Vorlesung
Mensch-Maschine-Interaktion

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Chapter 5
Designing Interactive Systems

- 5.1 Design vs. Requirements
- 5.2 Design and development process
- 5.3 Creativity methods
- 5.4 Tools and methods in the early design phase
  - 5.4.1 Scenario Development and Persona
  - 5.4.2 Sketches and Storyboards
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- 5.6 Wizard of Oz
- **5.7 Approaches to making systems interactive**
- 5.8 Describing and specifying interactive systems

How to design an interactive system?

- Activity based
  - Giving instructions
    - issuing commands using keyboard and function keys and selecting options via menus
  - Conversing
    - interacting with the system as if having a conversation
  - Manipulating and navigating
    - acting on objects and interacting with virtual objects
  - Exploring and browsing
    - finding out and learning things
- Based on (physical) objects or artefacts, e.g.
  - Office equipment
  - Tool
  - Book

Giving instructions

- Where users instruct the system and tell it what to do
  - e.g. tell the time, print a file, save a file
- Very common conceptual model, underlying a diversity of devices and systems
  - e.g. Unix shells, CAD, word processors, DVD player, vending machines
- Main benefit is that instructing supports quick and efficient interaction
  - good for repetitive kinds of actions performed on multiple objects

Conversing

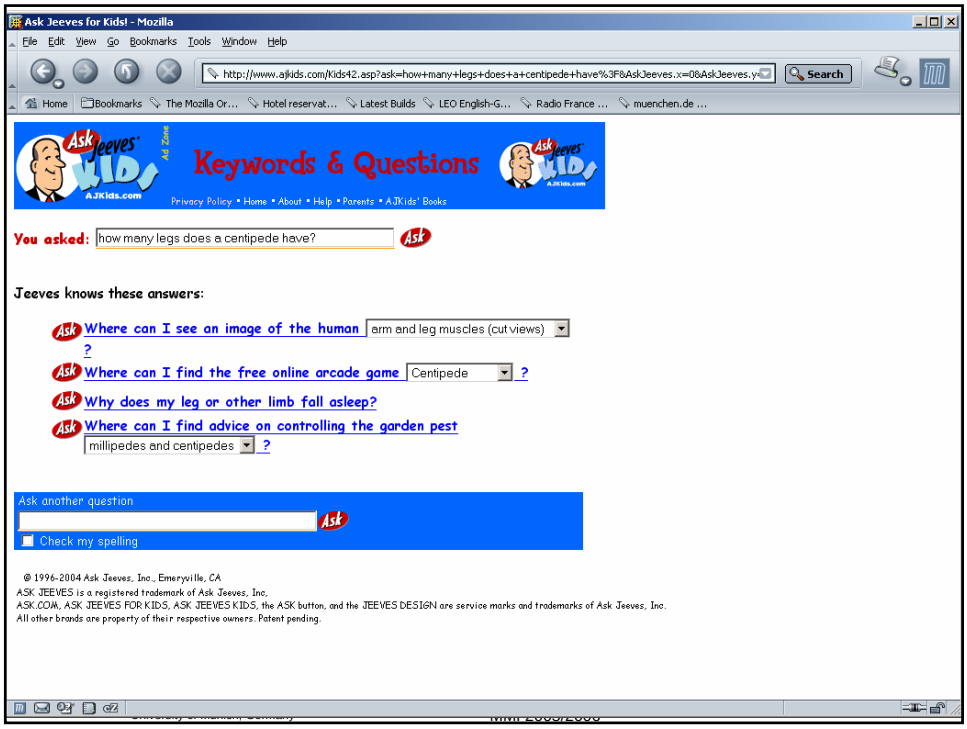
- Underlying model of having a conversation with another human
- Range from simple voice recognition menu-driven systems to more complex 'natural language' dialogues
- Examples include timetables, search engines, advice-giving systems, help systems
- Recently, much interest in having virtual agents at the interface, who converse with you, e.g. Microsoft's Agents (e.g. Clippy)

Pros and cons of conversational model

- Allows users, especially novices and technophobes, to interact with the system in a way that is familiar
  - makes them feel comfortable, at ease and less scared
- Misunderstandings can arise when the system does not know how to parse what the user says
  - e.g. child types into a search engine, that uses natural language (http://www.ajkids.com/, http://www.ask.com/) the question:

"How many legs does a centipede have?"

and the system responds:


Ask Jeeves for Kids! - Mozilla
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Ask Jeeves KIDS
AJKids.com
Keywords & Questions
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You asked: how many legs does a centipede have?
Jeeves knows these answers:
Where can I see an image of the human
arm and leg muscles (cut views)
?
Where can I find the free online arcade game
Centipede
?
Why does my leg or other limb fall asleep?
Where can I find advice on controlling the garden pest
millipedes and centipedes
?
Ask another question
Check my spelling
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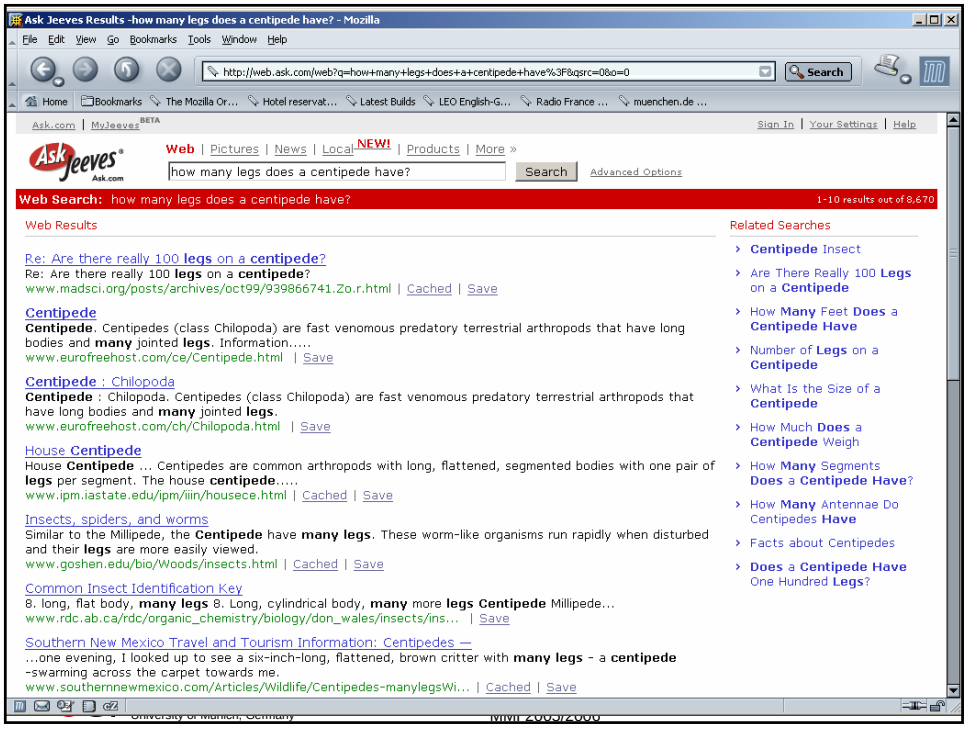
Ask Jeeves Results -how many legs does a centipede have? - Mozilla
File Edit View Go Bookmarks Tools Window Help
http://web.ask.com/web?q=how+many+legs+does+a+centipede+have%3F&qsrc=0&o=0
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Sign In | Your Settings | Help
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how many legs does a centipede have?
Search
Advanced Options
Web Search: how many legs does a centipede have?
1-10 results out of 8,670
Web Results
Re: Are there really 100 legs on a centipede?
Re: Are there really 100 legs on a centipede?
www.madsci.org/posts/archives/oct99/939866741.Zo.r.html | Cached | Save
Centipede
Centipede. Centipedes (class Chilopoda) are fast venomous predatory terrestrial arthropods that have long bodies and many jointed legs. Information.....
www.eurofreehost.com/ce/Centipede.html | Save
Centipede : Chilopoda
Centipede : Chilopoda. Centipedes (class Chilopoda) are fast venomous predatory terrestrial arthropods that have long bodies and many jointed legs.
www.eurofreehost.com/ch/Chilopoda.html | Save
House Centipede
House Centipede ... Centipedes are common arthropods with long, flattened, segmented bodies with one pair of legs per segment. The house centipede.....
www.ipm.iastate.edu/ipm/iiin/housece.html | Cached | Save
Insects, spiders, and worms
Similar to the Millipede, the Centipede have many legs. These worm-like organisms run rapidly when disturbed and their legs are more easily viewed.
www.goshen.edu/bio/Woods/insects.html | Cached | Save
Common Insect Identification Key
8. long, flat body, many legs 8. Long, cylindrical body, many more legs Centipede Millipede...
www.rdc.ab.ca/rdc/organic_chemistry/biology/don_wales/insects/ins... | Save
Southern New Mexico Travel and Tourism Information: Centipedes —
...one evening, I looked up to see a six-inch-long, flattened, brown critter with many legs - a centipede -swarming across the carpet towards me.
www.southernnewmexico.com/Articles/Wildlife/Centipedes-manylegsWi... | Cached | Save
Related Searches
Centipede Insect
Are There Really 100 Legs on a Centipede
How Many Feet Does a Centipede Have
Number of Legs on a Centipede
What Is the Size of a Centipede
How Much Does a Centipede Weigh
How Many Segments Does a Centipede Have?
How Many Antennae Do Centipedes Have
Facts about Centipedes
Does a Centipede Have One Hundred Legs?

Manipulating and Navigating

- Involves dragging, selecting, opening, closing and zooming actions on virtual objects
- Exploits users' knowledge of how they move and manipulate in the physical world
- Examples
  - what you see is what you get (WYSIWYG)
  - the direct manipulation approach (DM)
- Shneiderman (1983) coined the term DM, came from his fascination with computer games at the time
- Common model in the desktop world

Core principles of DM

- Continuous representation of objects and actions of interest
- Physical actions and button pressing instead of issuing commands with complex syntax
- Rapid reversible actions with immediate feedback on object of interest

Why are DM interfaces so enjoyable?

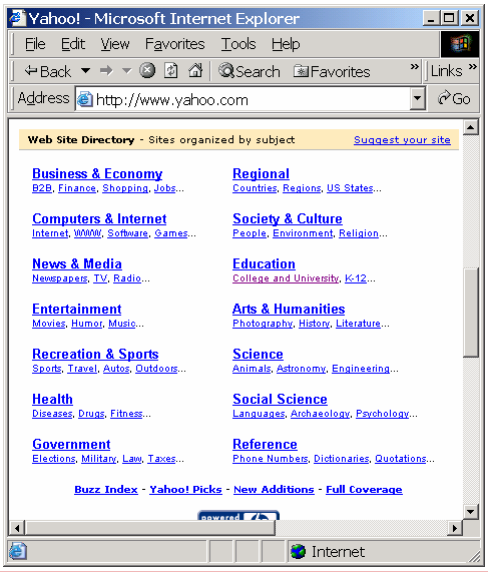
- Novices can learn the basic functionality quickly
- Experienced users can work extremely rapidly to carry out a wide range of tasks, even defining new functions
- Intermittent users can retain operational concepts over time
- Error messages rarely needed
- Users can immediately see if their actions are furthering their goals and if not do something else
- Users experience less anxiety
- Users gain confidence and mastery and feel in control

What are the disadvantages with DM?

- Some people take the metaphor of direct manipulation too literally
- Not all tasks can be described by objects and not all actions can be done directly
- Some tasks are better achieved through delegating
  - e.g. spell checking
- Can waste extensive screen space
- Moving a mouse around the screen can be slower than pressing function keys to do same actions

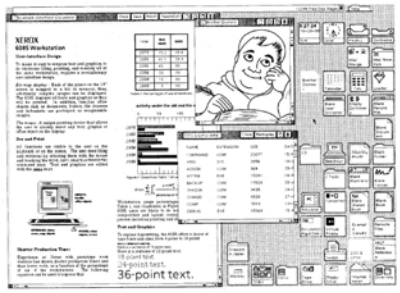
Exploring and browsing

- Similar to how people browse information with existing media (e.g. newspapers, magazines, libraries)
- Information is structured to allow flexibility in the way user is able to search for information
  - e.g. multimedia, web

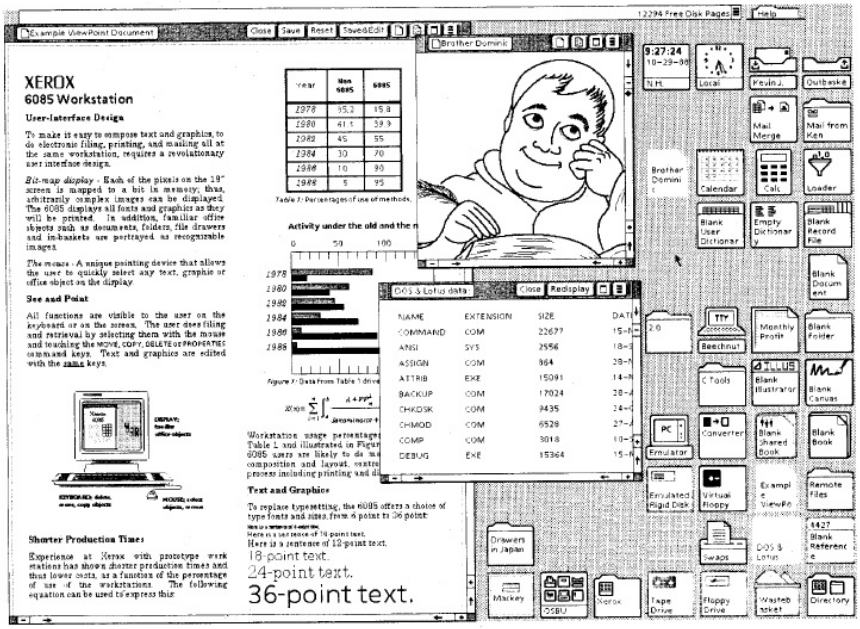


Conceptual models based on objects

- Usually based on an analogy with something in the physical world
- Examples include books, tools, vehicles
- Classic: Star Interface based on office objects



Johnson et al (1989)



Johnson et al (1989)

Which conceptual model is best?

- Direct manipulation is good for ‘doing’ types of tasks, e.g. designing, drawing, flying, driving, sizing windows
- Issuing instructions is good for repetitive tasks, e.g. spell-checking, file management
- Having a conversation is good for children, computer-phobic, disabled users and specialised applications (e.g. phone services)
- Exploring and browsing is good if the task is explorative

- Hybrid conceptual models are often employed, where **different ways of carrying out the same actions are supported at the interface**
  - Toolbar, Menus and Keyboard short cut offer same function
  - Can replace *Expert-Mode* and *Novice-Mode* in the UI

Interface Metaphors

- Interface designed to be similar to a physical entity but also has own properties
  - e.g. desktop metaphor, web portals
- Can be based on activity, object or a combination of both
- Exploit user's familiar knowledge, helping them to understand 'the unfamiliar'

- Benefits
  - Makes learning new systems easier
  - Helps users understand the underlying conceptual model
  - Can be very innovative and enable the applications to be made more accessible to a greater diversity of users

Problems with Interface Metaphors

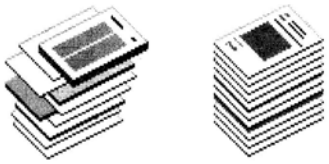
- Sometimes break conventional and cultural rules
  - e.g. recycle bin placed on desktop
- Can constrain designers in the way they conceptualize a problem space
- Can conflict with design principles
- Forces users to only understand the system in terms of the metaphor
- Designers can inadvertently use bad existing designs and transfer the bad parts over
- Limits designers' imagination in coming up with new conceptual models

Data Mountain

(Robertson, UIST'98, Microsoft)

„Pile" metaphor

(Mander et al., CHI'92, Apple)



(a) (b)

Figure 1. Piles on the desktop. In general, piles can contain various media, such as folders and individual documents. The pile in (a) was created by the user, and is consequently disheveled in appearance. In addition, the system can create piles for the user, based on rules explicitly stated by the user or developed through user-system collaboration. These piles have a neat appearance, as shown in (b), to indicate that there is a script, or set of rules, behind them.

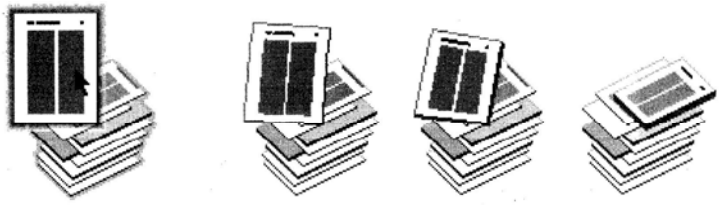
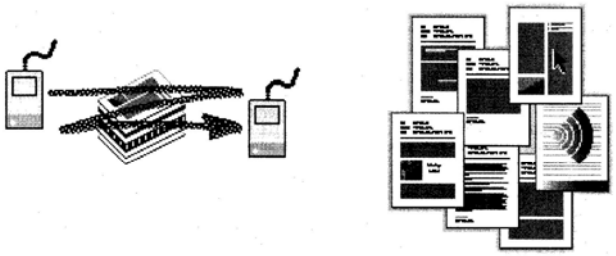


Figure 2. Adding a document to a pile. If a document is positioned over an existing pile, the pile highlights to show that it can accept the new document. When the mouse button is released the document 'drops' onto the pile.



(a) (b)

Figure 4. Browsing by spreading out a pile. Gesturing sideways with the mouse pointer, or with a finger in the case of a touch screen, causes the pile contents to spread out. Individual items can now be directly manipulated.

(a) (b) (c)

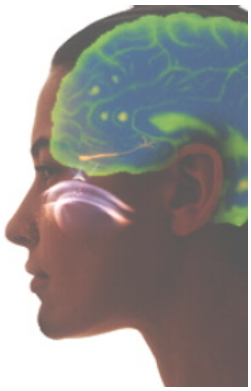
Figure 5. Browsing while maintaining the pile's structure. Gesturing vertically with the mouse pointer as shown in (a), or with a finger in the case of a touch screen, generates a 'viewing cone' (b) that contains a minature version of the first page of the item under the pointer. This viewing cone will follow the vertical position of the pointer; the miniature changes as the pointer moves over each item. The user can move through the pages of an item in the viewing cone by using the left and right cursor keys on the keyboard. When an item is visible in the viewing cone, it can be selected by clicking the mouse button. The item then appears next to the pile on the desktop, as shown in (c).

Interaction Mode vs. Interaction Style

- Interaction mode:
  - what the user is doing when interacting with a system, e.g. instructing, talking, browsing or other
- Interaction style:
  - the kind of interface used to support the mode
  - E.g. Command, Speech, Data-entry, Form fill-in, Query, Graphical, Web, Pen, Augmented reality, Gesture

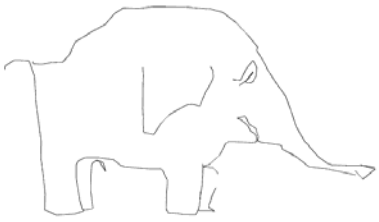
Many kinds of interaction styles available…

- Command
- Speech
- Data-entry
- Form fill-in
- Query
- Graphical
- Web
- Pen
- Augmented reality
- Gesture and even...

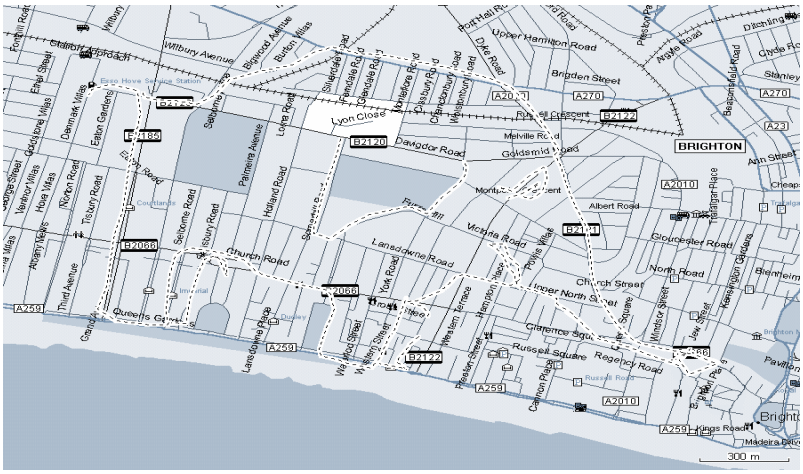


Interacting via GPS and cell phone…

- Drawing an elephant by walking round the streets of a city (or other mode of transport) and entering data points along the way via the cell phone
- Example: Brighton and Hove(UK) by J. Wood by foot, track length 11.2km (see www.gpsdrawing.com for more examples)

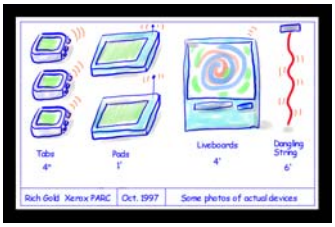


Making art by recording where walking in a city



Interaction paradigms

- "a particular philosophy or way of thinking about interaction design" Preece, Rogers & Sharp, 2002, Interaction Design, Wiley, p60
- Past: The Desktop – intended for single user sitting in front of standard PC
- Present: "Beyond the Desktop"
- Alternative interaction paradigms
  - Ubiquitous computing
  - Pervasive computing
  - Wearable computing
  - Augmented reality
  - Tangible bits
- See advanced topics in MMI



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- 5.6 Wizard of Oz
- **5.7 Describing and specifying interactive systems**

Interactive Systems
What can be described?

- System functionality with regard to interaction
- Overall interaction concepts (metaphors, styles)
- Layout of key screens, sketches
- Layout of user interface elements (e.g. buttons, icons)
- Navigation and interaction details
- Interactive behavior of a system
- Platform requirements
- Functional assertions (e.g. login will take on average 7 seconds, average time per case is 2 minutes)
- User groups
- …

Interactive Systems How to describe them?

- Informal
  - System descriptions in plain text
  - Scenarios and use cases
  - Sketches and designs
  - Task-action-mappings
- Semi-formal
  - Task-action-grammar
  - Abstract UI description languages
  - UMLi
- Implementation languages
  - XML based languages (e.g. XUL)
  - Can be used to generate a concrete UI for the target platform
- …more next term

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