

502045

# Software Engineering

## Chapter 09

### Lesson 13: Graphic User Interface

# User interface design

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- User interface design principles
- User interaction
- Information presentation
- User support
- Interface evaluation

# 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

# 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**

# 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.

# User-centred design

- The aim of this chapter is to sensitise software engineers to key issues underlying the design rather than the implementation of user interfaces
- **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

# Design principles

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- **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.

# Design principles

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- **Consistency**
  - The system should display an appropriate level of consistency. Commands and menus should have the **same format**, command punctuation should be similar, etc.

# Design principles

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- **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.

# Design principles

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- User guidance
  - Some user guidance such as help systems, on-line manuals, etc. should be supplied

# Design principles

- **User diversity** (variety)
  - Interaction facilities for **different types of user should be supported**. For example, some users have seeing difficulties and so larger text should be available
  - Provide guidance, but power users require shortcuts

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# User-system interaction

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- 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?

# Interaction styles

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

# Direct manipulation advantages

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- 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

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- The derivation of an appropriate information space model can be very difficult
- Direct manipulation interfaces can be complex to program and make heavy demands on the computer system

# 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

- 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	<input type="text"/>	ISBN <input type="text"/>
Author	<input type="text"/>	Price <input type="text"/>
Publisher	<input type="text"/>	Publication date <input type="text"/>
Edition	<input type="text"/>	Number of copies <input type="text"/>
Classification	<input type="text"/>	Loan status <input type="text"/>
Date of purchase	<input type="text"/>	Order status <input type="text"/>

# 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

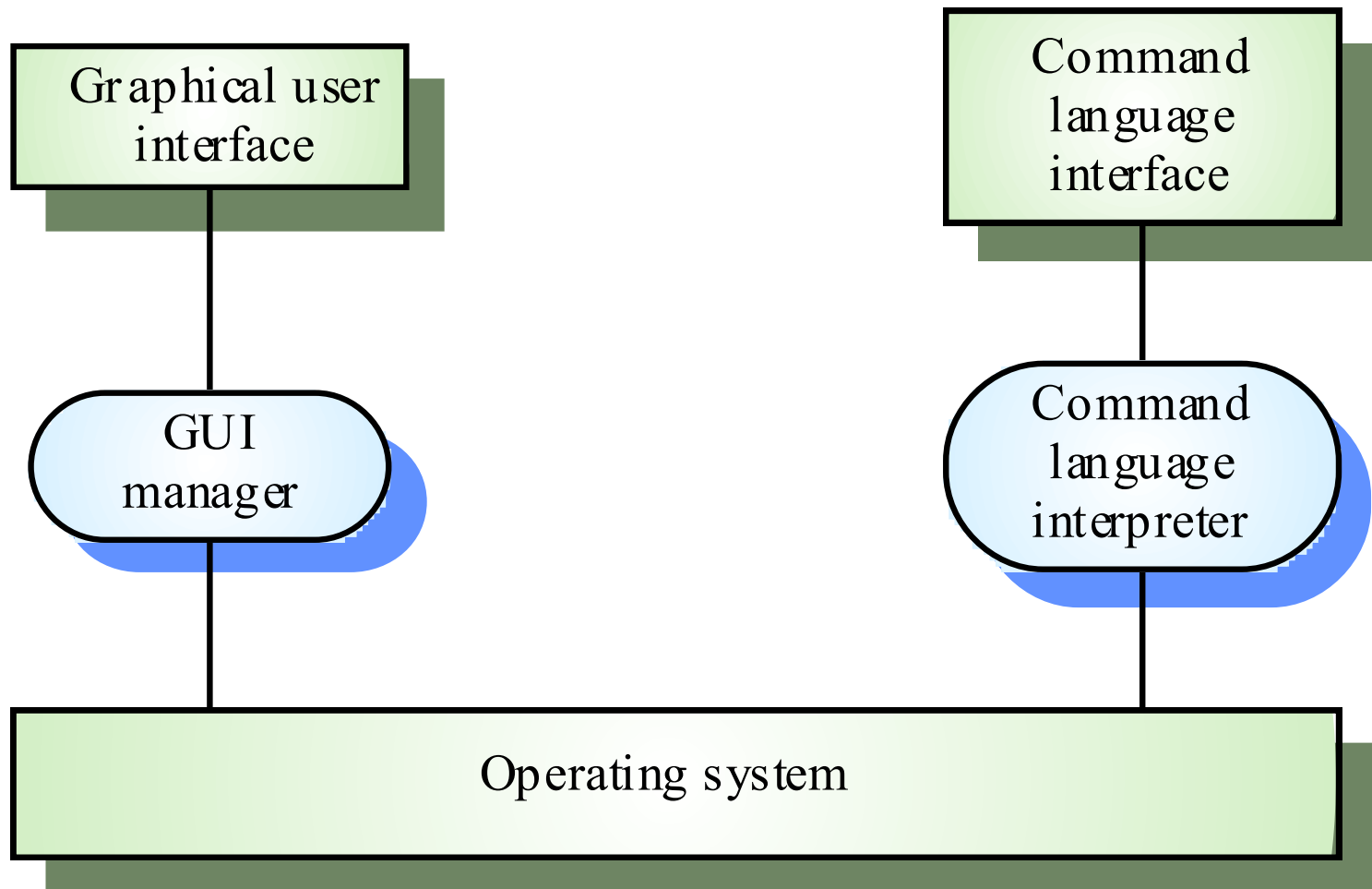
# Problems with command interfaces

- 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

# 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**
- **Search engine**

# Multiple user interfaces



# User interface design

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- User interface design principles
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# Information presentation

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- Text
- Graphic
- Color

# Information presentation

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# 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

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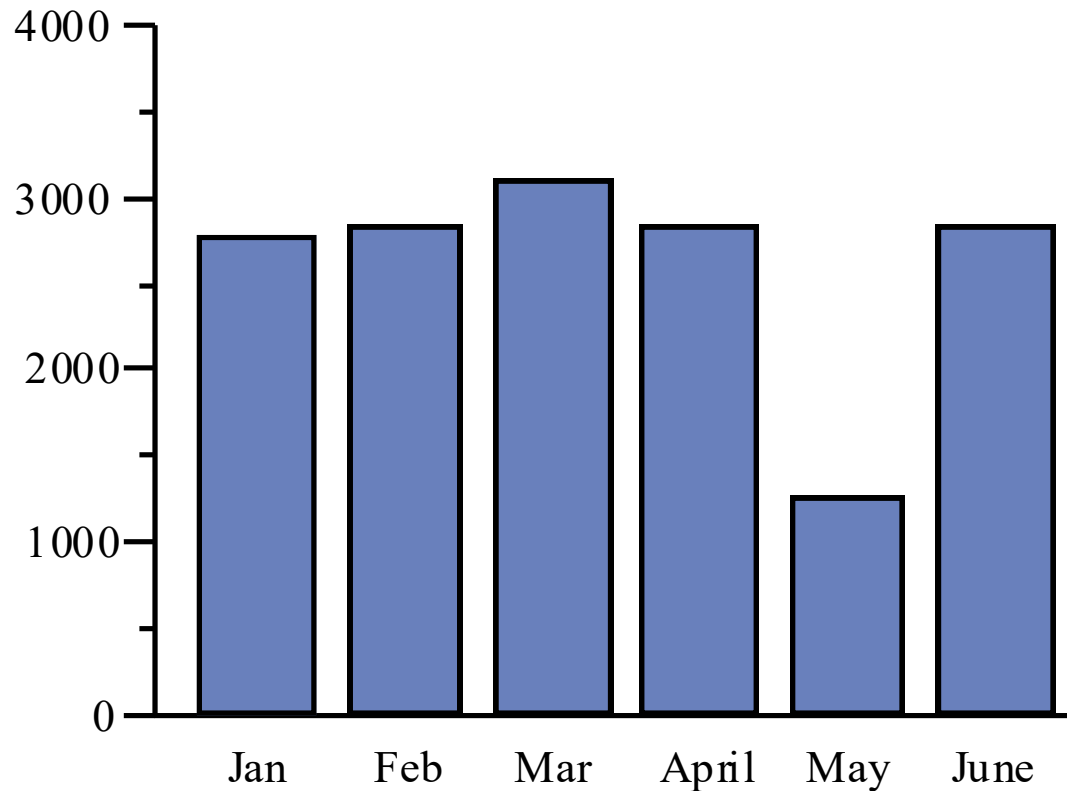
- Is the user interested in precise information or data relationships?
- How quickly do information values change? Must the change be indicated immediately?
- Must the user take some action in response to a change?
- Is there a direct manipulation interface?
- Is the information textual or numeric? Are relative values important?

# Textual vs graphics

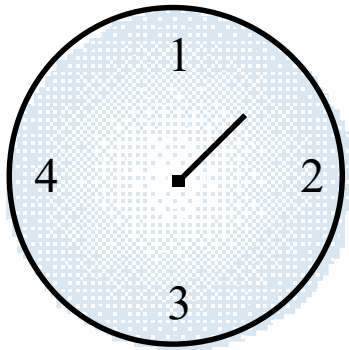
- can take a long time to download if the user is working over a slow, dial-up connection (**not graphic**)
- precise information (**text**) vs relationships between data (**graphic**)
- changes relatively slowly (**text**) vs changes quickly (**graphic**)

# Alternative information presentations

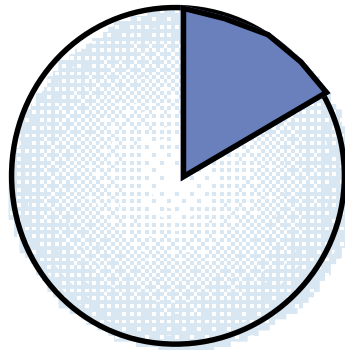
Jan	Feb	Mar	April	May	June
2842	2851	3164	2789	1273	2835



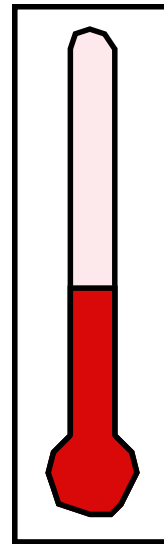
# Dynamic information display



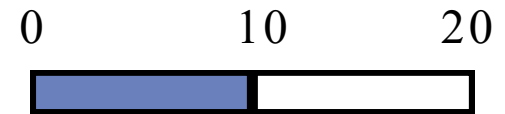
Dial with needle



Pie chart

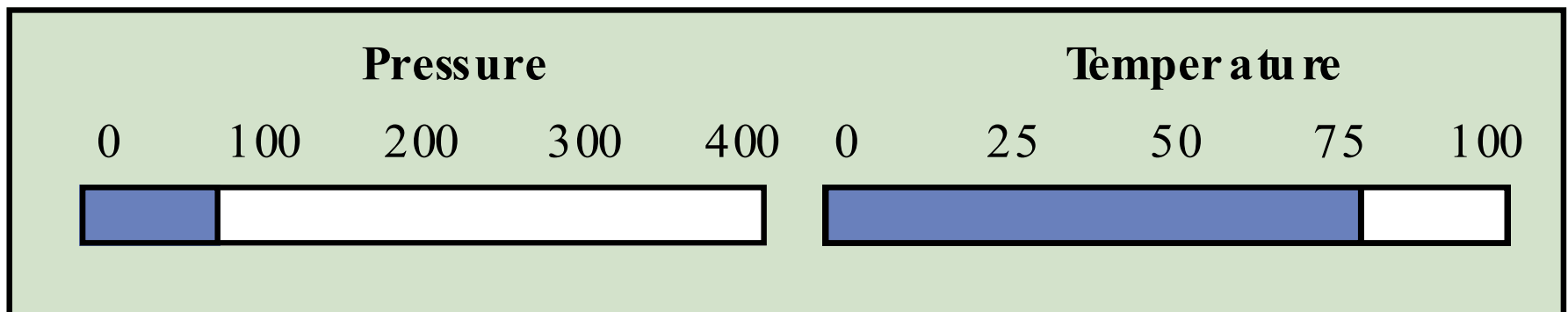


Thermometer



Horizontal bar

# Displaying relative values



# 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

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- Don't use too many colours
- Use colour change to show a change in system status
- Allow users to control colour coding
- Design for monochrome then add colour

# Colour use guidelines

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- Use colour coding consistently
- Avoid colour pairings which clash
- Be aware that colour displays are usually lower resolution
- you should use colour for highlighting, but you should not associate meanings with particular colours

# Key points

- Systems should provide on-line help. This should include “help, I’ m in trouble” and “help, I want information”
- Error messages should be positive rather than negative.
- A range of different types of user documents should be provided
- Ideally, a user interface should be evaluated against a usability specification