User interface design

The user interface

- Should be designed to match:
  - Skills, experience and expectations of its anticipated users.
- Users often judge a system by its interface rather than its functionality.
- A poorly designed interface can cause a user to make catastrophic errors.
- Poor user interface design is the reason why so many software systems are never used.

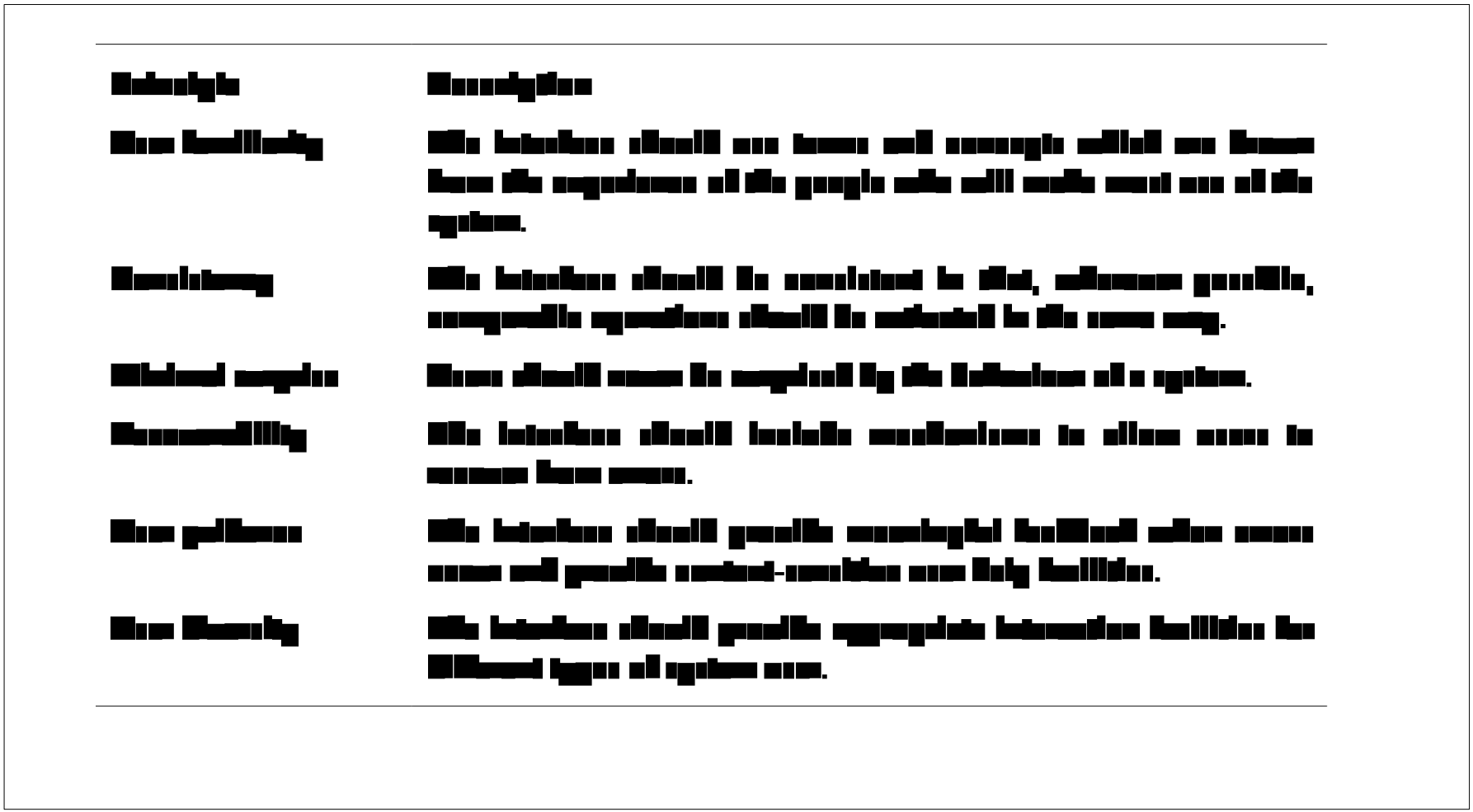
Human factors in interface design

- Limited short-term memory
  - People can instantaneously remember about 7 items of information. If you present more than this, they are more liable to make mistakes.
- People make mistakes
  - When people make mistakes and systems go wrong, inappropriate alarms and messages can increase stress and hence the likelihood of more mistakes.
- People are different
  - People have a wide range of physical capabilities. Designers should not just design for their own capabilities.
- People have different interaction preferences
  - Some like pictures, some like text.

UI design principles

- Take in account:
  - the needs, experience and capabilities of the system users.
- Be aware of people's physical and mental limitations (e.g. limited short-term memory)
- Recognise that people make mistakes.
- Note that: not all principles are applicable to all designs.

User interface design principles

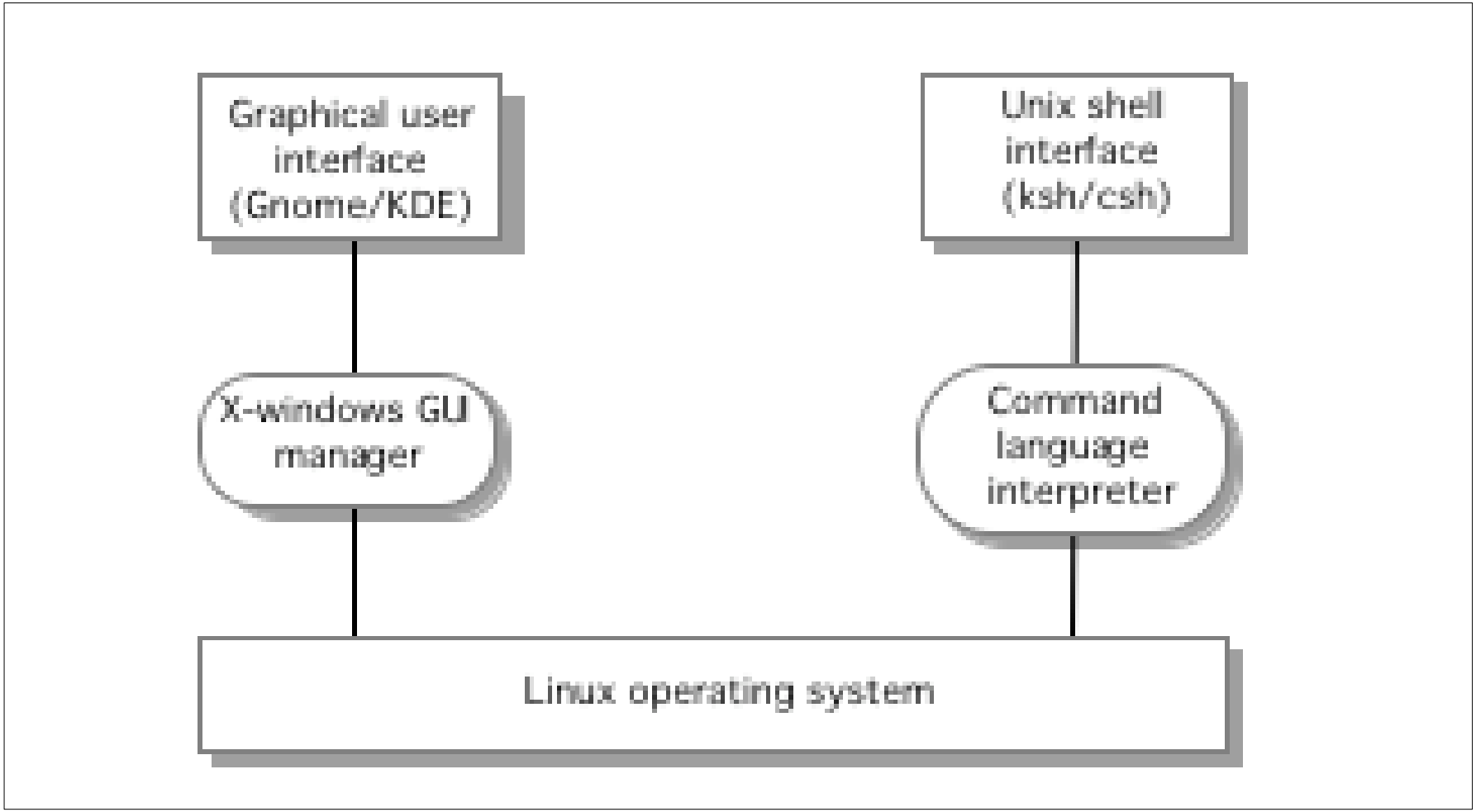


Design issues in UIs

- Two problems must be addressed in interactive systems design
  - How should information from the user be provided to the computer system?
  - How should information from the computer system be presented to the user?

Interaction styles

Multiple user interfaces



Information presentation

- Information presentation is concerned with presenting information to users.
  - Direct presentation
    (e.g. text in a word processor)
  - Indirect presentation
    (e.g. in some graphical form).
- The Model-View-Controller approach is a way of supporting multiple presentations of data.

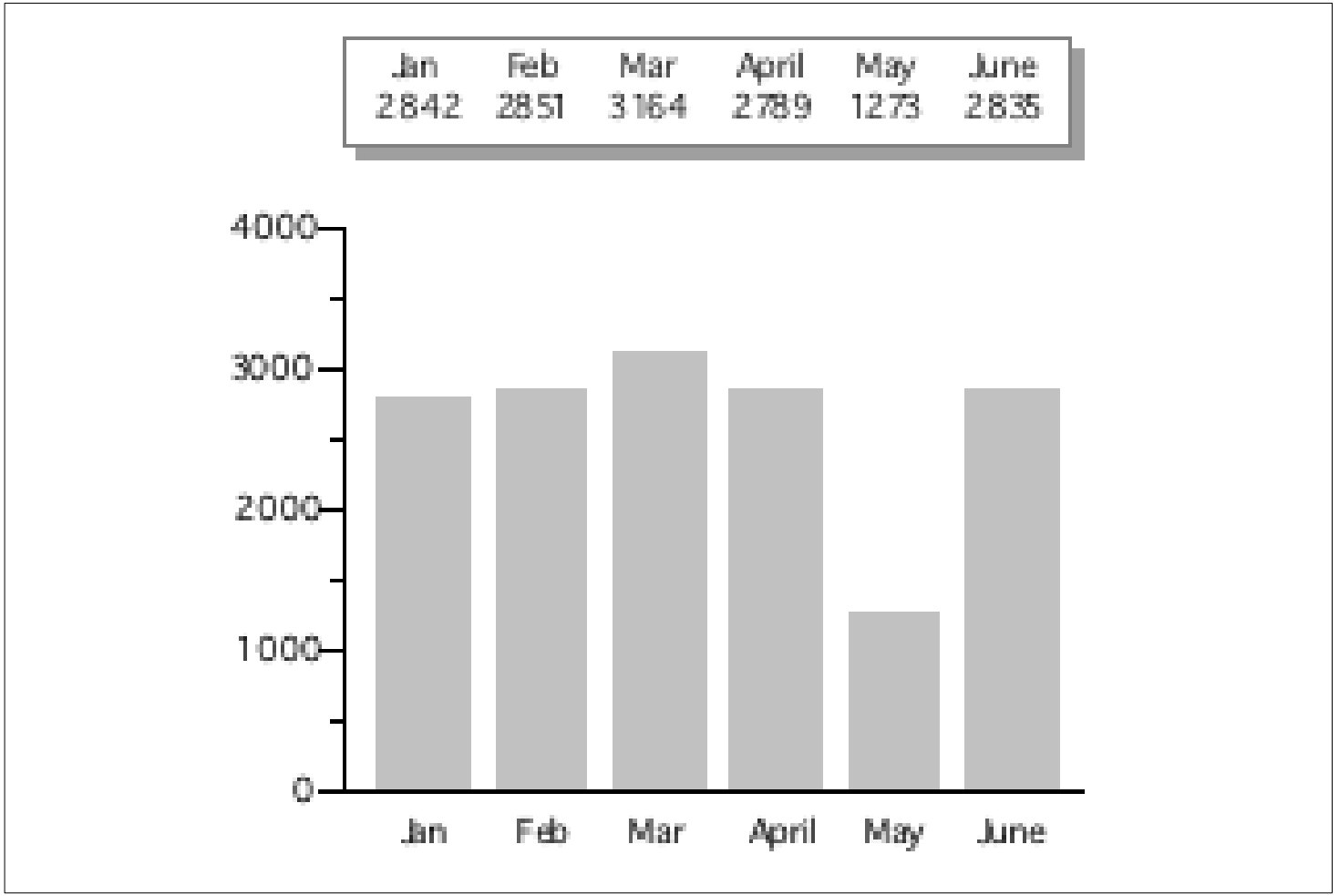
Information presentation

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

Information display factors

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

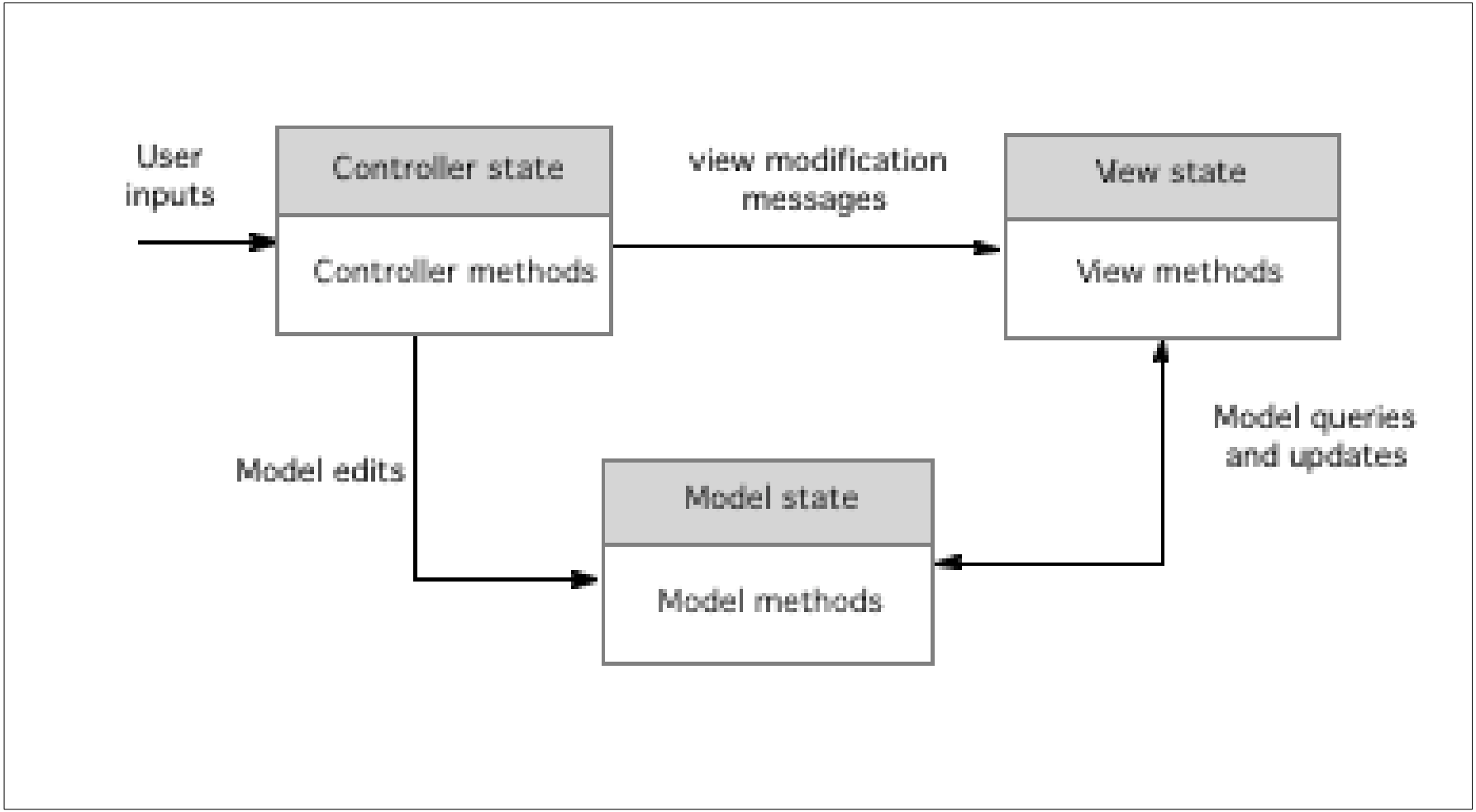
Alternative information presentations



Analogue or digital presentation?

- Digital presentation
  - Compact - takes up little screen space;
  - Precise values can be communicated.
- Analogue presentation
  - Easier to get an 'at a glance' impression of a value;
  - Possible to show relative values;
  - Easier to see exceptional data values.

Model-view-controller



Data visualisation

- Techniques for displaying large amounts of information.
- Visualisation can reveal relationships between entities and trends in the data.
- Possible data visualisations are:
  - Weather information collected from a number of sources;
  - The state of a telephone network as a linked set of nodes;
  - Chemical plant visualised by showing pressures and temperatures in a linked set of tanks and pipes;
  - A model of a molecule displayed in 3 dimensions;
  - Web pages displayed as a hyperbolic tree.

Colour displays

- Colour adds an extra dimension to an interface and can help the user understand complex information structures.
- Colour can be used to highlight exceptional events.
- Common mistakes in the use of colour in interface design include:
  - The use of colour to communicate meaning;
  - The over-use of colour in the display.

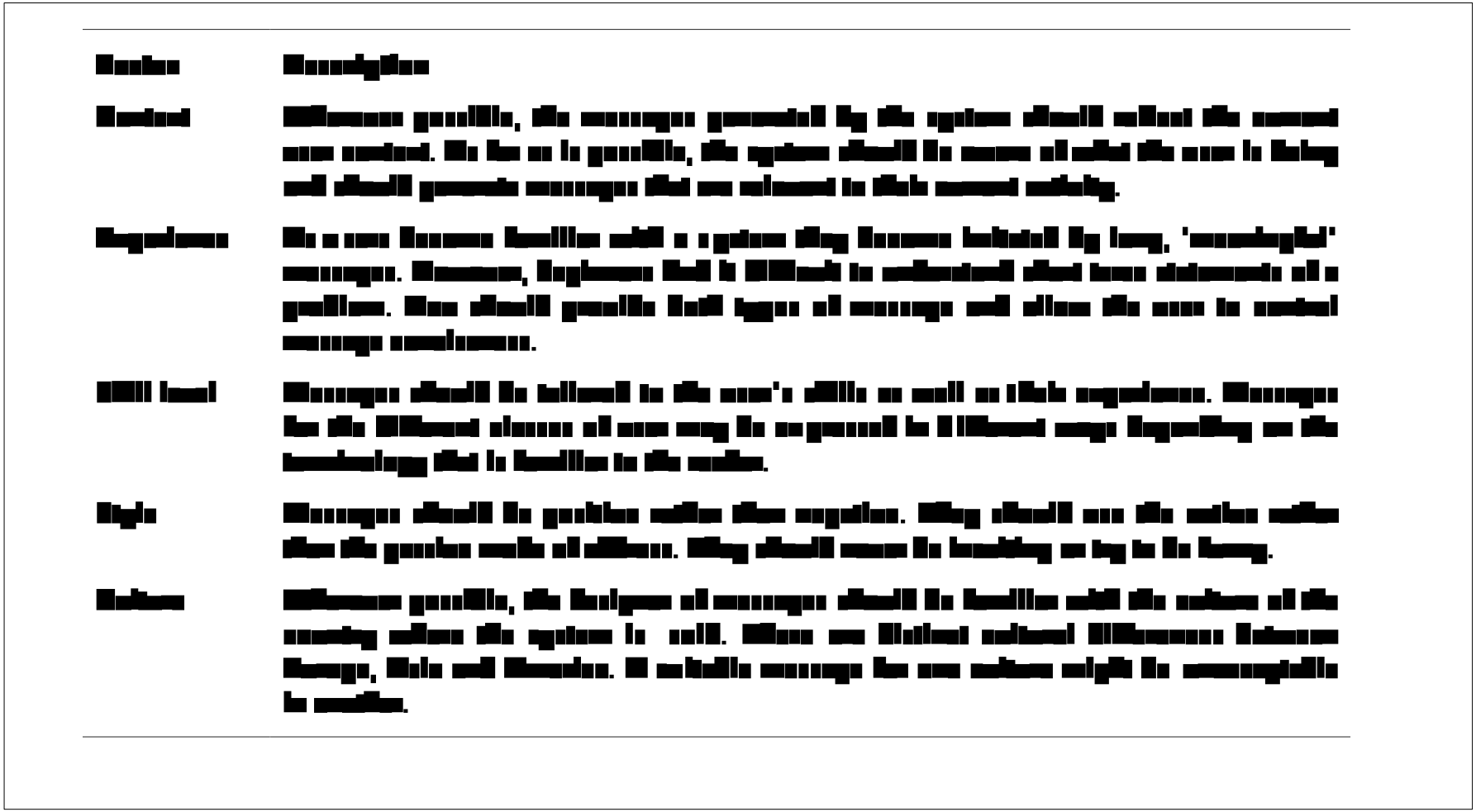
Colour use guidelines

- Limit the number of colours used and be conservative in their use.
- Use colour change to show a change in system status.
- Use colour coding to support the task that users are trying to perform.
- Use colour coding in a thoughtful and consistent way.
- Be careful about colour pairings.

Error messages

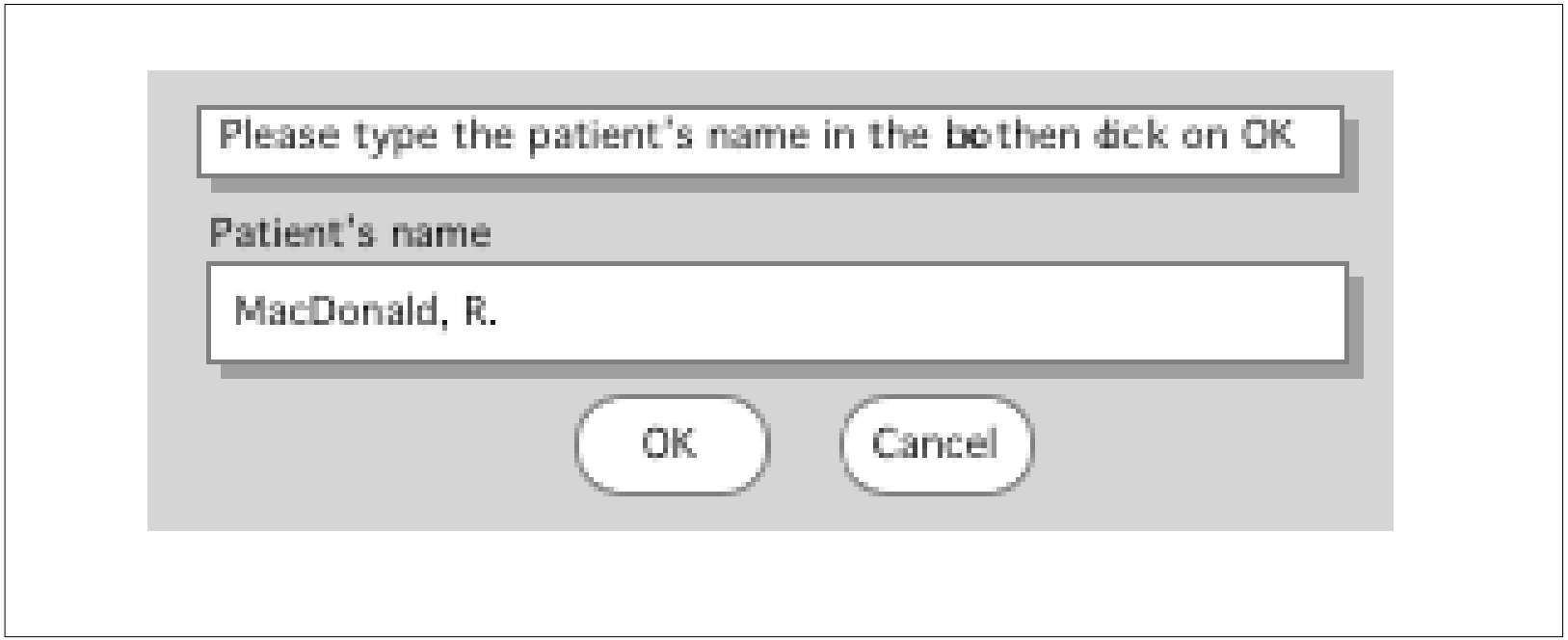
- Error message design is critically important. Poor error messages can mean that a user rejects rather than accepts a system.
- Messages should be polite, concise, consistent and constructive.
- The background and experience of users should be the determining factor in message design.

Design factors in message wording

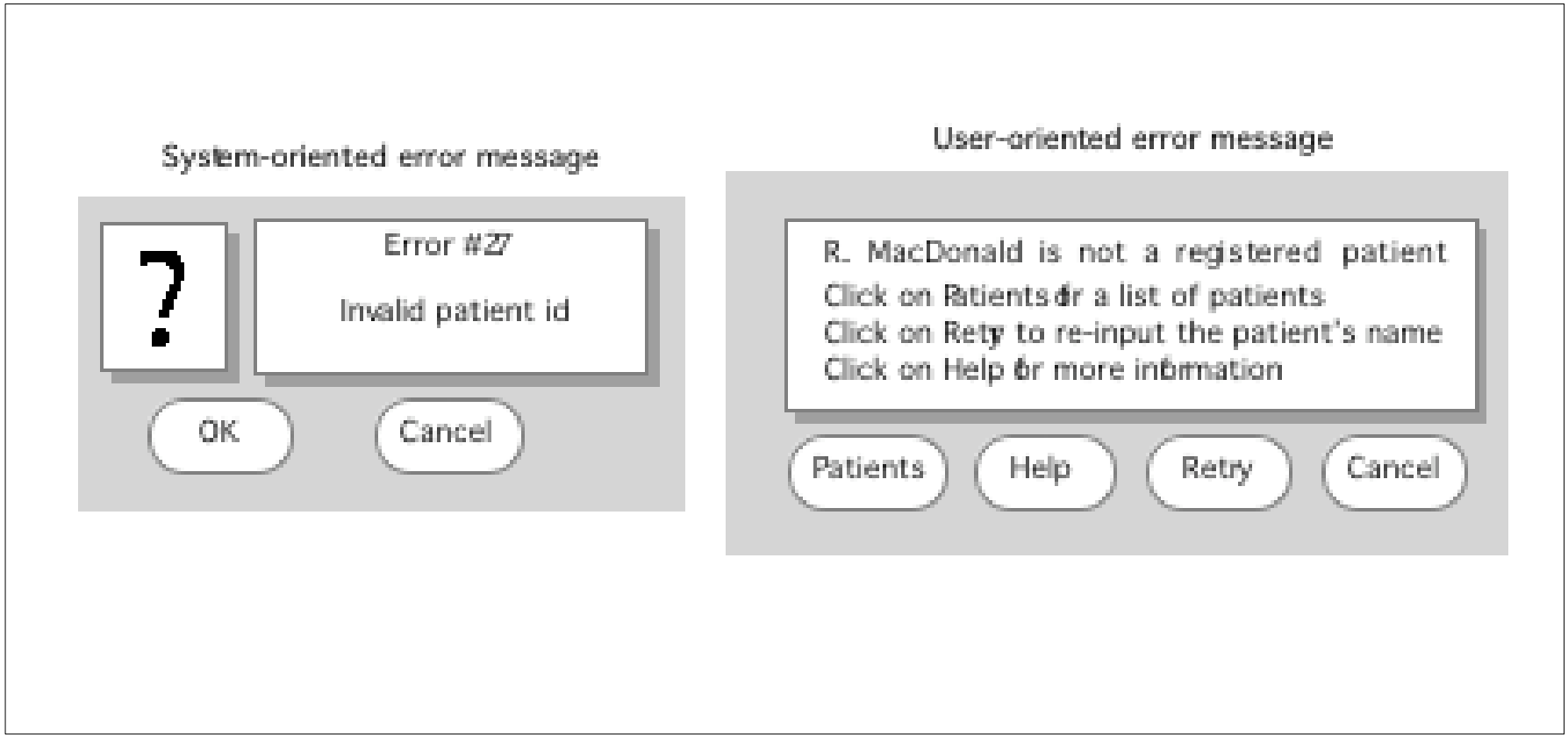


User error

- Assume that a nurse misspells the name of a patient whose records he is trying to retrieve.



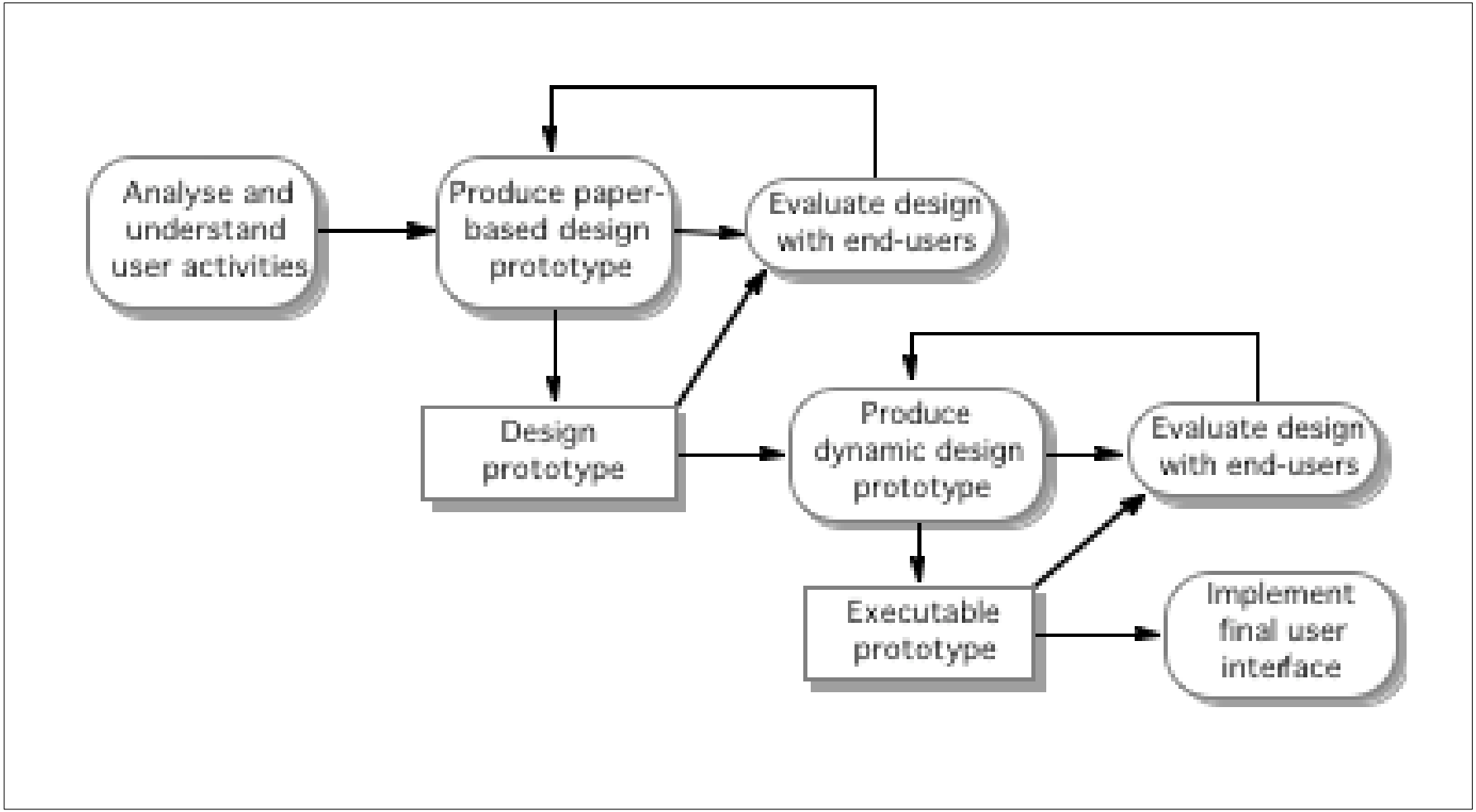
Good and bad message design



The UI design process

- UI design is an iterative process involving close liaisons between users and designers.
- The 3 core activities in this process are:
  - User analysis. Understand what the users will do with the system;
  - System prototyping. Develop a series of prototypes for experiment;
  - Interface evaluation. Experiment with these prototypes with users.

The design process



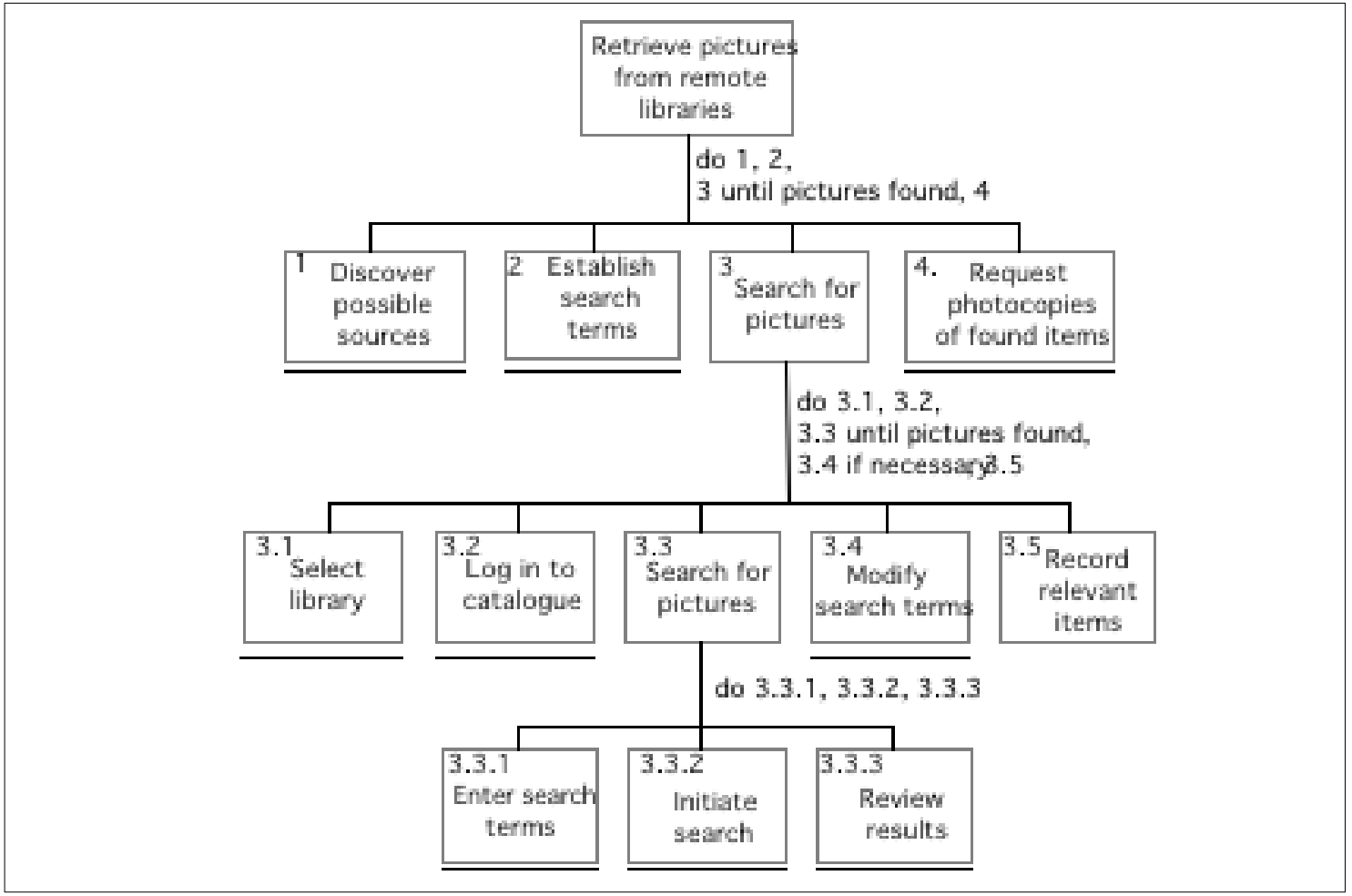
User analysis

- If you don’t understand what the users want to do with a system, you have no realistic prospect of designing an effective interface.
- User analyses have to be described in terms that users and other designers can understand.
- Scenarios where you describe typical episodes of use, are one way of describing these analyses.

Analysis techniques

- Task analysis
  - Models the steps involved in completing a task.
- Interviewing and questionnaires
  - Asks the users about the work they do.
- Ethnography
  - Observes the user at work.

Hierarchical task analysis



Interviewing

- Design semi-structured interviews based on open-ended questions.
- Users can then provide information that they think is essential; not just information that you have thought of collecting.
- Group interviews or focus groups allow users to discuss with each other what they do.

Ethnography

- Involves an external observer watching users at work and questioning them in an unscripted way about their work.
- Valuable because many user tasks are intuitive and they find these very difficult to describe and explain.
- Also helps understand the role of social and organisational influences on work.

User interface prototyping

- The aim of prototyping is to allow users to gain direct experience with the interface.
- Without such direct experience, it is impossible to judge the usability of an interface.
- Prototyping may be a two-stage process:
  - Early in the process, paper prototypes may be used; Work through scenarios using sketches of the interface
  - The design is then refined and increasingly sophisticated automated prototypes are then developed.

Prototyping techniques

- Script-driven prototyping
  - Develop a set of scripts and screens using a tool such as Macromedia Director. When the user interacts with these, the screen changes to the next display.
- Visual programming
  - Use a language designed for rapid development such as Visual Basic. See Chapter 17.
- Internet-based prototyping
  - Use a web browser and associated scripts.

User interface evaluation

- Full scale evaluation is very expensive and impractical for most systems.
- Simple evaluation techniques
  - Questionnaires for user feedback.
  - Video recording of system use and subsequent tape evaluation.
  - Instrumentation of code to collect information about facility use and user errors.
  - The provision of code in the software to collect on-line user feedback.

Usability attributes