Mobile Web-based Application Development

SYST24444

Week 1

About me

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Course Outline

For week wise class plan, please refer to:

Class Plan24444

Objectives

- Describe the important characteristics of mobile web browsing platforms
- Explain three strategies for effectively handling mobile clients
- Describe significant mobile web protocols
- Describe several common mobile operating systems and web browsers
- Explain best principles for design content for mobile web clients

Mobile Web Landscape

- Mobile web browsers have characteristics that are different from desktop browsers
  - Screen Size
  - Bandwidth
  - Signal Quality
  - Protocol Support
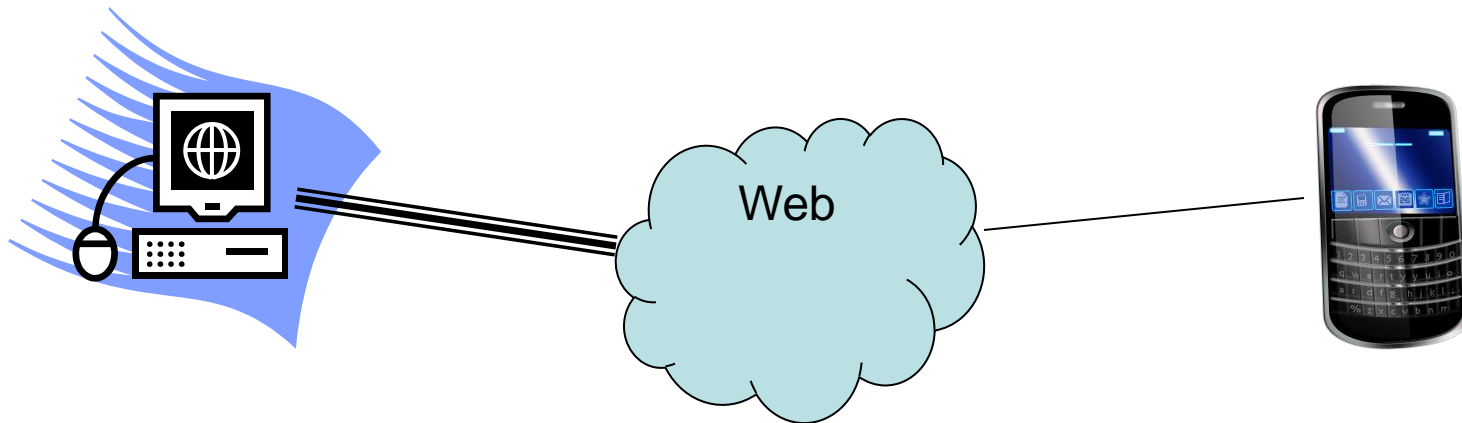 - Client-Side Processing Capability

Screen Size

- A mobile device screen is typically a fraction of the size of a desktop monitor screen
- Content must be adapted accordingly
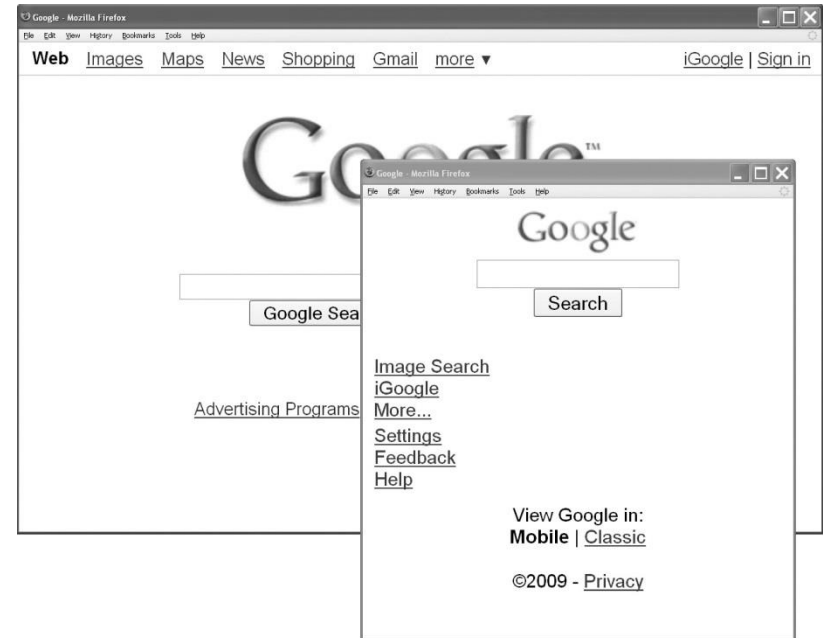
Bandwidth

- Mobile devices operate on cellular or satellite radios that provide much less bandwidth than stationary networks

Signal Quality

- Mobile communications are subject to intermittent outages due to interference and dead zones

Protocol Support

- Mobile browser support for HTML elements may be limited

- Not all HTML elements are supported by all browsers

  Tables   Scripts

  Frames   Styles

  Applets   etc.

Client-Side Processing Capability

- Mobile platforms have smaller processors and limited battery life

- Scripts and plug-ins (flash, applets, pdf, etc.) that require extra processing may be disabled

Solutions for Mobile Browsers

- Solutions for providing content to mobile browsers include
  - Content Differentiation
  - Portal Differentiation
  - Content Adaptation

Content Differentiation

- The HTTP User-Agent header can be used to provide customized content

  - Header from a Windows CE platform:
    User-Agent: Mozilla/4.0 (compatible; MSIE 6.0; Windows CE; IEMobile M.N)

  - Header from Firefox (desktop):
    User-Agent: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-GB; rv:1.9.1.3) Gecko/20090824 Firefox/3.5.3 (.NET CLR 3.5.30729)

- The webapp can then respond with a resource that is appropriate for that client

Portal Differentiation

- Different websites are maintained for different clients
  - For example:

    www.mywebapp.com   for desktop clients
    www.mywebapp.mobi   for mobile clients

- There are objections to this approach, however, since it could lead to separate desktop and mobile webs

Content Adaptation

- A proxy server automatically adapts web content to fit the limitations of a mobile client

Mobile Client — Compressed Steam → Proxy Server — HTTP/HTML → Web Server
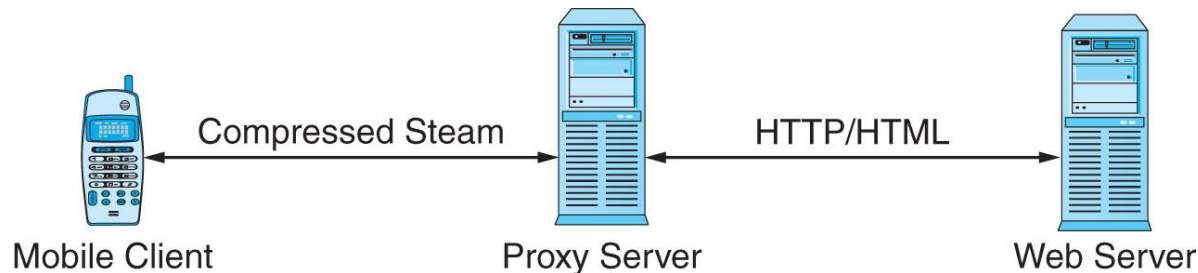
- Proxy servers may not be able to deal effectively with all content, however

Mobile Device Protocols

- Mobile Web Protocols include
  - XHTML Basic
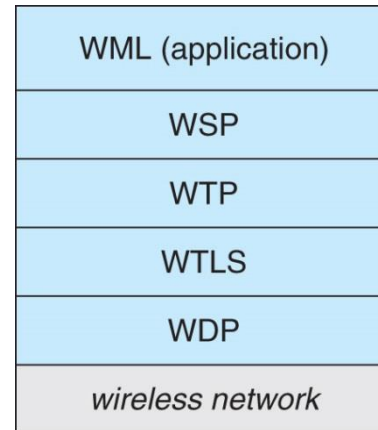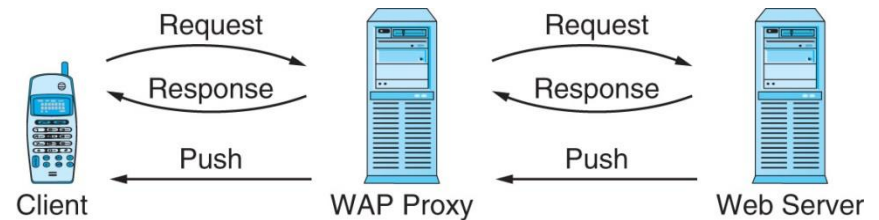 - Wireless Application Protocol (WAP)
  - iMode

XHTML Basic

- Adopted by W3C in 2000 as a standard for creating XHTML docs for limited clients
- Some HTML elements are excluded from XHTML Basic/1.1:
  - Frames
  - Image Maps
  - Nested Tables
  - Bidirectional Text
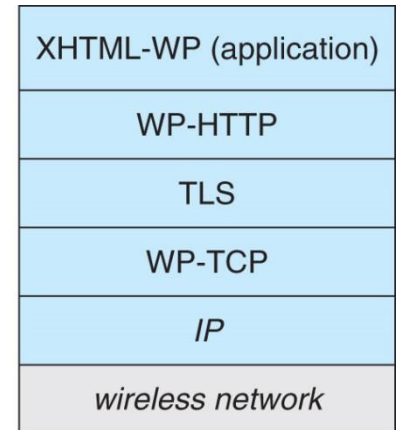 - Text Editing (<ins> and <del> tags)

Wireless Access Protocol (WAP)

- Developed in 1998 by WAP Forum
- Uses proxy servers to interface with clients
- Clients implement the WAP protocol stack with proxies
- Protocols include "push" content

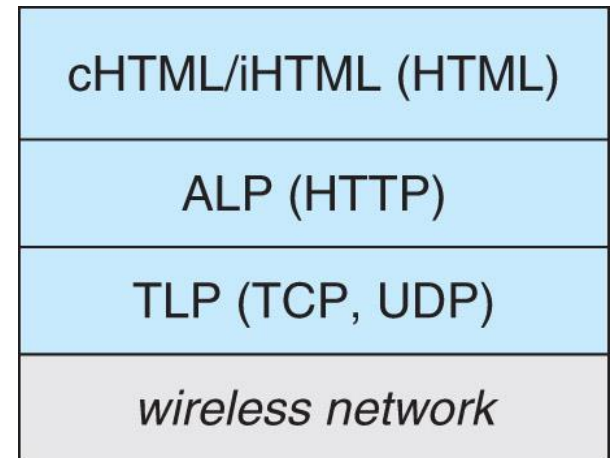| WML (application)	XHTML-WP (application)
WSP	WP-HTTP
WTP	TLS
WTLS	WP-TCP
WDP	IP
wireless network	*wireless network*

(a) WAP 1.0   (b) WAP 2.0

iMode

- Developed by Japan's DoCoMo phone co.
- Used for browsing, e-commerce, bill paying, etc.
- Uses compact HTML (cHTML) and a modified web protocol stack

cHTML/iHTML (HTML)
ALP (HTTP)
TLP (TCP, UDP)
wireless network

Mobile Web Software
Micro Operating Systems

- Android: open source, by Google and the Open Handset Alliance

- PalmOS: developed for PalmPilot Personal Digital Assistant(PDA)

- Symbian: proprietary OS for smart mobile phones; widely used

- Windows Mobile: proprietary; mini version of MS Windows

Mobile Web Software Micro-Browsers

- Blazer: developed for PalmOS devices
- Internet Explorer Mobile: lightweight version of Internet Explorer
- Opera Mini: lightweight version of Opera browser; uses a proxy server system
  - proxies execute JavaScript in advance
  - content forwarded in binary for faster response

Best Practices – General

- Provide a consistent user experience, regardless of client. Users should feel at home with either desktop or mobile.

- Use correct markup for mobile clients.

- Be aware of device limitations. Consult databases of device profiles.

- Use request header information, if available, to customize responses.

Best Practices
Client Limitations (1/2)

- Don't use unsupported features, such as
  - Image maps
  - Pop-up windows
  - Nested tables
- Avoid large graphics that exceed size limitations for mobile browsers
- Send only content that the client device supports

Best Practices
Client Limitations (2/2)

- Design applications to fail gracefully when features are not supported
  - Style sheets
  - Tables
  - Cookies
  - Fonts and colors

Best Practices
Layout Adaptation

- Divide large pages into smaller sections if possible
- Use headings to indicate page structure so that proxies can adapt content
- Do not use tables to layout pages
- Use relative size measures (em, not px)
- Use <label> to identify labels for form fields

Best Practices
User Interaction Efficiency (1/2)

- Keep URIs short to minimize typing
- Place essential content near the top to help users find pages
- Use a consistent navigation mechanism
- Balance breadth and depth of page hierarchy
- Provide effective page titles for display and bookmarking

Best Practices
User Interaction Efficiency (2/2)

- Provide a text equivalent for each non-text item (image, applet, script, etc.)

- Minimize key strokes for data entry: provide default entries and menus

- Use scrolling in one dimension only

- Provide helpful error messages with links (back, retry, home, etc.)

Elements of Web Development

Web Sites Interface

http://wateronwheels.com
- **http://moodle.org**
- **http://www.shmarketing.co.uk/**
- **http://gatesnfences.com**

Elements of Web Design

- Interface Design
- Information Design
- Navigation Design

The user interface

- User interfaces should be designed to match the skills, experience and expectations of its anticipated users.

- System users often judge a system by its interface rather than its functionality.

- A poorly designed interface can cause a user to make catastrophic errors.

- Poor user interface design is the reason why so many software systems are never used.

Human factors in interface design

- Limited short-term memory
  - People can instantaneously remember about 7 items of information. If you present more than this, they are more liable to make mistakes.

- People make mistakes
  - When people make mistakes and systems go wrong, inappropriate alarms and messages can increase stress and hence the likelihood of more mistakes.

- People are different
  - People have a wide range of physical capabilities. Designers should not just design for their own capabilities.

- People have different interaction preferences
  - Some like pictures, some like text.

UI design principles

- UI design must take account of the needs, experience and capabilities of the system users.
- Designers should be aware of people's physical and mental limitations (e.g. limited short-term memory) and should recognise that people make mistakes.
- UI design principles underlie interface designs although not all principles are applicable to all designs.

User interface design principles

Principle	Description
User familiarity	The interface should use terms and concepts which are drawn from the experience of the people who will make most use of the system.
Consistency	The interface should be consistent in that, wherever possible, comparable operations should be activated in the same way.
Minimal surprise	Users should never be surprised by the behaviour of a system.
Recoverability	The interface should include mechanisms to allow users to recover from errors.
User guidance	The interface should provide meaningful feedback when errors occur and provide context-sensitive user help facilities.
User diversity	The interface should provide appropriate interaction facilities for different types of system user.

Design issues in UIs

- Two problems must be addressed in interactive systems design

  - How should information from the user be provided to the computer system?

  - How should information from the computer system be presented to the user?

- User interaction and information presentation may be integrated through a coherent framework such as a user interface metaphor.

Web-based interfaces

- Many web-based systems have interfaces based on web forms.

- Form field can be menus, free text input, radio buttons, etc.

- In the LIBSYS example, users make a choice of where to search from a menu and type the search phrase into a free text field.

LIBSYS search form

LIBSYS: Search

Choose collection   [All ▲▼]

Keyword or phrase   [   ]
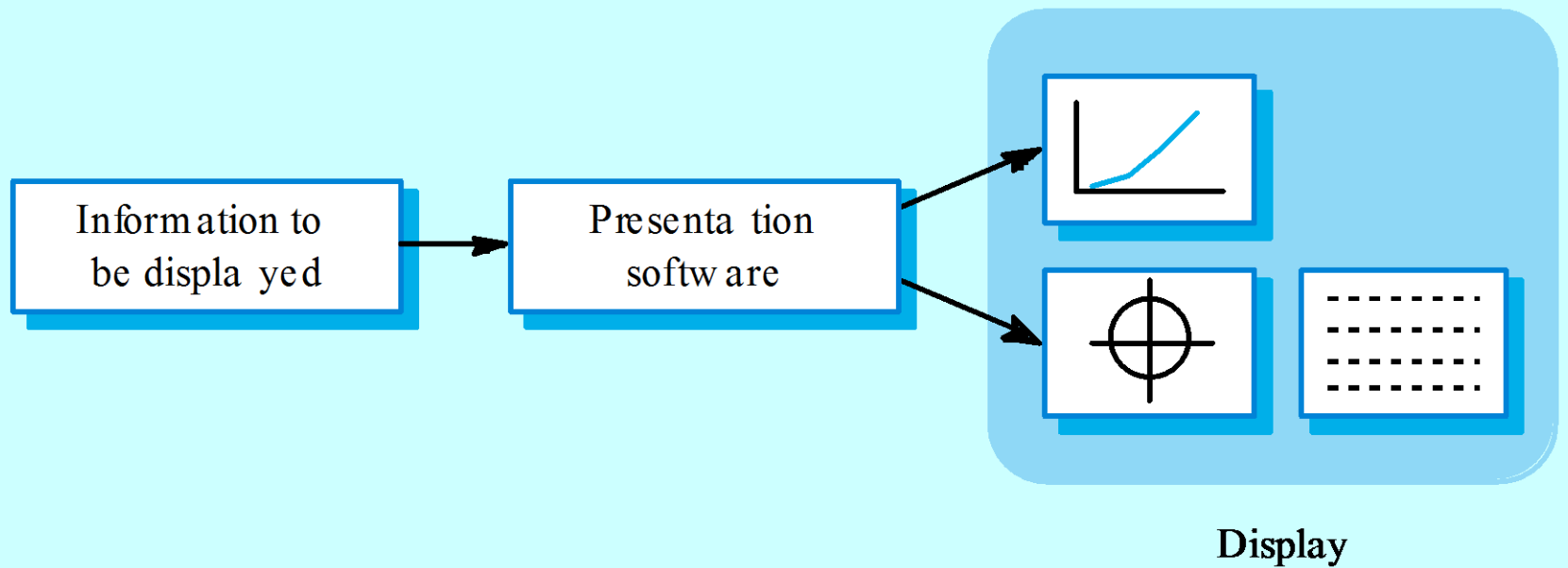
Search using   [Title ▲▼]

Adjacent words   ● Yes   ○ No

[Search]   [Reset]   [Cancel]

Information presentation

- Information presentation is concerned with presenting system information to system users.
- The information may be presented directly (e.g. text in a word processor) or may be transformed in some way for presentation (e.g. in some graphical form).

Information presentation

Information presentation

- Static information
  - Initialised at the beginning of a session. It does not change during the session.
  - May be either numeric or textual.
- Dynamic information
  - Changes during a session and the changes must be communicated to the system user.
  - May be either numeric or textual.

Information display factors

- Is the user interested in precise information or data relationships?

- How quickly do information values change? Must the change be indicated immediately?

- Must the user take some action in response to a change?

- Is there a direct manipulation interface?

- Is the information textual or numeric? Are relative values important?

Analogue or digital presentation?

- Digital presentation
  - Compact - takes up little screen space;
  - Precise values can be communicated.
- Analogue presentation
  - Easier to get an 'at a glance' impression of a value;
  - Possible to show relative values;
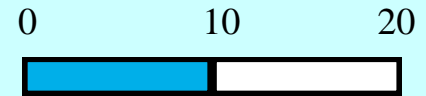 - Easier to see exceptional data values.

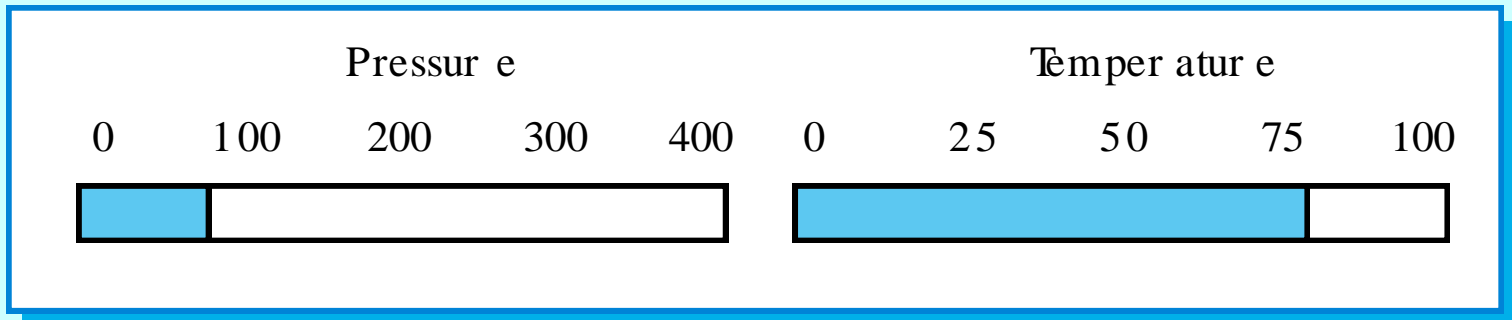# Presentation methods
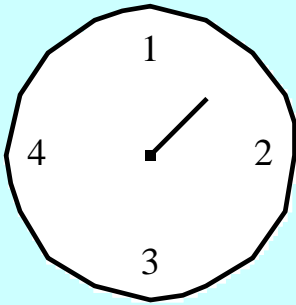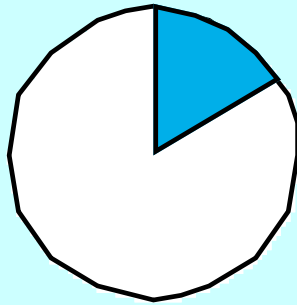
Dial with needle   Pie chart   Thermometer   Horizontal bar

Displaying relative values

Pressure

| 0 | 100 | 200 | 300 | 400 |

Temperature

| 0 | 25 | 50 | 75 | 100 |

Data visualisation

- Concerned with techniques for displaying large amounts of information.

- Visualisation can reveal relationships between entities and trends in the data.

- Possible data visualisations are:
  - Weather information collected from a number of sources;
  - The state of a telephone network as a linked set of nodes;
  - Chemical plant visualised by showing pressures and temperatures in a linked set of tanks and pipes;
  - A model of a molecule displayed in 3 dimensions;
  - Web pages displayed as a hyperbolic tree.

Colour displays

- Colour adds an extra dimension to an interface and can help the user understand complex information structures.

- Colour can be used to highlight exceptional events.

- Common mistakes in the use of colour in interface design include:
  - The use of colour to communicate meaning;
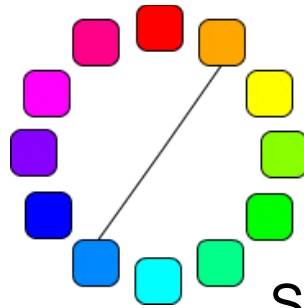 - The over-use of colour in the display.

Colour use guidelines

- Limit the number of colours used and be conservative in their use.

- Use colour change to show a change in system status.

- Be careful about colour pairings.
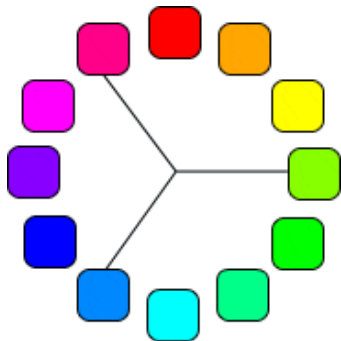
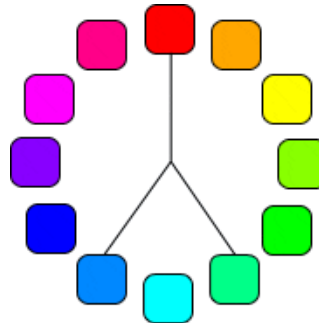# Using Colors on Your Page

Analog Colors
Harmonious
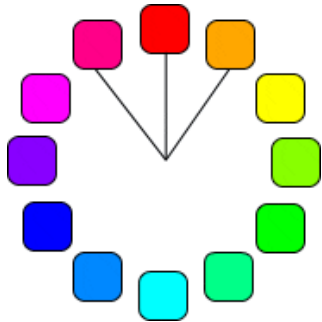
Complementary
Highlight

Triad
Colorful & Balanced

Split Complementary
Contrast & Harmony

- Rule o' Thumb: Use 3 Colors
  - o Primary color: sets tone of design
  - o Secondary color: "back up" primary color
  - o Highlight color: emphasis

Error messages

- Error message design is critically important.
  Poor error messages can mean that a user rejects rather than accepts a system.

- Messages should be polite, concise, consistent and constructive.

- The background and experience of users should be the determining factor in message design.

Be consistent

- Consistent syntax of input

- Consistent language and graphics
  - same visual appearance across the system (e.g. widgets)
  - same information/controls in same location on all windows
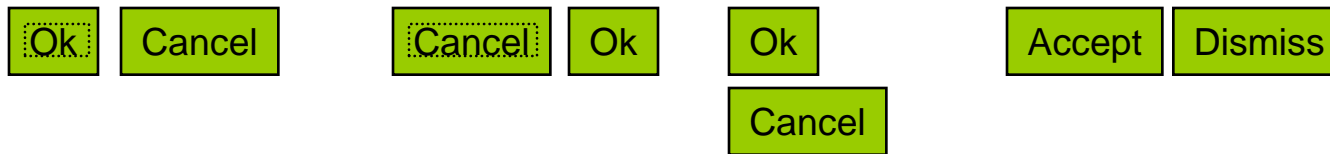
- Consistent effects
  - commands, actions have same effect in equivalent situations
    - predictability

Provide feedback

- Continuously inform the user about
  - what it is doing
  - how it is interpreting the user's input
 - user should always be aware of what is going on
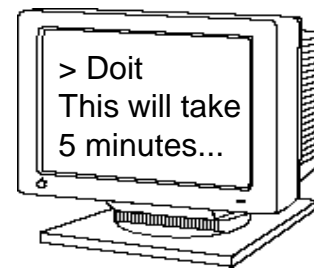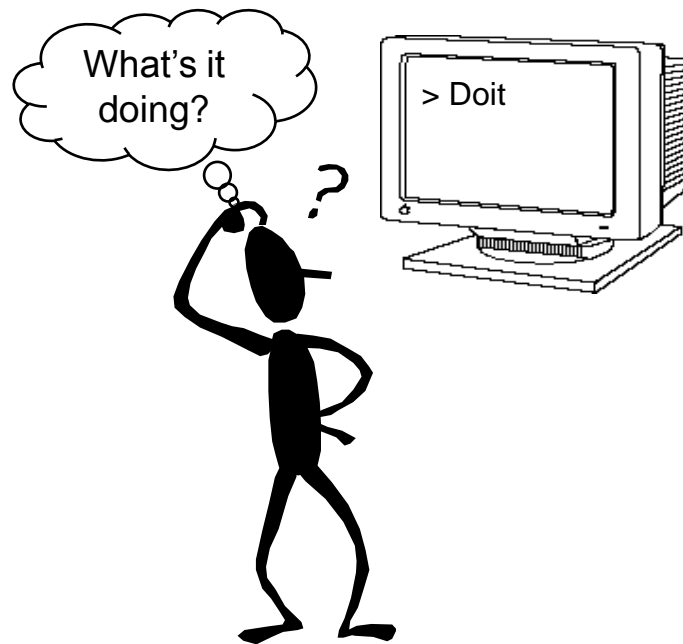
Requirements from the scenario

- Users may not be aware of appropriate search terms so need a way of helping them choose terms.

- Users have to be able to select collections to search.

- Users need to be able to carry out searches and request copies of relevant material.

Analysis techniques

- ## Task analysis
  - Models the steps involved in completing a task.

- ## Interviewing and questionnaires
  - Asks the users about the work they do.

- ## On-site observation
  - Observes the user at work.

Hierarchical task analysis
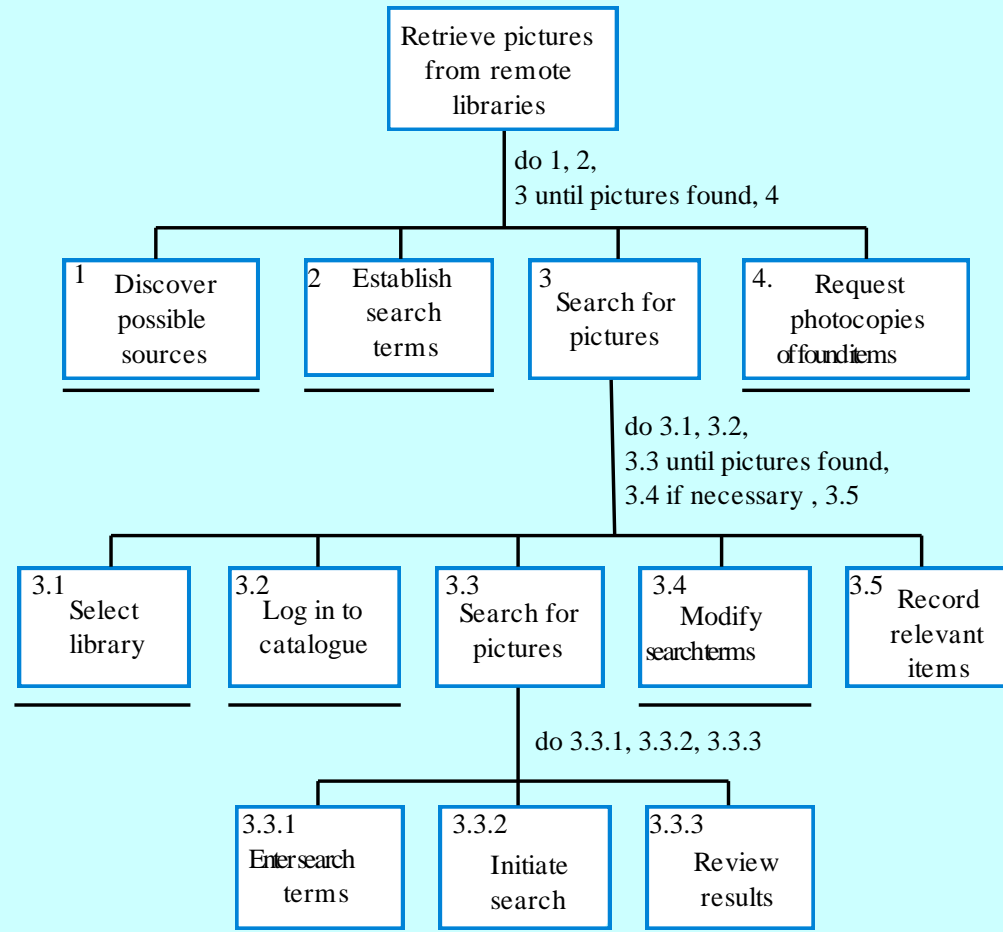
Interviewing

- Design semi-structured interviews based on open-ended questions.

- Users can then provide information that they think is essential; not just information that you have thought of collecting.

- Group interviews or focus groups allow users to discuss with each other what they do.

On-site Observation

- Involves an external observer watching users at work and questioning them in an unscripted way about their work.

- Valuable because many user tasks are intuitive and they find these very difficult to describe and explain.

- Also helps understand the role of social and organisational influences on work.

User interface prototyping

- The aim of prototyping is to allow users to gain direct experience with the interface.
- Without such direct experience, it is impossible to judge the usability of an interface.
- Prototyping may be a two-stage process:
  - Early in the process, paper prototypes may be used;
  - The design is then refined and increasingly sophisticated automated prototypes are then developed.

Simple evaluation techniques

- Questionnaires for user feedback.
- Video recording of system use and subsequent tape evaluation.
- Instrumentation of code to collect information about facility use and user errors.
- The provision of code in the software to collect on-line user feedback.

Navigation

- Every page of a site should let you know:
  - Where am I
  - What's here
  - Where can I go now
  - Where have I been

Design of methods of finding one's way around the information structure.

- People don't always work from the home page – they get to a page from a link or from a search