

Week 8:

UI Design

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KHOA CÔNG NGHỆ 1
TRƯỜNG ĐẠI HỌC K



Adapted from slides of Ian Sommerville

Topics covered

1. Design issues
2. User interface design process
3. User analysis
4. User interface prototyping
5. Interface evaluation





Some UIs

A screenshot of the Google Maps interface. The map shows the city of Ho Chi Minh City, Vietnam, with various neighborhoods like DA KAO, BẾN THÀNH, and BÌNH HƯNG highlighted. Major roads are labeled with names like QL1A, HL80, and DT10. A search bar at the top left contains the text "Search Google Maps". On the right side, there are zoom controls (+, -, ×), a location marker, and a compass icon. A small satellite view window is visible in the bottom left corner.

A screenshot of the Amazon website during the Black Friday Deals Week. The main banner features a "black friday DEALS WEEK" offer for Amazon Dash Button Devices, showing a price drop from \$4.99 to \$2.49. Below the banner, a hand is shown pressing a blue "Charmin" Dash button. The page also includes a "Black Friday Deals Week" section with various product thumbnails.

A continuation of the Amazon Black Friday Deals Week interface. It shows more product offers and promotional banners, including a "black friday DEALS WEEK" banner for shoes.

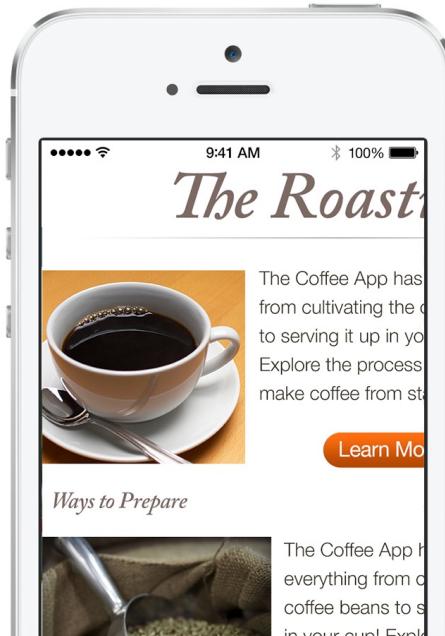
The Google homepage. The iconic Google logo is at the top center. Below it is a search bar with a microphone icon for voice search. Underneath the search bar are two buttons: "Google Search" and "I'm Feeling Lucky". At the bottom of the page, there's a link to "Google offered in: Tiếng Việt Français 中文 (繁體)".

The TED website homepage. The top navigation bar includes links for "WATCH", "DISCOVER", "ATTEND", "PARTICIPATE", "ABOUT", and "LOG IN". The main content area features a video thumbnail of an interview between Leah Chase and Pat Mitchell titled "An interview with the Queen of Creole Cuisine". To the right, there are other video thumbnails, such as "America's native prisoners of war" and "What is consciousness?". A "NEWEST TALKS" section at the bottom shows thumbnail images of speakers like Scott Galloway and a person giving a presentation.

Some UIs



	Edit
Coffee	28 g >
Grain Size	~113.3 μm >
Water	1241 ml >
Temperature	103°C >
Time	223 s >
Serving	310.25 ml >
Metric English	




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**ornare imperdiet blandit lectus. Morbi tristique*

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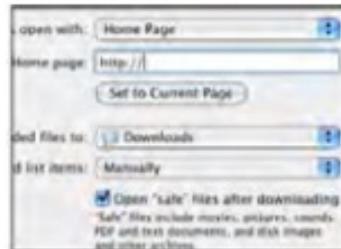
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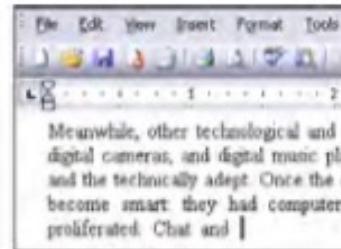
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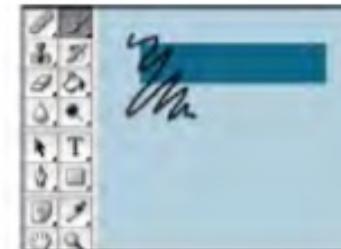




Forms



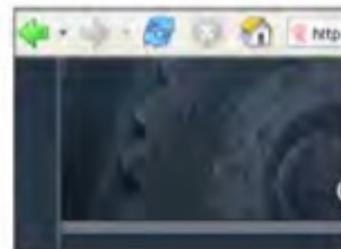
Text editors



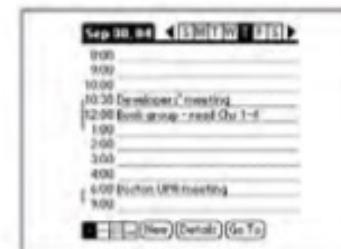
Graphic editors

A	B	C		
1	Time	XeX	XeY	XeZ
2	0	-12071.9	0	-30
3	6.12E-22	-12071.9	-5.7E-65	-30
4	1.54E-21	-12071.9	-9.8E-64	-30
5	3.6E-09	-12071.9	-1.1E-23	-30
6	2.16E-07	-12071.9	-2.5E-21	-30
7	1.12E-06	-12071.9	-3.4E-19	-30
8				
9				
10				

Spreadsheets



Browsers



Calendars



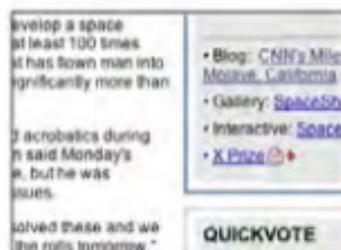
Media players



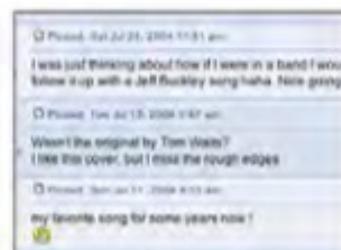
Information graphics



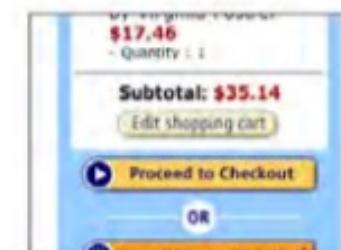
Immersive games



Web pages



Social spaces



E-commerce sites

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User interface

- User interfaces should be designed to match the **skills, experience** and **expectations** of its anticipated users.
- System users often judge a system by its **interface** rather than its functionality.
- A poorly designed interface
 - Can cause a user to make catastrophic errors.
 - 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

- UI design must take account of the **needs, experience** and **capabilities** of the system users.
- Designers should
 - be aware of peoples physical and mental limitations (e.g. limited short-term memory) and
 - should recognise that people make mistakes.
- UI design principles underlie interface designs although not all principles are applicable to all designs.



UI design principles

- User familiarity
 - The interface should use terms and concepts which are drawn from the experience of the people who will make most use of the system.
- Consistency
 - The interface should be consistent in that, wherever possible, comparable operations should be activated in the same way.
- Minimal surprise
 - Users should never be surprised by the behaviour of a system.



UI design principles

- Recoverability
 - The interface should include mechanisms to allow users to recover from errors.
- User guidance
 - The interface should provide meaningful feedback when errors occur and provide context-sensitive user help facilities.
- User diversity
 - The interface should provide appropriate interaction facilities for different types of system user.



Design issues in UIs

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



Interaction styles

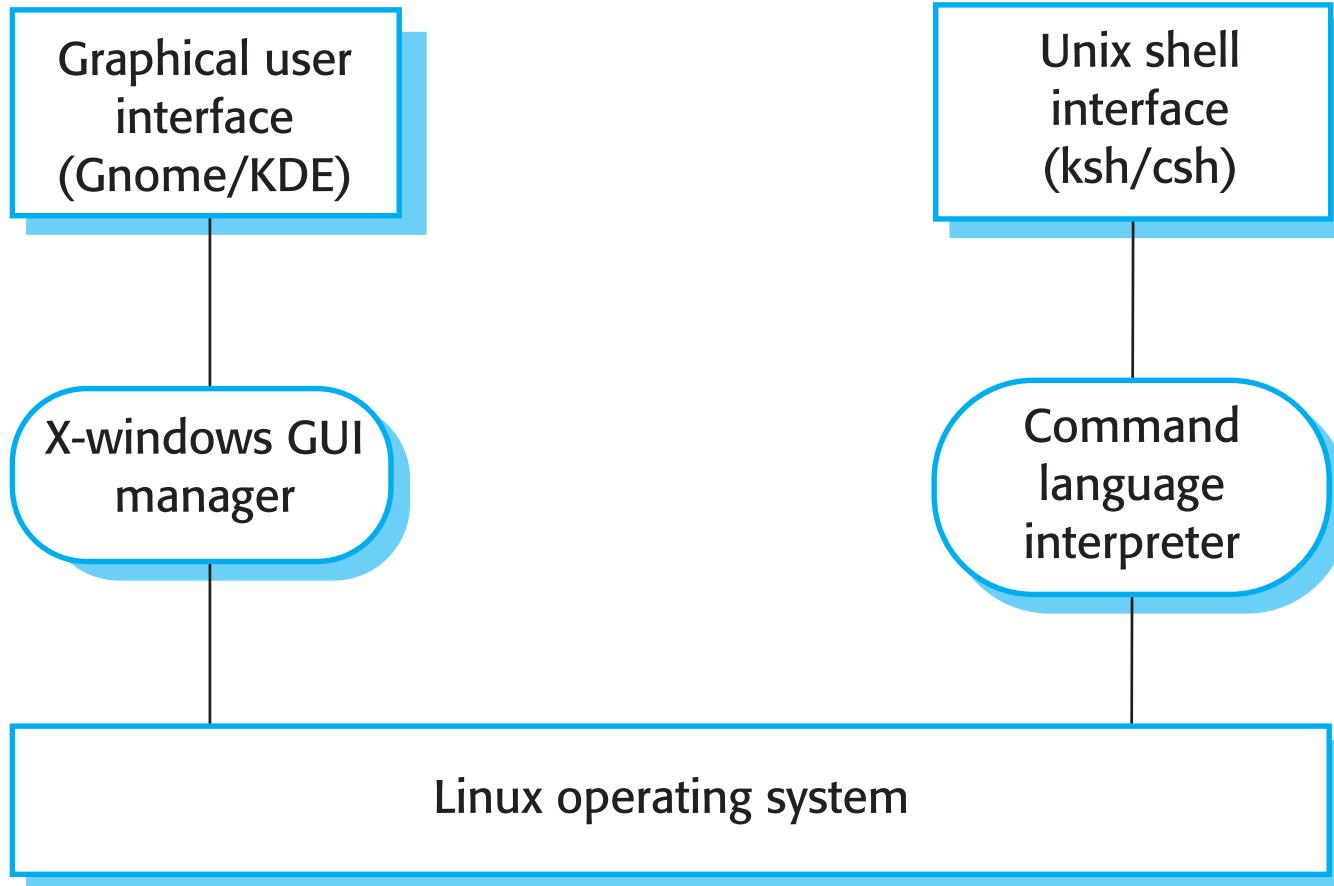
- Direct manipulation
- Menu selection
- Form fill-in
- Command language
- Natural language



Interaction styles

Interaction style	Main advantages	Main disadvantages	Application examples
Direct manipulation	Fast and intuitive interaction Easy to learn	May be hard to implement. Only suitable where there is a visual metaphor for tasks and objects.	Video games CAD systems
Menu selection	Avoids user error Little typing required	Slow for experienced users. Can become complex if many menu options.	Most general-purpose systems
Form fill-in	Simple data entry Easy to learn Checkable	Takes up a lot of screen space. Causes problems where user options do not match the form fields.	Stock control, Personal loan processing
Command language	Powerful and flexible	Hard to learn. Poor error management.	Operating systems, Command and control systems
Natural language	Accessible to casual users Easily extended	Requires more typing. Natural language understanding systems are unreliable.	Information retrieval systems

Multiple user interfaces



Web-based interfaces

- Many web-based systems have interfaces based on web forms.
- Form field can be menus, free text input, radio buttons, etc.



Example: LIBSYS system

- Users make a choice of where to search from a menu and type the search phrase into a free text field.
- LIBSYS interaction
 - **Document search:** Users need to be able to use the search facilities to find the documents that they need.
 - **Document request:** Users request that a document be delivered to their machine or to a server for printing.





LIBSYS search form

LIBSYS: Search

Choose collection

All



Keyword or phrase

Search using

Title



Adjacent words

Yes

No

Search

Reset

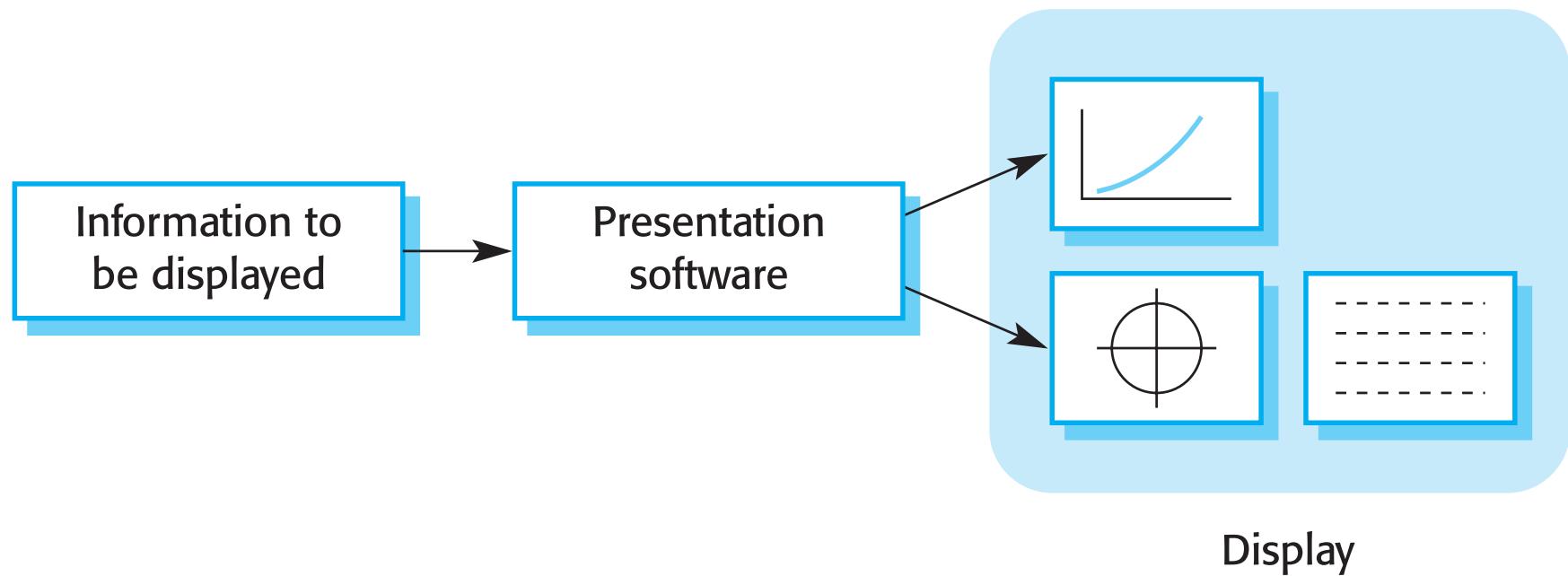
Cancel

Information presentation

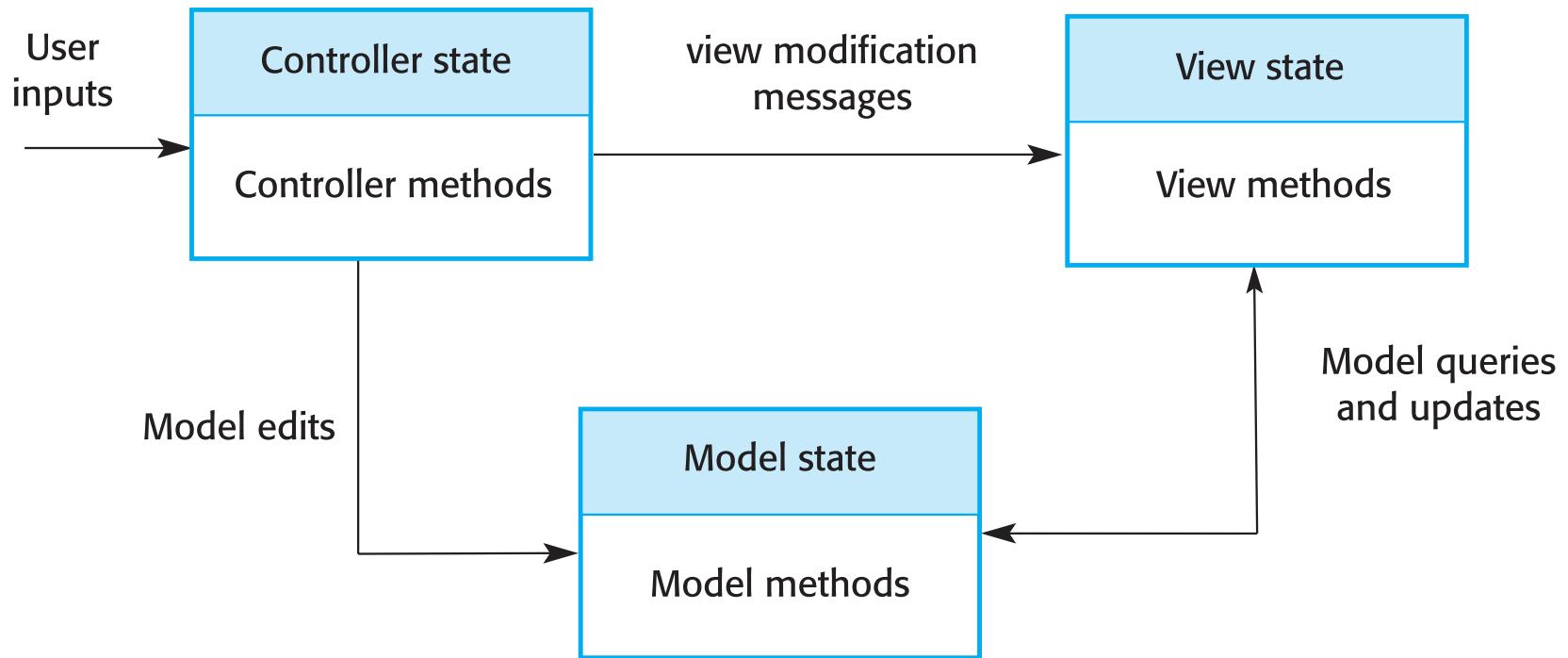
- Is concerned with presenting system information to system users.
- The information may be
 - presented directly (e.g. text in a word processor)
 - or transformed in some way for presentation (e.g. in some graphical form).
- The Model-View-Controller approach is a way of supporting multiple presentations of data.



Information presentation



MVC model of user interaction



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

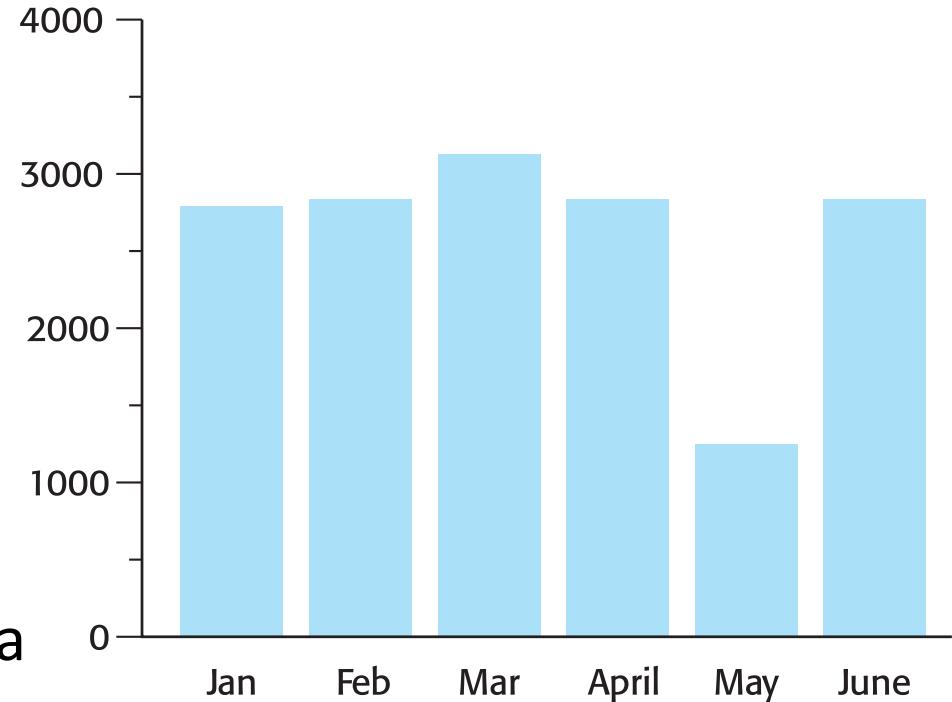
- Is the user interested in precise information or data relationships?
- How quickly do information values change?
Must the change be indicated immediately?
- Must the user take some action in response to a change?
- Is there a direct manipulation interface?
- Is the information textual or numeric? Are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



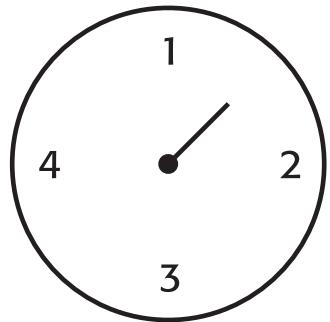
Alternative information presentations

- 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.

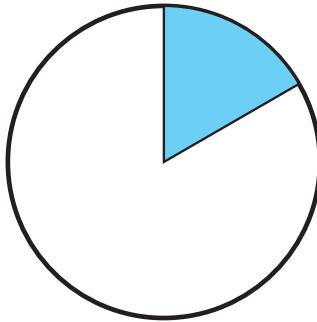
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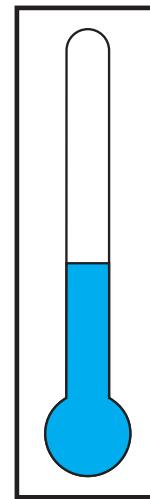
Presentation methods



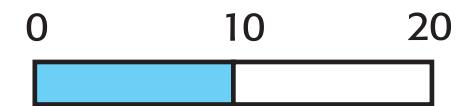
Dial with needle



Pie chart



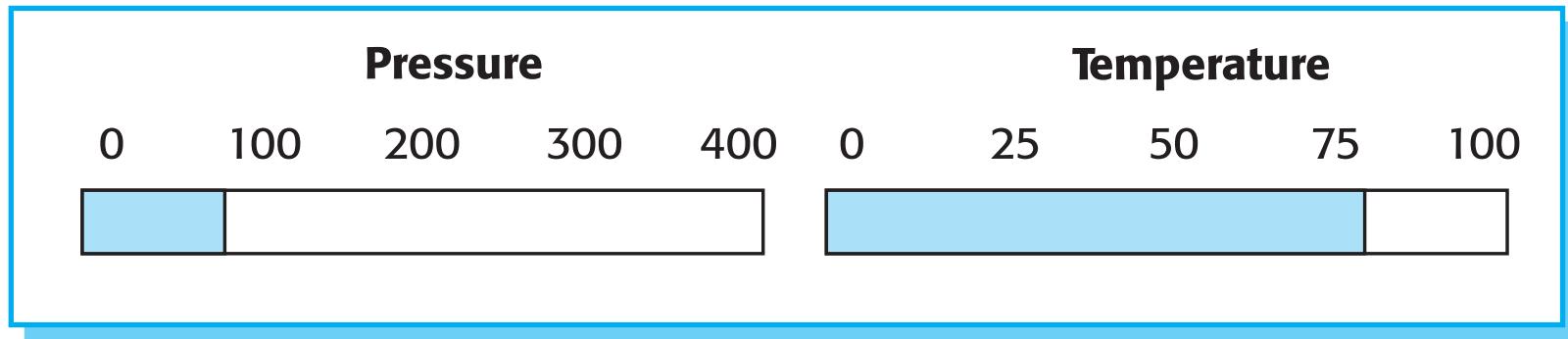
Thermometer



Horizontal bar



Displaying relative values



Data visualisation

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

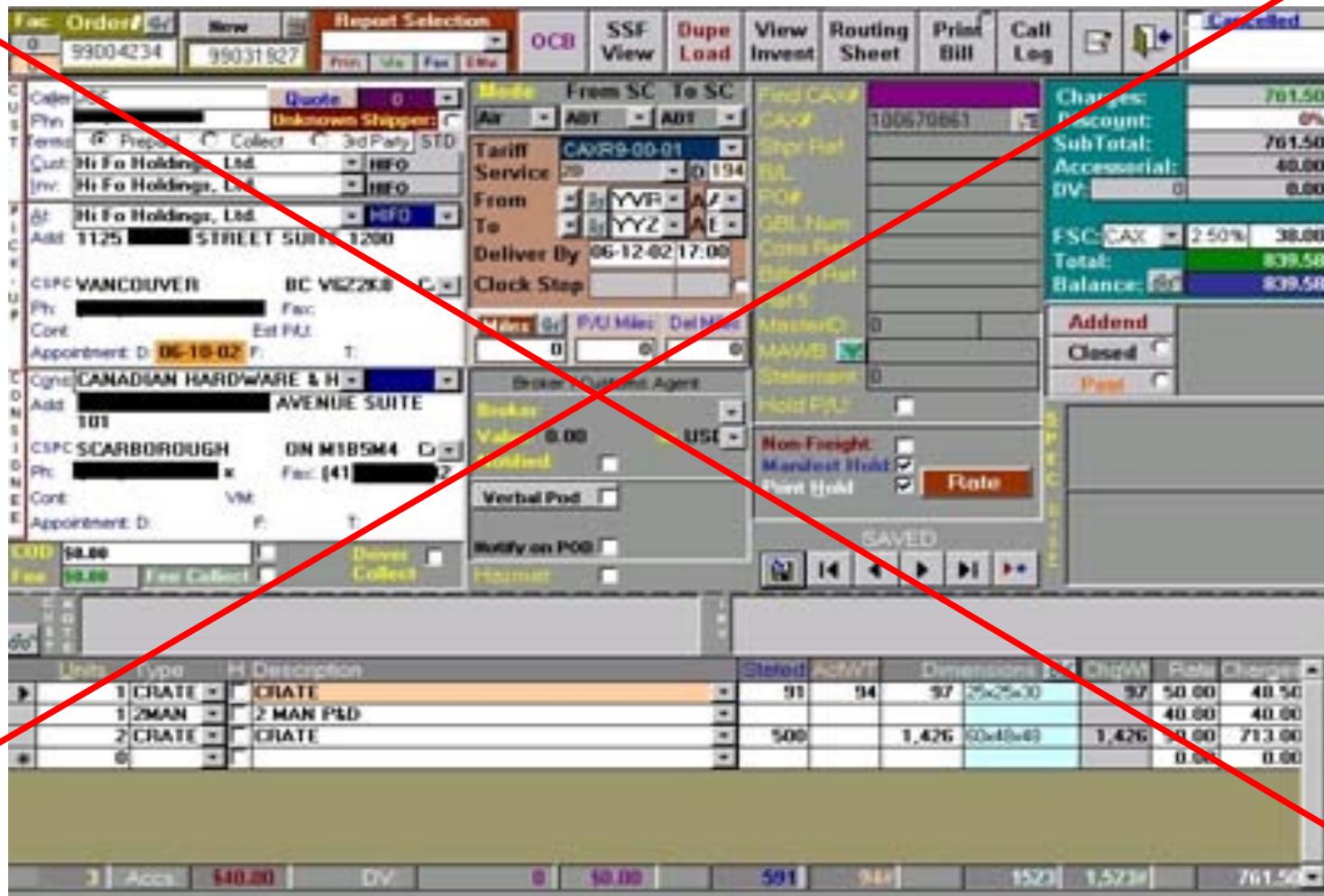


Colour displays

- 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.



Example



The application window displays the following information:

- Order Details:**
 - Order ID: 99004234
 - Shippers: Hi-Fi Holdings, Ltd.
 - Consignees: CANADIAN HARDWARE & H...
 - Address: 1125 [REDACTED] STREET SURV 12000
 - City: VANCOUVER
 - Province: BC
 - Postal Code: V6Z2K8
 - Phone: [REDACTED]
 - Fax: [REDACTED]
 - Contact: [REDACTED]
 - Appointment Date: 06-10-02
- Shipping Manifest:**
 - Mode: Air
 - From SC: YYV
 - To SC: YYZ
 - Tariff: CAVR9-00-01
 - Service: 10194
 - From: YYV
 - To: YYZ
 - Deliver By: 06-12-02 17:00
 - Clock Stop: [REDACTED]
 - Weight: 0
 - P/C Miles: 0
 - Delivery: 0
 - Broker/Customs Agent: [REDACTED]
 - Broker: [REDACTED]
 - Value: \$0.00
 - USE: [REDACTED]
 - Modified: [REDACTED]
 - Verbal Prod: [REDACTED]
 - Notify on POS: [REDACTED]
 - Printout: [REDACTED]
- Charges:**
 - Base: \$61.50
 - Discount: 0%
 - SubTotal: \$61.50
 - Accessorial: \$0.00
 - DV: \$0.00
 - FSC: CAZ 2.50% \$0.00
 - Total: \$61.50
 - Balance: \$0.00
- Buttons:**
 - Addend
 - Closed
 - Paid
- Table:**

Unit	Type	Description	Stated	Actual	Dimensions	Box	Crown	Rate	Charge
1	CRATE	CRATE	91	94	97	25x25x30	97	50.00	48.50
1	2MAN	2 MAN PED						40.00	40.00
2	CRATE	CRATE	500		1,426	60x48x48	1,426	70.00	713.00
6								0.00	0.00

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.



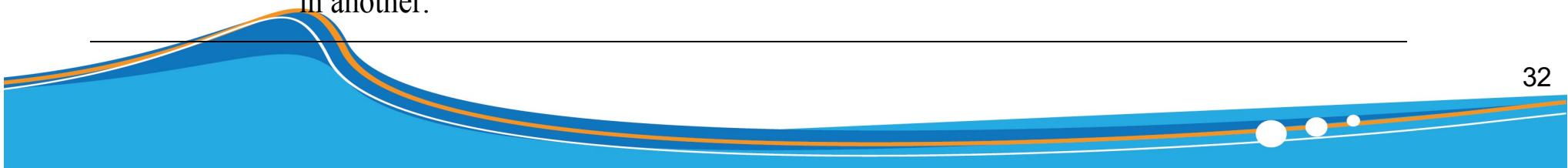
Error messages

- 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.



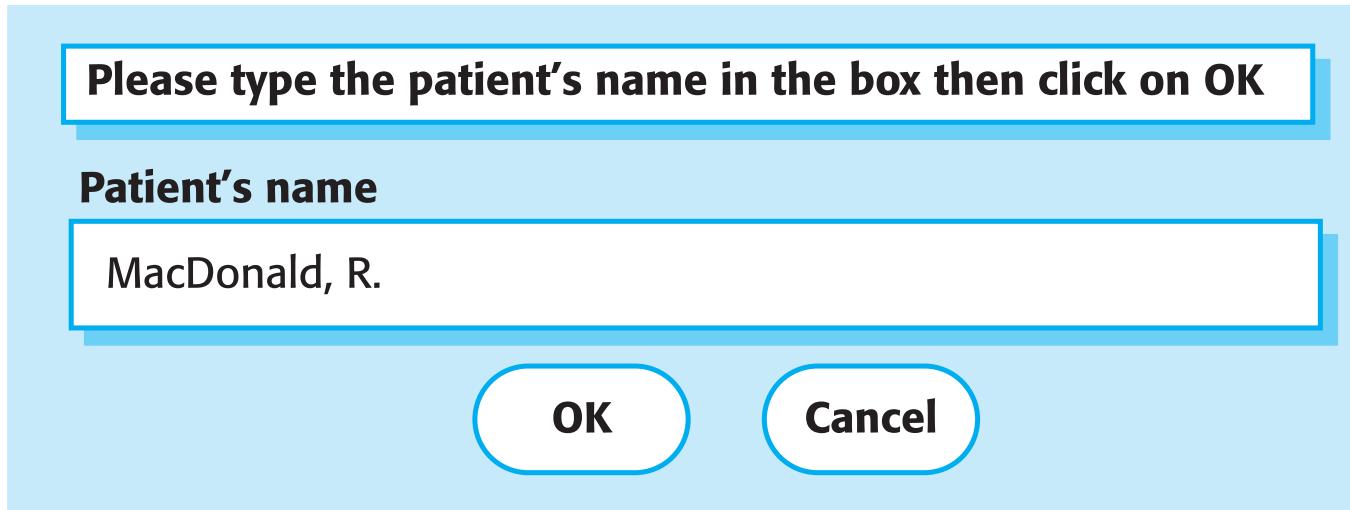
Design factors in message wording

Factor	Description
Context	Wherever possible, the messages generated by the system should reflect the current user context. As far as is possible, the system should be aware of what the user is doing and should generate messages that are relevant to their current activity.
Experience	As users become familiar with a system they become irritated by long, ‘meaningful’ messages. However, beginners find it difficult to understand short terse statements of a problem. You should provide both types of message and allow the user to control message conciseness.
Skill level	Messages should be tailored to the user’s skills as well as their experience. Messages for the different classes of user may be expressed in different ways depending on the terminology that is familiar to the reader.
Style	Messages should be positive rather than negative. They should use the active rather than the passive mode of address. They should never be insulting or try to be funny.
Culture	Wherever possible, the designer of messages should be familiar with the culture of the country where the system is sold. There are distinct cultural differences between Europe, Asia and America. A suitable message for one culture might be unacceptable in another.



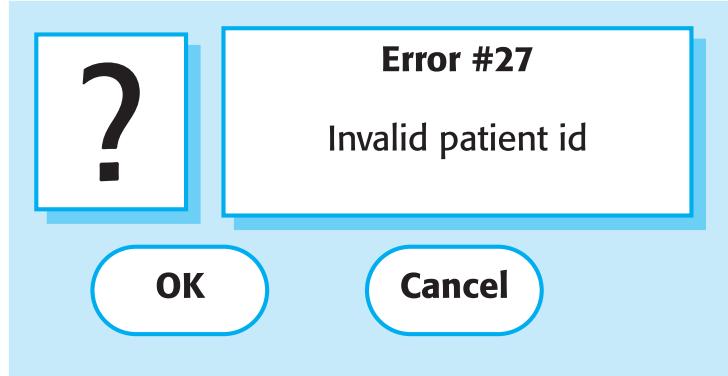
User error

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

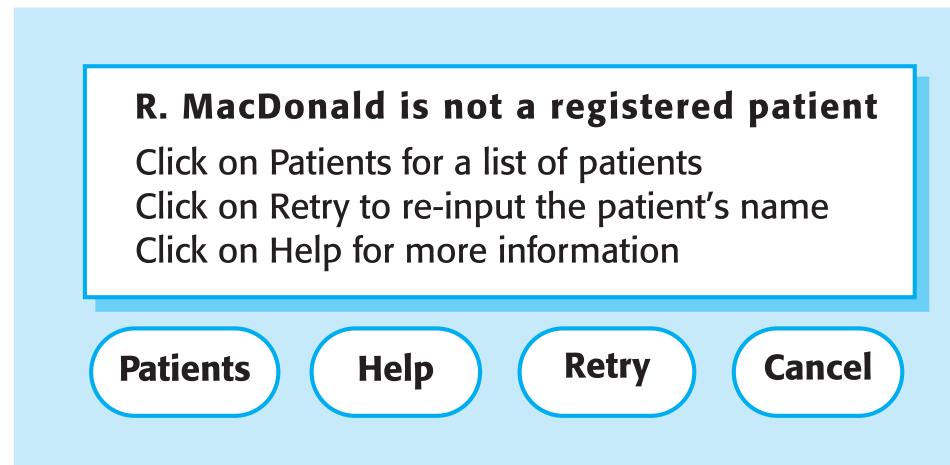


Good and bad message design

System-oriented error message



User-oriented error message



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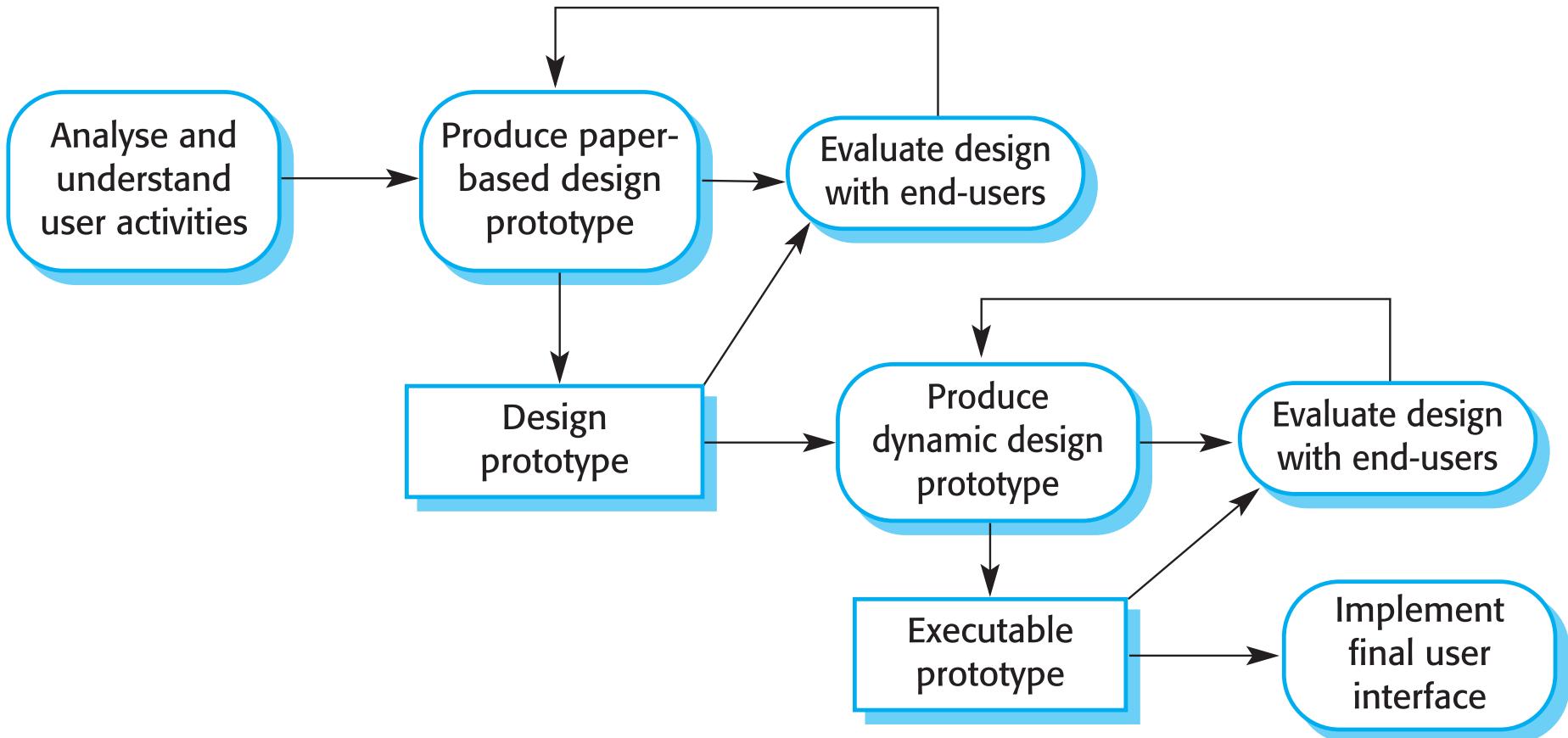


UI design process

- 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



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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.



User interaction scenario

Jane is a student of Religious Studies and is working on an essay on Indian architecture and how it has been influenced by religious practices. To help her understand this, she would like to access some pictures of details on notable buildings but can't find anything in her local library.

She approaches the subject librarian to discuss her needs and he suggests some search terms that might be used. He also suggests some libraries in New Delhi and London that might have this material so they log on to the library catalogues and do some searching using these terms. They find some source material and place a request for photocopies of the pictures with architectural detail to be posted directly to Jane.



Requirements from the scenario

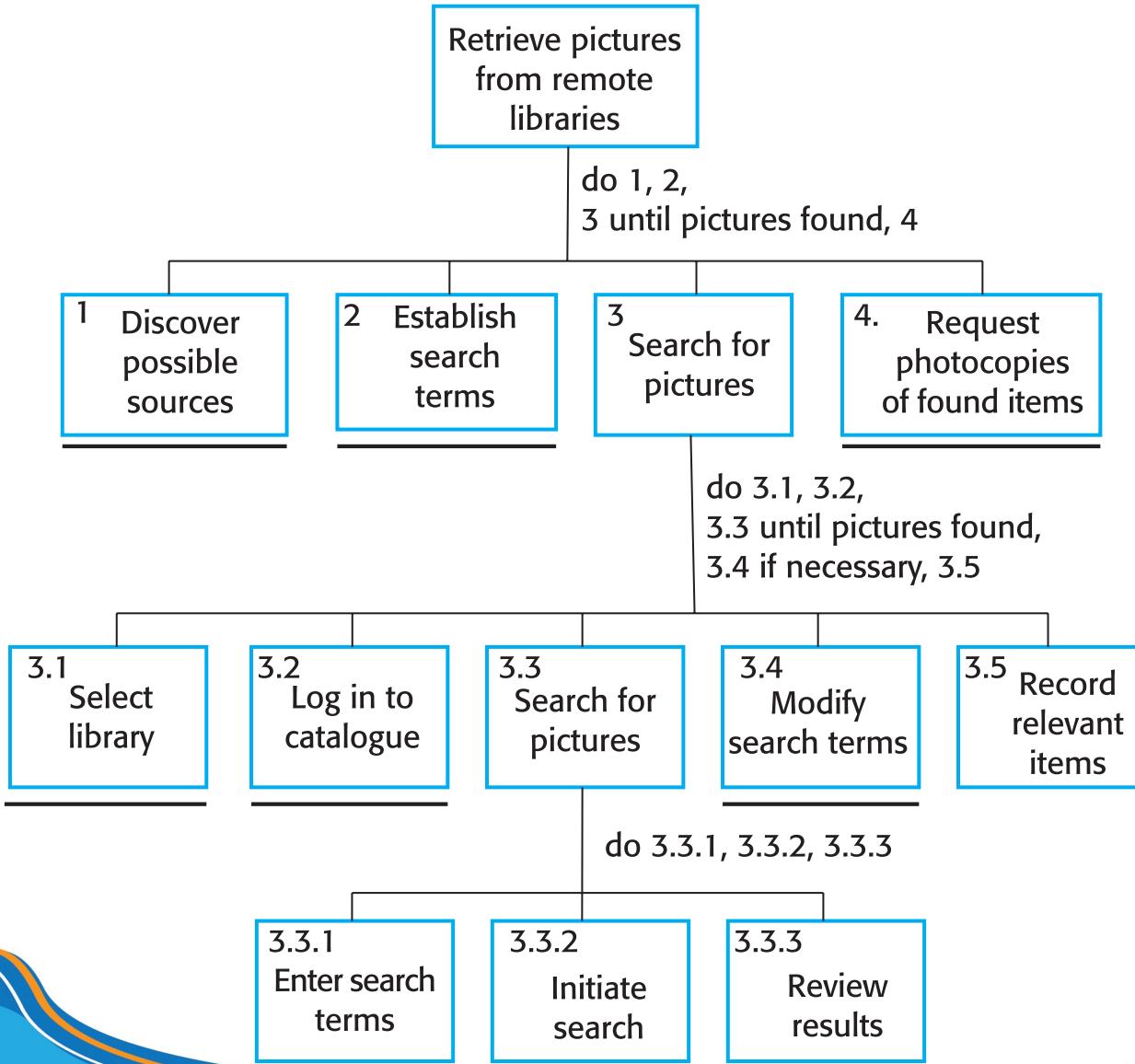
- Users may not be aware of appropriate search terms so need a way of helping them choose terms.
- Users have to be able to select collections to search.
- Users need to be able to carry out searches and request copies of relevant material.



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 (HTA)



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.



Ethnographic records

Air traffic control involves a number of control ‘suites’ where the suites controlling adjacent sectors of airspace are physically located next to each other. Flights in a sector are represented by paper strips that are fitted into wooden racks in an order that reflects their position in the sector. If there are not enough slots in the rack (i.e. when the airspace is very busy), controllers spread the strips out on the desk in front of the rack.

When we were observing controllers, we noticed that controllers regularly glanced at the strip racks in the adjacent sector. We pointed this out to them and asked them why they did this. They replied that, if the adjacent controller has strips on their desk, then this meant that they would have a lot of flights entering their sector. They therefore tried to increase the speed of aircraft in the sector to ‘clear space’ for the incoming aircraft.



Insights from ethnography

- Controllers had to see all flights in a sector. Therefore, scrolling displays where flights disappeared off the top or bottom of the display should be avoided.
- The interface had to have some way of telling controllers how many flights were in adjacent sectors so that they could plan their workload.



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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;
 - The design is then refined and increasingly sophisticated automated prototypes are then developed.



Paper prototyping

- Work through scenarios using sketches of the interface.
- Use a storyboard to present a series of interactions with the system.
- Paper prototyping is an effective way of getting user reactions to a design proposal.



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.
- Internet-based prototyping
 - Use a web browser and associated scripts.



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User interface evaluation

- Some evaluation of a user interface design should be carried out to assess its suitability.
- Full scale evaluation is very expensive and impractical for most systems.
- Ideally, an interface should be evaluated against a usability specification. However, it is rare for such specifications to be produced.



Usability attributes

Attribute	Description
Learnability	How long does it take a new user to become productive with the system?
Speed of operation	How well does the system response match the user's work practice?
Robustness	How tolerant is the system of user error?
Recoverability	How good is the system at recovering from user errors?
Adaptability	How closely is the system tied to a single model of work?



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.

