1.9 Designing the user interface

Issues relating to user interface design have already been covered in Chapters 1.2 and 1.6. It features again in Chapter 2.1. This chapter should be read in conjunction with those sections.

1.9 a The importance of good interface design

However complex the software, however expensive and powerful the hardware, a computer system is unusable if there is no intuitive, simple-to-use interface with the human being who is in control of the system or for whom the system is producing results. The human–computer interface (HCI) must:

- be unambiguous so that decisions made are clearly understood by both the user and the software
- allow the user to input all the data that the user thinks is important and that is necessary to allow the system to produce results
- produce the output to the user in a format which is easily understandable.

There are a number of factors that need to be considered when designing an interface:

- who it is for?
- what information needs to be conveyed?
- the circumstances under which the interface must operate
- the effectiveness of the communication
- the satisfaction with using it – i.e. is it intuitive to use?

The intended user of the interface must be considered. An interface designed for very young children to learn number work is going to be very different from an interface designed for the manager of a chemical factory to keep a check on the reactions around the plant. A complex user interface (Figure 1.9.1 on page 88) is not necessarily inappropriate.

The information that the interface is intended to convey to the user is a factor in the design. The interface that the manager would use to study a particular reaction is very different from the interface the same person would use if they wanted to see the flow of a chemical around the whole factory. The reaction would be shown in tables of figures or graphs. The flow around the factory would probably be in the form of a diagrammatic representation of the factory, i.e. "visual".

The circumstances under which the interface is to operate are also important. At the end of Chapter 1.8 we considered the case of a nurse looking after a group of patients. In those circumstances, an audible warning is far more sensible than a visual one, which may be ignored if the nurse is working away from the computer for a short period of time.

Finally, the designer of the interface needs to take account of the purpose for which the interface was designed. If the user is using the computer to play a game, then of paramount importance is that the interface adds to the enjoyment of the user.

All these factors are important when the interface is being designed, although some are more important than others in particular applications.

> ### Activity
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> Explain why software designed to teach students about volcanoes needs good interface design. What are the factors that need to be taken into consideration?
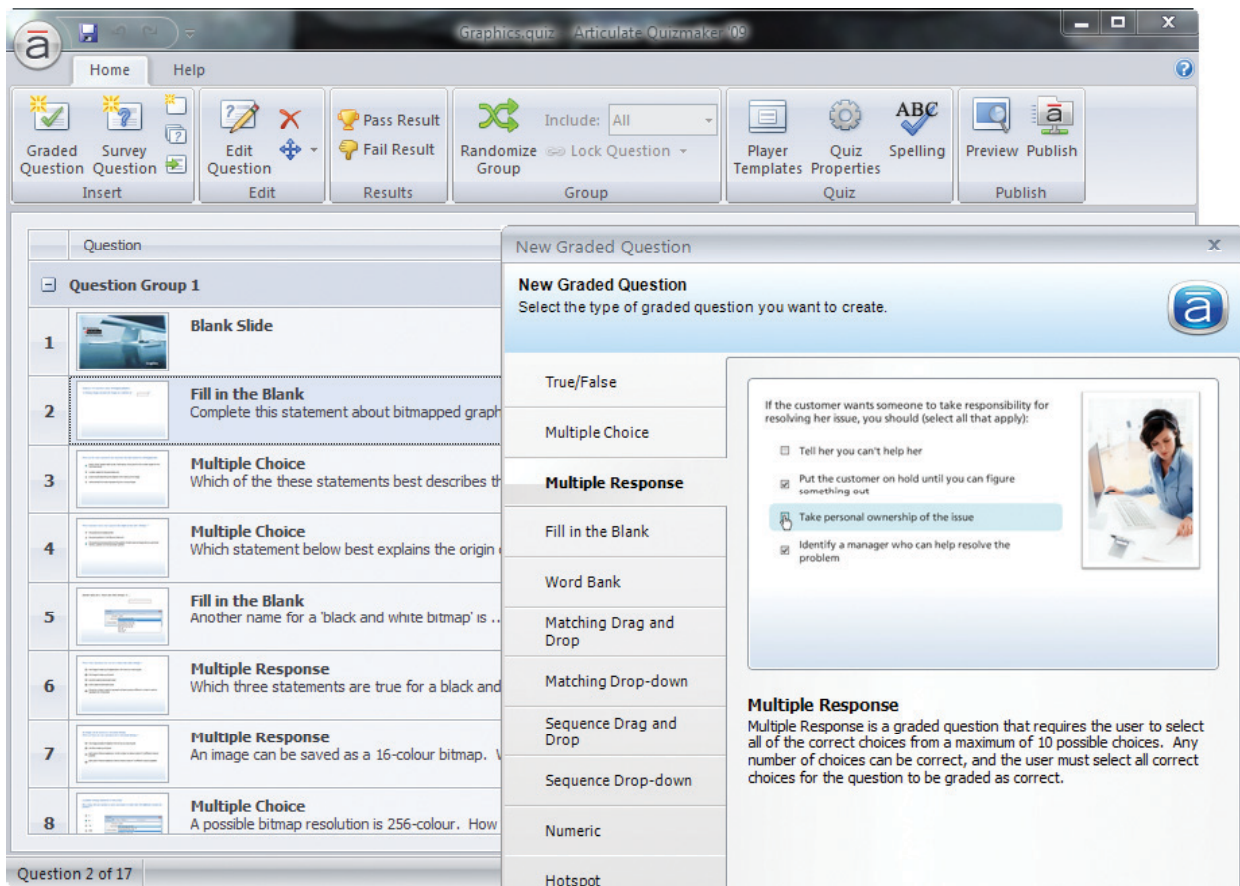
Figure 1.9.1   A modern user interface.

Behind the interface is the software that produces what is used for communication. An equally important part of the interface is the hardware that will be used for the communication. When choosing peripheral devices, a number of factors need to be taken into account:

- Who are the users that are going to use the application?
  - the age of the user
  - their reading ability
  - their ability to use a keyboard and a mouse
  - their ability with computer systems
  - their understanding of the software
  - whether they need instruction in how to use it
  - any physical disabilities which may make some hardware impossible to use
- Is the system automated in any way? If so the peripherals may include sensors and actuators.
- Under what circumstances will the system be used? If the input and output devices are to be used in the open air, then the environment will dictate some restrictions which would not be necessary if the system was being used in a computer room.
- What applications or system software is being used? The software dictates the type of input required and the type of output produced. Consequently, it also has an influence on the peripherals that are suitable for the input and output.

When answering questions drawn from this section, compare the requirements of the system with the characteristics of the available hardware devices. Be prepared to state why a particular choice has been made.

1.9 b HCI design issues

Before attempting the design of any interface the developer must be clear exactly what each screen is

attempting to do. Any computer program is likely to include the following aspects:

- input of data to the computer application
- output of information to the screen
- a warning message to indicate a potential problem
- an indication that the computer is currently processing (e.g. downloading a large file) and requires no input from the user.

The developer must be aware of the volume of information which is to be presented and whether or not the user is expected to retain this information. For example, will the user be comfortable with a data entry form that scrolls vertically? Should the data entry be split across two screens?

The three fundamental features which must be considered for any interface are colour, layout and content.

Colour

Colour is an important consideration when designing any HCI. The contrasting use of colours can highlight the more important information or can be used to distinguish one type of information from another. The different levels of contrast between colours are necessary if the individual items of information are to stand out. Black on white provides the highest possible contrast, while dark blue on black would be very difficult to read.

Colour choice can also be very important to the organisation for whom the software is being produced. It is important in many instances to ensure that corporate colour schemes are used.

Colour can be used as an indicator of the data being highlighted. For example, red is often used as a warning colour and green to signify that there is no problem. Care, however, must be taken with the choices; colour-blind users may not be able to tell the difference between green and red and other colour combinations.

Layout

The layout of data on the screen is important. The eye naturally scans in the direction required for reading (e.g. from left to right and from top to bottom in English). This means that more important information should be positioned on the screen where the user will read. The volume of information on the screen

at any one time is also important. There is a limit to the amount that the eye can follow, and the brain can process, in one sweep of the screen content.

If information should be read in order, then the correct screen order is the same as for reading in the language of the interface (e.g. left to right).

It is also important to maintain a similar layout across software which is part of a software suite. For example, common commands should be placed in the same screen locations in all the software that controls a chemical factory, so that users get used to the layout of the interface. The same word should be used for the same command on all screens.

> ### Activity
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> Consider software that you use in school or college: a database, a spreadsheet, a word processor or a web page creation program. Look at how the interface is set out. Note all the similarities and differences in the interfaces for each piece of software. You should end up with a much bigger list of similarities than of differences. If the differences are too many then either the software comes from different manufacturers or has been badly designed. Users do not want to have to learn different things for all the different pieces of software that they use.

Content

The content of the information presented is important. A user soon learns to ignore unnecessary items of information that are put on the screen. Similarly, if a piece of information is highlighted but the operator does not perceive the urgency, then all such highlighted information is ignored.

(1.9 c) The characteristics of a user interface

This material has been covered in previous sections:

- Chapter 1.2 covers the different types of interface that we study on this course. This includes a distinction between different interface types according to the information that the application uses and the intended user of the system.
- Chapter 1.4 covers the hardware that is used to support the interface. It also considers the requirements of different applications and justifies the choices made.

• Chapter 1.6 covers the design of interfaces, discussing the importance of different decisions about input and output design.

Module 2 discusses the design and implementation of interfaces. The topics are included in this part of the syllabus to test candidates on the theory of interface design and the design of interfaces for practical situations.

Summary

• There are a number of factors that need to be considered when designing an interface:
  – who it is for?
  – what information needs to be conveyed?
  – the circumstances under which the interface must operate
  – the effectiveness of the communication
  – the satisfaction with using it – i.e. is it intuitive to use?
• A good interface design:
  – is unambiguous so that decisions made are clearly understood by both the user and the software
  – accepts the data that the user thinks are important and the data that are necessary to allow the system to produce results
  – produces output in a format that is easily understandable.
• The three fundamental features which must be considered for any interface are colour, layout and content.

Test yourself

1. A company has a workforce of around 2000 employees. Some employees work in the office using the computer system for administrative tasks, while others use the computer system on the production line manufacturing goods to satisfy orders received.
   a. Describe the factors that would have been considered in the design of the software interfaces to be used by the office workers and the production line workers. [6]

   ### Hint
   Relate your answer to the scenario and do not stray into other areas that are not relevant.

   b. Select appropriate peripheral hardware for the application areas, giving reasons for your choices. [12]
   c. A clerk has to key in the details of all new employees from a standard form which the new employees complete. Explain how a form-based software interface would be useful to the clerk who has to key in the data. [4]
   d. Explain the types of output that would be expected from the computer in the factory, if it is used to control the speed of the production line as well as being a tool for the workers. [4]