



HNDIT2022- Software Development

Week 10 & 11: Introduction to concept of user interface design

The User Interface

- 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

Graphical user interfaces

- Most users of business systems interact with these systems through graphical interfaces although, in some cases, legacy text-based interfaces are still used

GUI characteristics

Characteristic	Description
Windows	Multiple windows allow different information to be displayed simultaneously on the user's screen.
Icons	Icons different types of information. On some systems, icons represent files; on others, icons represent processes.
Menus	Commands are selected from a menu rather than typed in a command language.
Pointing	A pointing device such as a mouse is used for selecting choices from a menu or indicating items of interest in a window.
Graphics	Graphical elements can be mixed with text on the same display.

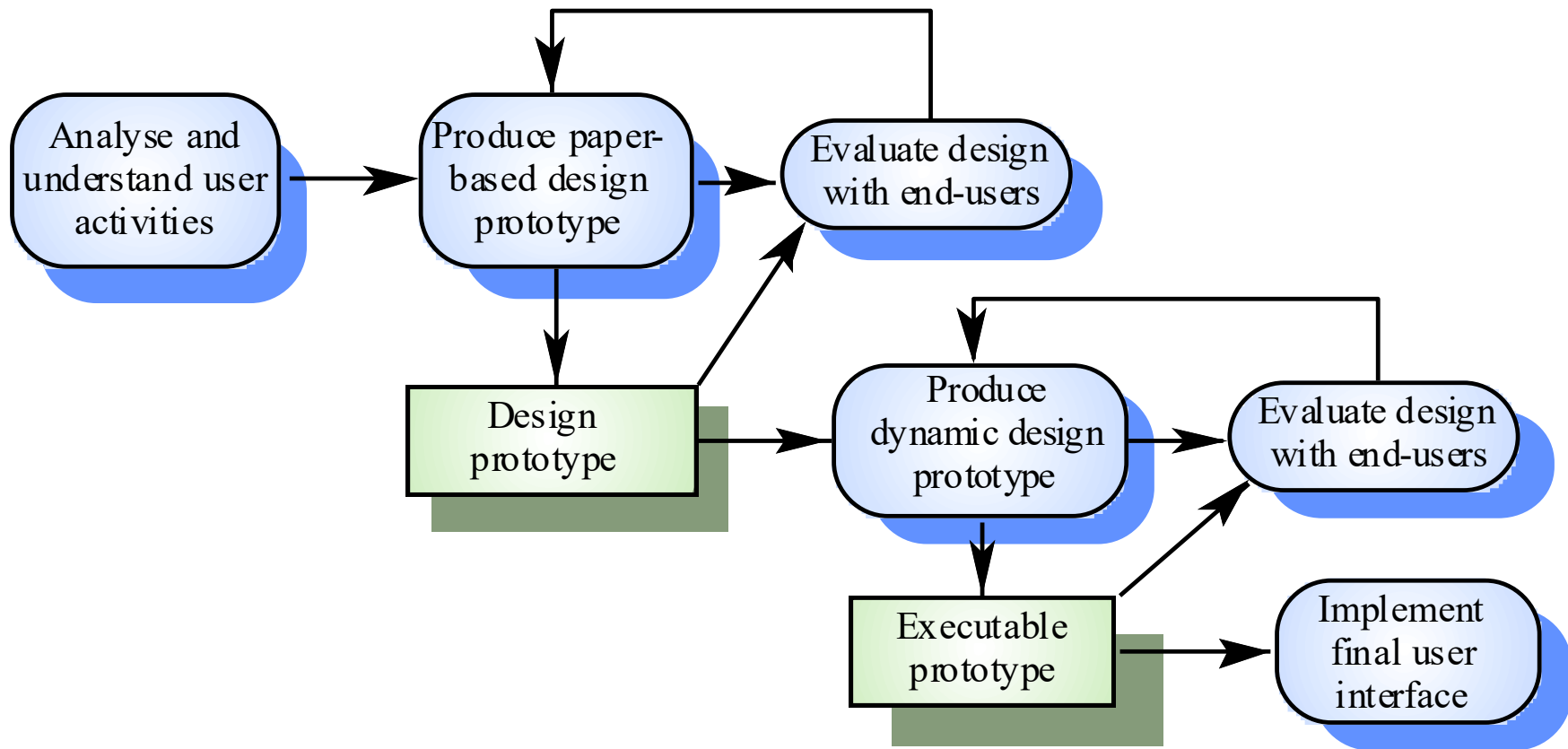
GUI advantages

- They are easy to learn and use.
 - Users without experience can learn to use the system quickly.
- The user may switch quickly from one task to another and can interact with several different applications.
 - Information remains visible in its own window when attention is switched.
- Fast, full-screen interaction is possible with immediate access to anywhere on the screen

User-centred design

- User-centred design is an approach to UI design where the needs of the user are paramount and where the user is involved in the design process
- UI design always involves the development of prototype interfaces

User interface design process



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 principles

- User familiarity
 - The interface should be based on user-oriented terms and concepts rather than computer concepts. For example, an office system should use concepts such as letters, documents, folders etc. rather than directories, file identifiers, etc.
- Consistency
 - The system should display an appropriate level of consistency. Commands and menus should have the same format, command punctuation should be similar, etc.
- Minimal surprise
 - If a command operates in a known way, the user should be able to predict the operation of comparable commands

Design principles

- Recoverability
 - The system should provide some resilience to user errors and allow the user to recover from errors. This might include an undo facility, confirmation of destructive actions, 'soft' deletes, etc.
- User guidance
 - Some user guidance such as help systems, on-line manuals, etc. should be supplied
- User diversity
 - Interaction facilities for different types of user should be supported. For example, some users have seeing difficulties and so larger text should be available

Choosing Interface Elements

- **Input Controls:** buttons, text fields, checkboxes, radio buttons, dropdown lists, list boxes, toggles, date field
- **Navigational Components:** breadcrumb, slider, search field, pagination, slider, tags, icons
- **Informational Components:** tooltips, icons, progress bar, notifications, message boxes, modal windows
- **Containers:** accordion

User-system interaction

- 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

Interaction styles

- Direct manipulation
- Menu selection
- Form fill-in
- Command language
- Natural language

Interaction style	Main advantages	Main disadvantages	Application examples
Direct manipulation	Fast and intuitive interaction Easy to learn	May be hard to implement Only suitable where there is a visual metaphor for tasks and objects	Video games CAD systems
Menu selection	Avoids user error Little typing required	Slow for experienced users Can become complex if many menu options	Most general-purpose systems
Form fill-in	Simple data entry Easy to learn	Takes up a lot of screen space	Stock control, Personal loan processing
Command language	Powerful and flexible	Hard to learn Poor error management	Operating systems, Library information retrieval systems
Natural language	Accessible to casual users Easily extended	Requires more typing Natural language understanding systems are unreliable	Timetable systems WWW information retrieval systems

Advantages and disadvantages

Direct manipulation advantages

- Users feel in control of the computer and are less likely to be intimidated by it
- User learning time is relatively short
- Users get immediate feedback on their actions so mistakes can be quickly detected and corrected

Direct manipulation problems

- The derivation of an appropriate information space model can be very difficult
- Given that users have a large information space, what facilities for navigating around that space should be provided?
- Direct manipulation interfaces can be complex to program and make heavy demands on the computer system

Control panel interface

Title	JSD. example	<input type="checkbox"/>	Grid	Busy
Method	JSD			
Type	Network	Units	cm ▶	QUIT
Selection	Process	Reduce	Full ▶	PRINT
NODE LINKS FONT LABEL EDIT				

Menu systems

- Users make a selection from a list of possibilities presented to them by the system
- The selection may be made by pointing and clicking with a mouse, using cursor keys or by typing the name of the selection
- May make use of simple-to-use terminals such as touchscreens

Advantages of menu systems

- Users need not remember command names as they are always presented with a list of valid commands
- Typing effort is minimal
- User errors are trapped by the interface
- Context-dependent help can be provided. The user's context is indicated by the current menu selection

Problems with menu systems

- Actions which involve logical conjunction (and) or disjunction (or) are awkward to represent
- Menu systems are best suited to presenting a small number of choices. If there are many choices, some menu structuring facility must be used
- Experienced users find menus slower than command language

Form-based interface

NEW BOOK

Title

ISBN

Author

Price

Publisher

Publication
date

Edition

Number of
copies

Classification

Loan
status

Date of
purchase

Order
status

Command interfaces

- User types commands to give instructions to the system e.g. UNIX
- May be implemented using cheap terminals.
- Easy to process using compiler techniques
- Commands of arbitrary complexity can be created by command combination
- Concise interfaces requiring minimal typing can be created

Problems with command interfaces

- Users have to learn and remember a command language. Command interfaces are therefore unsuitable for occasional users
- Users make errors in command. An error detection and recovery system is required
- System interaction is through a keyboard so typing ability is required

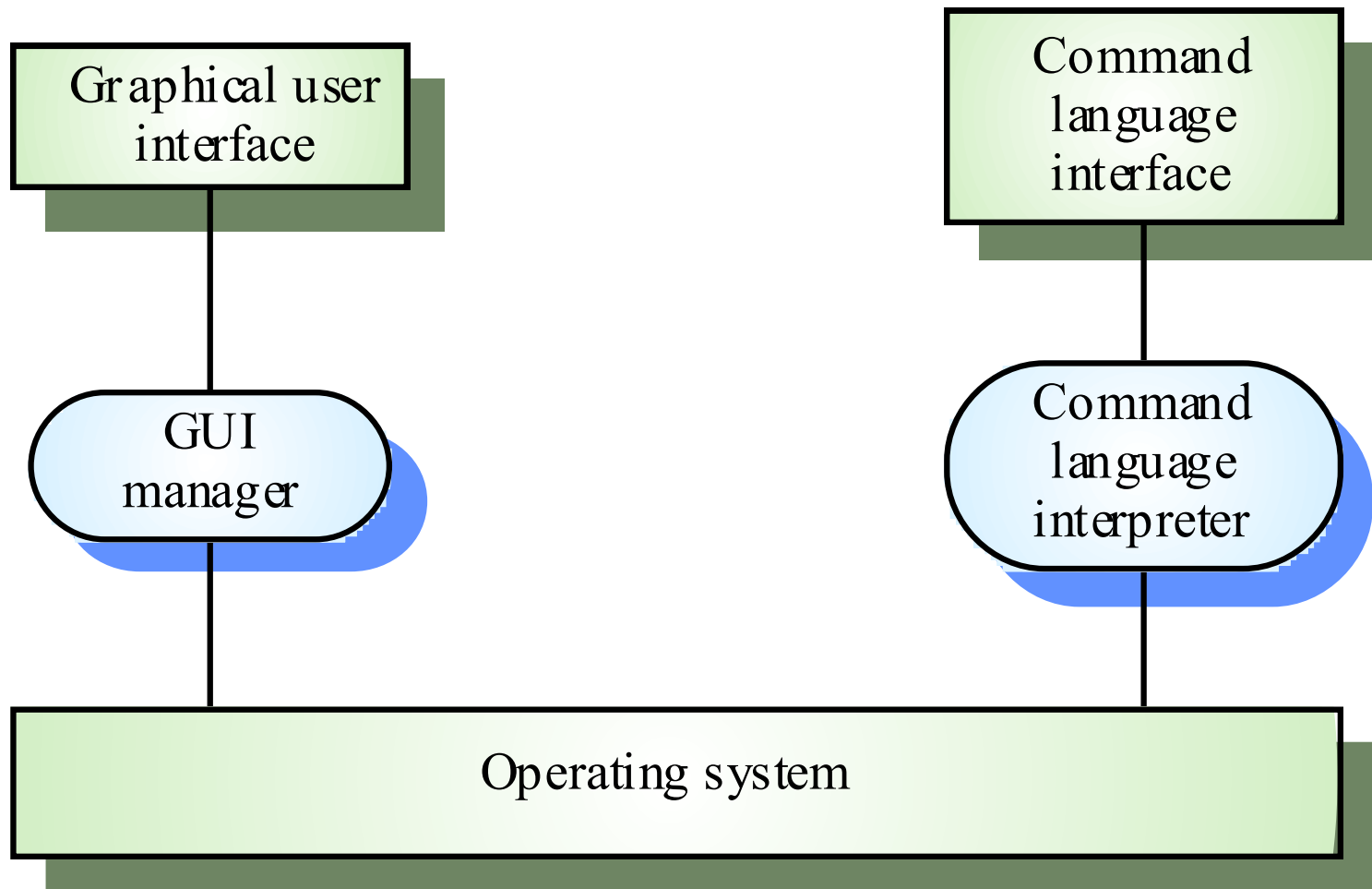
Command languages

- Often preferred by experienced users because they allow for faster interaction with the system
- Not suitable for casual or inexperienced users
- May be provided as an alternative to menu commands (keyboard shortcuts). In some cases, a command language interface and a menu-based interface are supported at the same time

Natural language interfaces

- The user types a command in a natural language. Generally, the vocabulary is limited and these systems are confined to specific application domains (e.g. timetable enquiries)
- NL processing technology is now good enough to make these interfaces effective for casual users but experienced users find that they require too much typing

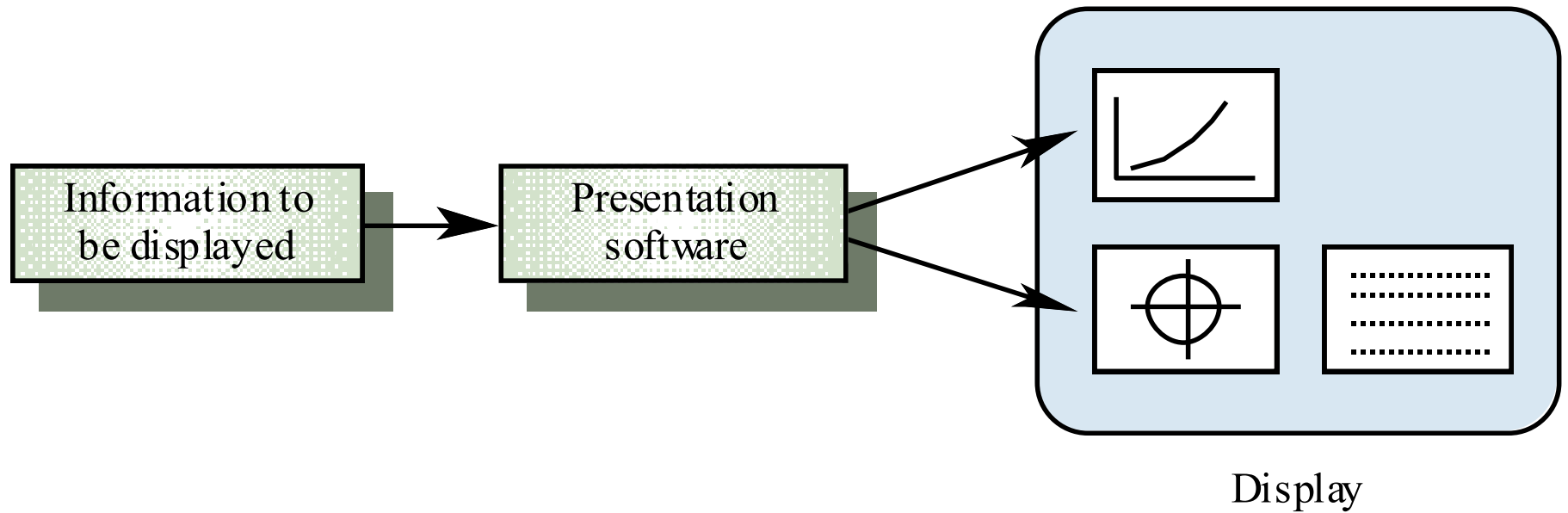
Multiple user interfaces



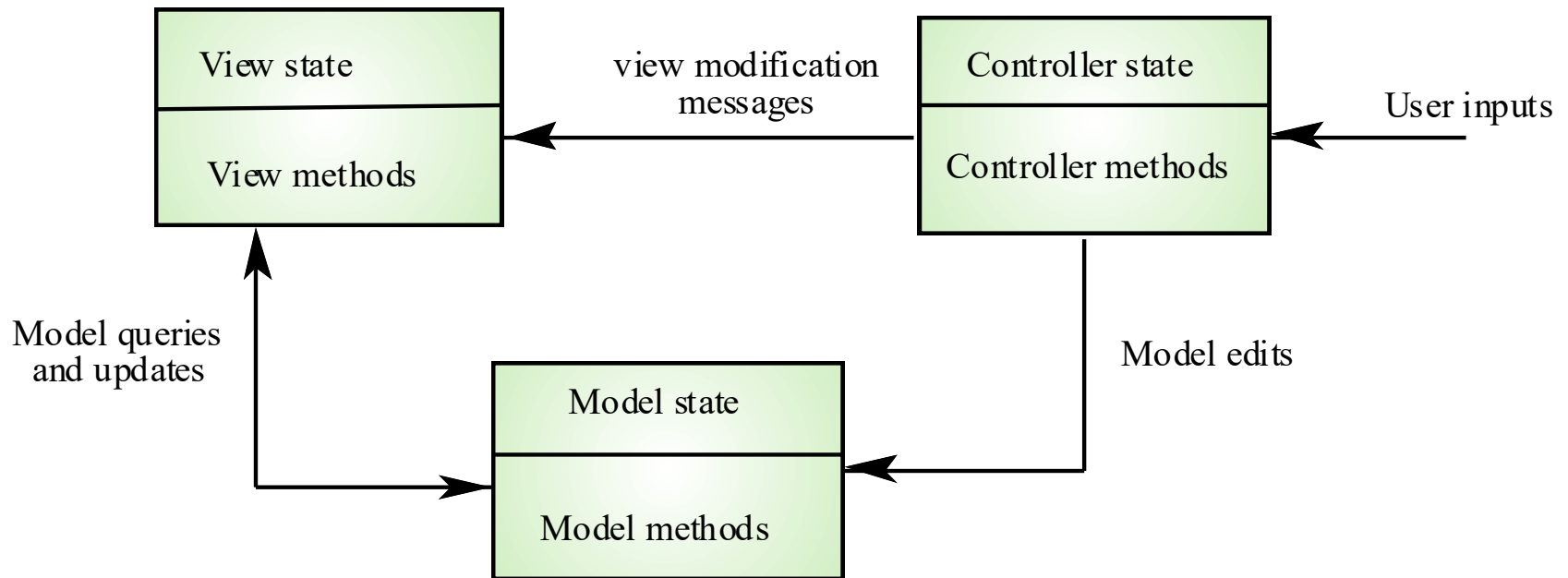
Information presentation

- 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)
- The Model-View-Controller approach is a way of supporting multiple presentations of data

Information presentation



Model-view-controller



Information presentation

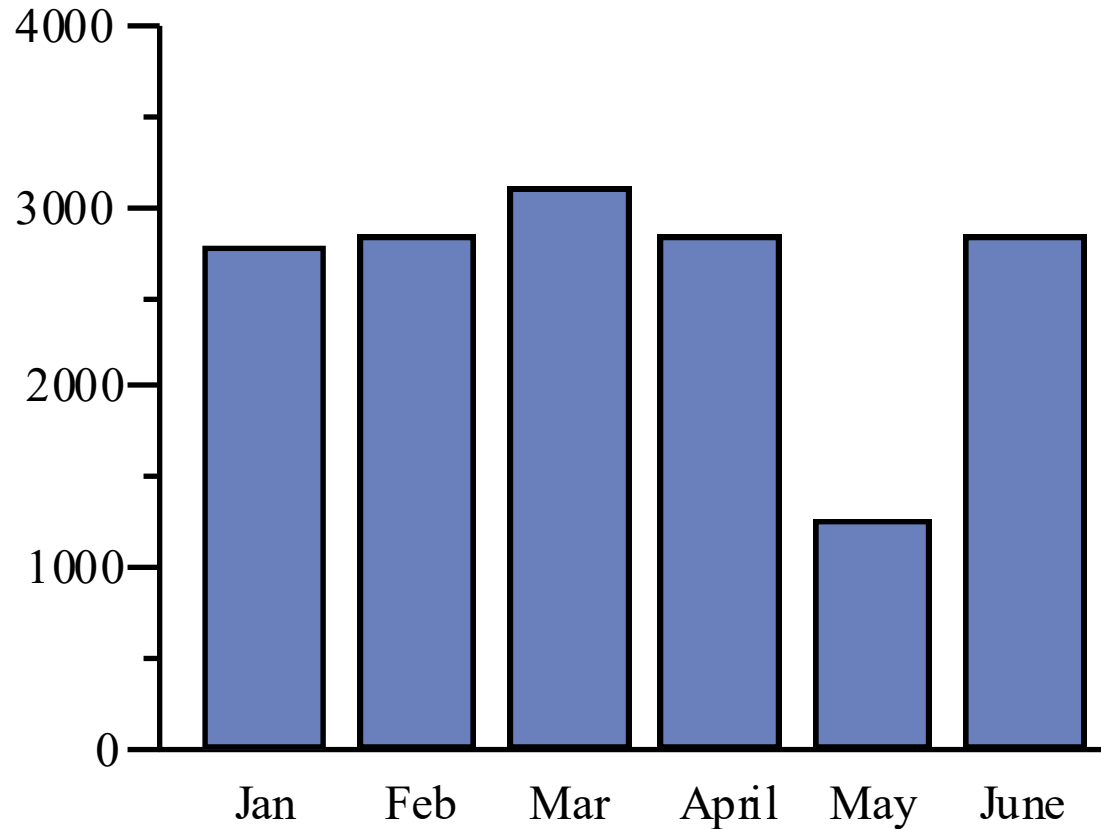
- Static information
 - Initialised at the beginning of a session. It does not change during the session
 - May be either numeric or textual
- Dynamic information
 - Changes during a session and the changes must be communicated to the system user
 - May be either numeric or textual

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?

Alternative information presentations

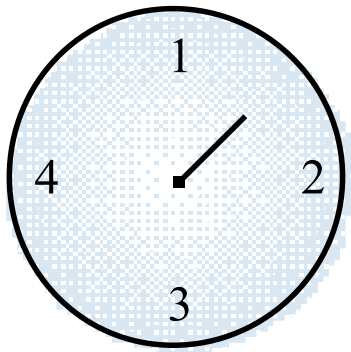
Jan	Feb	Mar	April	May	June
2842	2851	3164	2789	1273	2835



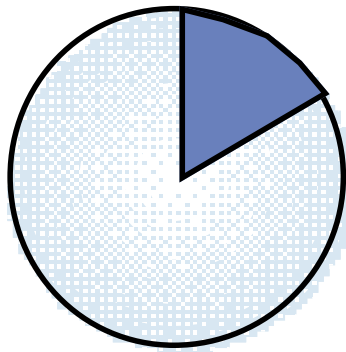
Analogue vs. digital presentation

- 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

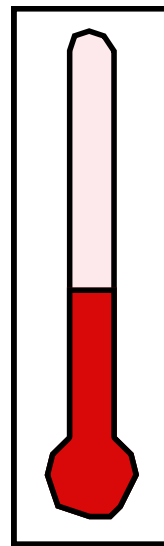
Dynamic information display



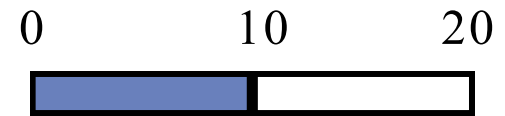
Dial with needle



Pie chart

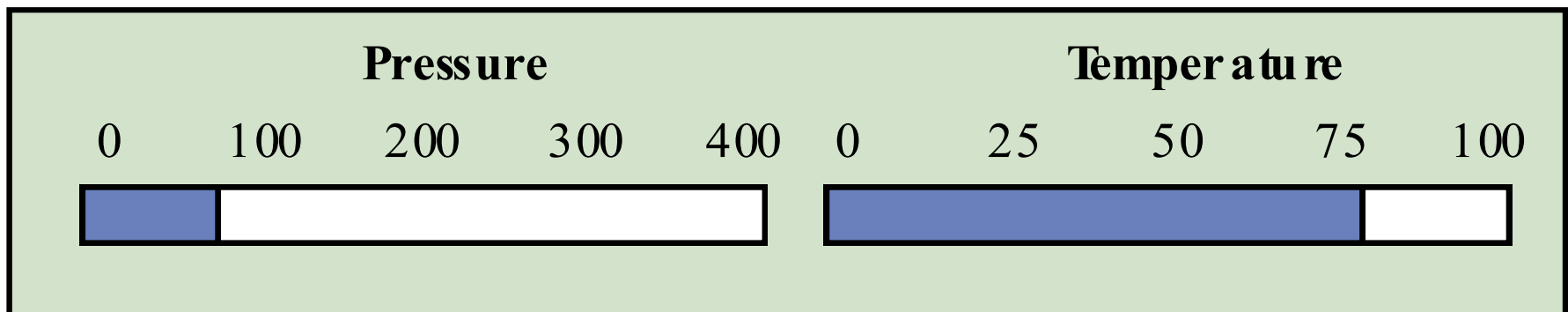


Thermometer

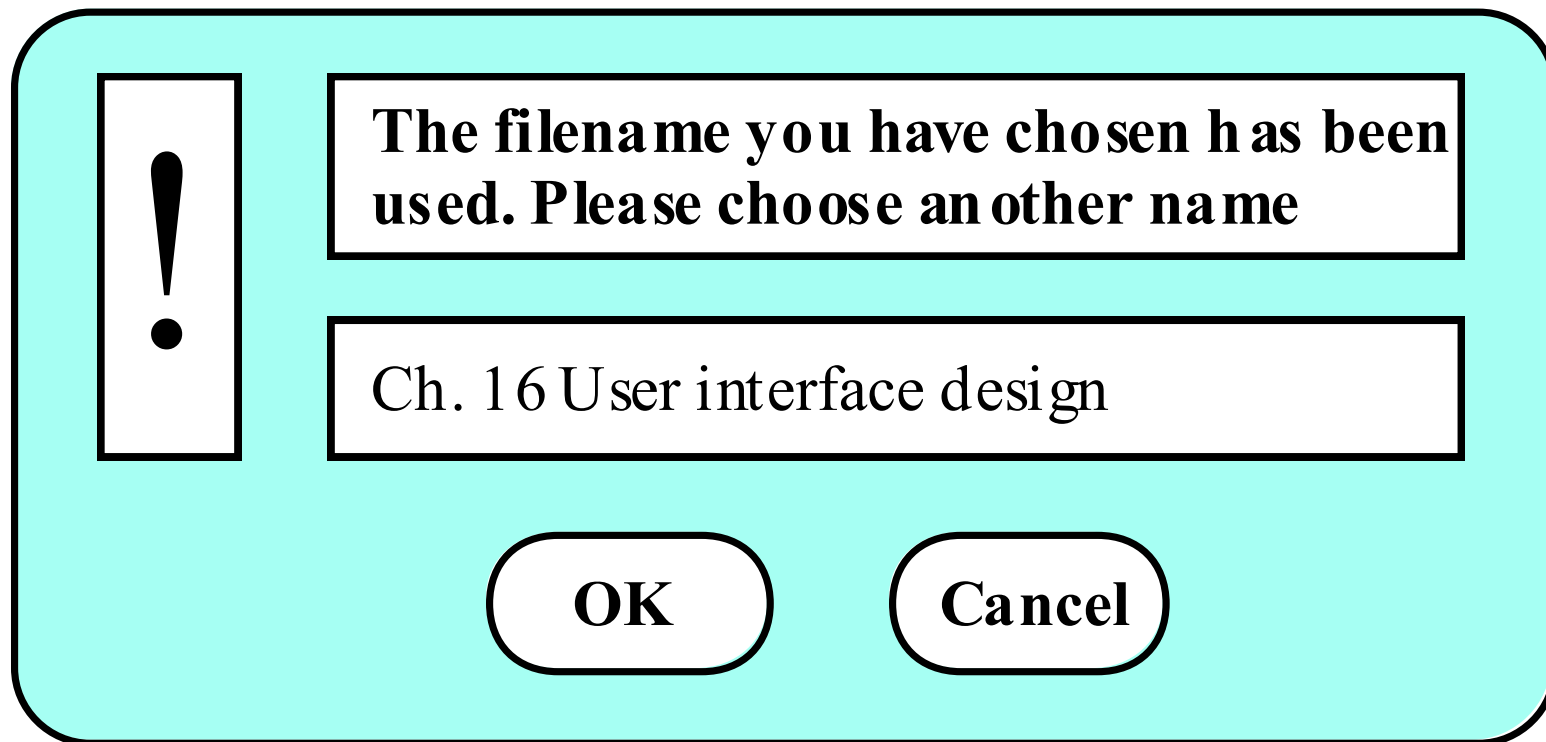


Horizontal bar

Displaying relative values



Textual highlighting



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
- 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
 - Over-use of colour in the display

Colour use guidelines

- Don't use too many colours
- Use colour coding to support use tasks
- Allow users to control colour coding
- Design for monochrome then add colour
- Use colour coding consistently
- Avoid colour pairings which clash
- Use colour change to show status change
- Be aware that colour displays are usually lower resolution

User support

- User guidance covers all system facilities to support users including on-line help, error messages, manuals etc.
- The user guidance system should be integrated with the user interface to help users when they need information about the system or when they make some kind of error
- The help and message system should, if possible, be integrated

Best Practices for Designing an Interface

- **Keep the interface simple.** The best interfaces are almost invisible to the user. They avoid unnecessary elements and are clear in the language they use on labels and in messaging.
- **Create consistency and use common UI elements.** By using common elements in your UI, users feel more comfortable and are able to get things done more quickly. It is also important to create patterns in language, layout and design throughout the site to help facilitate efficiency. Once a user learns how to do something, they should be able to transfer that skill to other parts of the site.
- **Be purposeful in page layout.** Consider the spatial relationships between items on the page and structure the page based on importance. Careful placement of items can help draw attention to the most important pieces of information and can aid scanning and readability.

- **Strategically use color and texture.** You can direct attention toward or redirect attention away from items using color, light, contrast, and texture to your advantage.
- **Use typography to create hierarchy and clarity.** Carefully consider how you use typeface. Different sizes, fonts, and arrangement of the text to help increase scanability, legibility and readability.
- **Make sure that the system communicates what's happening.** Always inform your users of location, actions, changes in state, or errors. The use of various UI elements to communicate status and, if necessary, next steps can reduce frustration for your user.
- **Think about the defaults.** By carefully thinking about and anticipating the goals people bring to your site, you can create defaults that reduce the burden on the user. This becomes particularly important when it comes to form design where you might have an opportunity to have some fields pre-chosen or filled out.

Thank you..