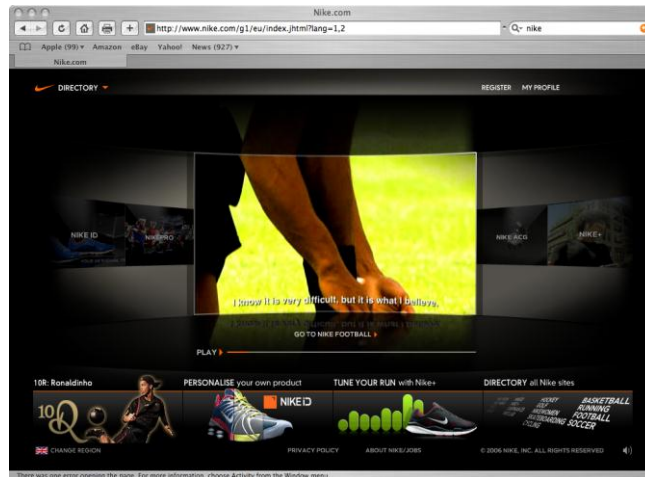
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www.pandora.com

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Research and design issues

- Sometimes want user to get lost
 - Ex:



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Types of Hardware

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7. Consumer electronics and appliances

- Everyday device in home, public place, or car
- And personal devices
- Used for short periods
- Minimal, if any, learning
- Popular for
 - Small, everyday tasks



www.id-book.com, www.support.apple.com,

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<http://www.zdnet.com/blog/digitalcameras/digital-photo-frames-are-more-popular-than-you-think/212>

Research and design issues

- Transient with short interactions
- Soft vs. hard controls
- Key principles
 - Visibility
 - Simplicity

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8. Mobile

- Handheld device
- Used on the move
- Pervasive
 - Used in everyday and working life
- Ex:
 - Order at restaurant
 - Multi-player gaming
 - QR Codes
- Popular for
 - Light everyday tasks
 - Entertainment



Improvements

- Novel interactions
- Vertical and horizontal scrolling
- Simpler browsers
- Lots of guidelines available

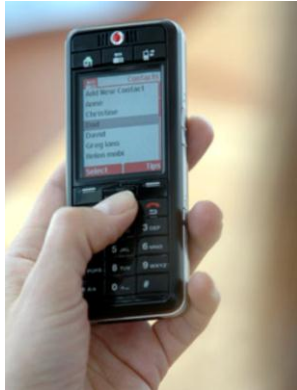
Pros and Cons

- The Good
 - Do things anywhere
 - Entertain when boredom strikes
- The Bad
 - Small screen
 - Small number of physical controls
 - Text entry is slow

Research and design issues

- Have to take The Bad into account
- Physical controls
 - Type
 - Where
 - How maps to software
- Usability and preference varies
 - Depends on dexterity and commitment
- Privacy

Phone diversity



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Input Methods

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9. Speech

- Person converses with system
- Ex: Apple's Siri
- Popular for
 - Basic inquiry
 - Call routing
 - The blind and visually impaired
- The Good
 - Not limited by input device
- The Bad
 - Limited by tech (Natural Language Processing)



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<https://www.apple.com/ios/siri/siri-faq/>

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Research and design issues

- Efficient navigation
 - Easy recovery
- Disambiguate human requests
- Choice of voice
 - Male / Female
 - Dialect
 - Accent

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10. Pen

- Digital writing instrument
 - Lightpen
 - Stylus
- Ex: Anoto
- Popular for
 - Taking notes
 - Annotation



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<http://digitalpennews.typepad.com/blog/anoto/>

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Pros and cons

- The Good
 - Users already skilled
 - Intuitive, direct interaction
- The Bad
 - Small display
 - Hand occludes
 - Large display
 - Awkward to reach certain elements
 - Have to move far
 - Fix: Context-aware menus
 - Can have lag and feel clunky

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Research and design issues

- Ergonomics
- Context control
- Underlying technology
 - Sensitivity
 - Proximity
 - Multi-pen

11. Touch

- Interact via finger
 - Swipe , flick, pinch drag, tap, etc.
- Ex:
 - Android
 - Flight check-in
- Popular for
 - Phones
 - Tablets
 - Kiosks

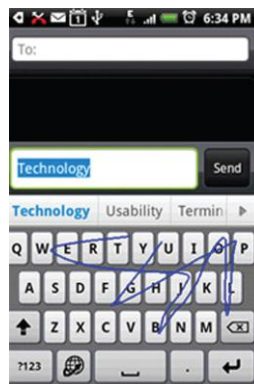


Pros and Cons

- The Good
 - Fluid, direct style of interaction
- The Bad
 - Finger gets in the way of screen
 - Need bigger buttons, so less space
 - Slow, error-prone typing

Research and design issues

- Is it better than mouse and keyboard?
- Multi-user screens



12. Air-based gestures

- Physical gestures
- Ex: Kinect
- Popular for
 - Games
 - Home automation
 - Sign language recognition



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<http://bpa.atech.edu/team3/Xbox%20Kinect.html>

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Pros and Cons

- The Good
 - Intuitive, direct input
- The Bad
 - People with disabilities
 - Accuracy
 - No physical feedback
 - Slow navigation

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Research and design issues

- Which gestures to use
- When does gesture start/end?
- How to differentiate gestures
- Are gestures aimed at the system?
- Would physical controller be better?

20. Brain-computer interface

- BCI
- Brain waves -> cursor
- User trained to concentrate on the task
- Ex: Mindwave



Pros and Cons

- The Good
 - System knows exactly what user wants
- The Bad
 - Feedback
 - Fix: External source of feedback
 - Neuroscience challenge
 - Technological challenge

Feedback

13. Haptic / Tactile

- Physical feedback

- Force
- Vibration
- Current



- Ex:

- Cell phone vibration while typing
- Video game controllers

- Popular for

- Simulation
- Instruction



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<http://www.videograndpa.com/?tag=ps3>

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Research and design issues

- Where to put actuators
- Single or sequence of 'touches'
- When to buzz
- Feedback intensity
- How feels in different contexts

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Hybrids

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14. Multi-modal

- Combo of inputs and outputs
 - touch, sight, sound, speech
- Ex: Wii
- Popular for
 - Mobile
 - Air based gestures
 - Most common is speech and vision



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<http://www.telegraph.co.uk/news/uknews/1563076/Elderly-addicted-to-Nintendo-Wii-at-care-home.html>

Pros and Cons

- The Good
 - Flexible
 - Efficient
 - Expressive
- The Bad
 - More complex
 - Harder to calibrate

15. Shareable

- For more than one person at a time
 - Multiple inputs
 - Sometimes simultaneous input
- Ex:
 - DiamondTouch
 - SmartBoards



Pros

- Large interactional space
- Can point to and touch info
- Simultaneously view interactions
- Shared point of reference
- More equitable participation

Research and design issues

- Fluid, direct methods of interaction
- Better than traditional?
- Personal space
- Affects on collaboration
 - Size
 - Orientation
 - Shape

16. Tangible

- Sensor-based
- Physical objects with digital representations
- Change to physical object has digital effect
- Ex:
 - Flow blocks
 - Urp
- Popular for
 - Learning
 - Play
 - Collaboration



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Pros and Cons

- The Good
 - Multi-user
 - Diverse object interactions
 - Facilitates creativity
- The Bad
 - Downsides to physical component
 - User may lose
 - Takes up space
 - Technological challenge

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Research and design issues

- Coupling between physical and digital
 - For learning, explicit mapping
 - For play, implicit and unexpected mapping
- Which physical artifact to use
 - Bricks, cubes
 - Sticky notes, tokens
- Key principle
 - Physical affordance

17. Augmented and mixed reality

- Augmented reality - virtual added to physical
- Mixed reality – virtual/physical hybrid
- Ex:
 - Map
 - Yelp
- Popular for
 - Medicine (original focus)
 - Air traffic control
 - Games
 - Head-up Display (HUD)



Pros and Cons

- The Good
 - Can work on top of existing objects
- The Bad
 - Technological limitations

Research and design issues

- Form
 - For learning, explicit mapping
 - For play, implicit and unexpected mapping
- When and where
 - Visible but not distracting
- Kind of device

18. Wearables

- **First:**
 - Head/eyewear-mounted cameras with info lookup
- **Ex:**
 - Ski jacket with integrated MP3 player controls
 - CuteCircuit
- **Popular for**
 - Fashion
 - Info on the go



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<http://www.cutecircuit.com/>

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Steve Mann

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



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Research and design issues

- Comfort
- Hygiene
- Ease of wear
- How control
- Privacy

19. Robots

- Four types
 - Remote robots
 - Domestic robots
 - Pet robots
 - Sociable robots
- Ex
 - Roomba
 - Paro



Pros and Cons

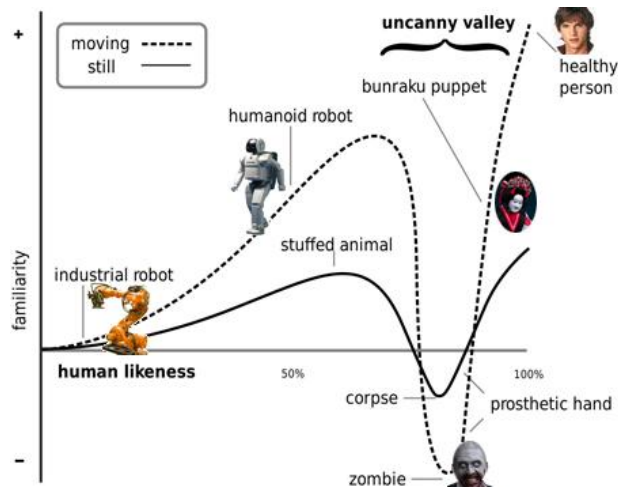
- The Good
 - Reduce stress and loneliness
 - Investigate / Explore dangerous settings
- The Bad
 - Hard to make human-like
 - Uncanny valley

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Pros and Cons



<http://spectrum.ieee.org/automaton/robotics/humanoids/040210-who-is-afraid-of-the-uncanny-valley>,

<http://io9.com/5974136/new-video-of-machine-perception-labs-creepy-robot-baby-shows-that-it-is-indeed-creepy>

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Research and design issues

- Reaction to physical robots vs. virtual ones
- Resemble human?
 - Pet interaction more believable
- Human-Human or Human-Computer

Which interface?

- Currently being researched
- Many times depends on requirements
- Reliability
- Social acceptability
- Privacy
- Ethics
- Location