Design of Interactive Systems (DIS)

Lecture 9: Techniques for designing interactive systems – Visual Interface Design

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Part II Techniques for designing interactive systems

- **Chapter 7**: Understanding
- **Chapter 8**: Envisionment
- **Chapter 9**: Design
- **Chapter 10**: Evaluation
- **Chapter 11:** Task Analysis
- **Chapter 12**: Visual Interface Design
- **Chapter 12**: Multimodal Interface Design

Introduction

- The design of the interface that mediates the **interaction** of people with devices is a crucial characteristic of the overall interaction design
- This is often referred to as the **user interface** (Ul)
- It consists of everything in the system that people come into contact with, whether that is **physically, perceptually** or **conceptually**.

Aims

- Understand different types of **interaction**, **command languages** and **graphical user interfaces** (GUIs)
- Understand and apply **interface design guidelines**
- Understand the issues of **information presentation** and **visualization**.

Introduction

- **Physically** people interact with systems by pressing buttons or moving lever
- We also interact **physically** through other senses, notably sound and touch.
- **Perceptually** people interact with a system through what they can see, hear and touch.
- Visual aspect is important to make things noticeable on screen.
- Buttons' size and labeling is important
- Instructions required
- **Conceptually** people interact with systems and devices through knowing what they can do and knowing how they can do it.
- **Conceptually** people employ a 'mental model' of what the device is and how it works.

Introduction

- Interface design is about creating an experience that enables people to make the best use of the system being designed.
- The vast majority of personal computers, phones and handheld and tablet devices have **graphical user interfaces (GUIs)** typically based on one of the main three software platforms: Apple (with its operating systems OS X and iOS), Microsoft Windows and Google's Android.

Introduction

- A command language is simply a set of words with an associated syntax, the rules governing the structure of how commands are put together.
- Command languages suffer from the problem that people:
  - Have to *recall* the name of a particular command from the range of literally hundreds of possibilities
  - Have to *recall* the syntax of the command.
- They are quick to execute and, particularly if there are only a few of them, people using them frequently will remember them.
- Commands can be spoken which makes for a very convenient interface

Graphical User Interface

- Graphical user interfaces (GUIs) are found on every personal computer, on smart phones, on touchscreen displays and so on.
- A direct manipulation (DM) interface is one where objects - usually graphical objects on a screen - are directly manipulated with a pointing device in place of the typed commands of command languages.

WIMPs

- A **window** is a means of sharing a device's graphical display resources among multiple applications at the same time
- An **icon** is an image or symbol used to represent a file, folder, application or device, such as a printer.
- A **menu** is a list of commands or options from which one can choose.
- The last component is a **pointing device** of which the mouse is the most widespread, but fingers are also used, as is the stylus.

Windows

- Windows allow a workstation's screen to be divided into areas which act like separate input and output channels that can be placed under the control of different applications.
- Early windowing systems were tiled (did not overlap), but overlapping windows were eventually suggested by Alan Kay.

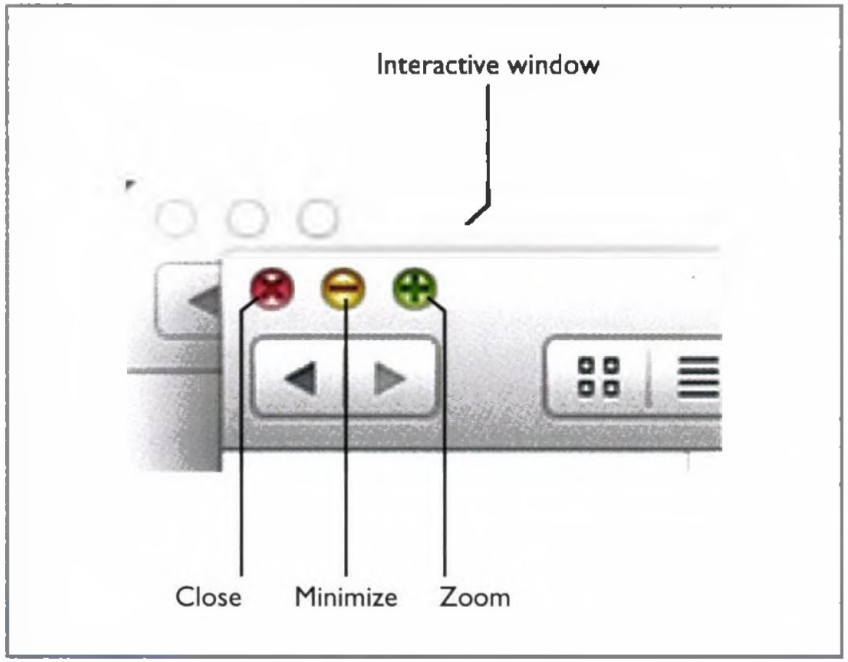


Figure 12.2 OS X window

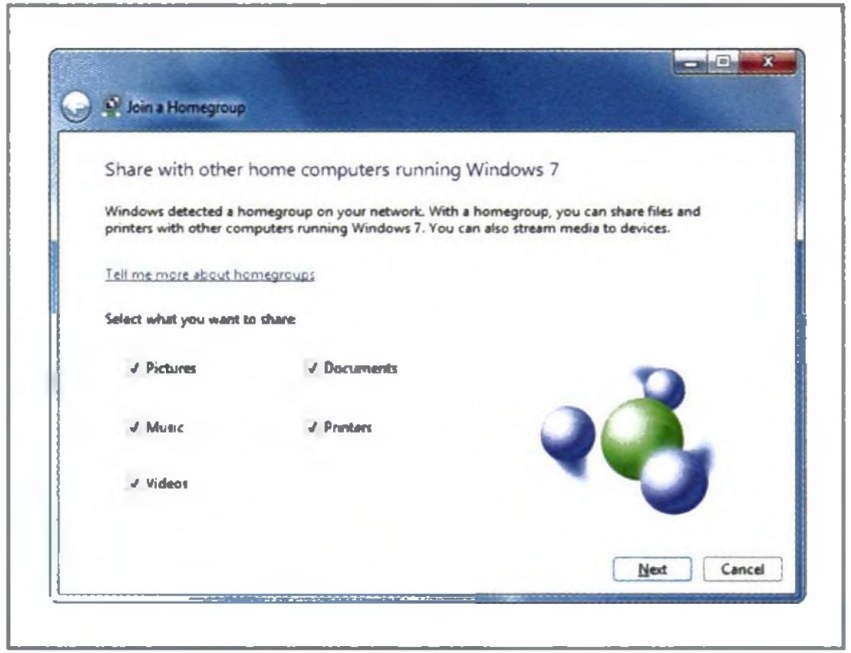


Figure 12.3 Windows 7 window

Icons

- Icons are used to represent features and functions on everything from software applications, DVD players and public information kiosks to clothing
- Icons are generally regarded as being useful in helping people to recognize which feature they need to access.
- Icons make use of three principal types of representation: metaphor, direct mapping and convention.
- The use of **metaphor** can be seen in icons for such things cut and paste operations that exist in many applications.
- The use of **direct mapping** is probably the simplest technique in the design of icons and involves creating a more or less direct image of what the icon is intended to represent.
- **convention** refers to a more or less arbitrary design of an icon in the first instance. For example, the icon representing the function ***save*** on the Mac that I am using to write this is representation of a floppy disk.

Icons

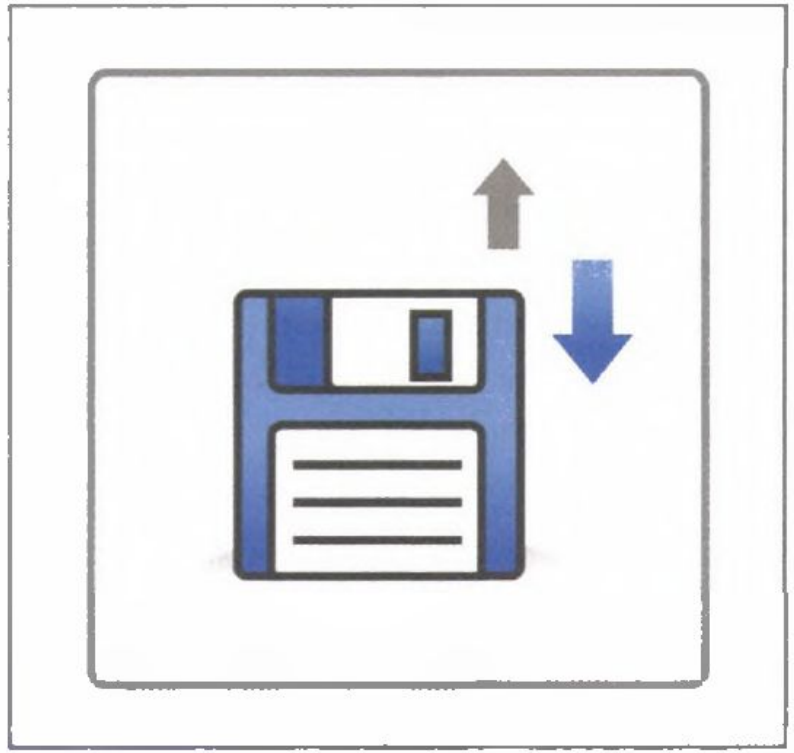


Figure 12.4 An icon representing a floppy disk

Figure 12.5 Examples of commonly used icons

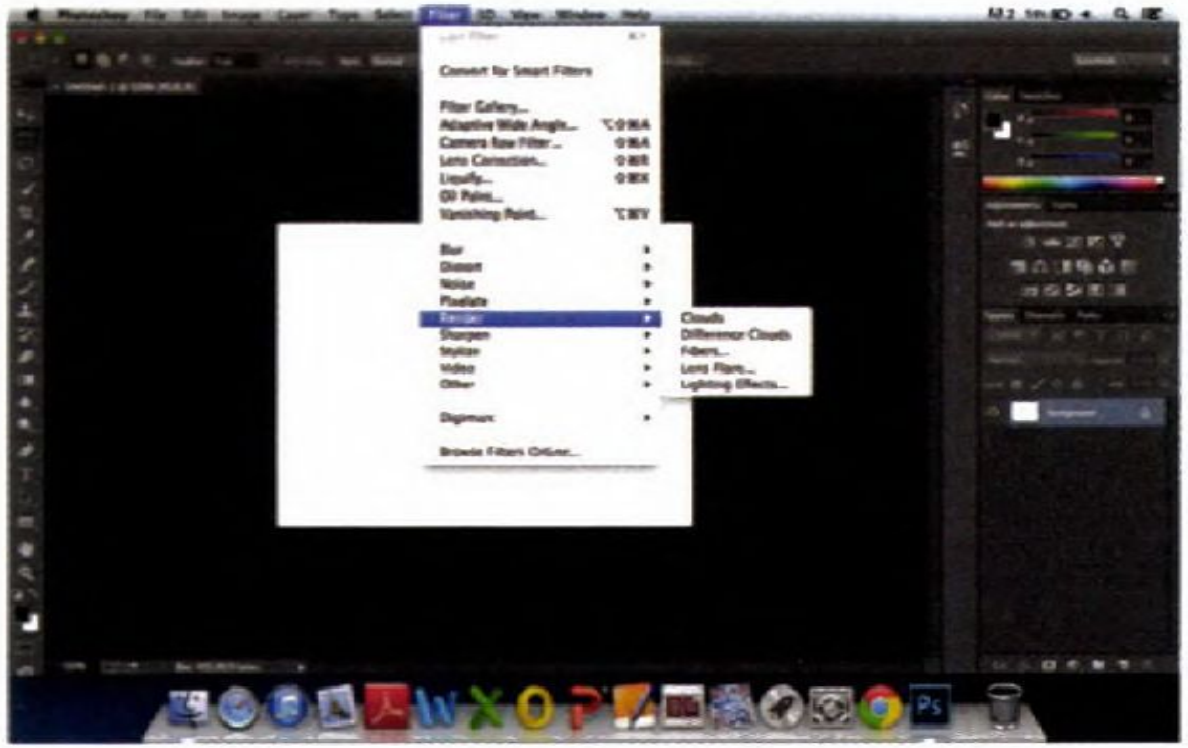
Icons

- William Horton (of William Horton Consulting, Inc.) has produced a detailed checklist (1991) designed to help the icon designer avoid a whole raft of common mistakes.

Understandable	*Does the image spontaneously suggest the intended concept to the viewer?*
Familiar	*Are the objects in the icon ones familiar to the user?*
Unambiguous	*Are additional cues (label, other icon documentation) available to resolve any ambiguity?*
Memorable	*Where possible, does the icon feature concrete objects in action? Are actions shown as operations on concrete objects?*
Informative	*Why is the concept important?*
Few	*Is the number of arbitrary symbols less than 20?*
Distinct	*Is every icon distinct from all others?*
Attractive	*Does the image use smooth edges and lines?*
Legible	*Have you tested all combinations of colour and size in which the icon will be displayed?*
Compact	*Is every object, every line, every pixel in the icon necessary?*
Coherent	*Is it clear where one icon ends and another begins?*
Extensible	*Can I draw the image smaller? Will people still recognize it?*

Menus

- Many applications of interactive systems make use of menus to organize and store the commands that are available.
- When a command or option (menu item) is selected from the list, an action is performed.
- Figure 12.7 is a screenshot of the Mac version of a typical **hierarchically** organized menu.



Menus

- **Hierarchical** menus are also called as **cascading menus**.
- Another frequently encountered form of menu is the **pop-up.**
- It is not attached to a menu bar in a fixed location
- The menu disappears after the selection.

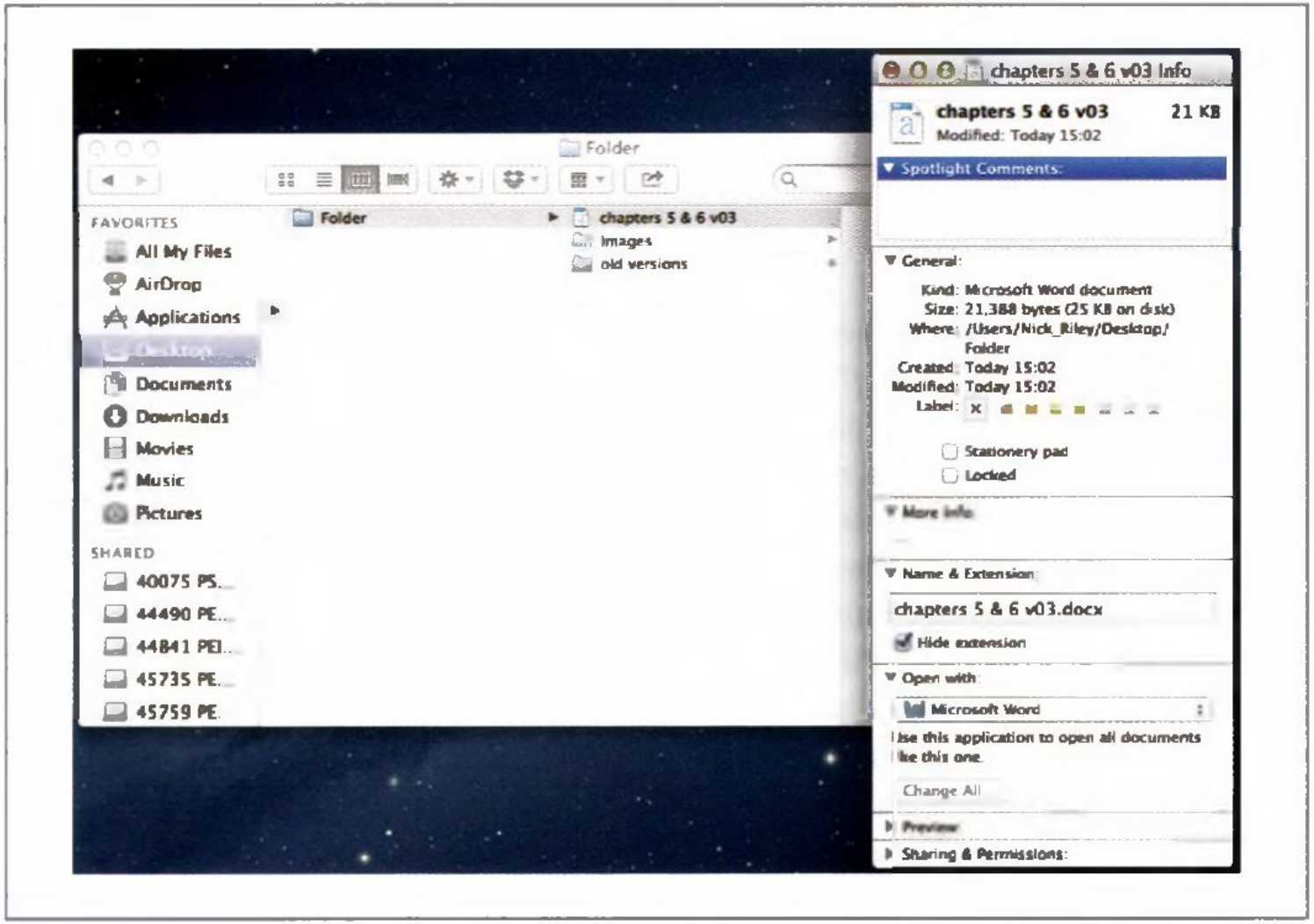


Figure 12.9 A screenshot of a pop-up menu (or panel) providing information on the file 'chapters 5 & 6 v03' after clicking on the file and using the context menu

Menus

- It includes a number of options that are not simple commands, so it is more usually referred to as a **panel**
- In this case it is also a **contextual menu**
- If a file is selected, the contextual menu offers file options. If instead a folder is selected, folder options are displayed.

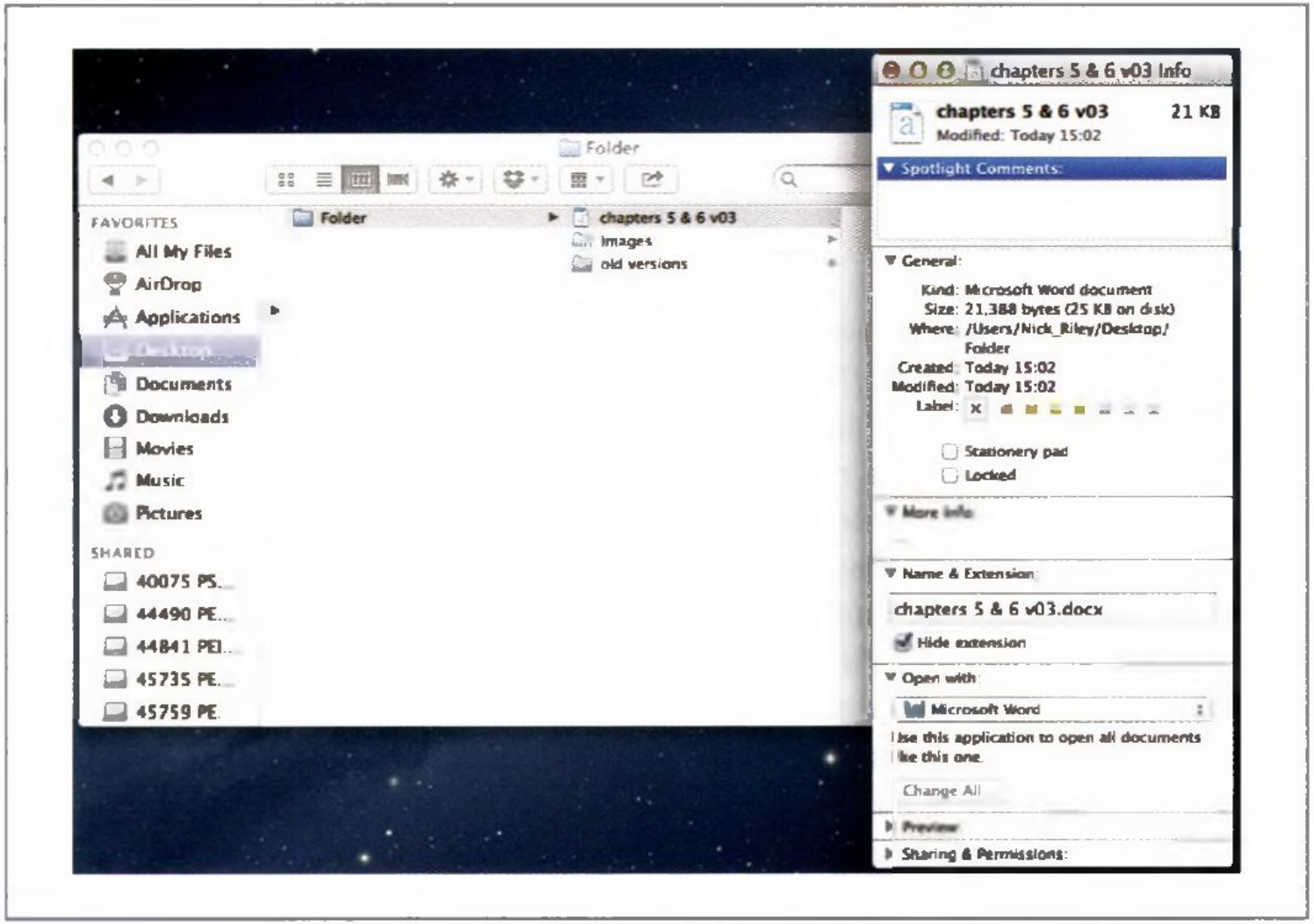


Figure 12.9 A screenshot of a pop-up menu (or panel) providing information on the file 'chapters 5 & 6 v03' after clicking on the file and using the context menu

Pointers

- The most common form of pointers is the mouse, but joysticks are also common, for example in game controllers
- On mobile phones and tablets, a stylus is often provided as the pointer
- On touchscreen systems the finger is used.
- Remote pointers include infra-red pointers, for example for doing presentations.

Interface design guidelines

- Modern graphical user interfaces have as part of their make-up a range of widgets including **buttons** and **radio buttons**, **sliders, scroll bars** and **checkboxes**.
- It is now very simple to create inelegant, unusable interfaces. This problem is well recognized and has resulted in the creation of **style guides**
- Style guides exist for the different kinds of windowing systems available and are occasionally written by specific software companies to ensure that their products are **consistent**, **usable** and **distinctive**.
- **Interface consistency** is an important result of using style guides as is evident on devices such as the iPhone.

Radio buttons

- Use a series of radio buttons to allow people to make *exclusive* choices, for example, the buttons on a radio: you can listen to FM or AM at any one time but not both.

Figure 12.14 Radio buttons and check boxes from Adobe® Photoshop® from Apple OS X

Checkboxes

- Checkboxes should be used to display individual settings that can be switched (checked) on and off.

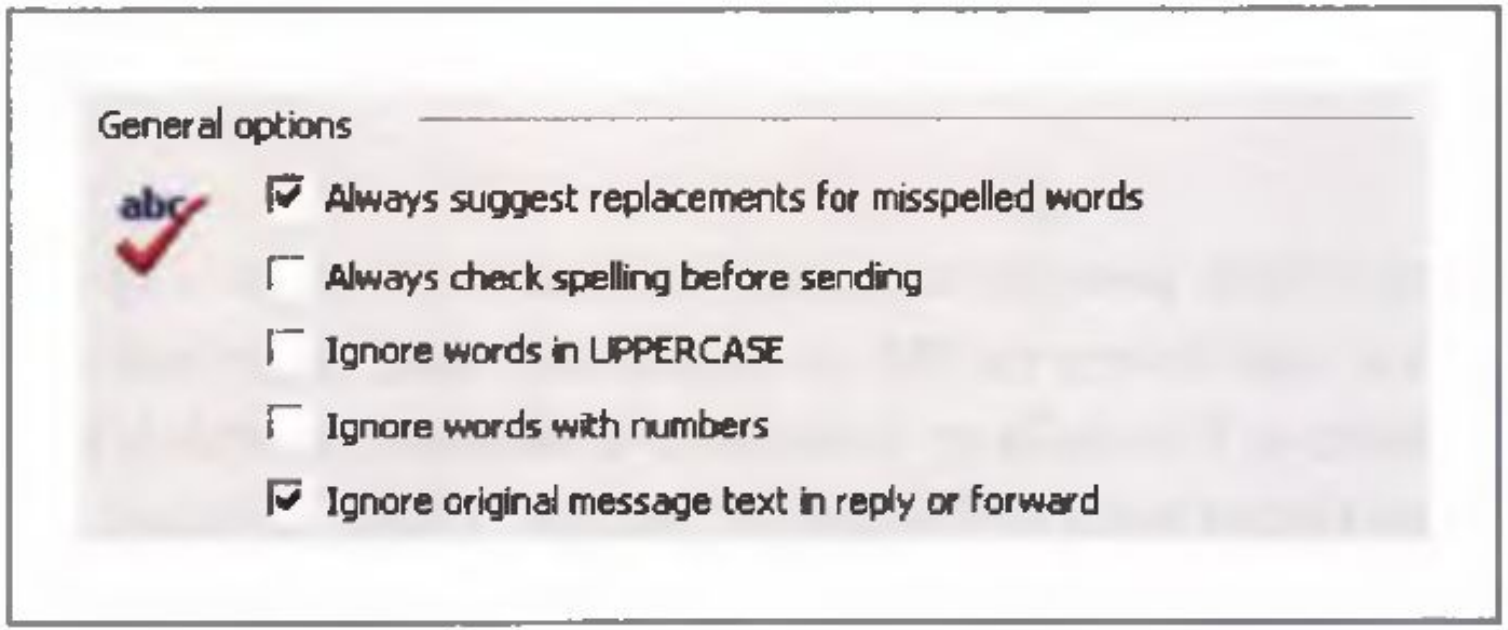
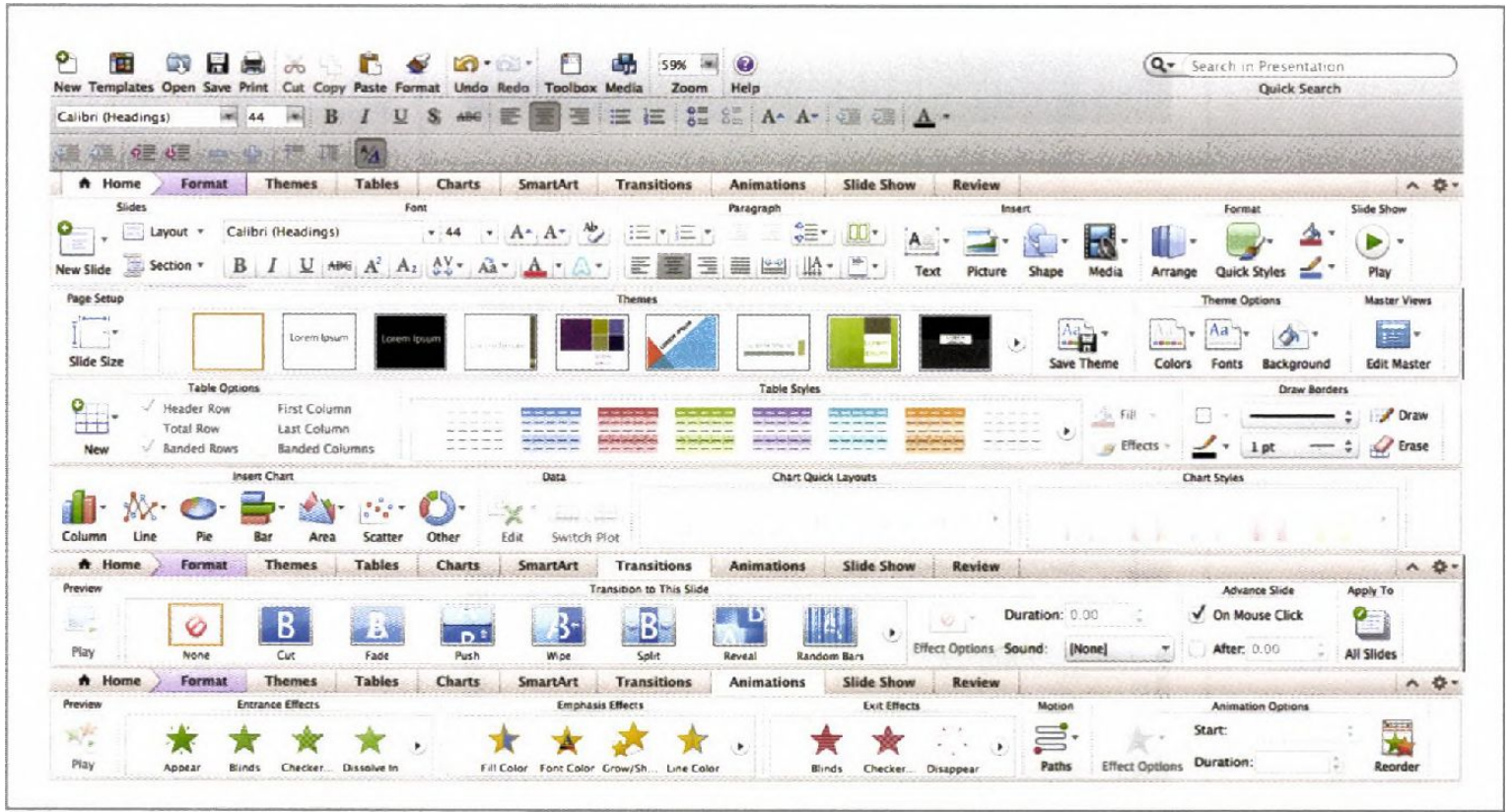


Figure 12.15 A checkbox from MS Outlook from Windows XP

Toolbars

- A toolbar is a **collection of buttons** grouped according to function (in this respect they are conceptually identical to menus).
- The buttons are represented as icons to give a clue as to their function. Passing the mouse pointer over an icon will usually trigger the associated ‘tool tip’,
- Toolbars are also configurable: their contents can be changed and one can choose whether or not they are displayed.



List boxes

- A list box is an accurately named widget as it is a box in which files and options are listed.

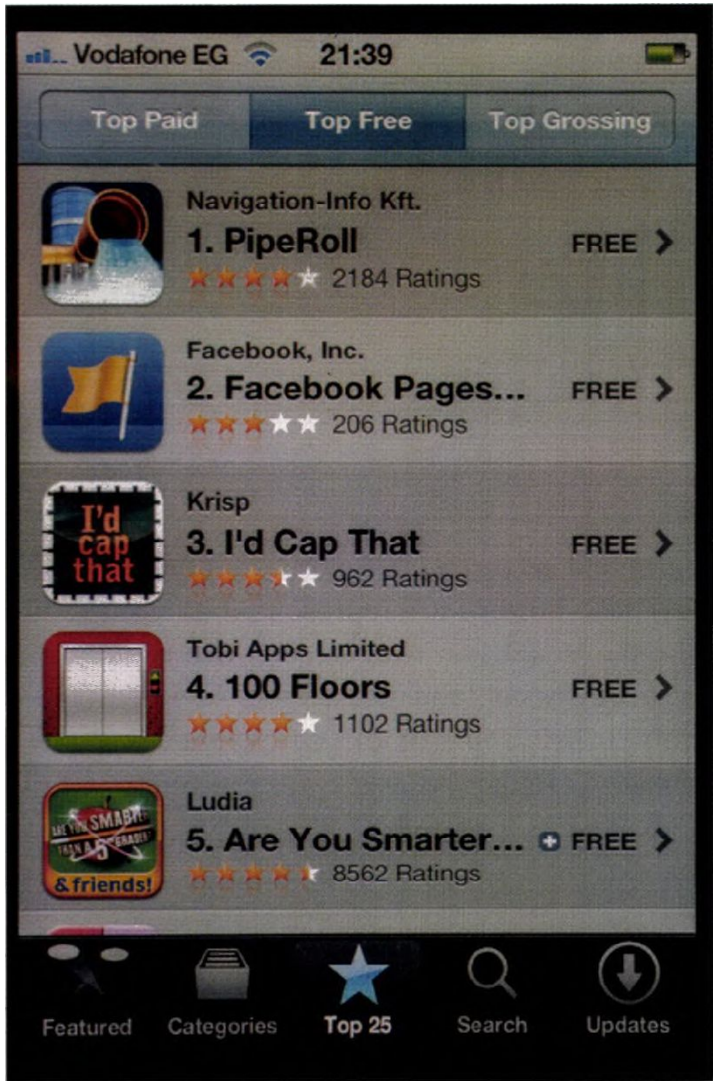


Figure 12.17 iPhone list box

Sliders

- A slider is a widget that can return analogue values: rather than setting, say, the volume to 7 on a scale of 10, people can drag a slider to a position three-quarters of the way along a scale.

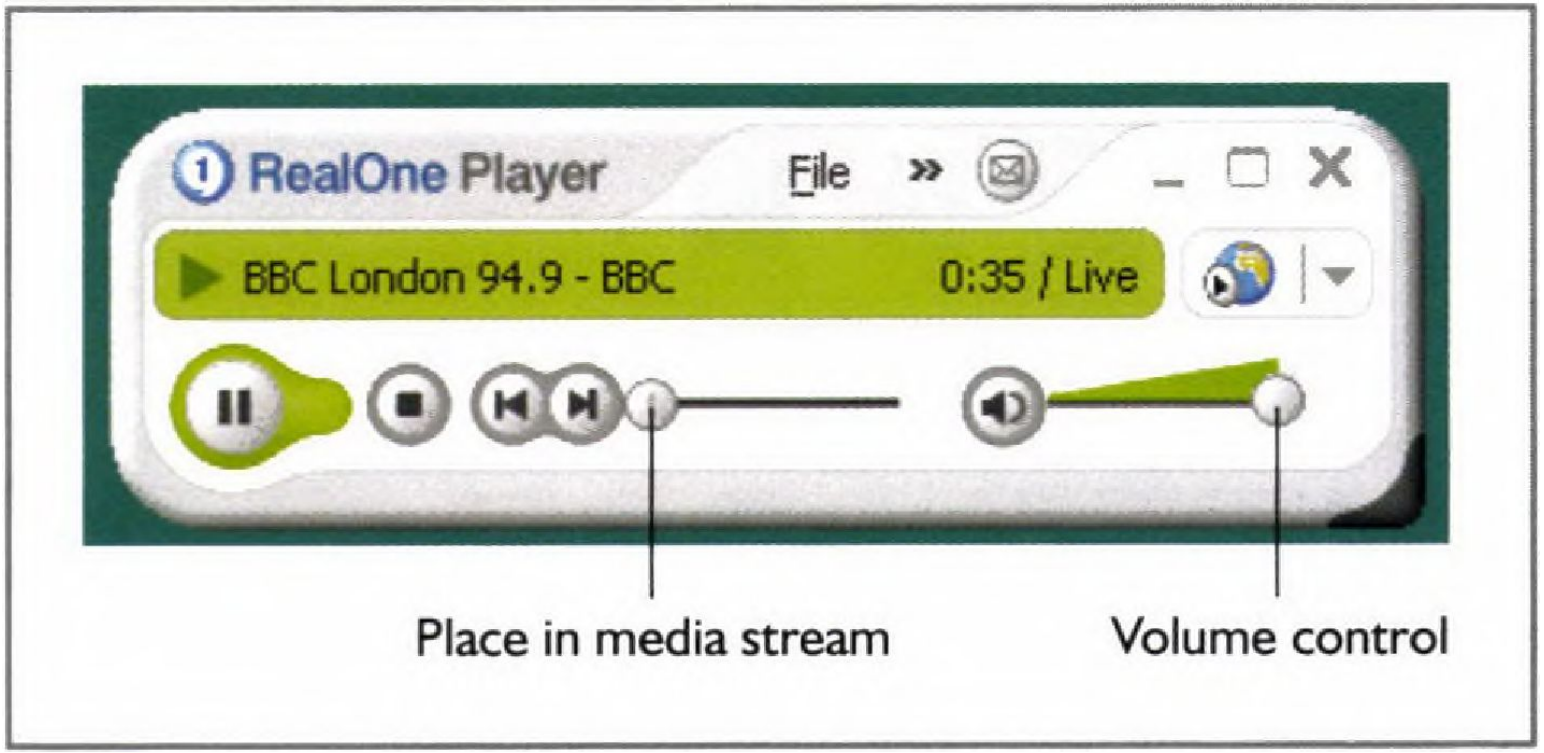


Figure 12.18 The RealOne Player® with two slider controls

Form fill

- Form filling is an interface style that is particularly popular with Web applications. Form fill interfaces are used to gather information such as name and address.
- The individual boxes are called **fields** and are frequently marked with an asterisk (*) to indicate that an entry is **mandatory**.

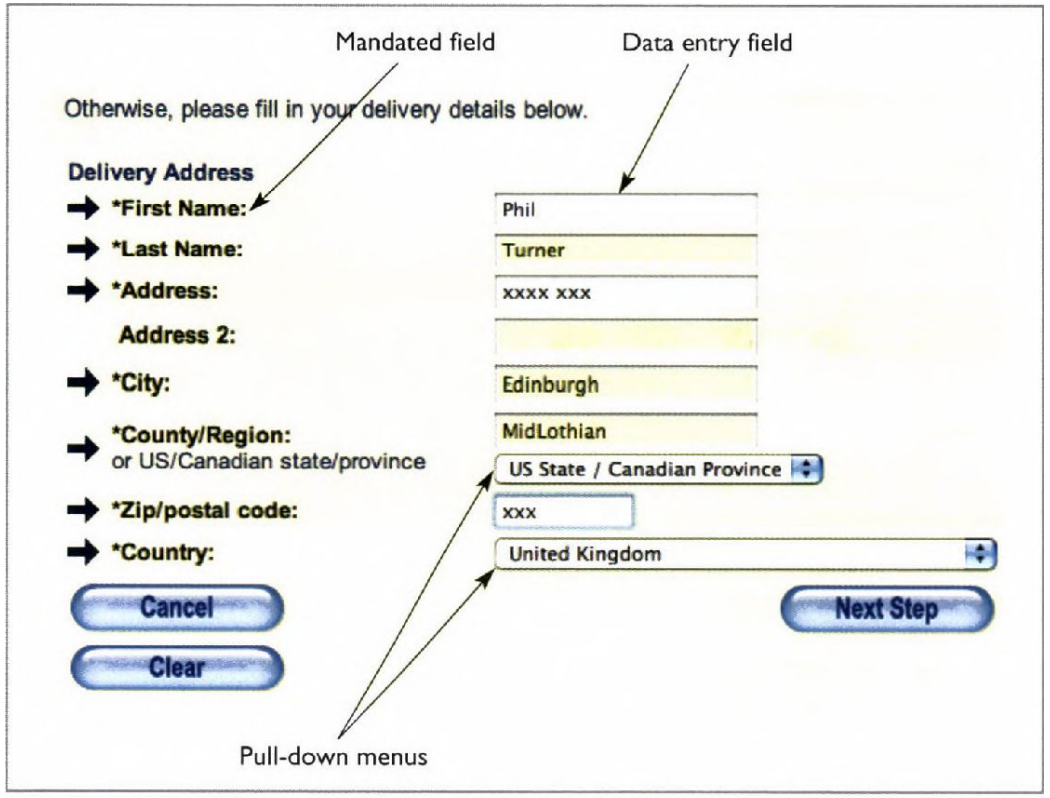


Figure 12.19 A typical form fill user interface

Wizards

- Wizard is the name given to a style of interaction that leads people by the metaphorical hand (or pointer) step-by-step through a series of questions and answers, picklists and other kinds of widgets to achieve a task.

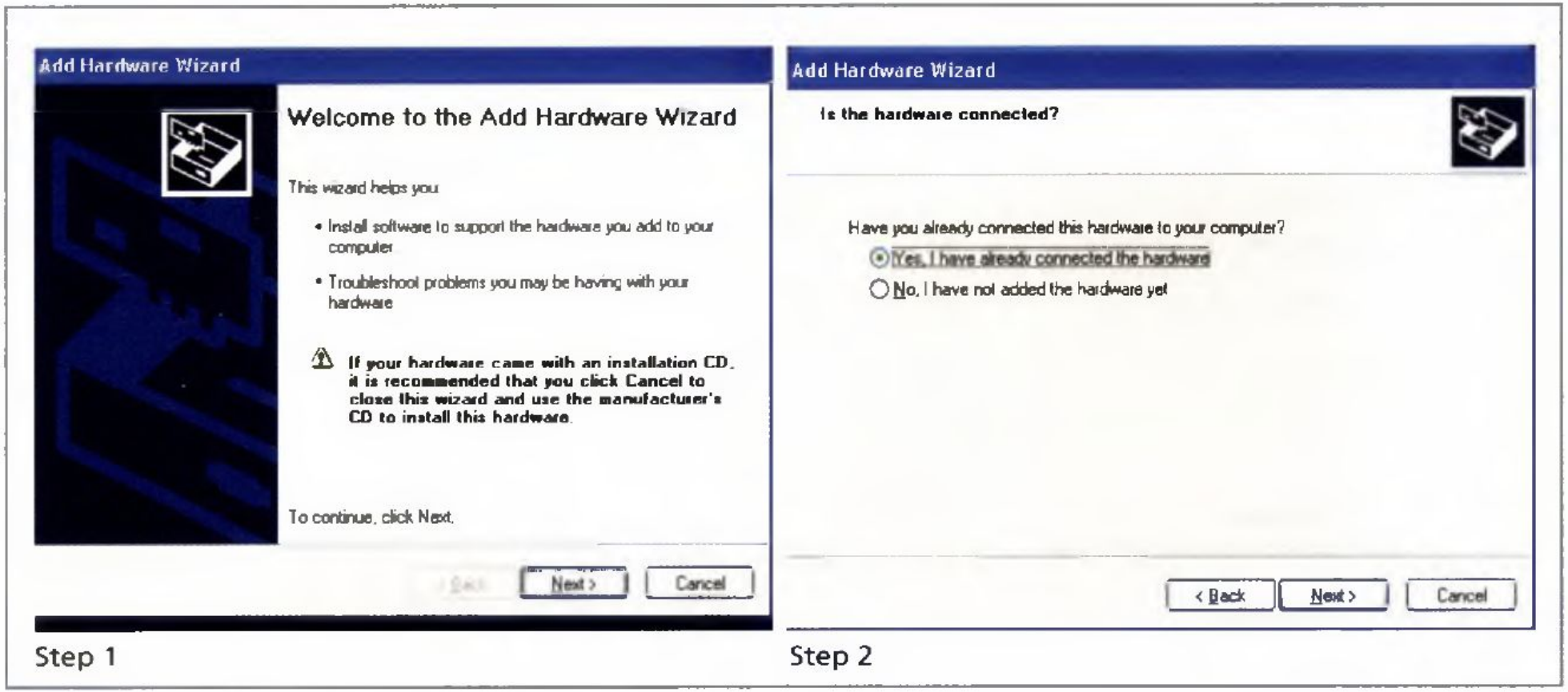


Figure 12.20 The Microsoft Add Hardware wizard

Alerts

- Figure 12.21 illustrates two different approaches (by the same software vendor) to alerting people to the presence of new mail.

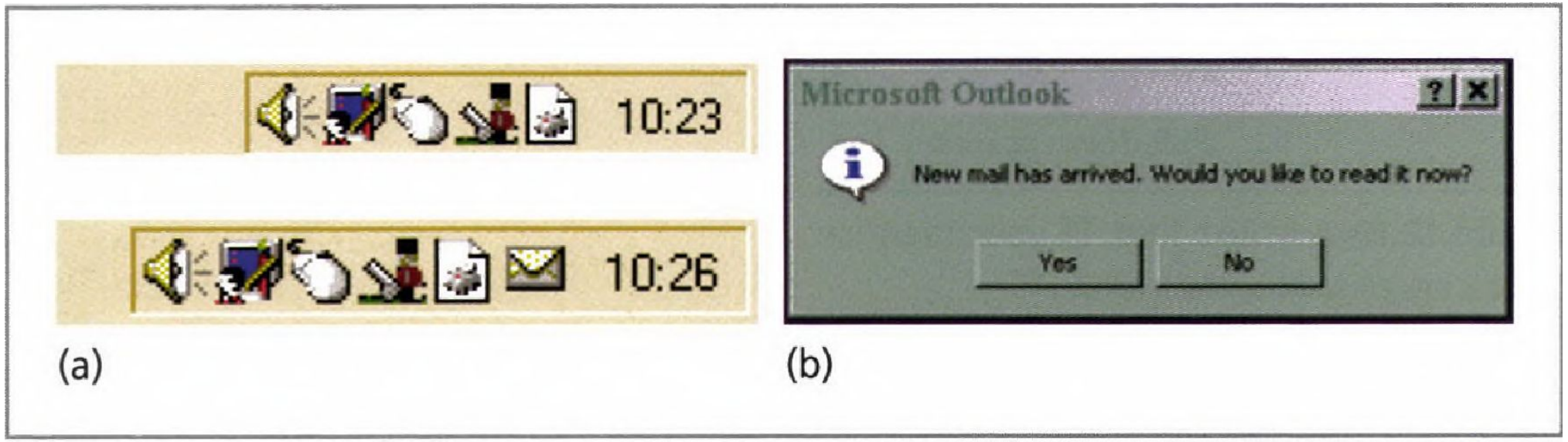


Figure 12.21 Attracting attention

Alerts

- Attracting attention is a simple enough matter - flash a light, use some other form of **attention**, ring a bell, and our attention is directed at that stimulus.
- However, the challenge of attracting and holding attention is to do so in a manner which:
  - Does not distract us from the main task, particularly if we are doing something important, such as flying an aircraft or operating a complex or hazardous tool
  - In certain circumstances *can* be ignored while in other circumstances *cannot* and *should not* be ignored
  - Does not overwhelm the user of a system with more information than they can reasonably understand or respond to.

Psychological principles and interface design

- Apple, Android and Microsoft have style guides and many development environments will ensure that designs conform to the standards they are aiming at.
- Cooper *et al.* (2007) argues that visual interface design is a central component of interaction design as it combines graphic design, industrial design and visual information design.
- Designers need to know about graphic design, such as what shape, size, colour, orientation and texture screen objects should be.

Guidelines from perception

- Perception research also provides us with other fundamental aspects of people's abilities that should be considered when designing visual interfaces.

Using proximity to organize buttons

- One of the *Gestalt* principles of perception is the observation that objects appearing close together in space or time tend to be perceived together.

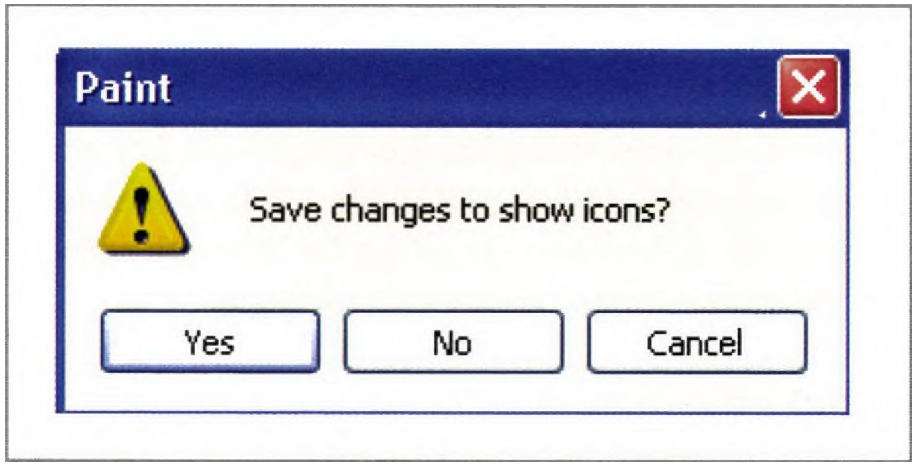


Figure 12.22 Equally spaced buttons - Windows XP

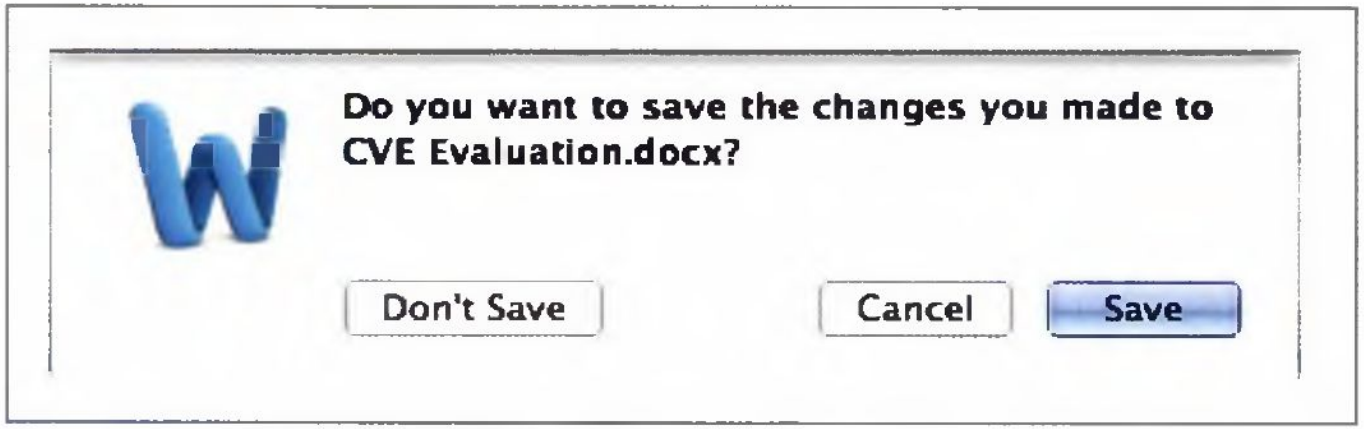


Figure 12.23 Buttons organized by proximity – OS X

Guidelines from perception

Using similarity to organize files

- A second *Gestalt* law we consider is that of **similarity.**

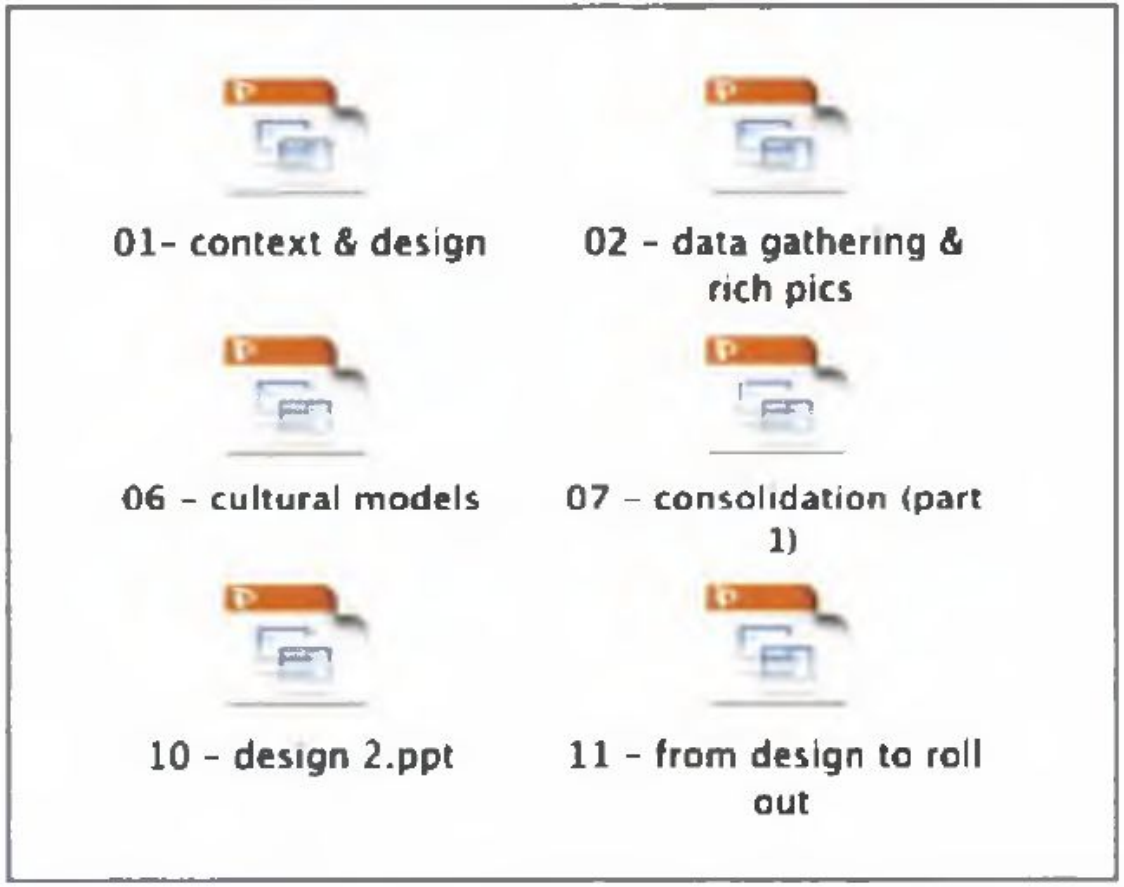


Figure 12.24 Organizing files using similarity

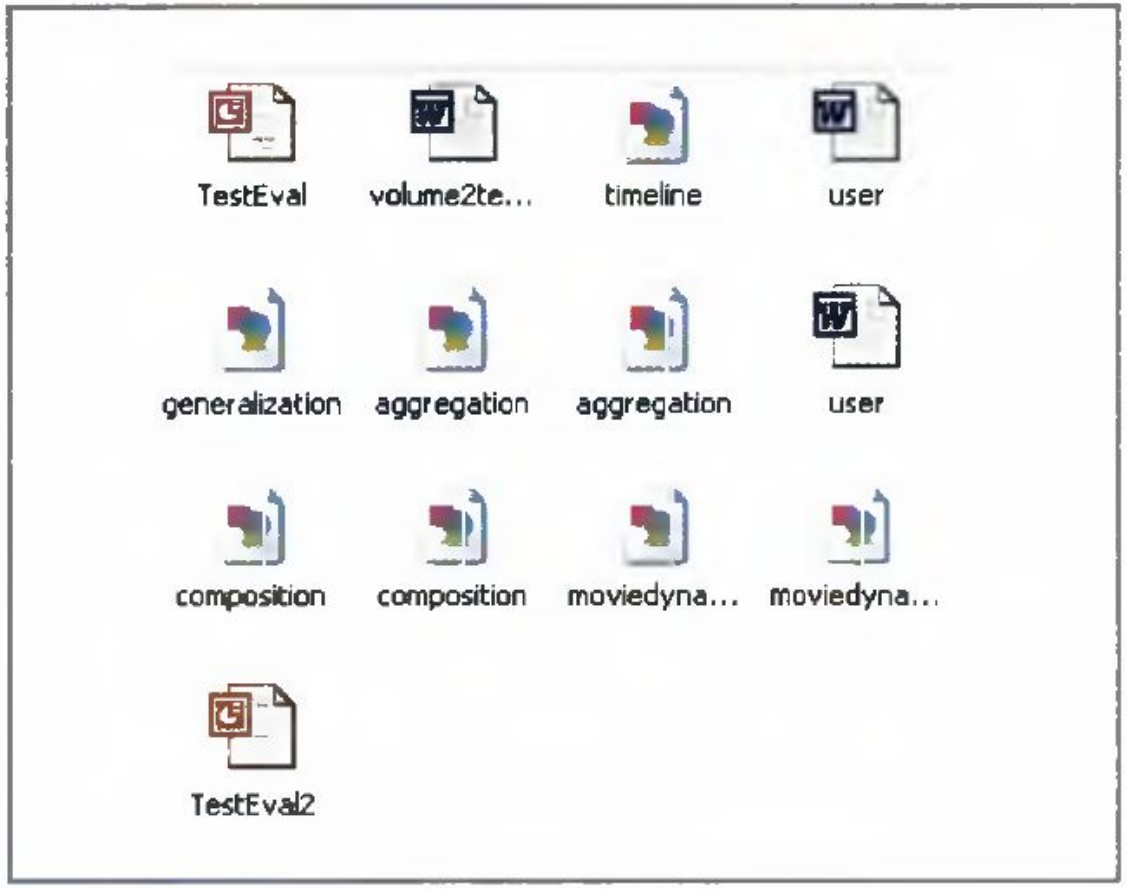


Figure 12.25 Disorganized files

Guidelines from perception

Using continuity to connect disconnected elements

- A third *Gestalt* law is continuity.
- The length of the slider is an indication of how much of the total document is visible. The slider indicates that about 80 per cent of the document is visible.

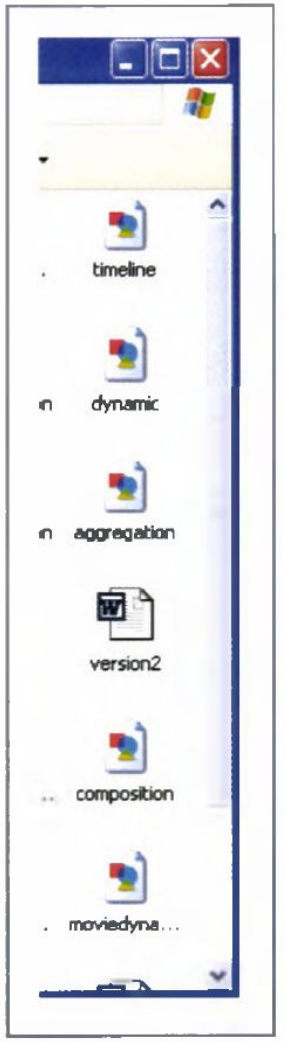


Figure 12.26 A Microsoft Windows XP scrollbar

Guidelines from perception

Closure

- This particular law refers to the fact that it has been found that closed objects are easier to perceive than those that are open.
- It describes our tendency to perceive segmented visual elements as complete or whole objects, even when we are missing information.

Despite these icons being reduced to the barest of elements, we perceive the pieces as wholes and form familiar objects: a file drawer, a shop window and awning, stacked folders, and mail.

Principles from memory and attention

- Our understanding of human abilities in remembering and attending to things also leads to a number of sound guidelines. Memory is usually considered in terms of our short-term or working memory and long-term memory.

Short term memory

- George Miller (1956) found that short-term memory is limited to only *7 ±2* 'chunks' of information.
- This principle has been used in HCI to suggest that menus should be restricted to about seven items, or Web navigation bars should be seven items.

Principles from memory and attention

Chunking

- Chunking is the process of grouping information into larger, more meaningful units, thus minimizing the demands on working memory. Chunking is a very effective way of reducing memory load.
- An example of chunking at the interface is the grouping of meaningful elements of a task into one place (or dialogue).

Principles from memory and attention

Chunking

- In Fig. 12.28, a large number of formatting options (font, alignment, border and document setting) have been chunked into a single, expandable dialogue. The ► symbol indicates that the selection will expand if selected.

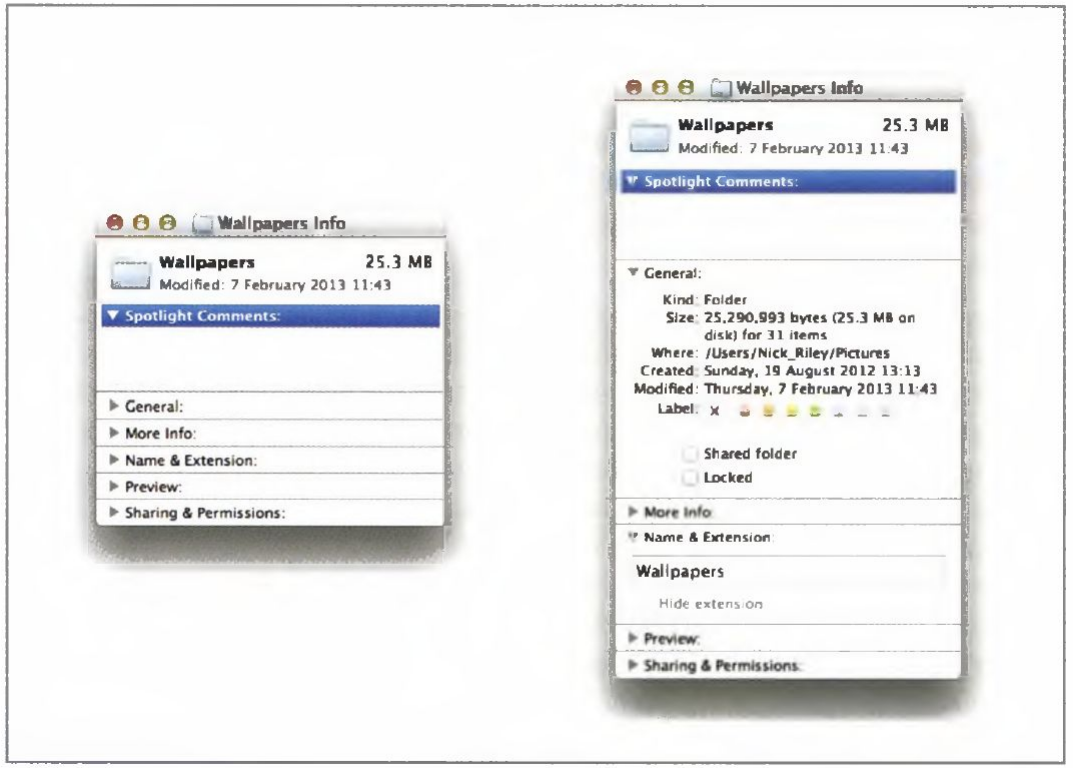


Figure 12.28 A *before* and *after* chunked dialogue

Principles from memory and attention

Time limitations

- Memories, particularly those in short-term or working memory, are surprisingly short-lived, so, it is essential to make important information presented persist (Figure 12.29); that is, do not flash an alert

Figure 12.29 An example of a persistent alert box

Principles from memory and attention

Recall and recognition

- Another guideline derived from our knowledge of memory is to design for recognition rather than recall.
- Recognition involves searching your memory and then deciding whether the piece of information matches what you have in your memory store.

Principles from memory and attention

Designing for memory

- The palette has been designed to use recognition rather than recall. The drop-down menus for style, name and size remove the need to recall the names of the fonts installed
- The palette has been organized into four chunks - font, alignment and spacing, borders and shading,
- The use of meaningful associations: B stands for bold, *I* for italic.
- The palette also relies on aspects of visual processing and the use of icons.

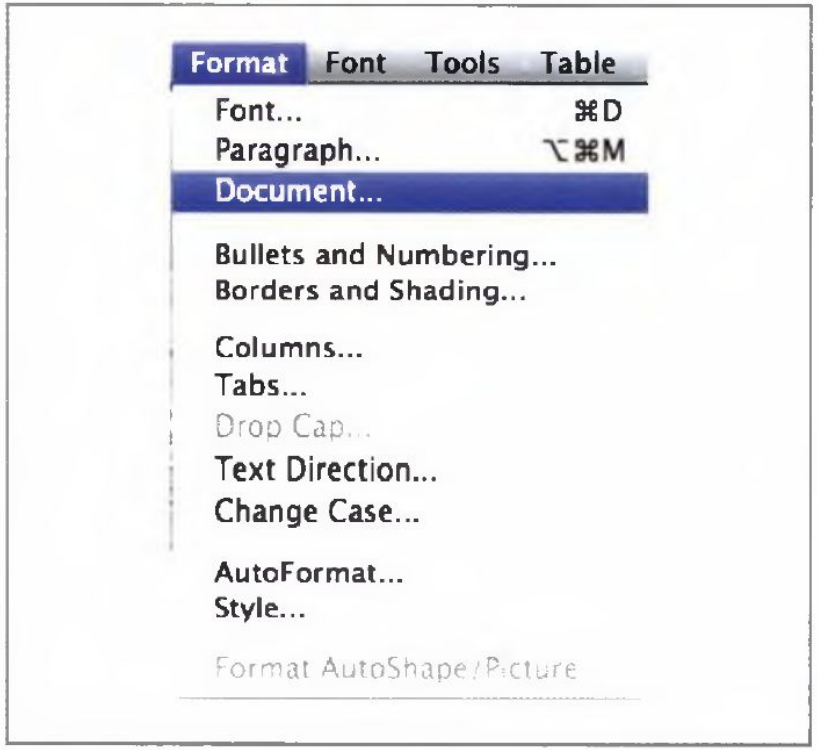


Figure 12.30 Interface widgets in OS X

Designing with color

- Designing colour into interactive systems is very difficult. If it were otherwise, why are most domestic electronic devices black?
- Aaron Marcus's excellent book *Graphic Design for Electronic Documents and User Interfaces* (Marcus, 1992) provides the following rules.
- Rule 1 Use a maximum of 5 ± 2 colours.
- Rule 2 Use foveal (central) and peripheral colours appropriately.
- Rule 3 Use a colour area that exhibits a minimum shift in colour and/or size if the colour area changes in size.
- Rule 4 Do not use simultaneous high-chroma, spectral colours.
- Rule 5 Use familiar, consistent colour codings with appropriate references.

Red	Danger, hot, fire
Yellow	Caution, slow, test
Green	Go, okay, clear, vegetation, safety
Blue	Cold, water, calm, sky
Warm colours	Action, response required, proximity
Cool colours	Status, background information, distance
Greys, white and blue	Neutrality

Error avoidance design guidelines

- The following design guidelines have been drawn from Reason and Norman's design principles:
  - Use knowledge to promote good conceptual model of the system by maintaining consistency of mapping between the designer's model, the system model and the user's model.
  - Simplify the structure of tasks so as to minimize the load upon vulnerable cognitive processes
  - Make both the execution and the evaluation sides of an action visible. Visibility in regard to the former allows users to know what is possible and how things should be done
  - Exploit natural mappings between intentions and possible actions, between actions and their effects on the system, between the actual system state and what is perceivable, and between the system state and the needs, intentions and expectations of the user.
  - Design for errors. Assume that they will happen, then plan for *error recovery*

Error message design guidelines

- Take care with the **wording and presentation** of alerts and error messages.
- Avoid using **threatening or alarming language** in messages (e.g. fatal error, run aborted, kill job, catastrophic error).
- Do not use **double negatives** as they can be ambiguous.
- Use specific, constructive words in error messages (e.g. avoid general messages such as **'invalid entry**' and use specifics such as 'please enter your name').
- Make the system 'take the blame' for errors (e.g. '**illegal command**' versus 'unrecognized command').
- **DO NOT USE ALL UPPERCASE LETTERS** as it looks as if you are shouting - instead, use a mixture of uppercase and lowercase.
- Use **attention-grabbing** techniques cautiously (e.g. avoid over-using 'blinks' on Web pages, flashing messages, 'you have mail', bold colours, etc.).
- Do not use more than **four different** font sizes per screen.
- Do not over-use **audio or video**.
- Use **colours** appropriately and make use of expectations (e.g. red = danger, green = ok).

Information design

- Interaction designers need to consider how to lay out the large amounts of data and information that are often involved in applications.
- They need to provide people with methods to interact with it.
- Information design is essentially to do with sense-making, with how to present data (often in large amounts) in a form that people can easily understand and use
- Information designers have to understand the characteristics of the different media being used to present data

Information design

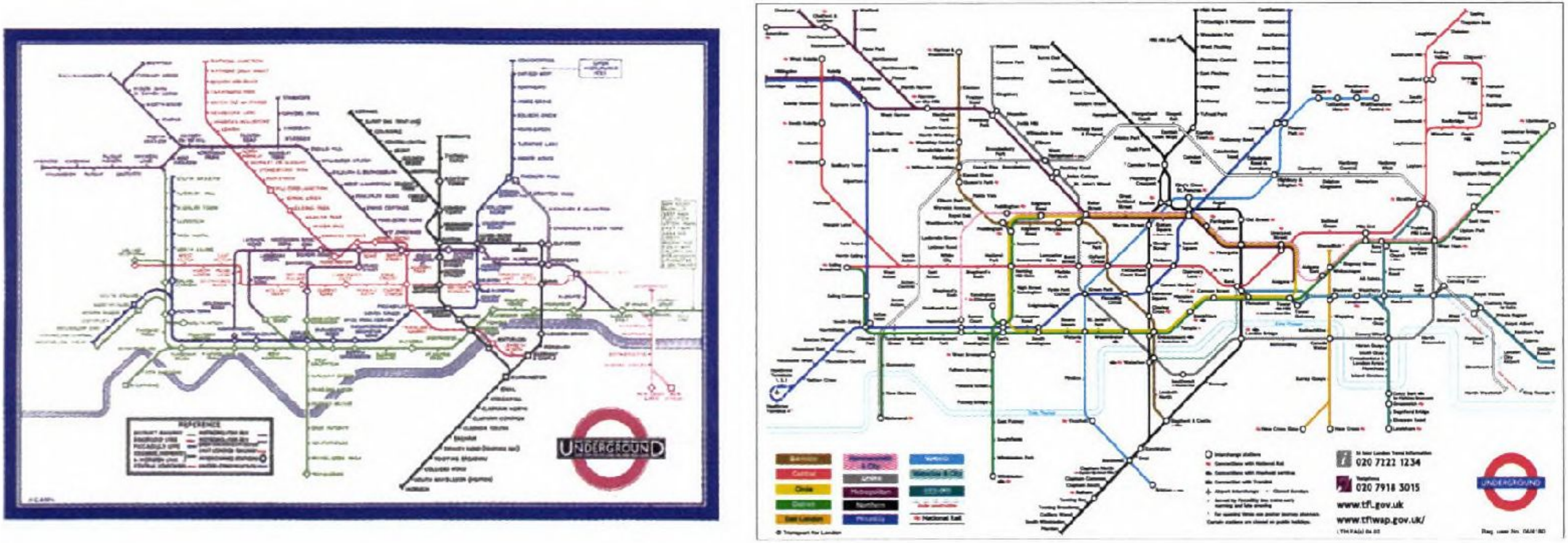
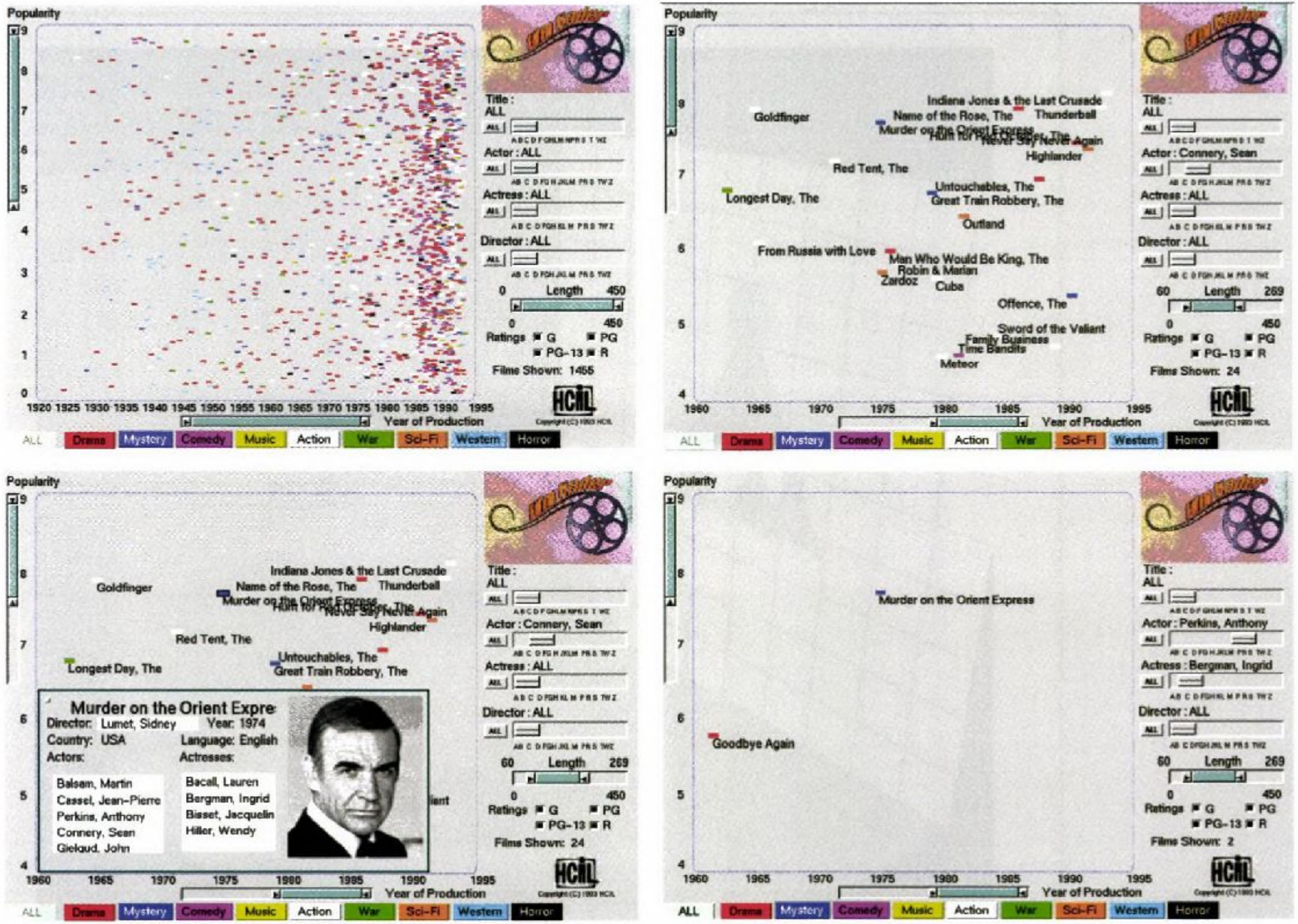


Figure 12.35 Maps of the London Underground rail network

Visualization

- The other key feature of information design is interactive visualization.
- With the vast amounts of data that are available, novel ways of presenting and interacting with this are necessary.
- Indeed, Card (2012) argues that visualization is concerned with ‘amplifying cognition’.
  - increasing the memory and processing resources available to people,
  - reducing the search for information,
  - helping people to detect patterns in the data,
  - helping people to draw inferences from the data,
  - encoding data in an interactive medium.


Popularity
Title : ALL
Actor : ALL
Actress : ALL
Director : ALL
Length
Ratings G PG PG-13 R
Films Shown: 1455
Year of Production
ALL Drama Mystery Comedy Music Action War Sci-Fi Western Horror
Goldfinger
Indiana Jones & the Last Crusade
Name of the Rose, The
Thunderball
Highlander
Red Tent, The
Untouchables, The
Great Train Robbery, The
Longest Day, The
Outland
From Russia with Love
Man Who Would Be King, The
Robin & Marian
Zardoz
Cuba
Offence, The
Sword of the Valiant
Family Business
Time Bandits
Meteor
Actor : Connery, Sean
Films Shown: 24
Murder on the Orient Expre
Director: Lumet, Sidney
Year: 1974
Country: USA
Language: English
Actors:
Actresses:
Balsam, Martin
Cassel, Jean-Pierre
Perkins, Anthony
Connery, Sean
Gielgud, John
Bacall, Lauren
Bergman, Ingrid
Bisset, Jacquelin
Hiller, Wendy
Murder on the Orient Express
Actor : Perkins, Anthony
Actress : Bergman, Ingrid
Goodbye Again
Films Shown: 2

Film finder