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Chapter 2
Understanding and Conceptualizing Interaction

B.Tech CSBS
VII Semester

Handled by
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Outline

1. Problem Space
2. Conceptual Models
3. Interface Metaphors
4. Interaction Paradigms
5. Conceptual Models to Physical Design

- To design an App for
  - Organizing
  - Storing
  - Retrieving email
    - Fast
    - Efficient
    - Enjoying way

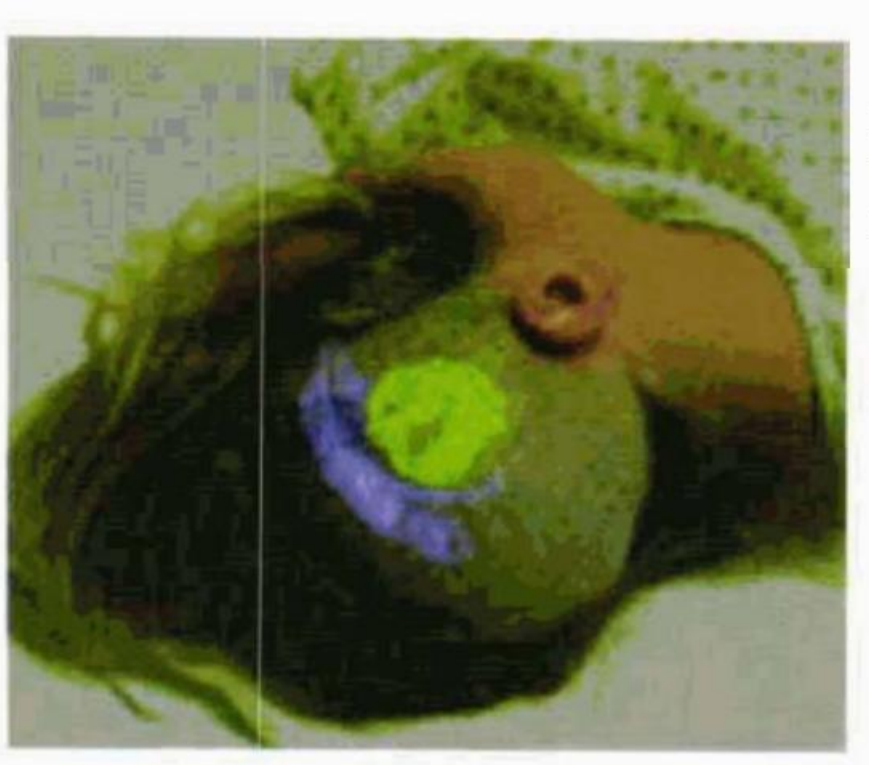
- Interaction designers would begin
  - By asking users about their current experiences
    - Saving mail
    - Look at existing mail tools
    - Begin thinking about
      - Why
      - What
      - How to design the application

- It is important to have a clear understanding of
  - What
  - Why
  - How to design something before coding save
    - Time
    - effort

Understanding Problem Space

- Process of creating interactive product begins at ‘nuts and bolts’
    - Designers work out to design
        - Physical interface
        - interaction styles
            - (menus, forms, speech, icons or commands)

- To create software providing drivers with
  - Better navigation
  - Traffic information
    - Augmented Reality (AR) can be used
      - AR combines
        - Physical and Virtual worlds



- https://www.youtube.com/watch?v=0m-eA1vVIZ4

- https://www.youtube.com/watch?v=0m-eA1vVIZ4
  - AR displays information
    - Where they are going
    - What to do at certain points
    - Images of places
    - Directions to follow
    - Dashboard/rear-view mirror

- A major problem with this proposal
  - Likely to be very unsafe
  - Easily distract drivers
  - Lure them to switch attention from the road

- It is better to make design decisions after
  - Understanding the nature of the problem space
  - Conceptualizing what you want to create
  - Articulating why you want to do so
    - This requires thinking of
      - How the design support people in everyday activities
      - How interactive product you have in mind achieve what you hope it will

- In the AR navigation for driving
  - Designers would
    - Analyze problems of existing forms of navigation while driving
      - (e.g. trying to read maps while moving the steering wheel)
    - ensure that drivers can continue to drive safely without being distracted

- Problem space focuses on solving an identified problem with an existing product

A large software company has decided to develop an upgrade of its web browser. *They assume that there is a need for a new one, which has better and more powerful functionality.* They begin by carrying out an extensive study of people's actual use of web browsers, talking to lots of different kinds of users and observing them using their browsers. One of their main findings is that many people do not use the bookmarking feature effectively. **A** common finding is that it is too restrictive and underused. ***In*** *fathoming why this is the case, it was considered that the process of placing web addresses into hierarchical folders was an inadequate way of supporting the user activity* of needing to mark hundreds and sometimes thousands of websites such that any one of them could be easily returned to or forwarded onto other people. *A n implication of the study was that a new way of saving and retrieving web addresses was needed.*

- Assumption

The existing way of organizing saved (favorite) web addresses into folders is inefficient because it takes too long and is prone to errors.

- Number of reasons that supports assumption

It is easy to lose web addresses by placing them accidentally into the wrong folders.

It is not easy to move web addresses between folders.

It is not obvious how to move a number of addresses from the saved favorite list into another folder simultaneously.

It is not obvious how to reorder web addresses once placed in folders.

- Assumptions for supporting this activity

If the bookmarking function was improved users would find it more useful and use it more to organize their web addresses.

Users need a flexible way of organizing web addresses they want to keep for further reference or for sending on to other people.

- Reasoning through assumptions enables to see the
  - Strengths
  - Weaknesses of the proposed design

- Following questions provide a useful framework to begin thinking through the problem space

Are there problems with an existing product? If so, what are they? Why do you think there are problems?

Why do you think your proposed ideas might be useful? How do you envision people integrating your proposed design with how they currently do things in their everyday or working lives?

How will your proposed design support people in their activities? In what way does it address an identified problem or extend current ways of doing things? Will it really help?

- Activity

At the turn of the millennium, WAP-enabled (wireless application protocol) phones came into being, that enabled people to connect to the Internet using them. To begin with, the web-enabled services provided were very primitive, being text-based with limited graphics capabilities. Access was very restricted, with the downloaded information being displayed on a very small LCD screen (see Figure 2.2). Despite this major usability drawback, every telecommunication company saw this technological breakthrough as an opportunity to create innovative applications. A host of new services were explored, including text messaging, online booking of tickets, betting, shopping, viewing movies, stocks and shares, sports events and banking.

What assumptions were made about the proposed services? How reasonable are these assumptions?

- Activity

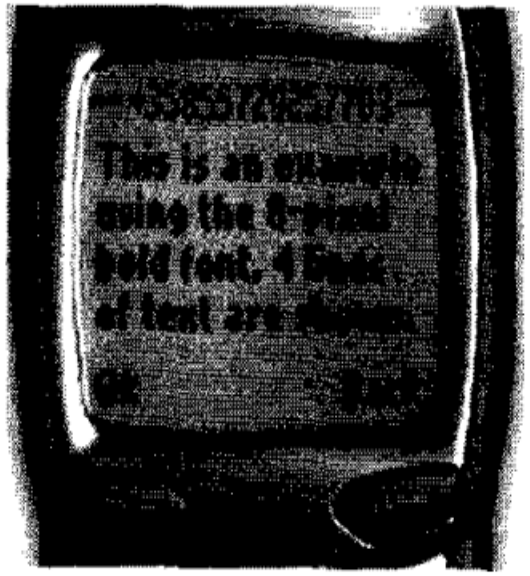


Figure 2.2 An early cell phone display. Text is restricted to three or four lines at a time and scrolls line by line, making reading very cumbersome. Imagine trying to read a page from this book in this way! The newer 3G (third generation) phones have bigger displays, more akin to those provided with handheld computers.

- The problem space for this scenario is open-ended
- There is no identifiable problem to be improved or fixed
- WAP technology provides opportunities to create new
  - Facilities
  - Experiences of people

- One of the main assumptions
  - people want to be kept informed of up-to-the-minute news wherever they are
- Other assumptions

That people want to be able to decide what to do in an evening while on their way home from work (e.g., checking TV listings, movies, making restaurant reservations).

That people *want to be able to interact with information on the move* (e.g., reading email on the train).

That people *will be happy* doing things on a mobile phone that they normally do using their PCs (e.g., reading email, surfing the web, playing video games, doing their shopping).

Conceptual Models (CM)

- The most important thing to design is the user's conceptual model
- Everything else should be subordinated to make the model
  - Clear
  - Obvious
  - Substantial
- That is almost exactly the opposite of how most software is designed

David Liddle

- Conceptual Model

a description of the proposed system in terms of a set of integrated ideas and concepts about what it should do, behave and look like, that will be understandable by the users in the manner intended.

  - Developing a conceptual model involves
    - Envisioning the proposed product based on
      - Users' need and the requirements identified
  - Designed to be
    - understandable
    - testable

- Key aspects of design process

  - Decide
    - what the users will be doing when carrying out the tasks
      - Searching for information?
      - Creating documents?
      - Communicating with other users?
      - Recording events?
      - Some other activity?
    - Interaction Mode
      - Browse
      - Ask questions
    - Interaction style
      - Menu
      - Speech inputs
      - commands

Nature of users' activities to support

Selection of specific kind of interface

- Conceptual Model
  - entails
    - Working out the behaviour of the interface
    - Interaction styles
    - Look and feel of the interface
    - “fleshing out” is always a good idea to explore number of possible designs
      - Assess the merits and problems of each one

- Fleshing out conceptual models should be done iteratively
  - Using number of methods, includes
    - Sketching out ideas
    - Story boarding
    - Describing possible scenarios
    - Prototyping aspects

- Conceptual Models can be broken into 2 main categories
  - Activity based
  - Objects based
- Conceptual Models based on Activities
  - Instructing
  - Conversing
  - Manipulating and Navigating
  - Exploring and browsing

Instructing

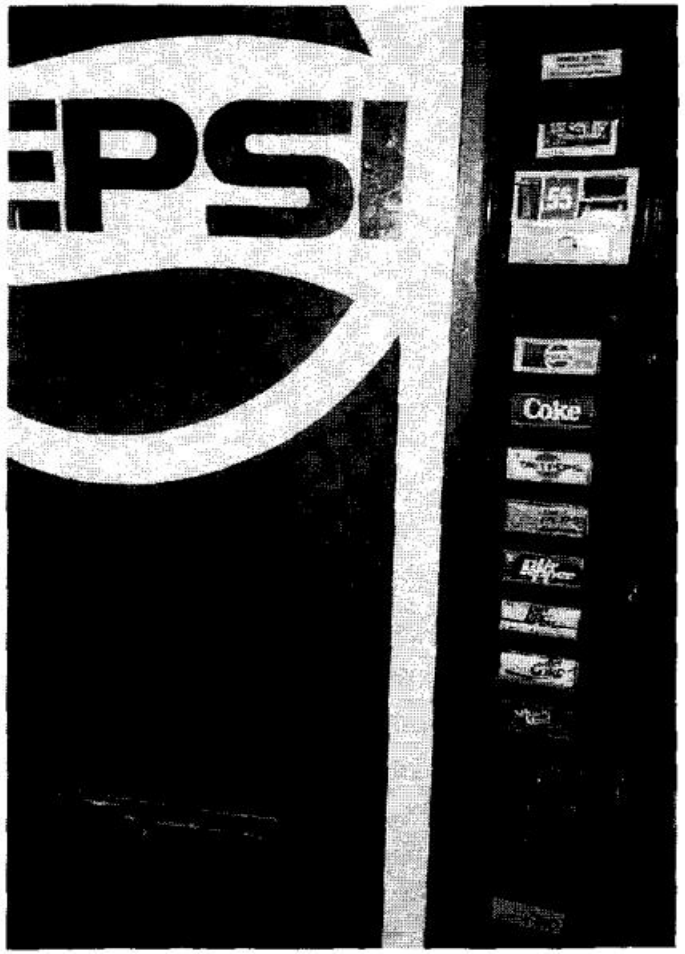
- Describes how users carry out tasks by instructing the system what to do
- Eg.
  - Tell the time
  - Print a file
  - Preparing coffee in coffee machine

- Instructions can be given by
  - Pressing buttons
  - Typing strings of characters

- OS like UNIX & DOS designed as command-based systems
  - User issues instructions to the command prompt

- Well-known applications
  - Word-processing
  - Email
  - CAD
    - Provide wide range of functions like
      - Saving a file (Ctrl + S)
      - Opening a file (Ctrl + O)
      - Copy (Ctrl + C)
      - Paste (Ctrl +V)

- Benefits
  - Supports quick and efficient interaction



Instructions based interaction style

Conversing

- Based on the idea of a person conversing with a system
- System acts as a dialog partner
- Reflects a more two-way communication process
- System acts like a partner than a machine simply obeys orders
- Useful for applications
  - To find out specific kinds of information
  - Want to discuss issues

- Sample applications
  - Advisory system
  - Help facilities
  - Search engines

- Kinds of conversation range
  - from simple voice-recognition menu driven systems
    - Banking
    - Ticket booking
    - Train time enquiries
  - To complex natural-language-based systems
    - Search engine
    - Help systems
- Benefit
  - Allows people to interact with the system in a way they are already familiar with

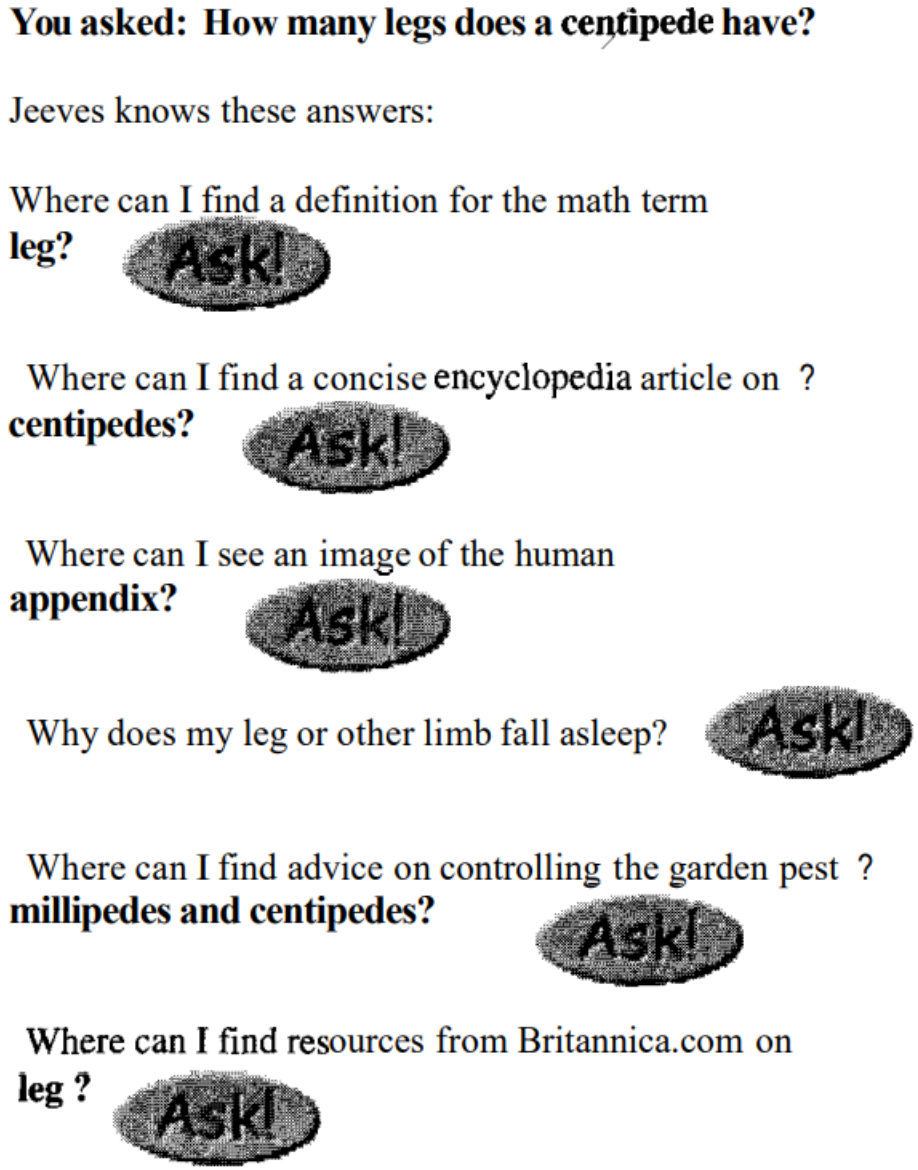
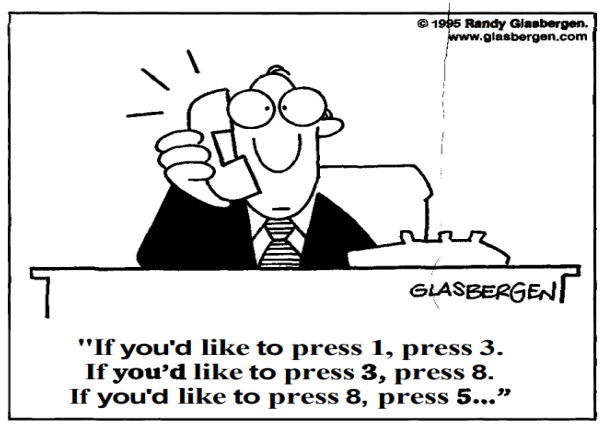


Figure 2.4 The response from "Ask Jeeves for Kids!" search engine when asked "how many legs does a centipede have?"

- Issues
  - Certain kinds of tasks are transformed into cumbersome one-sided interactions

```
<user dials an insurance company>
"Welcome to St. Paul's Insurance Company. Press 1 if new
customer, 2 if you are an existing customer".
<user presses 1>
"Thank you for calling St. Paul's Insurance Company. If you
require house insurance press 1, car insurance press 2,
travel insurance press 3, health insurance press 4, other
press 5"
<user presses 2>
"You have reached the car insurance division. If you re-
quire information about fully comprehensive insurance press
1, 3rd-party insurance press 2..."
```



- Conversing conceptual model is now animated agents
  - Various kinds of characters, ranging
    - from real people appearing at the interface
    - To cartoon images

- https://www.youtube.com/watch?v=nkcKaNqfykg&t=115s

- Animated agents
  - Become highly visible and tangible
  - Act and talk like human being
  - Can be more believable
  - Easier for people to work with

- The user able to
  - See
  - Hear
  - Even touch
  - Animated agent

- Dialogue partner
  - Hidden from view
  - Difficult to discern what is behind

Manipulating and Navigating

- Describes the activity of
  - manipulating objects
  - Navigating through virtual spaces like how they do in the physical world
- Virtual objects can be manipulated by
  - Moving
  - Selecting
  - Opening
  - Closing
  - Zooming in and out

- Direct manipulation of objects
  - Direct manipulation interfaces possess three fundamental properties (Ben Shneiderman)

continuous representation of the objects and actions of interest

rapid reversible incremental actions with immediate feedback about the object of interest

physical actions and button pressing instead of issuing commands with complex syntax

- Benefits of direct manipulation interfaces include

helps beginners learn basic functionality rapidly

experienced users can work rapidly on a wide range of tasks

infrequent users can remember how to carry out operations over time

no need for error messages, except very rarely

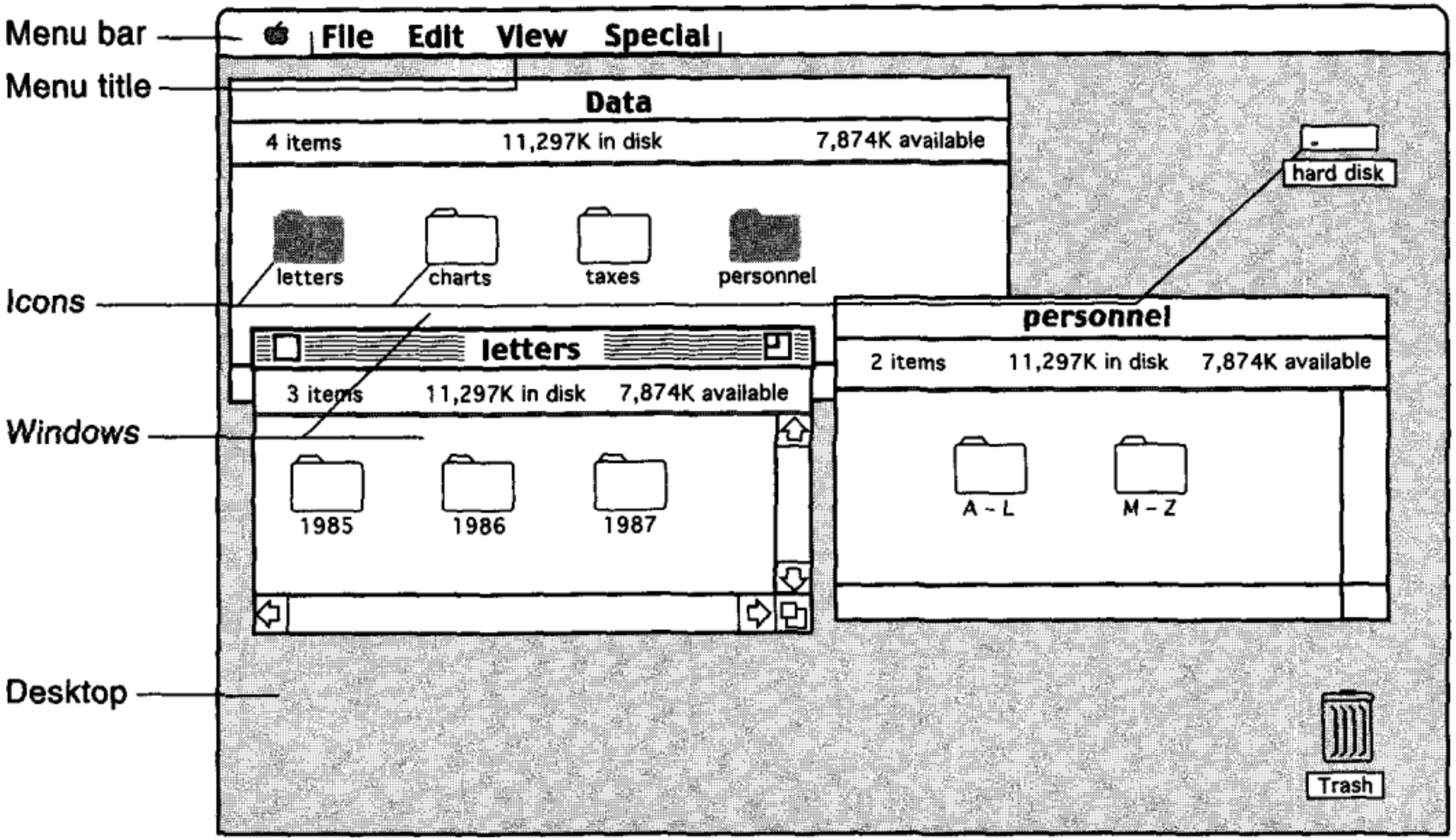
users can immediately see if their actions are furthering their goals and if not do something else

users experience less anxiety

users gain confidence and mastery and feel in control

https://www.youtube.com/watch?v=0MOPKrG7Cx0

https://www.youtube.com/shorts/DLiqk5uKaeg



- Kinds of direct manipulation interfaces
  - Video games
  - Data visualization tools
  - CAD Systems
  - Virtual Reality

- Drawback
  - People expect certain things to happen in the way they would in the physical world
  - All tasks can be described by objects and not all objects can be done directly

Exploring and Browsing

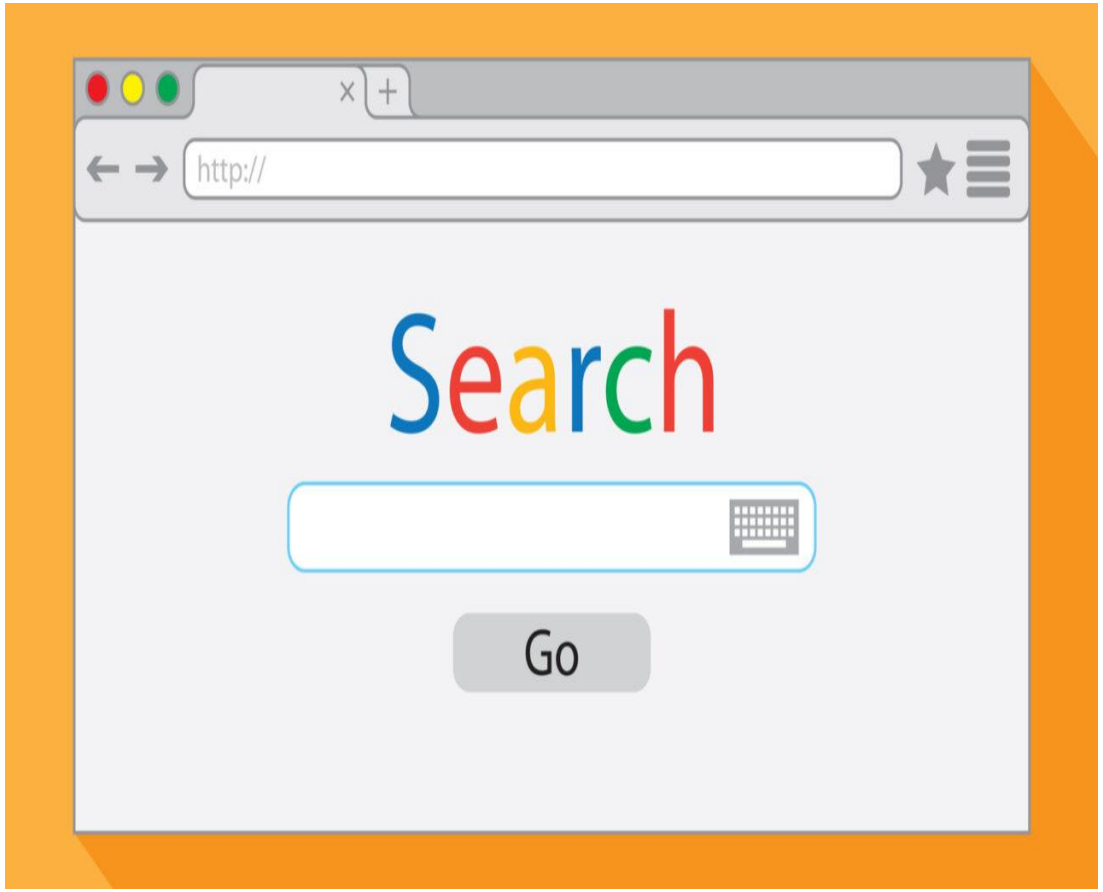
- Allow people to
  - Explore
  - Browse information
- Applications
  - Web pages
  - Portals
  - E-commerce

- Much thought needs to
  - structuring the information
  - Effective navigation

Interface Metaphors

- Another way of describing conceptual models
- Similar to aspects of a physical entity
    - Also has its own behaviors and properties
- Used on
    - an activity
    - an object
    - both

- Eg.
  - Search engine
    - Designed in comparison with the physical object – a mechanical engine
    - Searches files
    - Extracts information
    - Prioritize results
    - Lists results



- Interface metaphors
  - Combine familiar knowledge with new concepts
  - Star was based on a conceptual model of familiar knowledge of an office
    - Papers
    - Folders
    - Filing cabinets
    - mailboxes

- Dragging a document icon – picking up a piece of paper
- Dragging electronic document onto folder – placing a physical document into physical cabin
- In addition,
    - Operations that couldn't be performed in the physical world may also be incorporated
        - Electronic files placed onto printer icon to print them out

- Interface metaphors
  - Composites
    - Combine pieces of familiar knowledge with system functionality
  - Other examples include
    - Scrollbar – combines the concept of a scroll with a bar, as in bar chart

    - Toolbar - combines the idea of a set of tools with a bar

- Benefits of interface metaphors
  - Helpful in understanding and learning to use the system
  - Eg.
    - Pipe command in Unix
      - Metaphorically represent the operations of pipe
        - Output of one program goes as input of another

- Bluetooth
  - Wireless technology that unites
    - Technology
    - Communication
    - Consumer electronics
  - Name of the king Harald Blue Tooth
    - United Scandinavia

Opposition to using interface metaphors

- Designers
  - Breaks the rules
    - Recycle bin (Trash can) should be placed under the desk but placed on the desktop
- Too constraining
  - Restricting the kinds of computational tasks that would be useful at the interface
    - Opening a file embedded in several hundreds of file in a directory
      - Scroll through a list of files seems inefficient
      - Better to allow user to open the file by typing its name

- Conflicts with design principles
  - Designers forced to make bad design solutions that conflict with basic design principles
    - Eg.
      - Trash can
- Not being able to understand system functionality beyond the metaphor
  - Users
    - may get fixed in their understanding of system
    - Face difficulties to learn beyond the interface metaphor
      - Electronic files placed onto printer icon to print them out

- Overly literal translation of existing bad designs
  - Designers create
    - a virtual object to resemble a familiar physical object that itself badly designed
    - Eg.
      - Virtual calculator designed to look and behave like physical calculator
        - Excessive use of modes
        - Poor labeling of functions
        - Manipulation of key sequences

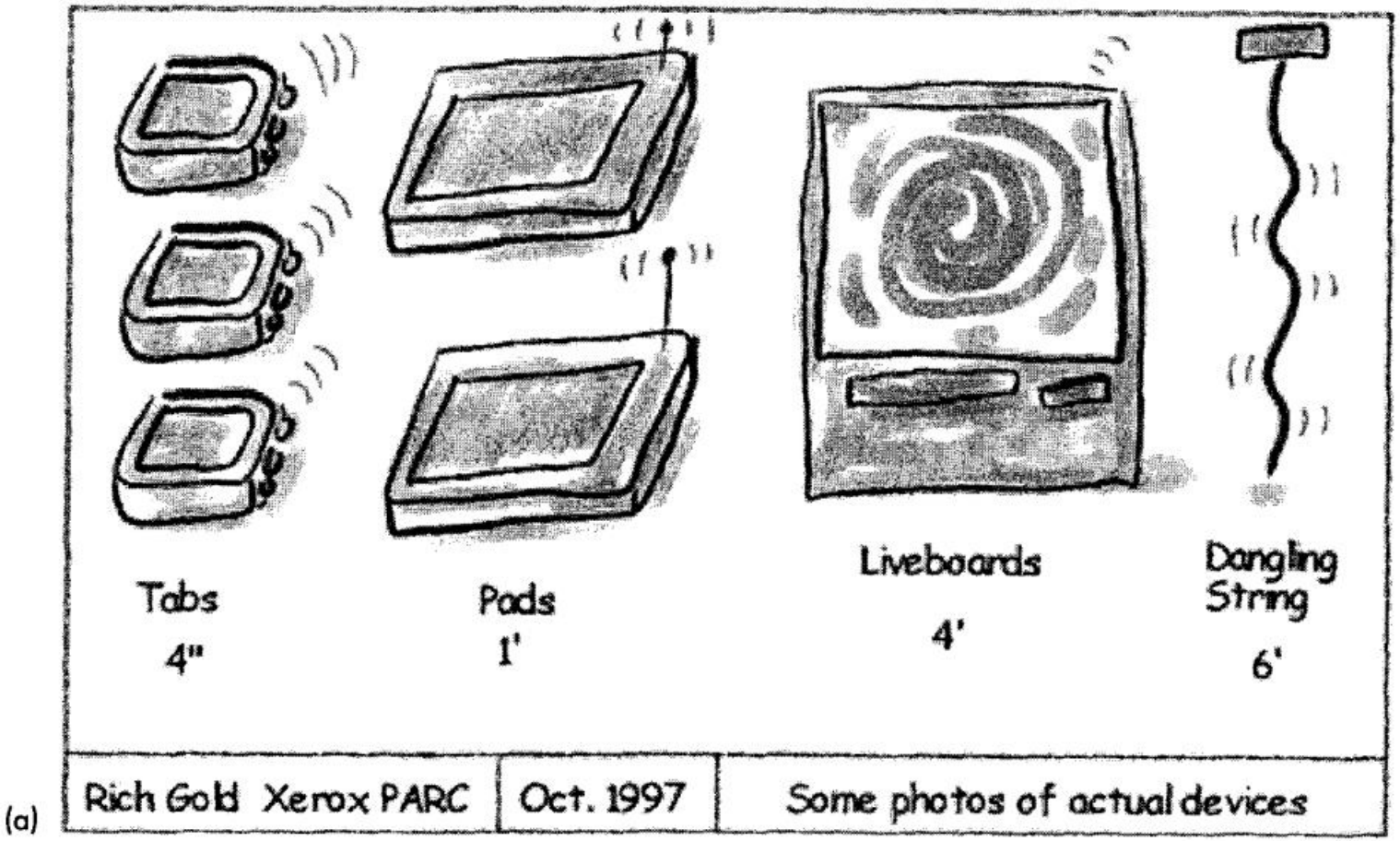
- Limits the designer's imagination in conjuring up new paradigms and models
  - Restricting designers in thinking what new functionality to provide
    - Based on the metaphor 'book'
      - Sun Microsystem's developed an 'online documentation' software
        - Designers were not thinking about
          - Reordering chapters
          - Relevance score of search results

- Designers
  - have to be aware of dangers of badly designed conceptual models
  - Develop interface metaphors effectively that combine
    - Familiar knowledge with new functionality

Interaction Paradigms

- Source of inspiration for the design of conceptual model
- For many years designers developed applications for desktop
  - Users
    - Sitting in front of a CPU, monitor, keyboard and mouse
  - Dominant approach to design the applications
    - GUI and WIMP (window, icons, mouse, pull-down menus)

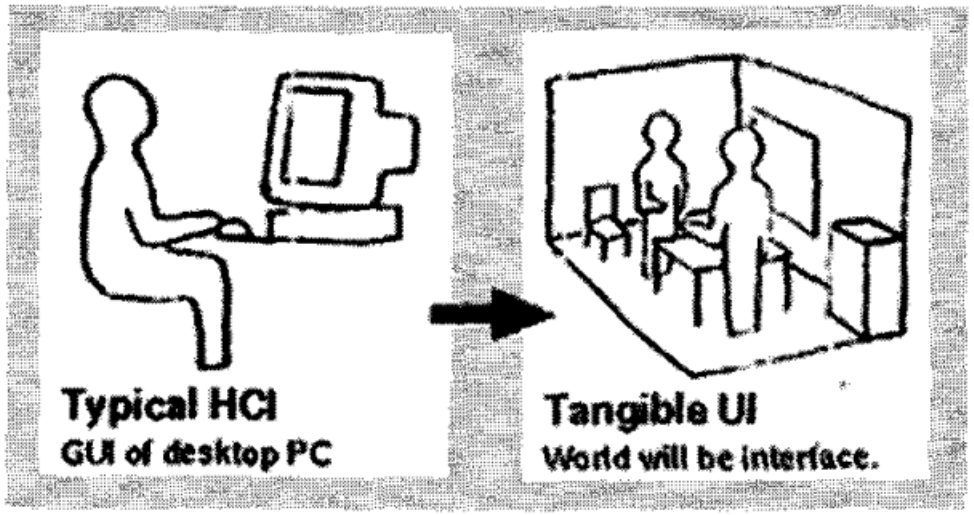
- Ubiquitous Computing
  - Technology embedded in the environment
- Pervasive Computing
  - Seamless integration of technologies
- Wearable Computing
  - wearables



(a)

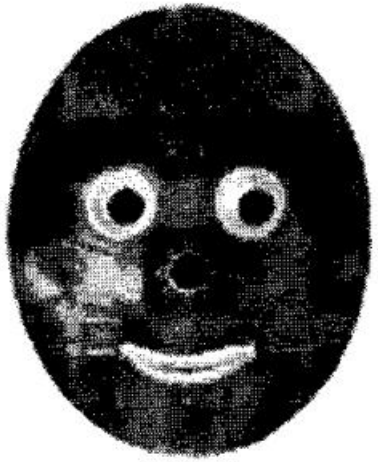
Figure **2.11** Examples of new interaction paradigms: (a) Some of the original devices developed as part of the ubiquitous computing paradigm. Tabs are small hand-sized wireless computers which know where they are and who they are with. Pads are paper-sized devices connected to the system via radio. They know where they are and who they are with. Liveboards are large wall sized devices. The "Dangling String" created by artist Natalie Jeremijenko was attached directly to the ethernet that ran overhead in the ceiling. It spun around depending on the level of digital traffic.

b)



(b) Ishii and Ulmer, MIT Lab (1997) Tangible bits: from **GUIs** of desktop **PCs** to Tangible User Interfaces. The paradigm is concerned with establishing a new type of HCI called "Tangible User Interfaces" (TUIs). TUIs augment the real physical world by coupling digital information to everyday physical objects and environments.

https://www.youtube.com/watch?v=4Gl6iaVXZu0



(c)

(c) Affective Computing: The project, called "**BlueEyes**," is creating devices with embedded technology that gather information about people. This face (with movable eyebrows, eyes and mouth) tracks your movements and facial expressions and responds accordingly.

From Conceptual Models to Physical Design

- Interaction design is an iterative process
  - Involves
    - Thinking through a design problem
    - Understanding user's need
    - Coming up possible conceptual model
    - Prototyping them
    - Evaluating them with respect to usability and user experience goals

- Thinking about design implications of evaluation studies
- Making changes to the prototype
- Evaluating the changed prototypes

- Many issues need to be addressed when developing and testing initial prototypes

  - the way information is to be presented and interacted with at the interface
  - what combinations of media to use (e.g., whether to use sound and animations)
  - the kind of feedback that will be provided
  - what combinations of input and output devices to use (e.g., whether to use speech, keyboard plus mouse, handwriting recognition)
  - whether to provide agents and in what format
  - whether to design operations to be hardwired and activated through physical buttons or to represent them on the screen as part of the software
  - what kinds of help to provide and in what format

- Many issues need to be addressed when developing and testing initial prototypes

  - ***information presentation***
    –which dialogs and interaction styles to use (e.g., form fill-ins, speech input, menus)
    –how to structure items in graphical objects, like windows, dialog boxes and menus (e.g., how many items, where to place them in relation to each other)
  - ***feedback***
    –what navigation mechanisms to provide (e.g., forward and backward buttons)
  - ***media combination***
    –which kinds of icons to use

THANK YOU