# Chapter 3

# Designing the user interface

The objectives of this chapter are:

- ☐ to describe briefly the main classes of user interface;
- ☐ to present principles of good HCI design;
- ☐ to encourage an understanding of the use of colour;
- ☐ to describe a task-oriented approach to UI design;
- ☐ to introduce guidelines for designing screens and windows;
- ☐ to illustrate the above through examples;
- ☐ to present a case study of a task-oriented approach to UI design.

## 3.1 Introduction

A well-designed user interface will provide a good match between the user's task needs, skill level and learning ability.

Well-designed interfaces provide a good match between the user's task needs, skill level and learning ability and will lead to satisfied and productive users. A good user interface will be easy to learn and easy to use and will encourage the user to experiment and try out new features within the system without getting frustrated. Well-designed interfaces will also help considerably towards 'selling' or encouraging the adoption of the computer system, either to user managers or to users themselves.

This chapter briefly introduces the main classes of user interface currently in use and suggests five principles of good design. These principles can be used to guide the design of the user interface or can be used to evaluate existing interfaces. The bulk of this chapter is devoted to an explanation of an approach to user interface design based on an understanding of user tasks and sequence of task execution. This is called a task-oriented approach and is to be compared with an object-oriented approach described in Chapter Four.

In a task-oriented design approach, the likely sequence of user system dialogue must be identified.

The task-oriented approach involves the designer in identifying those tasks which will be shared between user and system and which will appear at the user interface. The sequence in which the user will carry out the interface tasks thus needs to be specified. Once the sequence of the user

system dialogue is understood, the next stage is to plan the design of the sequence of screens or windows which will support the dialogue. A procedure for planning the design is presented here, together with some of the more popular design guidelines. At the end of the chapter there is a case study of a task-oriented approach to user interface design.

This chapter also discusses the use of colour at the user interface, including general guidance on how to plan the use of colour and criticism of specific screens where colour is not used to good effect.

In order to understand what is meant by a 'good' or 'well-designed' user interface, we need to have some understanding of the classes of user interface commonly available and of their appropriateness for given situations.

Different classes of interactive dialogue will be used in different situations.

## 3.2 Classes of user interface

Interaction between the end-user and the system is achieved through interactive dialogues. There are a number of different classes of interactive dialogue and each of these has advantages and disadvantages depending on the situation in which they are used. The five major classes are discussed below:

1. *Command language*
   Command language dialogues are those in which the user types instructions to the computer in a formally-defined command language. For example, 'mv file1 file2', is a UNIX command for copying file1 into file2. The advantages of this approach is that it is very flexible, allowing users to create their own commands; it supports user initiative and it appeals to 'power' users, typically to software and system developers. Command language usually requires a significant level of training and a high degree of memorization.

Command language supports user initiative and frequent users.

2. *Natural language*
   Natural language interfaces are those in which the user's command language is a significant, well-defined subset of some natural language such as English. For example 'Which women work in New York City' is a typical user input to the Intellect system from AI Corp., Cambridge, MA. Natural language interfaces are typically easy to learn, although they often require considerable typing skills on the part of the user. They can also be slow to use if the system is unclear as to the exact meaning of the user request and has to seek clarification. However, natural language systems are increasing in sophistication and a great deal of research and development work is currently being undertaken.

A natural language statement can be syntactically correct but semantically meaningless. For example, 'square triangles taste nice'.

3. *Menu systems*
   Menu systems allow the user to issue commands by selecting choices

Menus allow the user to select from a predefined set of options.

from a menu of displayed alternatives. Menu systems are popular since they reduce learning time, reduce the number of keystrokes necessary and structure decision making. Most of the currently available fourth generation environments provide screen design tools which support the development of menu-based interfaces.

4. *Form filling dialogues*

The use of forms provides the user with a simple means of entering data.

Form filling dialogues are those in which the user enters data by filling in fields in one or more forms displayed on the screen. The use of forms on the screen considerably simplifies data entry and requires very little training to use. Forms management tools, similar to those available for menus, can be found within fourth generation environments.

5. *Direct manipulation interfaces*

Direct manipulation interfaces are those in which the user manipulates, through button pushes and movements of a pointing device such as a mouse, a graphic or iconic representation of the underlying data. An icon is a graphical symbol or pictogram used instead of words. Most direct manipulation interfaces use window systems or environments, in which the user's screen is divided into a number of possibly overlapping rectangular areas, each of which handles a specific function.

For the user, direct manipulation interfaces are WYSIWYG, 'What You See Is What You Get'.

Direct manipulation interfaces represent task concepts visually, are easy to learn and use, encourage exploration or experimentation with the system features and generally result in a high level of user satisfaction. Such interfaces are traditionally difficult to design and to program. However, most of the user interface design standards currently being put forward are based on direct manipulation interfaces.

Choosing the most appropriate class of user interface to match the needs and expectations of the users is an important aspect of good user interface design. For any given class of user interface a number of design decisions must be made by the interface designer, particularly in terms of what information should appear on the screen, how much information, in what order, what type of error messages, where should error messages be displayed on the screen and so on. To assist in making the 'right' design decisions and achieving a good user interface, a number of design guidelines are available. Some are introduced in the next section.

## 3.3 Principles of good design

Much guidance is currently available in the literature in the form of lists of interface design guidelines or principles. The major guidelines common to many of the texts can be summarized into five categories: naturalness, consistency, non-redundancy, supportiveness and flexibility.

1. *Naturalness*

A natural dialogue is one which does not cause the user to alter significantly his or her approach to the task in order to interact with the system. In this case the ordering of the dialogue is important. The ordering of user input, for example, should be geared towards the normal order of working of the user rather than whatever is easier for the programmer. This requires careful study of the tasks the user undertakes before, during and after each interactive session.

'Natural' to the user may not be 'natural' to the designer.

The use of language which is natural to the user is also important. Jargon may be desirable, provided that it is the jargon used every day in the user's department and not that used in the computer department. A designer might consider a task to be 'updating a file' but if the users call it 'posting P45s', then that is how the dialogue should refer to it. Phrasing should be self-explanatory; for example, words such as, 'print', 'end' and 'copy' have obvious meanings, whereas 'pip' (the CP/M keyword for copy) and 'mv' (the UNIX keyword for rename) do not. Use of non-standard abbreviations should be avoided since they slow down word recognition and introduce unnecessary stress.

Use the jargon of the user, not the jargon of the designer.

2. *Consistency*

A consistent dialogue ensures that expectations which the user builds up through using one part of the system are not frustrated by idiosyncratic changes in the conventions used in another part. For example in one system 'list' usually meant display on the screen, but occasionally meant output to a printer. Consistent layout for screens which fulfil a similar function ensures that the user knows where to look for instructions and error messages. The dialogue should also be consistent with established norms; for example, from PCs to cash dispensers, people have become accustomed to confirming a command by pressing Return or Enter. Diversion from norms will cause confusion.

The user builds up expectations of the dialogue.

The designer must be consistent.

3. *Non-redundancy*

A non-redundant dialogue requires the user to input only the minimum information for the system's operation. For example, a user should never have to supply leading zeros, for example, '00010' instead of '10'. A user should not be asked to give information which can be automatically derived by the system or which has been entered previously. Default values can be used to minimize the amount of input. Similarly, redundant information should not be output. Too much information on one screen is detrimental to the clarity of the screen and will delay the user unnecessarily when he or she tries to 'spot' a particular field or item.

User input should be minimal; no leading zeros.

4. *Supportiveness*

The supportiveness of a dialogue refers to the amount of assistance the dialogue provides to the user in running the system. It has three major

aspects: the quantity and quality of instructions provided; the nature of the error messages produced and the confirmation of what the system is doing. Instructions to the user are provided both by the system's prompts and by any additional help facilities. Error messages should be helpful and not obscure, for example, 'syntax error' is not at all helpful. At the very least the system should tell the user what is the cause of the syntax error, for example, 'missing apostrophe on line 30'. Inputs should be confirmed: if their acceptance will result in an irreversible action, for example, delete file; if a code has been entered and the user has to check the associated description or when confirmation of completion of particular actions is desirable.

Displaying 'fatal error in program' is not being supportive of the user.

5. *Flexibility*

The flexibility of a dialogue refers to how well it can cater for or tolerate different levels of user familiarity and performance. This depends largely on the skill and expertise of the user in relation to a given task. Different types of dialogue may be used in different situations; for example, a hierarchical menu structure for use by a first-time user may be navigated using commands and parameters once the user becomes more experienced.

Different levels of user familiarity should be catered for.

## 3.4 Evaluate designs using the principles

These five principles of good design can also be used to evaluate existing user interfaces.

For example, Fig. 3.1 shows a form which is completed by a travel agent when a customer wishes to book a ferry.

Fig 3.2 shows a screen design which could be used when automating the ferry booking procedure.

Five principles of good design: naturalness, consistency, non-redundancy, supportiveness and flexibility.

This screen design is obviously unsatisfactory, but why? The five principles can be used as a basis for identifying the problems.

### 3.4.1 Results of evaluation of screen design

The screen design is examined against each of the five principles in turn in order to identify why the screen design in Fig. 3.2 is unsatisfactory.

*Principle one: non-redundancy*

Redundancy has been caused by changing from a manual system to an on-line system.

- The screen contains superfluous information. For example, first choice and second choice do not need to be displayed at the same time. The user will be able to make a choice of outward voyage and inward voyage and if that choice is not available,the user will simply make another choice. The concept of first and second choice is only appropriate for the manual system where the form will be sent away to make the booking.

| OUTWARD VOYAGE | | INWARD VOYAGE | RESERVED ACCOMMODATION | | | | |
|---|---|---|---|---|---|---|---|
| First choice | From | From | Type of cabin preferred | OUTWARD Night/Day | | INWARD Night/Day | |
| | To | To | | | | | |
| Date | | | | | | | |
| Sailing time | | | If whole cabin is not required, No. of berths/couchettes* | Male | Female | Male | Female |
| Second Choice | From | From | | | | | |
| | To | To | *delete as applicable | | | | |
| Date | | | No. of reclining seats | | | | |
| Sailing time | | | No. of Club Class seats | | | | |

| | |
|---|---|
| NAME AND ADDRESS (Block capitals please)<br>Name | VEHICLE DETAILS<br>Reg. No. |
| Address<br>(or Agent's stamp) | Overall length (inc. roof-top luggage) m Height under 1.83m*/over 1.83m* (inc. roof-top luggage)<br>*delete as applicable |
| | CARAVAN*/TRAILER* DETAILS<br>*delete as applicable |
| | Overall length (inc. tow-bar) m Height under 1.83m*/over 1.83m*<br>*delete as applicable |
| Post Code | Motorcycle Reg. No. Solo/combination*<br>*delete as applicable |
| Telephone No. | PASSENGERS<br>No. of adults (inc. driver) No. of children (over 4 and under 14) |
| CHALET/CARAVAN/CAMPING SITE<br>please tick appropriate box<br>❑ Tent rental<br>❑ Chalet<br>❑ Caravan/camping site | INSURANCE<br>Holiday insurance ❑ Vehicle cover extension ❑<br>Caravan/trailer cover extension ❑ |
| | Car make Car model |
| | Date of return if not stated above Age of vehicle if personalized number plate |
| | Please tick box if cover required for winter sports activities ❑ |

**Figure 3.1** *Fast Ferries reservation form.*

*Principle two: naturalness:*

- Information is not in logical groupings. Although the information on the screen has been copied from the form, the groupings implied by the lines on the form are no longer obvious when transferred to the screen.
- The use of uppercase throughout makes for poor readability.
- The use of arbitrary abbreviations; for example, RECLIN is used to mean 'number of reclining seats'. The meaning of this abbreviation may not be obvious to the user.

Natural logical groupings have been lost when the designer has tried to get the whole form onto the screen.

The design in Fig. 3.2 is simply a copy of the form in Fig. 3.1. Why is this not a 'good' design?'

```
FAST FERRIES

                OUTWARD VOYAGE  INWARD VOYAGE   RESERVED ACCOMMODATION
1ST CHOICE FROM STN TO SAM    FROM DIP TO WEY   CABIN  OUT DAY  IN  NIGHT
             1105  891031        2230 891222          BTHS/CHTS          1M 2F

2ND CHOICE FROM STN TO SAM   FROM SAM TO STN   RECLIN          0          0
CONFIRMED  1105  891031          2330 891222     CLUB CLASS SEATS 0          0
NAME AND ADDRESS              VEHICLE DETAILS
NAME MRS. E. CURRY            REGNO E999GGY
ADDRESS  14 CHESTER AVE         OVERALL LENGTH  3.4M HEIGHT  Y
           CHELTENHAM             CARAVAN/TRAILER CARAVAN
           GLOS.                    OVERALL LENGTH  3.3M HEIGHT  N
POSTCODE  CH1  1AX                  MOTORCYCLE REGNO:
TELEPHONE NO: 025437571             PASSENGERS: NO. ADULTS 3 NO. CHILDREN 0

CHALET/CARAVAN/CAMPING SITE  INSURANCE
TENT RENTAL N                HOLIDAY  VEHICLE COVER   C/T  EXTENSION
CHALET N                        Y            Y                Y
CARAVAN/CAMPING SITE   Y      CAR MAKE  FORD  MODEL  SIERRA COSWORTH
                                 DATE OF RETURN            AGE
                                 WINTER SPORTS


CONFIRM?
```

**Figure 3.2** *Screen design copying form layout in Fig. 3.1*

- The screen is too full, and it is difficult to distinguish one area of the form from another.

*Principle three: consistency:*

Captions are used in an inconsistent way.

- Inconsistent use of captions — some are alongside the data fields, some are above.
- Some data fields have no captions, for example, sailing times and dates.
- some captions are too verbose, for example,

CHALET/CARAVAN/CAMPING SITE

*Principle four: supportiveness*

No navigational information is given.

- Some captions do not convey the meaning of the data field; for example, HEIGHT YES is meaningless.
- It is difficult to distinguish group items from individual items.
- It is impossible to distinguish between the captions and the data
- fields they are supposed to identify.
- No navigational information is given; for example, next screen, escape, main menu.

*Principle five: flexibility*

The user has no flexibility regarding the ordering or 'chunking' of data entry.

- All the information requested has to be input before confirmation.

Thus by using the five principles of good design as a basis for examining an existing user interface it is possible to identify the reasons why a particular design is poor and to see what needs to be improved.

### 3.4.2 How to produce a better design

The evaluation of the screen design given in Fig. 3.2 illustrates the fact that it is not sufficient just to transfer the manual way of doing things onto the user interface. Later in this chapter, two alternative approaches to designing the user interface are introduced.

The first takes a task-oriented approach, focussing on the sequence in which the user carries out the task. In the case of the ferry booking form, in Fig. 3.1, we are interested in the sequence in which the travel agent will interact with the customer and with the system. For example, the travel agent will ask the customer for a destination and preferred date of travel, and will then enter this information into the system. The system then displays a choice of crossing available and presents these to the customer. The customer makes a choice and the travel agent then asks for details about passengers and so on. The task-oriented approach is concerned with user tasks and likely sequencing of interactions.

To produce a better design, a systematic approach should be adopted, using either a task-oriented or an object-oriented approach.

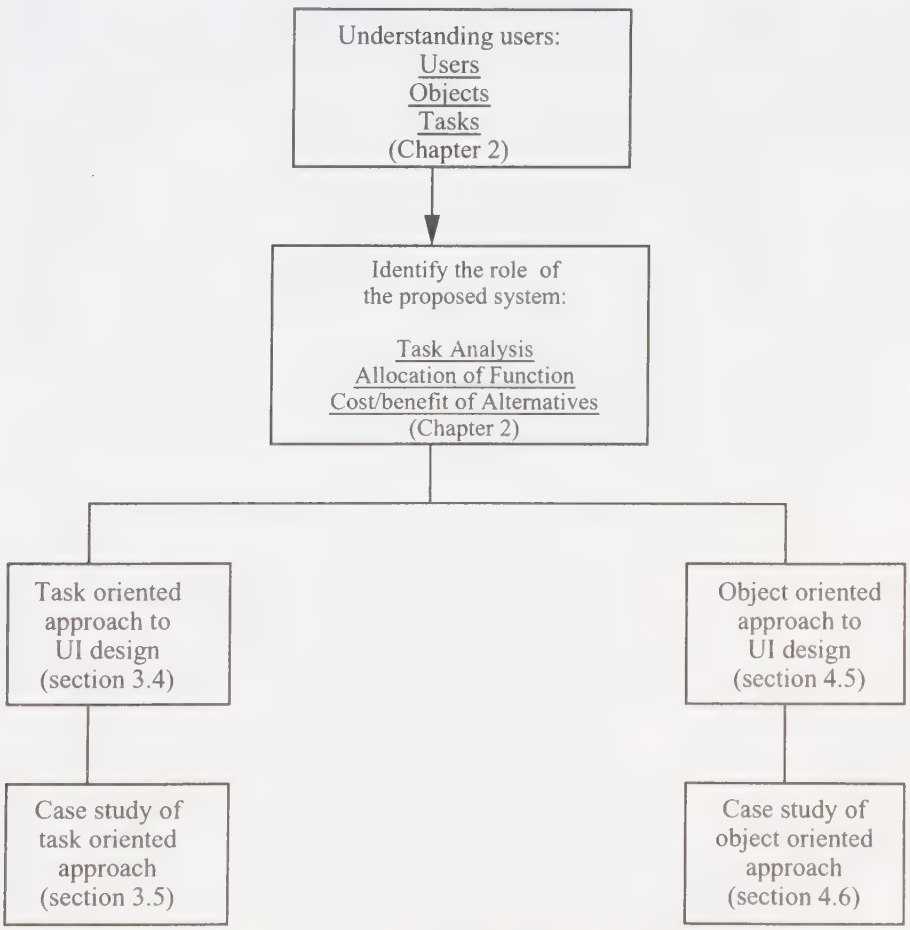


**Figure 3.3** *Diagram showing the relationship between Chapters Two, Three and Four*

The second takes an object-oriented approach, focussing on the objects being dealt with by the user. In the case of Fast Ferries, the travel agent deals with enquiries, reservations, bookings, customers, tickets, receipts, payments and so on. The object-oriented approach is concerned only with objects and how they are manipulated and no sequencing is implied.

Whichever approach is adopted, it is vital to begin with a thorough understanding of the users and an agreement as to the role of the proposed system. Figure 3.3 illustrates the relationship between the techniques discussed in Chapter Two and those which follow.

No matter which design approach is followed, it is likely that the designer will consider the use of colour. The next section deals with factors which affect the choice and use of colour at the user interface.

## 3.5 Factors influencing the choice of colour

### 3.5.1 Understanding colour

The correct use of colour in screen design often causes difficulty for software designers since they often lack the training and visual perception of the graphic designer or artist.

There are no hard and fast rules associated with the use of colour.

In this section, some issues are considered in relation to the everyday use of colour. There are no hard and fast rules and perhaps the software designer can only expect to develop some empathy with the subject. Following a general discussion on colour a number of colour screen designs are evaluated. The section concludes with a number of guidelines which may assist the software designer.

### 3.5.2 Discussion on colour

The discussion is centred around the contents of the colour plates 1—8. These have been reproduced from a set of colour slides by Lindsay W. MacDonald, March 1993 called *Colour in Computer Graphics* under the auspices of the UK Advisory Group on Computer Graphics.

*Plate 1: colours look darker and smaller against white*

The appearance of a colour depends on the lightness and colour of the surrounding region, an effect known as simultaneous contrast. The result is that colours tend to look darker and smaller against white, and lighter and larger against black.

Colour depends on the lightness and colour of the surrounding region.

*Plate 2: the appearance of colour changes according to the surrounding colours*

Coloured surrounds can cause a coloured region to appear to be tinged with the complementary hue of the surround. Here the grey lines of the cross look yellowish against the blue background and bluish against the yellow background, even though it is exactly the same grey throughout.


Plate 1


Plate 2

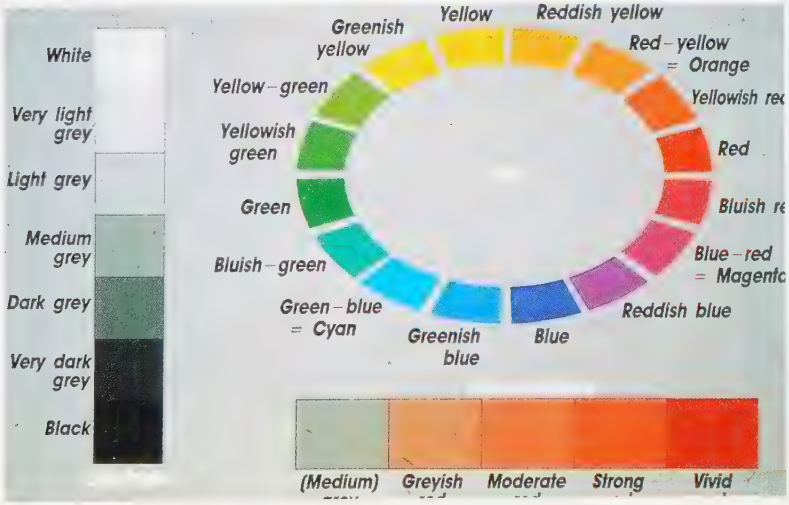


Plate 3

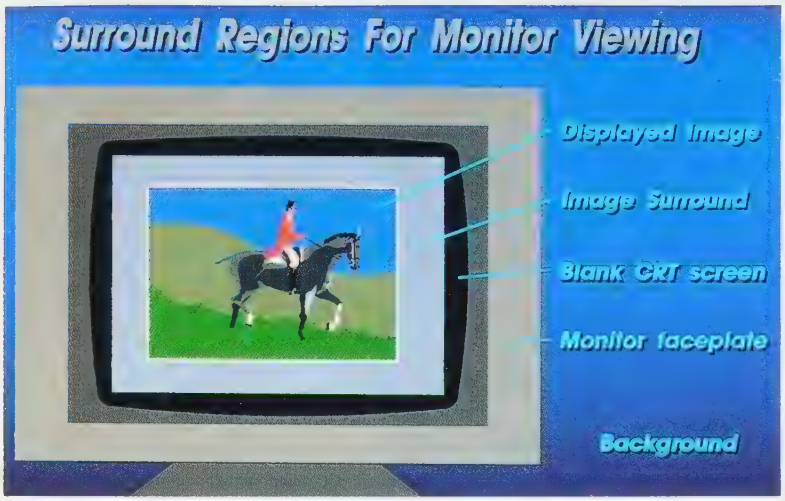


Plate 4

With THE POST he once again tried to transfer local newspaper technogy to national newspaper publication, and again he discovered it did not work. This time the process using personal computers and standard, well-proven software, was let down simply by the length of time it was taking him to produce the paper. Copy deadlines were too early, so Mr Shah's newspaper could not compete on news.

One mistake which Mr Shah repeated from his first venture was not to provide what the reader wanted. That is an exclusive comodity, of course. With TODAY Mr Shah employed local

Mr Shah's first attempt at national newspaper publishing proved to be the catalyst Fleet Street needed to pull itself out of the dark ages. The result of the shock that was TODAY can be witnessed in Fleet Street's empty buildings and in the tabloid's colour.

So far the Daily Mirror is the only paper which has got the colour quite right all the way through. It has done it because it has paid for the technology necessary to do it. The Daily Mail has taken a diferent route and decided to move into flexography. There is a small capital saving with flexography, but the real benefits should

Plate 5


Plate 6

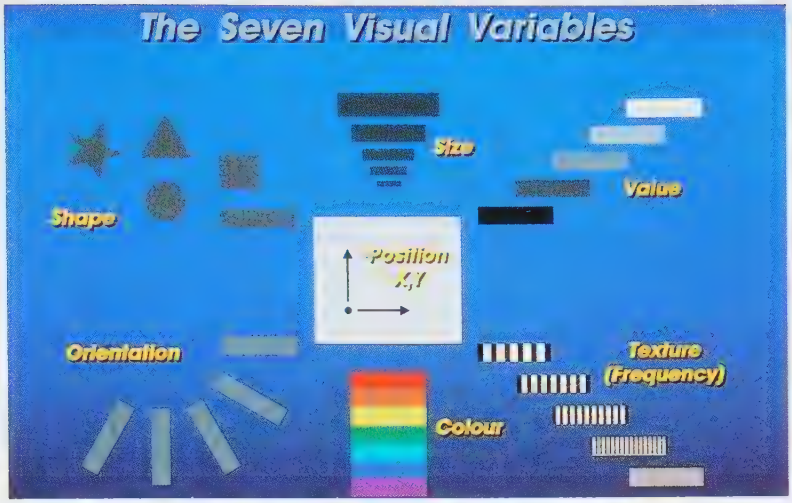


Plate 7


Plate 8

Plate 9

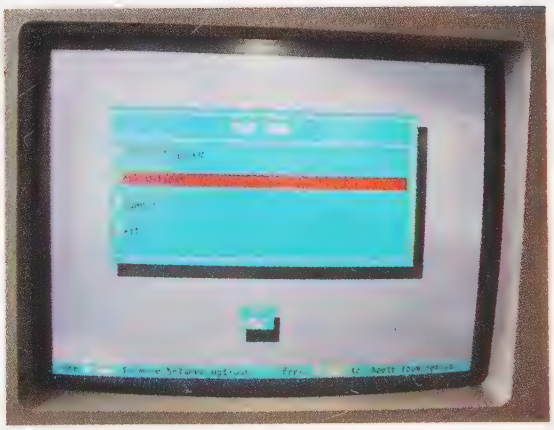

Plate 10

Plate 11

Plate 12

Plate 13

Plate 14

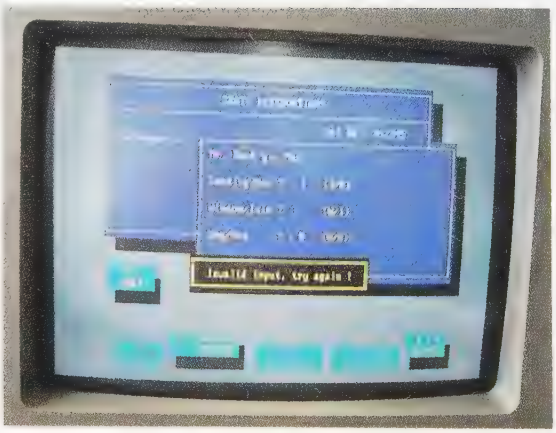

*Plate 3: a simple colour naming system*

Different systems will support different colour naming systems. For example, some may provide the user with the means of specifying a colour for a graphic object on the screen display in terms of hue, saturation and brightness.

Colour depends on the palette provided by the implementation platform.

*Plate 4: surround regions for monitor viewing*

The appearance of a colour always depends on the conditions under which it is viewed. One of the most important factors is the surrounding field. A typical computer screen consists of several concentric zones. The most important is the image background, over which the application has full control, but which is often neglected. A light surround will make the image look darker, through the simultaneous contrast effect, (Plate 1), and vice versa.

The lightness and colour of the blank CRT screen, monitor faceplate and office surround, being successively further away, affect the image appearance to a lesser degree but cannot be ignored. Ideally they should be unobtrusive, neutral in colour and graded in lightness from the image background.

Colour depends on the condition under which it is viewed.

*Plate 5: text manipulation applications*

There are four categories of colour-related task, which make different demands on the user: text manipulation, chart and graph design, monitoring and modelling. Legibility is the most important criterion for text processing systems, and monochrome monitors are frequently preferred because of their inherently greater sharpness. On a colour monitor, however, satisfactory legibility can be achieved through attention to presentation and font design. Here colour is used to good effect for both association, highlighting in yellow the results of the word-search for all occurrences of 'Mr. Shah', and for differentiation by highlighting in red all spelling errors.

Legibility of text is often better on monochrome monitors.

*Plate 6: modelling applications*

In modelling applications the display is intended to represent the appearance of an object or scene. The purpose of the image should be clearly understood. Is it to portray a real product as realistically as possible, or to impress the observer into believing something about the product represented by the image? The art of the graphic designer is to achieve a memorable result with an economy of means. Here the potency of the car has been conveyed through the vibrancy of the red, whilst the illusion of depth is enhanced by using reddish colours for the foreground and bluish colours for the background.

The appearance of an object can change through appropriate use of colour.

*Plate 7: the seven visual variables*

Colour should generally be used not just for aesthetic purposes, but as a means of increasing the information content of a display or of improving the

display by making it easier to interpret. The principles of good graphic design are just as important to computer displays as they are to the more traditional media. In particular, colour should be used in conjunction with other visual attributes of position, shape, size, brightness, orientation and texture. A good principle is to ensure that the layout is meaningful in monochrome ('get it right in black and white') and to then add colour sparingly.

Colour can be used to increase information content.

*Plate 8: icons and colour conventions*

Colour has the ability to evoke emotional responses or to trigger memories. Warm hues (red, orange, yellow) generally imply action or warning, whereas cool hues (green, blue, grey) can imply passivity or safety.

These associations of colour are used to advantage in many of the familiar objects in the everyday world, such as the highly systematic colour codes and icons in road signs. Traffic lights, for example, can be employed as metaphors in graphic displays, conveying to the user a message consistent with real-world experience. A particularly effective symbol is the red STOP sign, which grabs visual attention and conveys an unambiguous command.

'Get it right in black and white' and then add colour sparingly.

### 3.5.3 Discussion on colour screens

Use everyday colour conventions and icons.

The screens showed in Plates 9—14 were produced as part of a student project for a system which deals with flight enquiries, reservations and bookings and illustrate a typical approach to the use of colour. Although some planning of the 'colour scheme' has occurred, there are too many colours and in some cases poor combinations of colours. Following is a brief discussion of the good and bad points associated with the screen designs and the use of colour.

Colour designs should also follow the five principles of good design.

The principles of good design (naturalness, consistency, non-redundancy, supportiveness and flexibility) introduced in section 3.3 are used as a basis for the discussion, together with issues related to the use of colour raised earlier in this section.

*Plate 9: the login screen*

The first screen is the Login screen, in which the name of the application AIRLINE RESERVATION SYSTEM is barely visible because there is insufficient contrast between the turquoise lettering and the grey background. (Plate 2). Also the black 'shadow' effect on the window in the middle of the screen gives the window the appearance of 'floating'. This is because of the effect of the surround regions, that is, the black CRT screen and the grey monitor (Plate 4). The screen in Plate 14 is much better in this respect because the whole screen is a single colour and simple lines are used as borders for windows.

The window appears of 'float' in Plate 9.

*Plate 10: main menu*

Here the user selection from the main menu is highlighted by changing the

colour of the selected item. The black lettering on the turquoise background is difficult to read. This screen when viewed with Plates 11—14 illustrates the inconsistent use of colour and position for the navigation commands. In Plate 10 the 'help' 'button' appears in the middle of the screen, in Plates 11—13 it is on the mid left and in Plate 14 it is on the bottom left. 'Help' should appear in a consistent and predictable position on every screen.

Black on turquoise is difficult to read in Plate 10.

In addition, the line at the bottom of Plate 10 tells the user to use 'arrows' to select a menu item and to press Return to confirm the choice. On all other screens the user is asked to use function keys and these appear as small 'windows'.

*Plate 11: error window*

Here the choice of colours is much improved: white on a blue background is normally very readable. Also the red on black small screen in the middle is used to warn the user of a problem or error situation. The use of red for warnings is consistent with issues raised in Plate 8.

White lettering on a blue background is easy to read in Plate 11.

*Plate 12: navigation commands*

The grey lettering on a bright green background is difficult to read. The navigation 'buttons' have moved from those in Plate 11. The navigation commands are also combined with other user options which are logically different. F2 PAYMENT, F4 NEXT PASSENGER, F5 PREVIOUS PASSENGERS, F6 SEAT RESERVATION deal with making a reservation, while F1, F3 and ESC deal with navigation. Also there are too many choices in the list of this type ('small windows'); they are not grouped logically and the use of capital letters makes reading slow.

Grey lettering on bright green is almost impossible to read on Plate 12.

*Plate 13: unavailable selections*

Here the warning for 'invalid input' is shown in yellow, whereas in Plate 11, warnings were shown in red. This is inconsistent. Some of the 'small windows' at the bottom of screen are shown in as 'faded' notifying that these selections are not available from this screen. This contravenes the principle of non-redundancy — why display information of the screen which is of no use?

Inconsistent use of colours between Plate 11 and Plate 13.

*Plate 14: highlighted captions*

The single blue background with white lettering for captions and yellow lettering for data items is now consistent and easy to read. However, there are still some problems with this screen; for example, why is one caption red? Why is the data items' 'total' in white when all others are in yellow? The warning window should be red as in Plate 11, rather than yellow.

Arbitrary use of colour in Plate 14.

### 3.5.4 Some guidelines on the use of colour

The above discussion illustrates the danger of using colour without due consideration as to how or when to use it. In this section some points of

guidance on the use of colour are offered. First there are some major points on how to approach the inclusion of colour into a design, then some specific guidance is given concerning the amount of colour, background colours, user needs and choice of colour.

The major points are:

Develop a plan of when, where and why colour should be used.

1. 'Get it right in black and white' and then add colour sparingly.
2. Develop a plan of when, where and why colour should be used.The plan should cover the 'suite' of screens or windows that are to be designed. Be consistent.
3. Test colour designs using the palettes available on the target computer systems — colour designs on paper may not transfer well to the system. Colours which work well together on one platform may not work as well on another.

Amount of colour

Not more than three or four colours per screen.

- Use the minimum number of colours and not more than three or four per screen.
- Do not overuse colour. The benefits of colour as an attention getter, information grouper and value assigner are lost if too many colours are used.

Background colours

- Use background colours in large blocks.
- Group related elements by using a common background colour.

Use darker and weaker colours as background.

- Use bright colours for emphasis and weaker colours for background areas.
- Not all colours are equally readable. Extreme care should be exercised with text colour relative to background colours. As a general rule, the darker colours such as blue, magenta and brown make good backgrounds

User needs

Be consistent with user expectations.

- Use colour coding consistent with user expectations.
- Similar colours should denote similar meaning.
- To avoid frequent refocussing and visual fatigue, extreme colour pairs such as red and blue or yellow and purple should be avoided.
- Older users may need higher brightness levels to distinguish colours.
- Colour blind users may not be able to distinguish some colour combinations, for example, red and green should be avoided. (between 7 and 10% of the population are colour blind).

Choice of colours

Avoid extreme colour pairs such as red and blue, or yellow and purple.

- Brightness and saturation draw attention.
- Link the degree of colour change to event magnitude.
- Colours change appearance as ambient light level changes.

- Opponent colours go well together. Yellow and blue are good combinations.
- The user could be allowed to choose their own preferred colour combinations, which may be helpful in cases of visual handicap.

Consider the lightness of the colour of the surrounding region.

These are suggestions only; there are too many variables in colour display, colour copying and human interpretation to make hard and fast rules. Plan the use of colours, experiment on the target system and test the designs with users.

Jackson *et al.*, 1994, provides a detailed, practical guide on the use of colour.

## 3.6 A task-oriented approach to user interface design

In Chapter Two, techniques for understanding user requirements were introduced. These involved considering the users from three perspectives: the users themselves, what they do, and their skills, attitudes and motivations; the tasks undertaken and the characteristics of the tasks; and the objects manipulated by the users. The CAD case study provided an example of how to do this in practice. The task hierarchies associated with the proposed system were identified next and the allocation of function decided.

The next stages in the HCI design process are to:

1. Identify which tasks will be shared between user and system.
2. Specify the flow of interaction between the user and the system in carrying out those tasks.
3. Plan the design in order to design a consistent set of screens and windows to support that interaction.

A task-oriented approach involves understanding users and tasks, and the sequencing of user actions.

Figure 3.4 shows the main stages that a designer might follow when taking a task-oriented approach to user interface design.

Stages 1 and 2 were explained in Chapter Two. The remainder of this section is concerned with the stages 3 to 7, while section 3.7 presents a case study of the first six stages. This case study is based on the ferry booking form for Fast Ferries, the example discussed earlier in this chapter.

### 3.6.1 Stage 3: identify shared tasks

This stage is illustrated with reference to the CAD case study presented in Chapter Two. Given the task hierarchy for 'interpret brief' (Chapter Two, Fig. 2.6) and the discussion which followed on allocation of function (Chapter Two, Table 2.3), it is likely that alternative 4 or 5 may be chosen. Both alternatives would allow the professional engineer to continue as 'expert' and the system should simply provide support for the design. Alternative 5 would also assist in assessing the costs and benefits of alternative designs.

If alternative 5 is chosen then it becomes possible to identify those tasks which will have a user system interface.

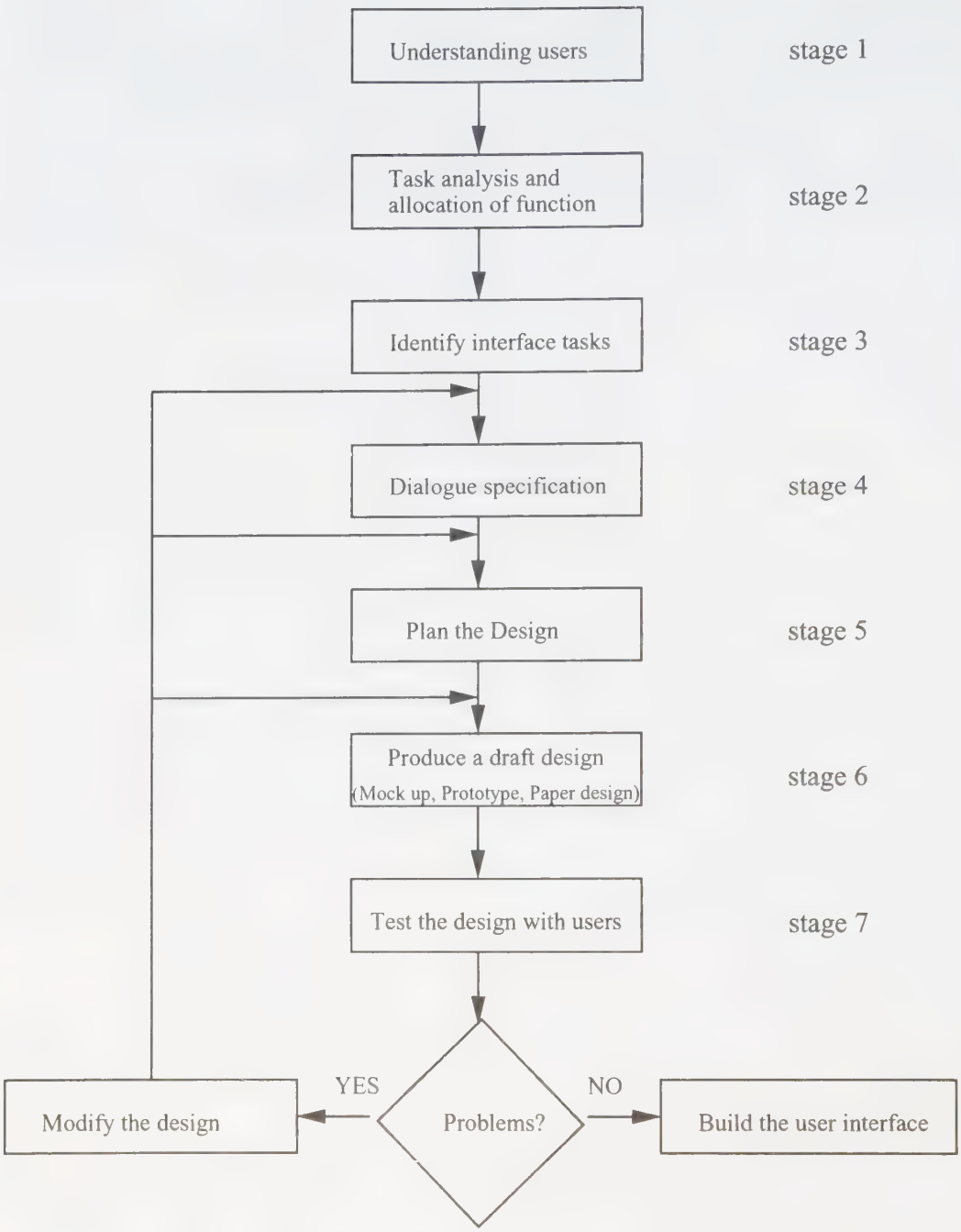


**Figure 3.4** *The main stages in task oriented user interface design.*

These tasks can be marked on the task hierarchy (Fig. 3.5). The shared tasks for alternative 5, 'partial development and partial checking' are indicated thus: **. Note that the subtask 'write report on recommendations' has been

excluded by the choice of alternative 5, and is not now considered to be part of the CAD system. However, the designer may need to be aware of the fact that the engineer will still need to carry out this task and therefore that the CAD system may need to be capable of providing input to some document preparation system.

Those tasks which are shared between user and system will have a user system interface.

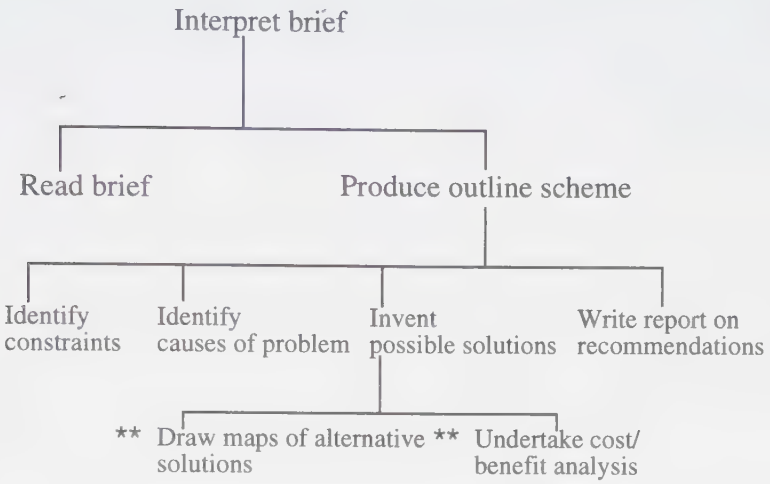


**Figure 3.5** *Task hierarchy for interpret brief showing interface** tasks.*

### 3.6.2 Stage 4: specify user system dialogues

Having identified the share task, the next stage is to analyse them in more detail in order to specify the dialogue between user and system. Several techniques are available to achieve this, as follows.

Two techniques for specifying the dialogue between user and system are introduced.

The first technique, dialogue network diagrams, is based on the use of state transition networks and enables the designer to specify the sequence of a dialogue between the user and the system. This technique is useful for systems where the user dialogue is primarily driven by a reasonably predictable sequence of actions. It can help the designer to consider the user interaction with the system from the user's point of view.

The second technique, logical dialogue controls (LDC) and logical dialogue outlines (LDO), is useful for specifying dialogues such as those for data entry systems, where the primary task of the user is to populate the database. This technique links user inputs directly to data items.

Both of these techniques are described below:

#### Dialogue network diagrams

Dialogue network diagrams are a specialization of state transition diagrams in which the progress of a dialogue between user and computer can be viewed as a series of transitions from one state to another.

Dialogue network diagrams help the designer to consider user interaction with the system from a user point of view.

The dialogue may be in a particular state awaiting input from the user, and it will progress to one of several possible states depending on the nature of the input received. This can be represented as a transition network (Fig. 3.6). Each state is represented by a node, denoted here by a circle. A node is defined as any point at which the dialogue outputs a message to the user or requests an input from the user. Transitions between nodes are indicated by directed arcs connecting two nodes; a label on the arc indicates the condition under which it is traversed. Note that there may be several arcs connecting two nodes, indicating that more than one condition can cause the transition to occur.

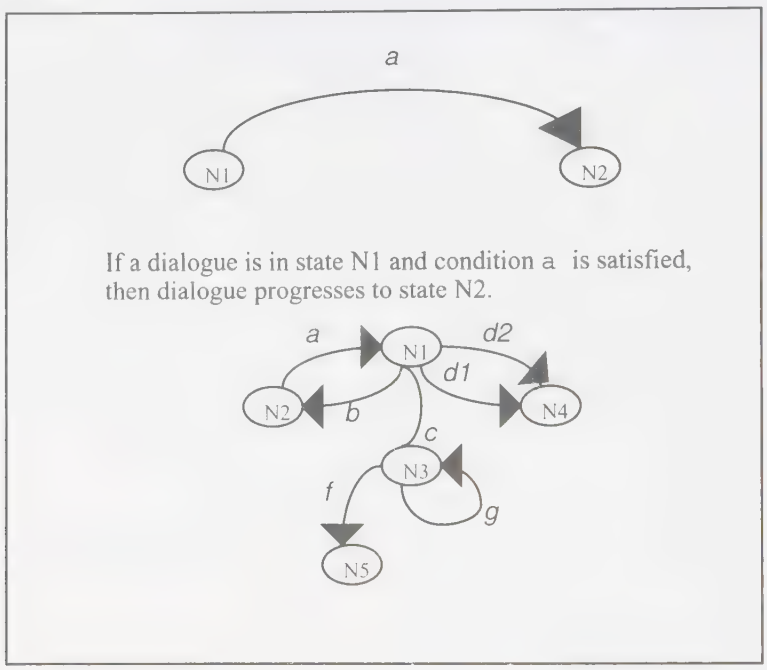


**Figure 3.6** *Nodes and arcs in a dialogue network.*

Network diagrams can be nested hierarchically to deal with complex sequences. A square is used to represent a call to a sub-dialogue sequence. Sub-dialogue sequences are labelled on the top-level diagram.

For example consider the case of the library mentioned earlier (section 2.5). Here we identified 'keep a record of books in stock' as an invariant task. The task hierarchy for this is given in Fig 3.7, and after a discussion of possible allocation of function it was decided that those tasks marked with ** will be shared between user and computer and hence will appear at the user interface. The other tasks in the hierarchy will be carried out by the user without the assistance of the computer.

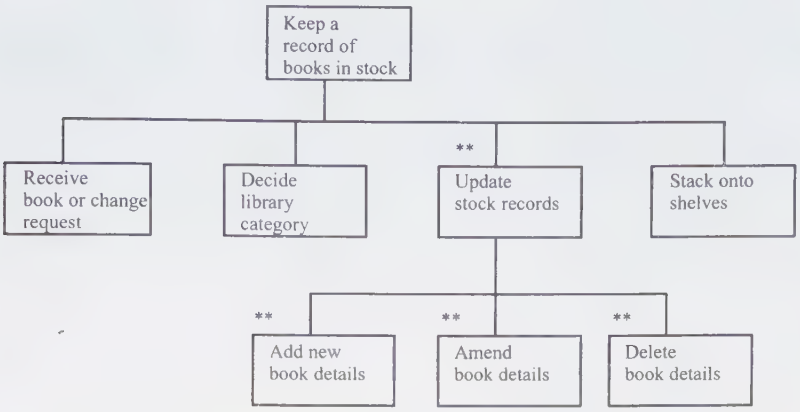


**Figure 3.7** *Task hierarchy showing interface** tasks.*

A more detailed analysis of how the user carries out these tasks may now be needed for the designer to establish the details of the sequence of the dialogue between user and system.

For the task of 'update stock records' a possible dialogue network diagram is shown in Fig. 3.8, where each of the squares is itself a dialogue network diagram for a sub-dialogue.

The designer needs to envision the actions the user will take.

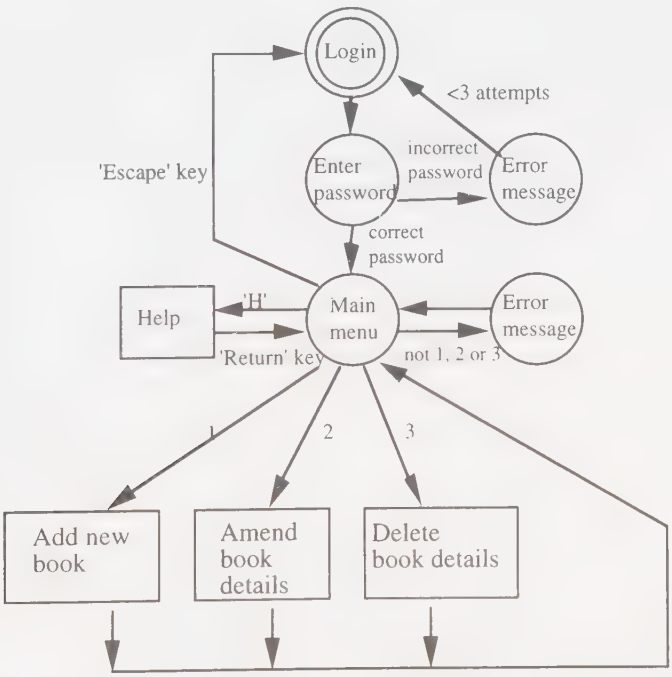


**Figure 3.8** *Example of a dialogue network diagram for update stock records.*

Logical dialogue outlines also represent dialogue sequences, but are closer to the programmer's view of the world, showing data items and updating files (Downs *et al.*, 1992).

### Logical dialogue outlines

Specifying the interaction between user and system is referred to as dialogue design within SSADM (Structured Systems Analysis and Design Method) Dialogue design takes place in the system design phase of SSADM, i.e. as part of Stage 5: process design. Dialogue design is used in SSADM to model the on-line screen handling and human-computer interaction of the required system. A flowchart, called a logical dialogue outline or LDO, is used to represent the progression of screens for a particular event.
The SSADM dialogue design procedure is as follows;

1. Identify on-line events.
2. Identify I/O data items.
3. Create an LDO, one per event.
4. Review LDOs against data flow diagrams.
5. Create logical dialogue controls (LDCs).
6. Validate the diagrams with appropriate users.

The objectives of the dialogue design step are to represent dialogue sequences, to communicate screen handling and interface concepts to the users and to provide a basis for the physical program design. Each LDO uses symbols similar to those used in flowcharts: a rectangle represents a single screen, a triangle represents a user decision point (one which requires a value judgment by the user) and start/stop and flow symbols are directly analogous to their flowchart equivalents.

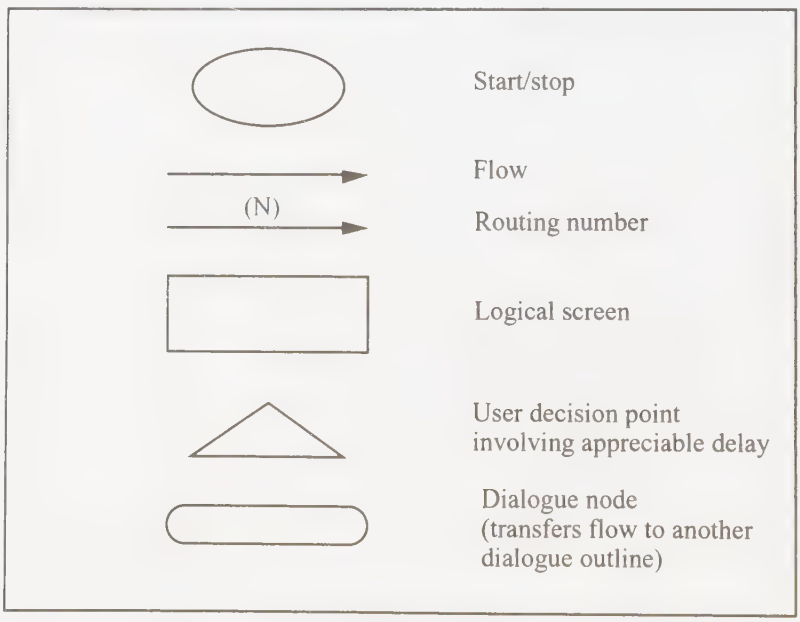


**Figure 3.9** *SSADM dialogue design symbols*

Figure 3.10 shows a dialogue (LDO) which allows a user to update a book entry in a library system.

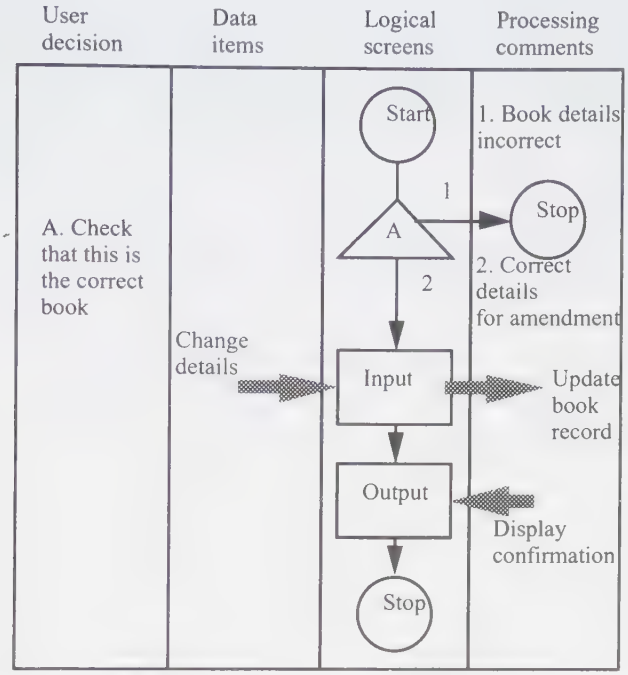


**Figure 3.10** *Example of a logical dialogue outline (LDO) for a library cataloguing system.*

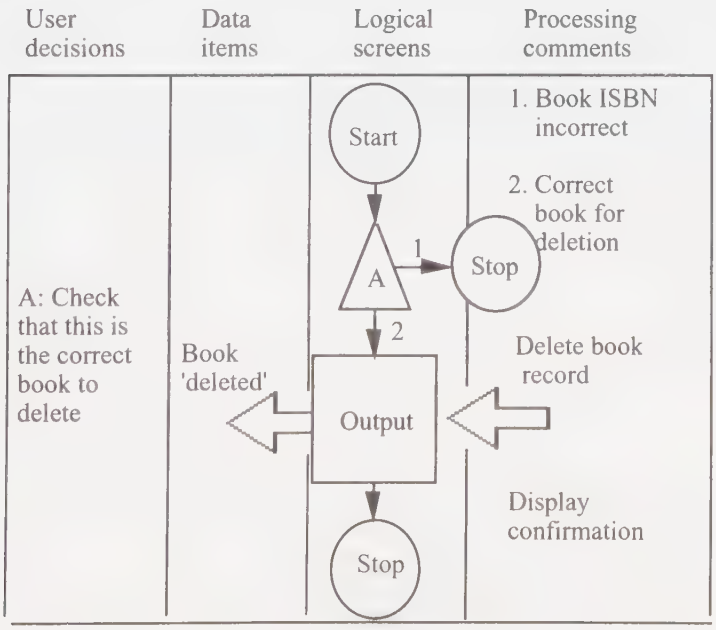


**Figure 3.11** *LDO for delete book details.*

Figure 3.11 shows a dialogue (LDO) which allows the user to delete book details.

LDOs are then linked together into charts to represent a higher level grouping of screens which are called logical design controls (LDCs). Related LDCs are usually linked together to form the lowest level of menu hierarchy.

Figure 3.12 shows the LDC which links the LDOs given in Figs 3.10 and 3.11.

Specifying user system dialogues enables the designer to identify the sequence of screens or windows that need to be designed.

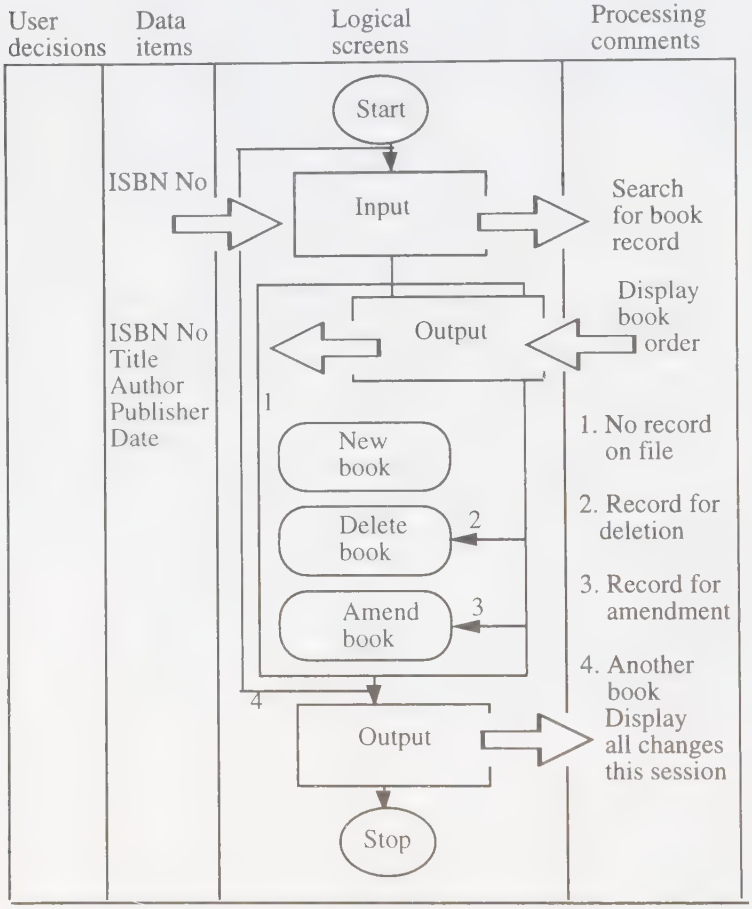


**Figure 3.12** *Example of SSADM logical dialogue control (LDC) for a library cataloguing system.*

Having specified the logical screens, sequencing of interactions and logical groupings of information, the next step is to design a consistent set of screens and windows associated with a particular application.

### 3.6.3 Stage 5: Plan the design of the user interface

Planning the design can be divided into four main steps:

1. Deciding what information should be displayed in each window.
2. Deciding how the information should be displayed.
3. Deciding where each field will appear.
4. Deciding what highlighting is required.

The designer should plan the design of the sequence of screens and windows specified in stage 4.

Stage 5, step one: what information should be displayed?

Don't display information just because it is available. **Only the information which is relevant** to the user at that point in the dialogue should be displayed.

Careful planning will ensure consistency within the design.

On the other hand **all the information relevant** to the user at that point should be displayed. This may involve some repetition from screen to screen, for example, the customer's name and address. Users should not be expected to remember information from one screen to another.

Information should be displayed in logical groupings i.e. a set of information which must be viewed as a composite entry in order to achieve a task. Logical groupings should not be split across screen or window boundaries. One window may contain one or more logical grouping(s).

Decide what information is needed by the user at each point in the dialogue.

*Some guidelines for menu design*

- menu lists should be in logical order and in logical groupings;
- hierarchical menus should be in logical groupings;
- each menu should permit only one selection by the user;
- each new option should be on a new line;
- selection should be by pointing device where possible;
- wording of menu options should be commands not questions;
- selection should be by initial letter, not by arbitrary code.

*Actions for the designer in step one* Study the tasks which the user will perform during an interactive session with the system and identify logical grouping of information. These may be groupings which are related together in time, for example, a series of questions concerning an enquiry or those related by topic, such as all the information relating to a customer. For each logical group produce a list of the required data items. Give each logical group a name, such as customer details, enquiry details. The window in Fig. 3.13 shows an example of a logical group of information.

Information should be displayed in logical groupings.

Stage 5, step two: how should the information be displayed?

Information should be presented in an immediately usable form. The user should not be required to manipulate the information, for example, look up codes, decipher dates and so on.

Decide how to display information so that it is immediately useful to the user.

'Logical groupings' refers to information which is related together in time, or linked by topic.

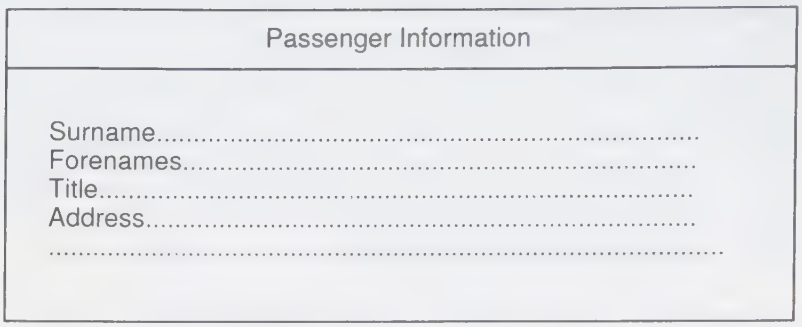


**Figure 3.13** *A logical grouping of information.*

*Some guidelines on information presentation*

Follow well-established guidelines for information presentation.

- use upper and lower case (as in road signs);
- use normal conventions; for example, accountants easily recognize negative values which are displayed in red or in brackets;
- caption names should be as brief as possible but with meaningful abbreviations;
- captions should be positioned in a natural and consistent physical relationship to the corresponding data fields.

*Some guidelines on data entry*

- explicit entry: users should be asked to check data before entry;
- explicit movement between fields: users should use Tab or Return or some other key to move explicitly from field to field;
- explicit delete: users should always be required to confirm any request for deletion;
- provide undo: wherever possible allow users to backtrack to a 'previous state', i.e. to undo their last action.

*Actions for the designer in step two*

- for each data item choose an appropriate caption;
- for each data item decide on the size and format, such as car registration — eight alphanumeric or null, return date — dd/mm/yy, caravan length — 99.9 or null;
- decide on the position of the data item relative to the caption.

The window in Fig. 3.14 shows the captions appearing consistently on the top of the columns.

Stage 5, step three: where should the information be displayed?

*Some guidelines on positioning of text*

Leave half the screen blank.

- leave approximately half of the total screen (window) blank;
- every screen (and window) should be self contained;

| Voyage: Dover to Calais | | | | | | |
|---|---|---|---|---|---|---|
| Mon | Tues | Wed | Thurs | Fri | Sat | Sun |
| 06.30 | 06.30 | 06.30 | 06.30 | 06.30 | 07.00 | 07.00 |
| 07.00 | 07.00 | 07.00 | 07.00 | 07.00 | 09.00 | 09.00 |
| 08.00 | 08.00 | 08.00 | 08.00 | 08.00 | 11.00 | 11.00 |
| 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 13.00 | 13.00 |
| 11.30 | 11.30 | 11.30 | 11.30 | 11.30 | 15.00 | 15.00 |
| 12.30 | 12.30 | 12.30 | 12.30 | 12.30 | 17.00 | 17.00 |
| 13.30 | 13.30 | 13.30 | 13.30 | 13.30 | 19.00 | 19.00 |

Planning the design will ensure consistency in the presentation of information.

**Figure 3.14** *Captions appear in a consistent position.*

- there should be an obvious starting point — usually top left — then proceed left to right and top to bottom;
- the same information should be displayed in a consistent and predictable relative position on the screen throughout the application, e.g. error messages should appear in a consistent position throughout the whole interactive session.

*Some guidelines for presentation of text*

- upper and lower case together can be read 13% more quickly than upper case only;
- UPPER CASE CAN BE USED TO ATTRACT ATTENTION;
- right-justified text with variable spacing is more difficult to read than evenly spaced text with a ragged margin;
- optimal spacing between lines is equal to or slightly greater than the height of the characters themselves.

*Design of windows* The advantages of multiple windows include:

- allowing users access to multiple sources of information;
- allowing information to be viewed from different perspectives, for example in program debugging;
- the user may examine the same information at different levels of detail, for example, overviews in one window with related windows containing further detail;
- allowing the system to attract the user's attention, for example, by displaying a new window in the middle of the screen;
- allowing the user to control multiple concurrent tasks in an environment where multitasking is provided.

The disadvantages of multiple windows include:

- the danger of 'overcrowding' on the screen;
- distraction from the task in hand by causing the user to manipulate the interface in order to obtain the information required;
- the 'desk-top' metaphor becoming the 'untidy desk top' metaphor.

Information should be displayed in a predictable and consistent position.

Some guidelines for the design of windows:

- the contents of a window should form a logically-related group;
- the borders of each window should be clearly delimited;
- avoid filling the screen with a multiplicity of small windows;
- windows should appear initially in a consistent position and have a consistent size;
- the default position and size should be adjusted to reflect user preference;
- the contents of each window and of each screen should reflect a logical ordering and consistent format and use minimum highlighting;
- the spatial positioning of windows on the screen should reflect a logical ordering.
- use of colours across the whole screen should be minimal and consistent;
- allow 'popping-up' of windows to attract user attention.

*Actions for the designer in step three* Use a template for screen layouts or hand draw draft designs. Plan the design of a sequence of screens (Fig. 3.15)

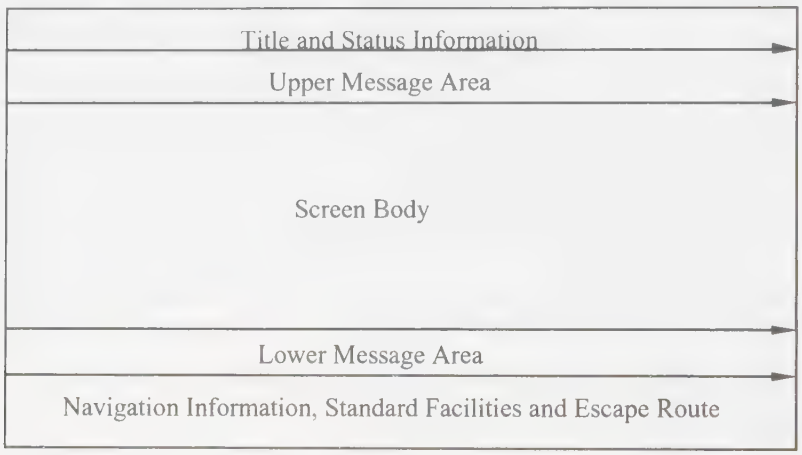


**Figure 3.15** *Example of a screen template.*

Stage 5, step four: when to use highlighting?

- Use only to make particular areas of the screen stand out from the rest;
- use blinking highlights only in extreme circumstances (rapid blinking could trigger an epileptic fit);
- use guidelines for use of colour but always experiment on actual system with target users;
- use beeps etc. to attract attention but take care in certain environments;
- use reverse video to highlight error situations.

*Actions for the designer in step four* Only use highlighting and colour when some positive advantage can be identified. Try out any colour design

on the actual screen. See section 3.5 for further discussion on the use of colour.

### 3.6.4 Stage 6: Produce a draft design

Use screen layout sheets, screen design aids, paper mock-ups or prototyping tools to produce a first draft.

### 3.6.5 Stage 7: Test the designs with users

Evaluate the layout in terms of the five design principles, then evaluate the effectiveness of the design through experimentation with target users.

The case study which follows illustrates the seven stages of task-oriented user interface design.

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## 3.7 A case study in task-oriented user interface design

This is a case study of a task-oriented approach to user interface design. The full analysis is not shown but representative; selected parts of the analysis and design are given to illustrate the process and concepts associated with the approach.

The case study used is that of the Fast Ferries reservation system referred to earlier in this chapter. Below is an overview of the sections which follow:

**Stage 1: Understanding users**

1.1 Business case
1.2 Workgroup table
1.3 Workgroup: sales staff: job issues
1.4 Generic user: travel agent: person issues
1.5 Task: enquiry: organization issues
1.6 Task: booking: organization issues
1.7 User, object, task: travel agent, voyage details, enquiry
1.8 User, object, task: travel agent, booking details, booking.

**Stage 2: Task analysis and allocation of function**

2.1 Task analysis
2.2 Allocation of function.

**Stage 3: Identification of shared tasks**

**Stage 4: User system dialogues**

4.1 Dialogue network diagrams.

**Stage 5: Plan the design**

5.1 Full-screen window template
5.2 Error popup window template.

**Stage 6: Design of screens and windows**
6.1 Main menu
6.2 Some enquiry windows
6.3 Some booking windows.

### 3.7.1 Stage 1: understanding users

The following subsections are an extract from the CRC stage 1 forms.

(1.1) Business case
(1.2) Workgroup table
(1.3) Workgroup: sales staff: job issues
(1.4) Generic user: travel agent: person issues
(1.5) Task: enquiry: organization issues
(1.6) Task: booking: organization issues
(1.7) User, object, task: travel agent, voyage details, enquiry
(1.8) User, object, task: travel agent, booking details, booking.

(1.1) Business case

The proposed system is intended to support the sales staff in travel agents, the aim being to provide a fast and more efficient enquiry and booking service. Ideally the system should come into general use over a period of one year, starting in one year's time. The buyers of the proposed system are the travel agent management, whose objectives are to improve the quality of customer service by reducing the number of errors in bookings and improving the speed of dealing with customers.

The users of the proposed system are mainly the sales staff in Fast Ferries accredited travel agents. Their customers are the general public, who make enquiries and bookings for ferry services. Some customers visit the travel agency, others telephone them. Fast Ferries itself has a sales department.

Enquiries by potential travellers concern routes, sailing and journey times, facilities and services. Bookings are for a specific outward and, optionally, a specific inward journey. Fast Ferries needs to know the total number of people travelling and the characteristics of any vehicle.

Fast Ferries also sells additional services: holiday and travel insurance, reserved accommodation, and a booking service for holiday sites.

The purpose of the proposed system is to provide an on-line system for enquiries and bookings at each sales position. It is intended that the system should support detailed enquiries and validate bookings as they are entered. The system should require minimum staff training time.

(1.2) Workgroup table

The workgroup table in Fig. 3.16 shows the three main workgroups within the travel agents. The management group and the financial group are likely to use the proposed system less frequently than the sales staff. These two

groups may still be important from the point of view of the user interface design and hence some further CRC type analysis may be required. However, in this case study, only the sales staff are described in more detail.

| Work Group Title | Sales staff group | Management group | Financial group |
|---|---|---|---|
| Relationship | 1 | 2 | 2 |
| Generic users ☐ | TRAVEL AGENT [1] | SENIOR TRAVEL AGENT [1] | MANAGER [2] |
| | ASSISTANT [1] | MANAGER [2] | ACCOUNTANT [2] |
| | SENIOR TRAVEL AGENT [1] | SECRETARY [3] | ☐ |
| | ☐ | ☐ | ☐ |
| | ☐ | ☐ | ☐ |
| | ☐ | ☐ | ☐ |

☐ Indicates relationship of user to the proposed system

**Figure 3.16** *Fast Ferries workgroup table.*

(1.3) Workgroup: sales staff: job issues
The sales staff are a primary workgroup, whose job issues are described in Fig. 3.17. The 'now' column indicates what the sales staff do in a typical week, with the percentages indicating the proportion of time spent on each task. The proposed column indicates what the proposed or desired situation will be once the system has been introduced. In this case there is quite a lot of potential for change and improvements which would help to meet the management objectives.

This form also helps the designer to identify key tasks which the system needs to support. For example, it is proposed that the time spent on enquiries is reduced from 25% to 15%, the time spent on bookings is reduced from 15% to 10% and that filing and paperwork is reduced from 10% to 4%. The design of the user interface will affect the workgroup's ability to achieve these reductions in time taken.

The other workgroup issues related to the social and organization aspects of the sales staff would also be considered, but they are not included here.

| | |
|---|---|
| Proposed system | FAST FERRIES |
| Work-group | SALES STAFF |
| Job issues | (A typical week) |

| Now | Proposed (e.g. 2 years on) |
|---|---|
| Dealing with customers, finding out their requirements (35%) | More effective, by using the system to support communication between customer and sales staff (25%) |
| Making enquiries regarding availability of ferries, times and prices of crossings, using the telephone and published timetable (25%) | Speed up service to customers (15%) |
| Making bookings and reservations for passengers and vehicles, by filling in the reservation form, together with the customer (15%) | Reduce time taken and reduce chances of double booking (10%) |
| Selling associated products such as insurance (2%)<br>Arranging accommodation (2%) | Reduce time taken (3%) |
| Informing ferry company of reservation details (2%) | Reduce time by using network (1%) |
| Recording information about bookings for management (5%)<br>Keeping files on customers and bookings (5%) | Reduce time and reduce paperwork (4%) |
| Dealing with payment (2%) | Same |
| Issuing tickets on behalf of the ferry company (2%) | Reduce time and reduce errors (1%) |
| Setting out and reading travel brochures (5%) | Same<br>New tasks:<br>Computer related (5%) |

Note:
% indicates the proportion of the working week spent on that particular task by the workgroup.

**Figure 3.17** *Fast Ferries sales staff job issues.*

Next the primary users within the sales staff group are described. The next section shows the travel agent person issues, now and proposed.

(1.4) Generic user: travel agent: person issues
The travel agent enjoys dealing with customers and wants to be helpful towards them. The proposed system should support this communication rather than obstruct it. The job is very visible to customers and the travel agent wants to be seen to be acting for a prestigious ferry line. The travel agent has knowledge of routes and booking routines and enjoys acquiring and using this knowledge.

Thus the designer needs to take account of the travel agent's view of the job and to design the system so that the positive aspects of the job are unchanged.

| Now | Proposed |
|---|---|
| **Attitude** | |
| Sociable | Unchanged |
| Likes helping people | |
| **Motivation** | |
| To be more helpful | More up-to-date information |
| Commission on voyage and service sales | Less hassle |
| **Aspiration/ambition** | |
| To act for a prestige ferry line | Unchanged |
| More commission on sales | |
| **Expertise** | |
| Knows ferry routes and timetable in outline | Unchanged |
| Knows booking routine | |
| **Skill** | |
| Many are touch typists, but are out of practice | Typing skills preferred, but high speed not essential |
| **Job** | |
| Very visible to customers | Unchanged |
| Seated, at a desk or counter | Unchanged |
| Office-like environment, with public access | |
| Similar to building society branches | |
| Much paper clutter | Less clutter |

Other primary users may be described. For example, the assistant may be responsible for much of the filing and paperwork and as such would be affected by the proposed change. Also it is important for the designer to understanding how filing and other paperwork is done now.

Next, some of the tasks of the travel agent are described.

(1.5) Task: enquiry: organization issues

| Now | Proposed |
|---|---|
| **Importance** | |
| High | Same |
| Many sales depend on it | |
| Helps avoid under — or over — booking | Same but more accurate |
| **Security** | |
| No security issues associated with the timetable | Same |
| Availability of sailings is inaccessible and security risk is low | High: commercially and financially sesnsitive if collated over all sailings and whole year |
| **Motivation** | |
| High | Same |
| Used to help customers | |
| **Skill level** | |
| Medium | Low: less reliance on memory |
| **Dependencies** | |
| Accuracy of timetable and availability | Same, but more up-to-date information |

(1.6) Task: booking: organization issues

| Now | Proposed |
|---|---|
| **Importance** | |
| High | Same |
| Is selling the core product | |
| Is selling additional profit-making services | |

| Now | Proposed |
|---|---|
| **Security** | |
| High | Same |
| Information must not be lost | |
| Includes personal data | May imply additional legal requirements |
| Other agent's bookings | Commercially and financially sensitive |
| **Motivation** | |
| High | Same |
| **Skill level** | |
| Booking: medium | Low: less reliance on memory |
| Data entry: low | Medium: Touch typists have advantage |
| **Dependencies** | |
| Accuracy of timetable | Same, but more up to date |
| Availability information | Is now accessible immediately |

(1.7) User, object, task: travel agent, voyage details, enquiry

*Interaction characteristics* There is a need for:
- route and timetable information;
- vehicle and accommodation availability information;
- up-to-date information;
- enquiry to be fast enough for telephone enquiries;
- enquiry/lookup to be available during booking;
- enquiry details to be transferred to booking details without re-typing.

(1.8) User, object, task: travel agent, booking details, booking

*Interaction characteristics* There is a need for:
- details to be checked for inclusion of vital data;
- details to be checked for consistency;
- details to be checked against up-to-date timetable and availability information;

- booking to be fast enough for telephone bookings;
- enquiry/lookup to be available during booking;
- enquiry details to be transferred to booking details without re-typing;
- reminder of additional services available.

### 3.7.2 Stage 2: Task analysis and allocation of function

Task analysis
A key invariant task which can be identified is that of 'serve customer'. Subtasks of 'serve customer' are 'answer customer enquiry' and 'make customer booking'. The task hierarchy is shown below in Fig. 3.18.

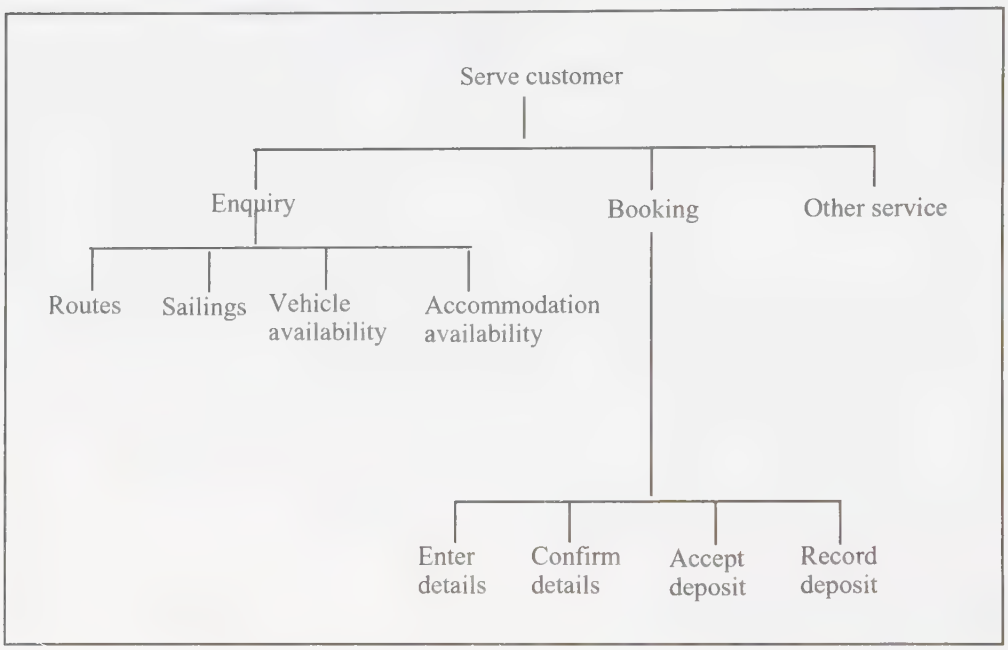
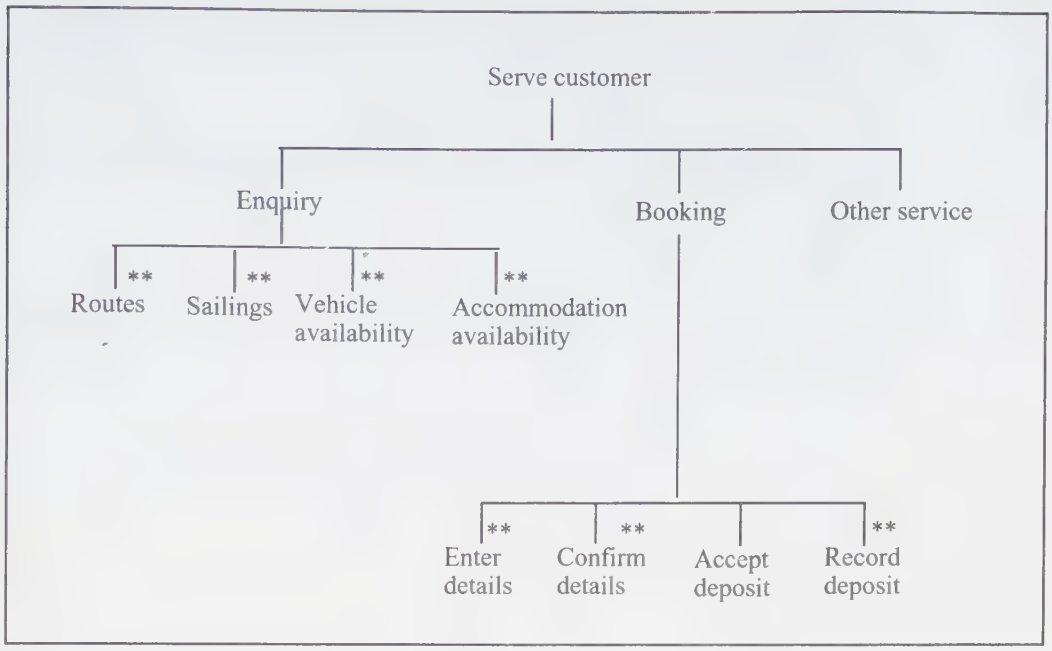



**Figure 3.18** *Task hierarchy for 'serve customer'*

Allocation of function
This section discusses the allocation of function between the computer system and travel agent staff.

*Sharing between user and computer*

1. *Fully automated: rejected.* Automatic ticket machines. The customer would find it difficult to enter all the details correctly without assistance, and is unlikely to buy extra services such as insurance. The travel agent would feel the machine clashes with the office environment, as well as taking up too much space.




Note: ** denotes shared tasks.

**Figure 3.19** *Task hierarchy for 'serve customer' showing tasks which are to be shared between user and computer.*

2. *System supplies general task support: rejected.* (Just word processing and printing.) The user would feel that the system is not an improvement over the existing pen and paper methods. Possibly it would be viewed as worse.

3. *System and user share the tasks: accepted.* The system provides task-related assistance and knowledge.

*Who or what controls the task?*

1. *The system totally controls the user: rejected.* This implies that the customer is also constrained in every way. This is liable to upset the customers who might not choose to be customers of Fast Ferries.

2. *The user totally controls the system: rejected.* Fast Ferries requires certain rules to be obeyed, such as knowing what type of vehicles are to be carried.

3. *The system enforces rules, leaving the user free in other respects: accepted.* The travel agent staff can work at the customer's pace, and in the customer's way if untypical.

*Type of support provided by the system*

1. *Active: rejected.* It is not clear what active support could be provided.

2. *Passive: accepted.* The system essentially records what the user and customer wants. The system does this in a helpful way, of course.

### 3.7.3 Stage 3: Identification of shared tasks

The task hierarchy in Fig. 3.19, has ** against the tasks which will be shared between user and system with respect to 'serve customer'.

### 3.7.4 Stage 4: user system dialogues

Dialogue network diagrams are drawn for the shared tasks in order to specify user system dialogue. The designer should draw the diagrams bearing in mind the interaction between the travel agent, the customer and the system. The designer should ask such questions as: in what order will the conversation take place? What information is needed at a given point? How can the system help the travel agent deal with any errors that may arise? What are the likely and unlikely actions of the travel agent at a given point? How will the system respond?

Below are the dialogue network diagrams for some of the shared tasks.

Conventions used

The diagrams use double circles for both entry and exit points. Where there is any doubt, entry and exit points are labelled with the name of the previous or next diagram or state. Return indicates that the next state is the one occupied just prior to entering the diagram.

Figure 3.20 shows the main menu for 'serve customer', where the user selects E for dealing with the enquiry and B for making a booking. This can be described as a level 1 diagram because it is the first level of shared task in the task hierarchy.

Figure 3.21 shows the network diagram for 'enquiry'. This can be thought of as a level 2 diagram because it shows the second level of shared task. The enquiry menu asks the user to select which they wish to see: ferry routes, sailing times, vehicle availability or accomodation availability. The choice will depend on the outcome of the travel agent's discussion with the customer; the order of selection cannot be predicted.

Figure 3.22 shows a level 3 diagram for the routes window, which would be selected by choosing R in the level 2 diagram in Fig. 3.21.

The routes window needs to display all the routes and a scrolling window is specified.

Figure 3.23 shows a level 3 diagram for the sailings window, which would be selected by choosing S from the enquiry menu in Fig. 3.21.

Figure 3.24 shows a level 2 diagram for making a booking, This would be selected by choosing B from the level 1 diagram in Fig. 3.20. Note that the logical groupings of information associated with making a booking each forms a subdialogue; for example, 'enter voyage details' or 'enter customer details' are subdialogues. Note also that the user does not need to enter all the data at once but may select whichever logical grouping is of concern and

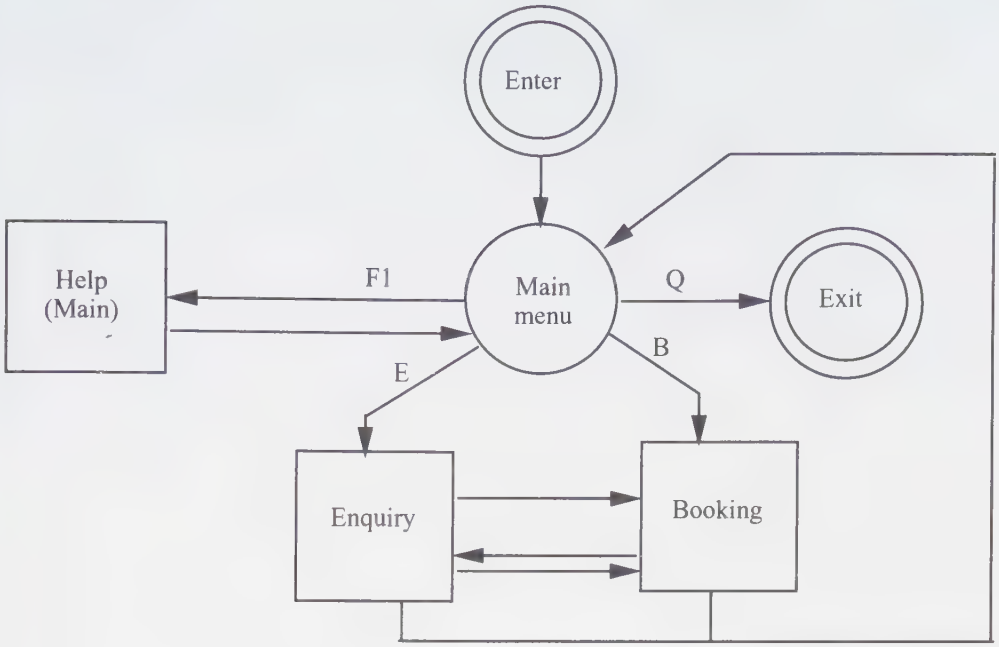



**Figure 3.20** *Level 1 diagram, main menu for 'serve customer'.*

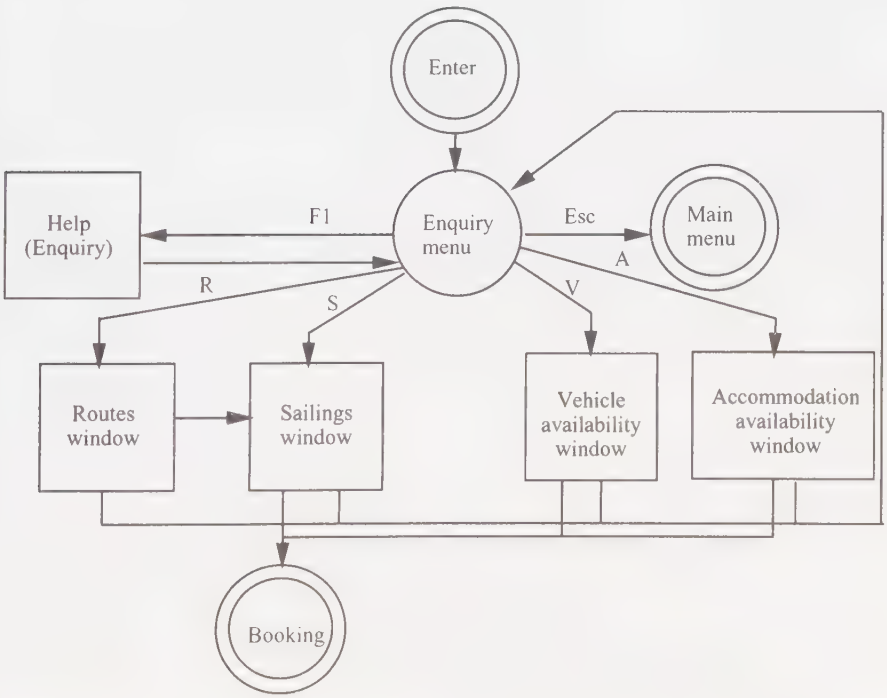



**Figure 3.21** *Level 2 diagram, menu for dealing with an enquiry.*

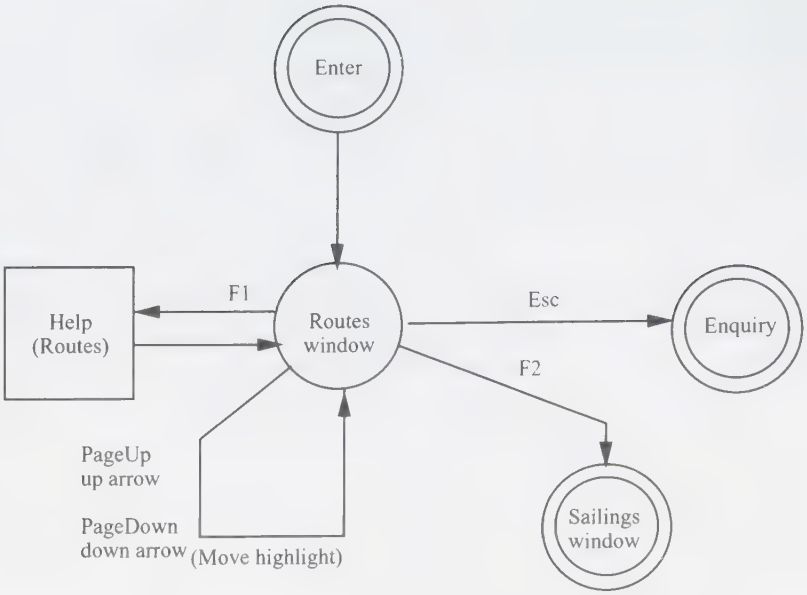



**Figure 3.22** *Level 3 diagram, dialogue for routes of ferries.*

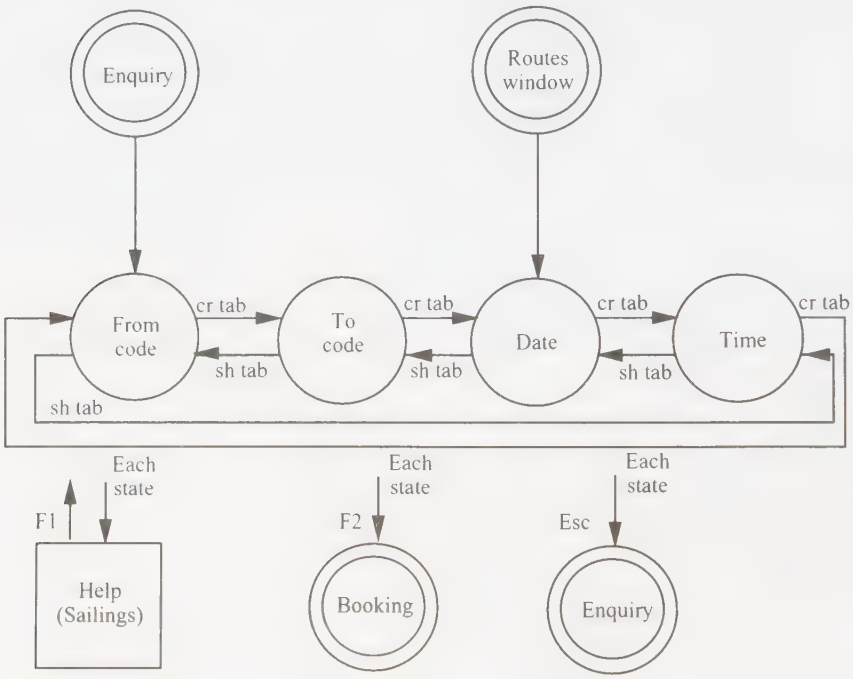



**Figure 3.23** *Level 3 diagram, dialogue for times of sailings.*

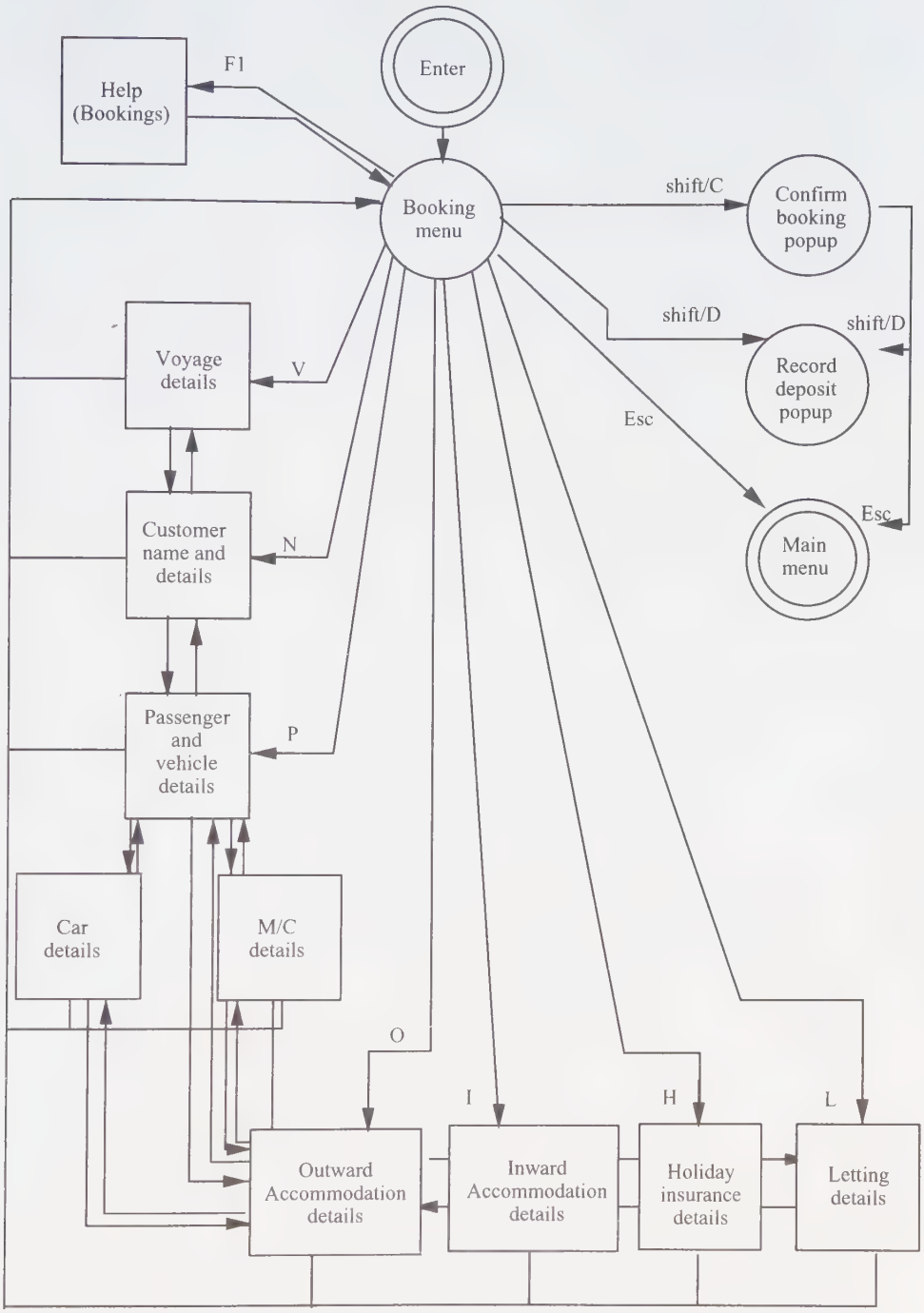



**Figure 3.24** *Level 2 diagram, making a booking.*

may enter the subdialogues in any order. However, the option is also provided for the user to move sequentially from one logical grouping to the next, if preferred.

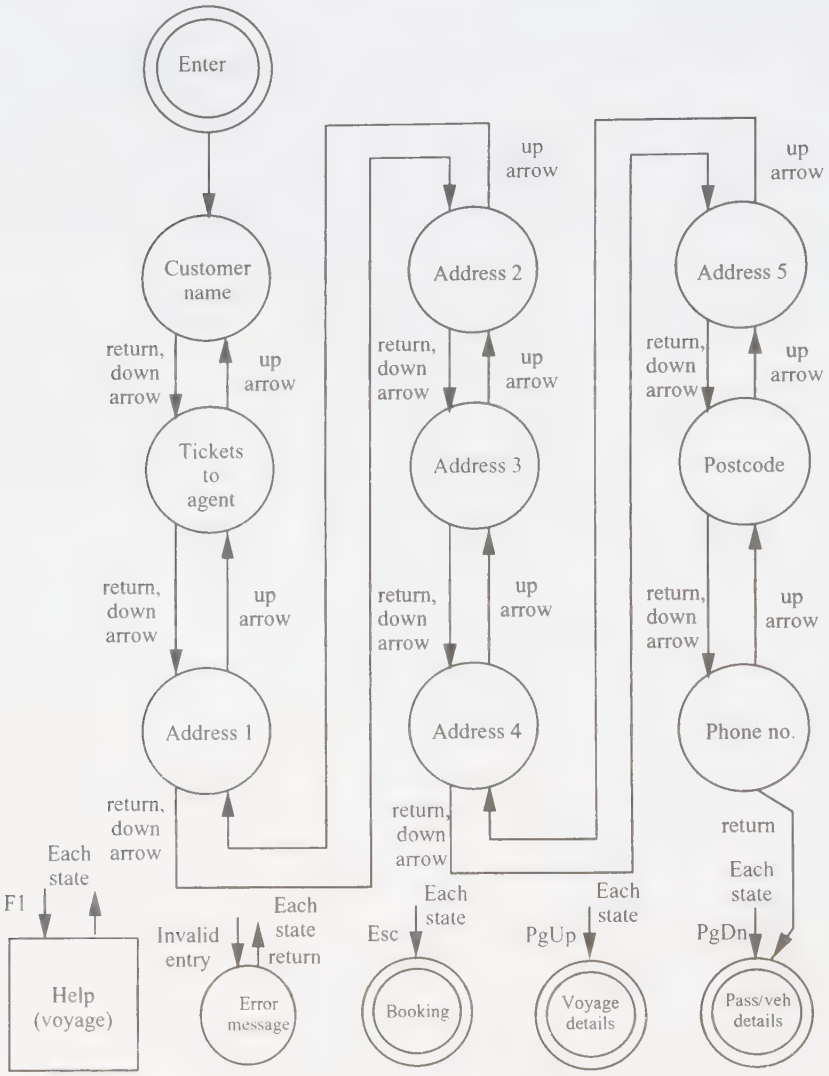



**Figure 3.25** *Level 3 diagram, enter customer name and details.*

Figure 3.25 shows a level 3 diagram for entering customer details. This would be selected by choosing N from the level 2, 'make a booking' diagram, (Fig. 3.24). At this level of detail, the network diagram is showing one item of information at a time, normally the lowest level of detail represented in a dialogue network diagram.

The above dialogue network diagrams represent only part of the full design.

### 3.7.5 Stage 5: plan the design

Full-screen template
Figure 3.26 shows the template for the screen design for an IBM PC DOS character screen.

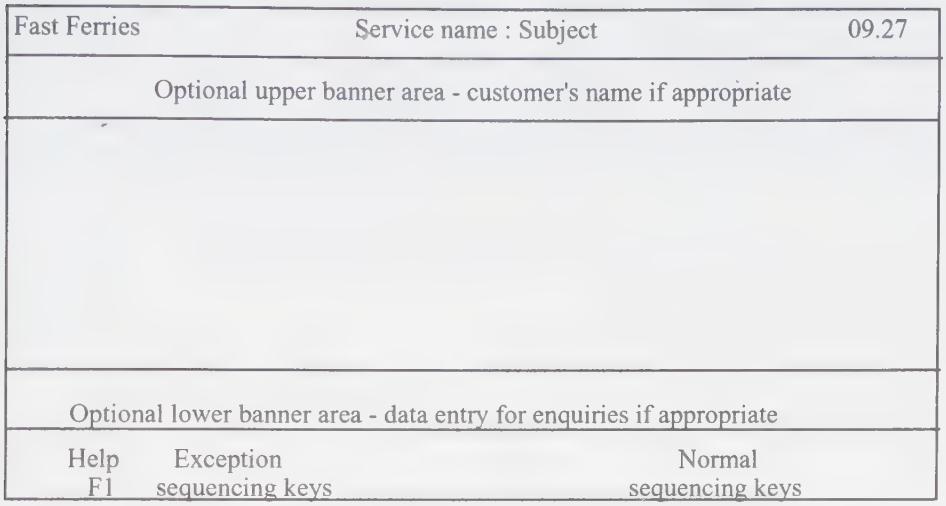



**Figure 3.26** *General screen template for Fast Ferries screens.*

Template for a pop-up window
Figure 3.27 shows the general design for a pop-up window.

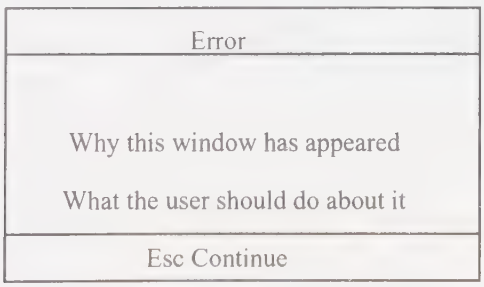



**Figure 3.27** *General template for pop-up error messages.*

### 3.7.6 Stage 6: design of screens and windows

Main menu
Figure 3.28 shows the screen design for the network diagram seen in Fig. 3.20. It shows the main menu for 'serve customer'

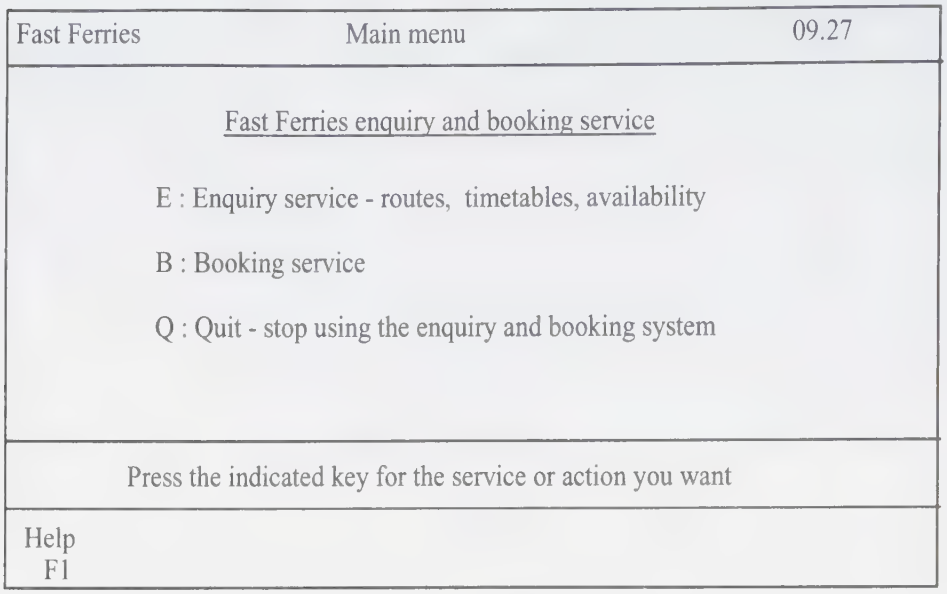



**Figure 3.28** *Main menu for 'serve customer'.*

Some enquiry screens
Figure 3.29 shows the screen design for the network diagram shown in Fig. 3.21, that is, the enquiry menu.

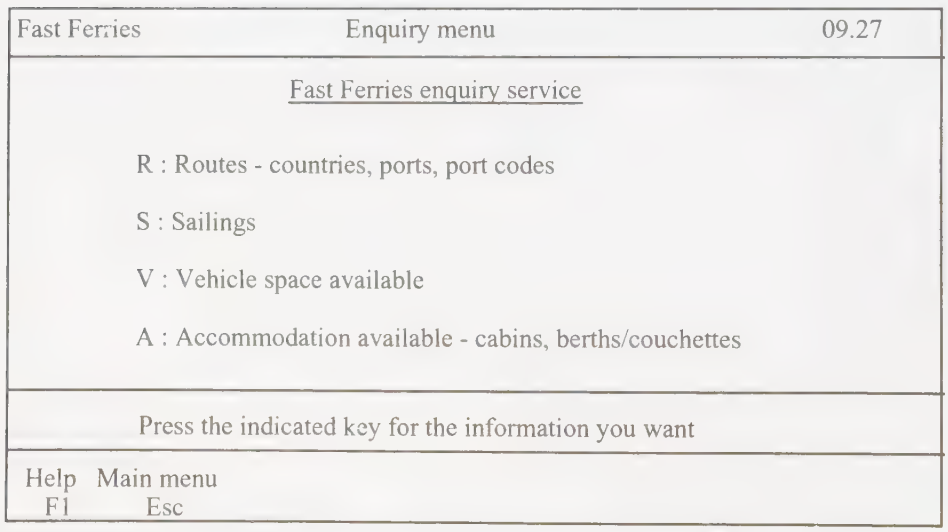



**Figure 3.29** *Menu for making an enquiry.*

Figure 3.30 shows the screen design associated with the network diagram in Fig. 3.22, indicating ferry routes. The highlighted line selects the 'from' and

'to' ports if F2 is pressed. The PageUp key moves the highlighted line up the table of routes, and PageDown moves it down the table.

Fast Ferries — Enquiry : routes — 09.27

| From | | | To | | | Hours |
|---|---|---|---|---|---|---|
| Country | Port | Code | Country | Port | Code | |
| England | Folkestone | FOL | Belgium | Ostend | OST | 10 |
| | Dover | DVR | France | Calais | CAL | 2 |
| | Dover | DVR | | Dunkirk | DUK | 2.5 |
| France | Calais | CAL | England | Dover | DVR | 2 |
| | Dunkirk | DUK | | Dover | DVR | 2.5 |
| Belgium | Ostend | OST | England | Folkestone | FOL | 10 |

Help F1 | Enquiry menu Esc | Sailings F2

Note:
Highlighted line selects the From and To ports if F2 is pressed.

**Figure 3.30** *Routes of ferries.*

Figure 3.31 shows the screen design associated with the network diagram in Fig. 3.23, indicating the times of sailings. Note that the currently selected sailing is highlighted in the table.

Fast Ferries — Enquiry : sailings — 09.27

21.02.94 — Dover to Dunkirk — 27.02.94

| Mon | Tues | Wed | Thur | Fri | Sat | Sun |
|---|---|---|---|---|---|---|
| 01.00 | 01.00 | 01.00 | 01.00 | 01.00 | 01.00 | 01.00 |
| 05.00 | 05.00 | 05.00 | 05.00 | 05.00 | 05.00 * | 05.00 |
| 09.00 | 09.00 | 09.00 | 09.00 | 09.00 | 09.00 * | 09.00 |
| | | | | | 11.30 * | |
| 13.00 | 13.00 | 13.00 | 13.00 | 13.00 | 13.00 | 13.00 |
| | | | | | 14.30 | |
| 17.00 | 17.00 | 17.00 | 17.00 | **16.30** * | 17.00 | 17.00 |
| | | | | 19.30 * | | |
| 21.00 | 21.00 | 21.00 | 21.00 | 21.00 * | 21.00 | 21.00 |
| | | | | 21.30 | | |

| From | To | Date | Time |
|---|---|---|---|
| **DVR** | **DUK** | **25.2.94** | **16.30** |

* : Fully Booked
* : Check Availability

Help F1 | Enquiry menu Esc | Booking F2

**Figure 3.31** *Times of sailings.*

Some bookings screens

Figure 3.32 shows the screen design associated with the level 3 network diagram in Fig. 3.25, showing 'enter customer details'.

```
Fast Ferries          Booking : Customer details          09.27

   Customer's name      : (Miss S G Barrington-Bayley          )
   Tickets to agent (Y/N) : (N)
   Customer's address   : (Rose Cottage
      (if needed)         (Delphi Lane                        )
      (for tickets)       (Alsager on the Wold                )
                          (Cheshire                           )
                          (via Stoke-on-Trent                 )
            Post code     : (ST7 1XY    )                     )
            Phone         : (04889 012 3457_)

Help      Booking menu                          Next/Prev
F1        Esc                                   PageDown/PageUp
```

**Figure 3.32** *Enter customer name and details.*

Figure 3.33 shows a confirm booking pop-up window. This would appear as a result of making a selection of C from the booking menu in Fig. 3.24.

```
┌──────────────────────────────────────┐
│           Confirm Booking            │
├──────────────────────────────────────┤
│                                      │
│   Confirm all booking details        │
│   and print deposit receipt          │
│                                      │
├──────────────────────────────────────┤
│ F1 Confirm          Esc Cancel       │
└──────────────────────────────────────┘
```

**Figure 3.33** *Confirm booking pop-up.*

### 3.7.7 Stage 7: test the designs with users

These designs should then be tested with some target users: for example, the designer could talk through a typical scenario of use with the user. A sequence of enquiry, reservation and booking screens could be shown. These could be paper- or computer-based designs. The designer should also check the designs against the five principles of good HCI design.

## 3.8 Summary

This chapter has covered both theory and practice of user interface design. The five principles: naturalness, consistency, supportiveness, flexibility and non-redundancy were introduced and these can be used both as a basis for designing user interfaces and as criteria for evaluating existing interfaces. Some guidelines have been given on the form and content of screen designs and on the use of colour.

A task-oriented user interface design method was introduced and illustrated through the use of a case study. This method is useful for those applications where the user interaction with the system occurs in a reasonably predictable sequence. The chapter which follows describes an object-oriented user interface design approach which is useful for those applications where the sequence of user interactions is not easily predicted. However, the guidelines and principles introduced in this chapter still apply.

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## Exercises for Chapter 3

**3.1** The screen shown below appears upon selection of the 'Enquiry about performance' from the main menu of the Theatre Booking System. Give five examples of how the screen design contravenes widely-recognized screen design guidelines.

Enquiry About Performance Screen

ENTER CUSTOMER NAME AND ADDRESS

WHICH PERFORMANCE?

WHICH NIGHT?

HOW MANY TICKETS?

ENTER TIME OF SHOW

METHOD OF PAYMENT

What Next? EXIT TO MAIN MENU? (press Q) QUIT (press E)

**3.2** Compare the following two techniques for dialogue specification:

1. Dialogue networks diagrams.
2. Logical dialogue outlines as used in SSADM.

**3.3** What criteria would you use in order to evaluate the design of a user interface?

**3.4** There are some inconsistencies in the screen designs in the Fast Ferries case study. Can you spot what they are?