chapter 3

The Interaction

The Interaction

- interaction models
  - translations between user and system
- ergonomics
  - physical characteristics of interaction
- interaction styles
  - the nature of user/system dialog
- interaction design
  - stages, usability, software life cycle

What is Interaction?

- communication

user ⟺ system

- but is that all … ?
  - see "language and action" …

The Interaction

- There are a number of ways in which the user can communicate with the system. These ways categorized into:
  - Batch input
  - Interactive input

- In the batch input, the user provides all the information to the computer at once and leaves the machine to perform the task.
- This approach does involve an interaction between the user and computer but does not support many tasks well.

Models of Interaction

terms of interaction
Norman model
interaction framework

Some Terms of Interaction

- Traditionally, the purpose of an interactive system is to aid a user in accomplishing goals from some application domain.
- Domain
  - the area of work under study
  - defines an area of expertise and knowledge in some real-world activity.
    - e.g. graphic design
- Goal
  - what you want to achieve
    - e.g. create a solid red triangle
- Task
  - how you go about doing it
  - ultimately in terms of operations or actions
    - e.g. … select fill tool, click over triangle

Models of Interaction

- Interaction involves at least two participants:
  - The user
  - The system

- Both of these two participants are complex and are very different from each other in the way that they communicate and view the domain and the task.

- Therefore, there must be an interface which effectively translate between these participants to allow the interaction to be successful.

Models of Interaction

- Models of interaction are used to help us:
  - to understand exactly what is going on in the interaction and identify the likely root of difficulties.
  - to provide us with a framework to compare different interaction styles and to consider interaction problems.

Donald Norman's model

- Norman's model of interaction is perhaps the most influential in HCI
- The user formulates a plan of action, which is then executed at the computer interface.
- When the plan, or part of the plan, has been executed, the user observes the computer interface to evaluate the result of the executed plan, and to determine further actions.

- The interactive cycle can be divided into two major phases:
  - execution
  - evaluation

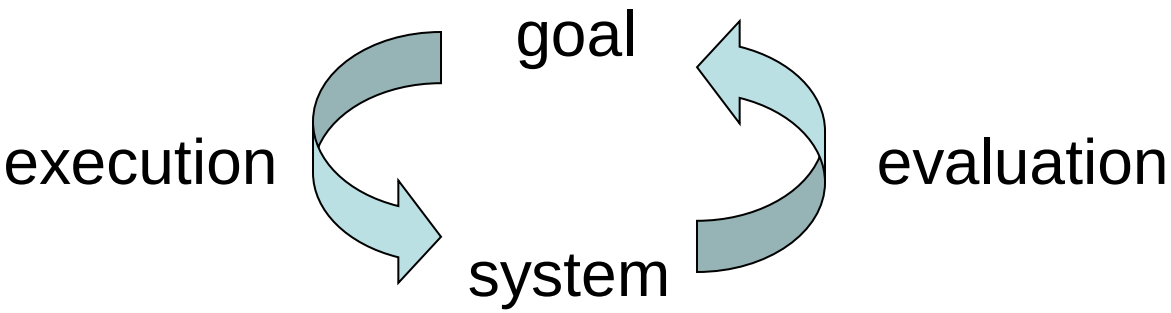
Donald Norman's model

- These can then be subdivided into further stages, seven in all.
- The stages in Norman's model of interaction are as follows:
  - user establishes the goal
  - formulates intention
  - specifies actions at interface
  - executes action
  - perceives system state
  - interprets system state
  - evaluates system state with respect to goal
- Norman's model concentrates on user's view of the interface

Donald Norman's model

- First the user forms a goal.
- what the user's needs to be done - domain and task language.
  - It is liable to be imprecise, therefore needs to be translated into the more specific intention.
    - intention is a specific action required to meet the goal.
- The user perceives the new state of the system, after execution of the action sequence, and interprets it in terms of his expectations.
  - If the system state reflects the user's goal then the computer has done what he wanted and the interaction has been successful.
  - otherwise the user must formulate a new goal and repeat the cycle.
- Norman uses this model of interaction to demonstrate why some interfaces cause problems to their users.

Execution/Evaluation Loop



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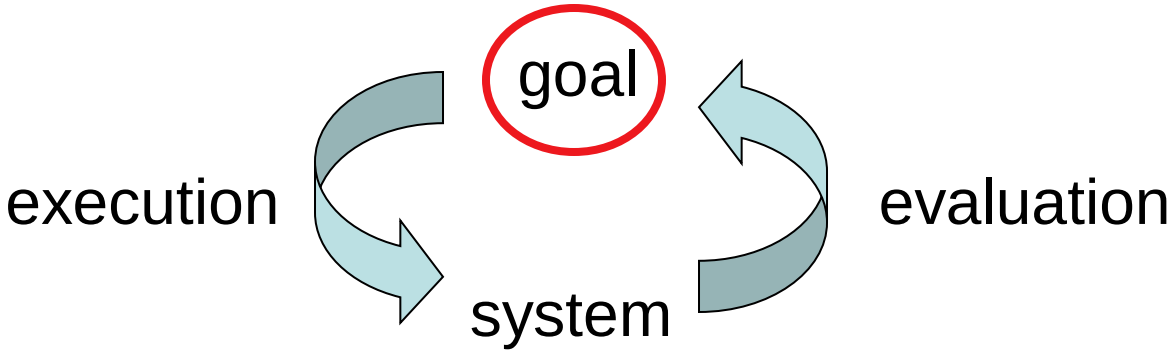

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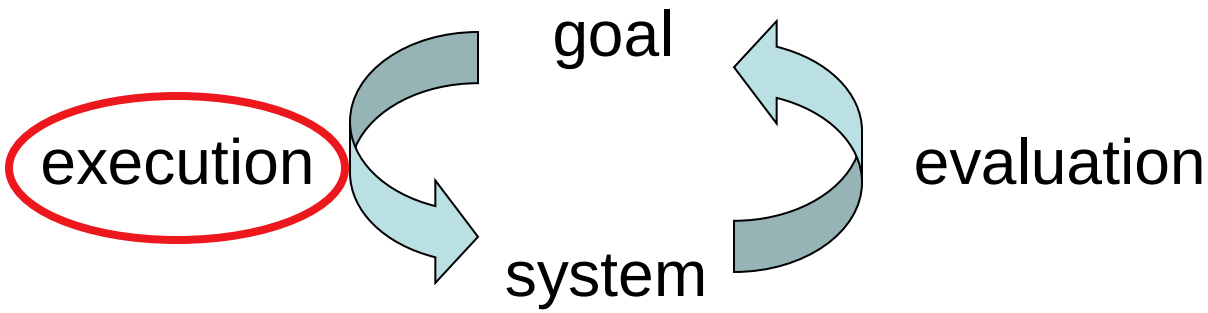

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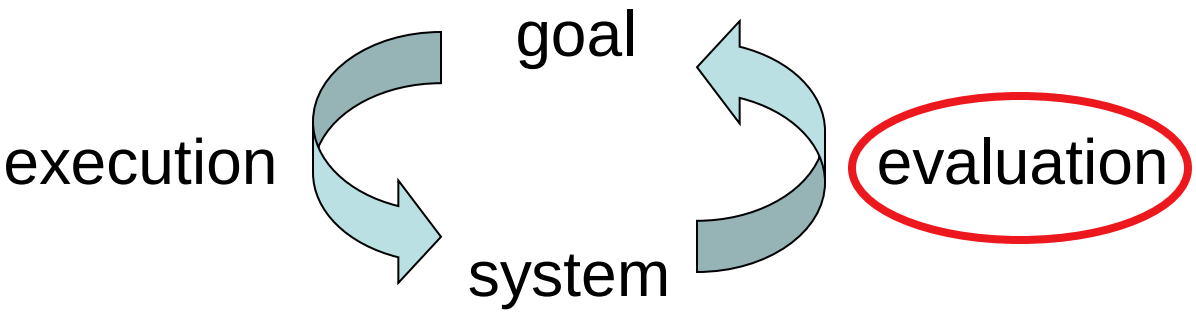

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Using Norman's Model

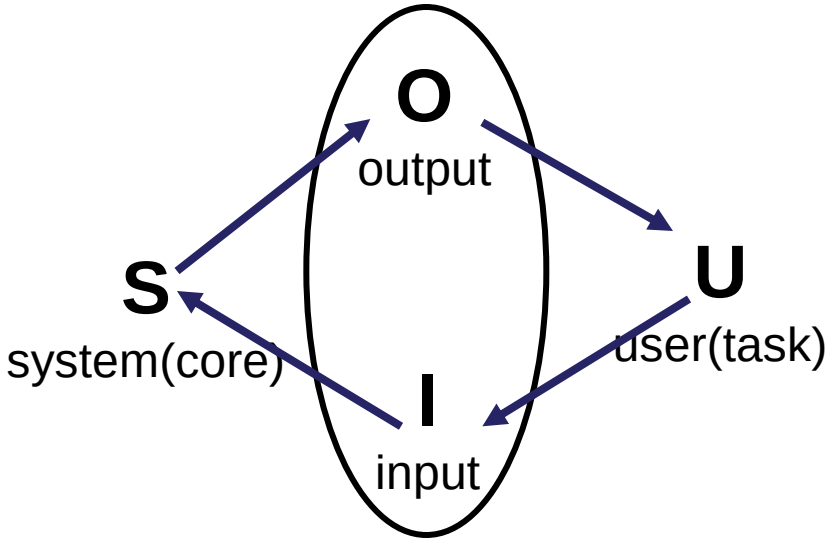
- Some systems are harder to use than others
  - Gulf of Execution
    - user's formulation of actions ≠ actions allowed by the system
  - Gulf of Evaluation
    - user's expectation of changed system state ≠ actual presentation of this state

Human Error - Slips and Mistakes

- slip
  -  understand system and goal
  -  correct formulation of action
  -  incorrect action
- mistake
  -  may not even have right goal!
- Fixing things?
  - slip – better interface design
  - mistake – better understanding of system

Interaction Framework

- interaction framework is extension of Norman…
- interaction framework attempts a more realistic description of interaction by including the system explicitly.



Interaction Framework

- interaction framework has 4 parts
  - user
  - input
  - system
  - output

- each has its own unique language

  interaction $\Rightarrow$ translation between languages

- problems in interaction = problems in translation

Interaction Framework

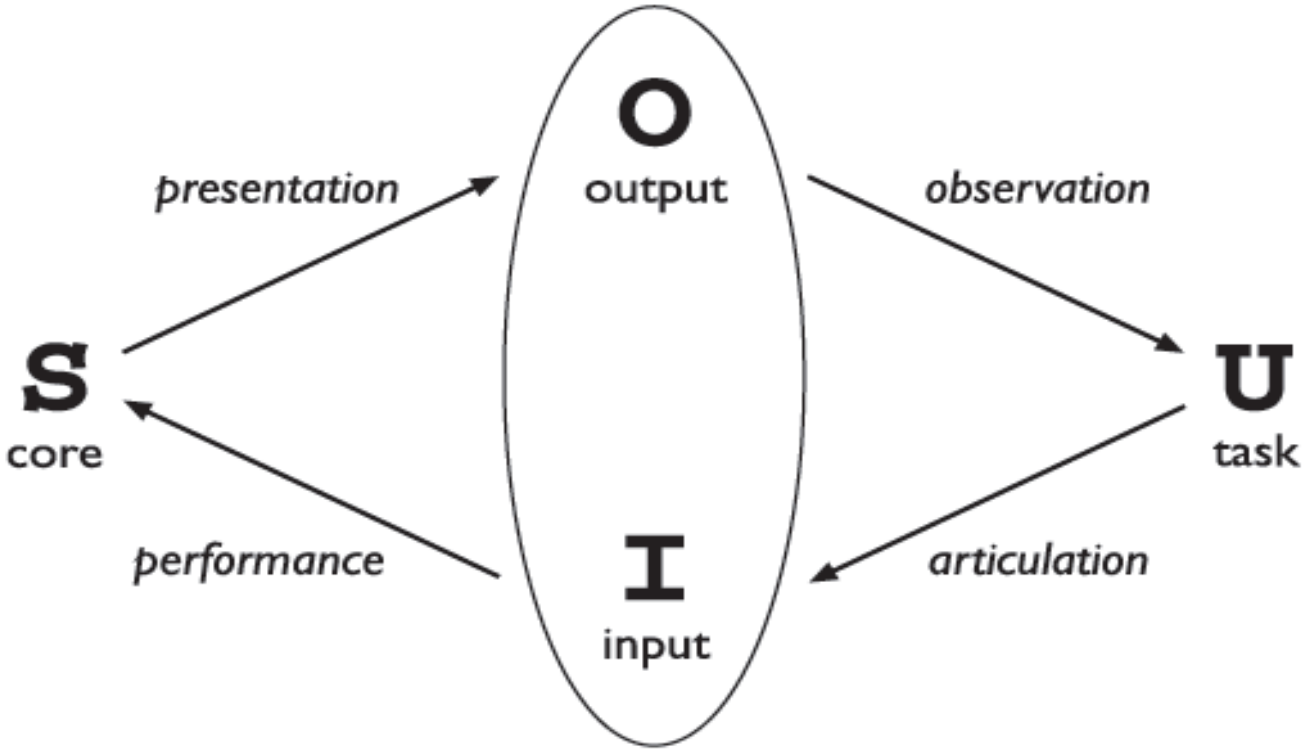
- When interface sits between the user and the system, there are four steps in the interactive cycle.
  - translation from one component to another.
- Steps of interactive cycle:
  - The user begins the interactive cycle with the formulation of a goal and a task to achieve that goal.
    - The only way the user can manipulate the machine is through the input.
  - The input language is translated into the core language as operations to be performed by the system.
  - The system then transforms itself by the operations.

Interaction Framework

- The system is in a new state, which must now be communicated to the user.
  - current values of system attributes are rendered as concepts or features of the output.
- The user should observe the output and assess the results of the interaction relative to the original goal, ending the evaluation phase (the interactive cycle).

- See the following figure (steps of interactive cycle)

Steps of Interactive Cycle

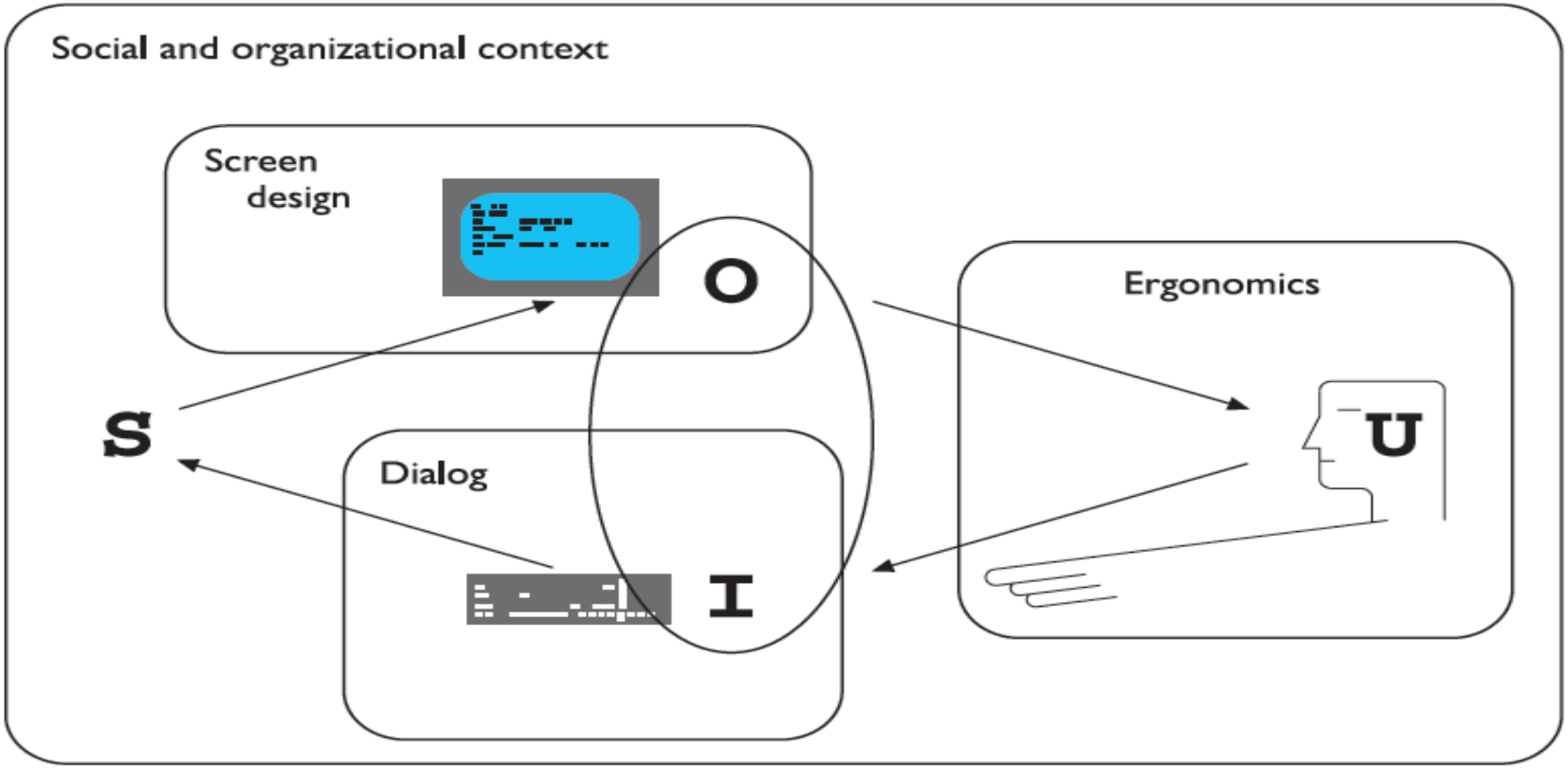


Translations between interaction components

Frameworks and HCI Related Issues

- Frameworks provide a basis for discussing other issues which relate to the interaction.
- The ACM SIGCHI Curriculum Development Group presents the interaction framework, and uses it to place different areas which related to HCI.
- See the following figure

Frameworks and HCI Related Issues



A framework of HCI (Adapted from ACM SIGCHI Curriculum Development Group)

Frameworks and HCI Related Issues

- The figure presents the social and organizational context, dialog, ergonomics, and screen design as the areas which related to the interaction.
- Each of these areas has important implications for the design of interactive systems and the performance of the user.
  - The entire framework can be placed within a social and organizational context that also affects the interaction.
  - field of ergonomics addresses issues on the user side of the interface (input, output, context).
  - Dialog design and interface styles (relates to the output) can be placed addressing both articulation and performance.
  - Presentation and screen design relates to the output branch of the framework.

Ergonomics

- Ergonomics (or human factors) is study of the physical characteristics of interaction
  - how the controls are designed
  - physical environment in which the interaction takes place
  - layout
  - physical qualities of the screen
- Ergonomics is a huge area, which is distinct from HCI but sits alongside it.
- Its contribution to HCI - Ergonomics good at defining standards and guidelines for constraining the way we design systems.

Ergonomics - Examples

- controls are designed and displays
  - e.g. controls grouped according to function or frequency of use
- surrounding environment
  - e.g. seating arrangements adaptable to cope with all sizes of user
- health issues
  - e.g. physical position, environmental conditions (temperature, humidity), lighting, noise
- use of colour
  - e.g. use of red for warning, green for okay

Interaction Styles

dialogue … computer and user

distinct styles of interaction

Interaction Styles

- There are a number of common interface styles which are:
  - command line interface
  - menus
  - natural language
  - question/answer and query dialogue
  - form-fills and spreadsheets
  - WIMP
  - point and click
  - three–dimensional interfaces

Command Line Interface

- CLI is way of expressing instructions to the computer directly.
  - function keys, single characters, short abbreviations, whole words, or a combination
  - suitable for repetitive tasks
  - better for expert users than novices
  - offers direct access to system functionality
  - command names/abbreviations should be meaningful!
- Typical example: the Unix system

Menus

- Menus is set of options displayed on the screen.
  - Options visible
    - easier to use
    - names should be meaningful
  - Selection by
    - numbers, letters, arrow keys, mouse
    - combination (e.g. mouse plus accelerators)
  - Often options hierarchically grouped
    - sensible grouping is needed
  - Restricted form of full WIMP system

Natural language

- Computer that is able to understand instructions expressed in everyday words! Natural language understanding, both of speech and written input.
- Familiar to user.
- Natural language is the subject of much interest and research.
- Problems
  - vague
  - ambiguous
  - hard to do well!
- Solutions
  - try to understand a subset
  - pick on key words

Query Interfaces

- Question and answer dialog
  - simple mechanism for providing input to an application in a specific domain.
  - The user is asked a series of questions (mainly with yes/no responses, multiple choice, or codes) and so is led through the interaction step by step.
  - interaction via series of questions
  - suitable for novice users but restricted functionality
  - often used in information systems
- Query languages (e.g. SQL)
  - used to retrieve information from database
  - requires understanding of database structure and language syntax, hence requires some expertise

Form-fills

- used primarily for data entry but can also be useful in data retrieval applications.
- Screen like paper form, with slots to fill in (see the following figure)..
- Data put in relevant place
- Requires
  - good design
  - obvious correction facilities

Form-fills

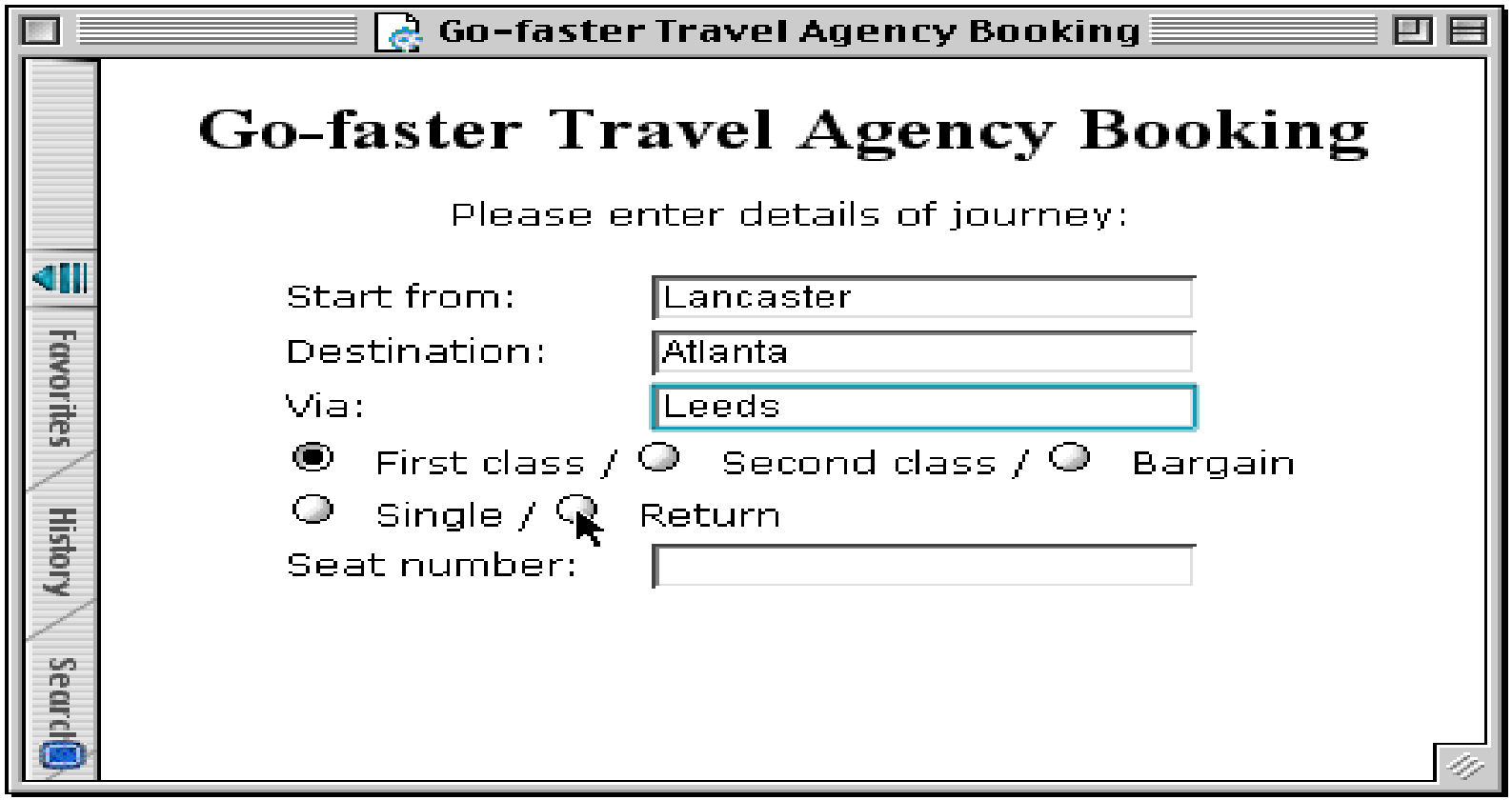


Figure: A typical form Filling Interface

Spreadsheets

- The first spreadsheet VISICALC, followed by Lotus 1-2-3.
- MS Excel most common today
- Sophisticated variation of form-filling.
  - grid of cells contain a value or a formula
  - formula can involve values of other cells
    - e.g. sum of all cells in this column
  - user can enter and alter data spreadsheet maintains consistency.

WIMP Interface

- WIMP is the default interface style for the majority of interactive computer systems.
  - especially PCs and desktop machines
- WIMP stands for:

  Windows

  Icons

  Menus

  Pointers

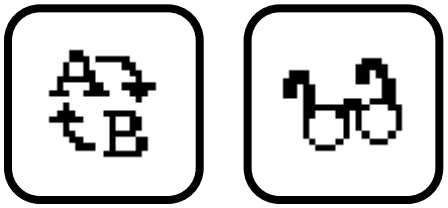
  … or windows, icons, mice, and pull-down menus!
- Examples of WIMP interfaces include (Microsoft Windows for IBM PC compatibles, MacOS for Apple Macintosh compatibles and various X Windows-based systems for UNIX).

Point and Click Interfaces

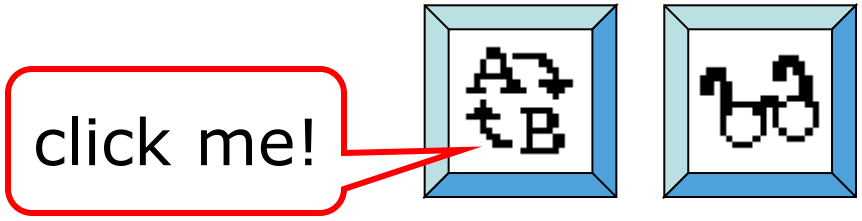
- Point-and-click interface style is obviously related to the WIMP style.
- used in ..
  - multimedia
  - web browsers
  - hypertext
- just click something!
  - icons, text links or location on map
- minimal typing

Three Dimensional Interfaces

- There is an increasing use of three-dimensional effects in user interfaces.
- The most obvious example is virtual reality.
  - but VR is only part of a range of 3D techniques available to the interface designer.
- 'ordinary' window systems
- 3D workspaces
  - use for extra virtual space
  - light and occlusion give depth
  - distance effects



flat buttons …



… or sculptured

Elements of The WIMP Interface

windows, icons, menus, pointers

+++

buttons, toolbars,
palettes, dialog boxes

Windows

- Windows is areas of the screen that behave as if they were independent
  - can contain text or graphics
  - can be moved or resized
  - can overlap and obscure each other, or can be laid out next to one another (tiled)

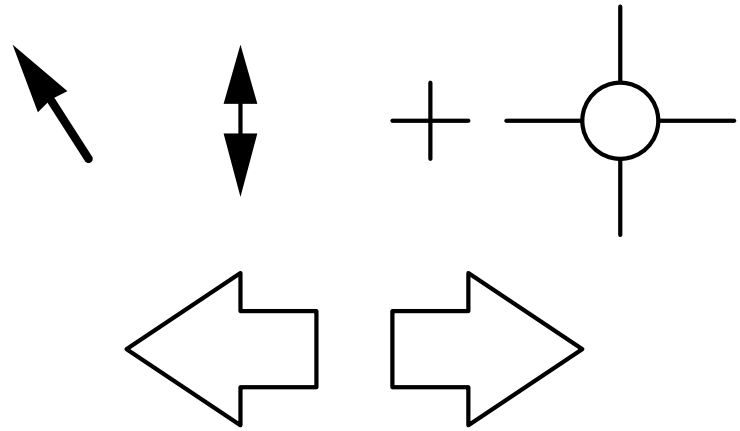
- scrollbars
  - allow the user to move the contents of the window up and down or from side to side
- title bars
  - describe the name of the window

Icons

- Icons is small picture or image
- represents some object in the interface
  - often a window or action
- windows can be closed down (iconised)
  - small representation fi many accessible windows
- icons can be many and various
  - highly stylized
  - realistic representations.

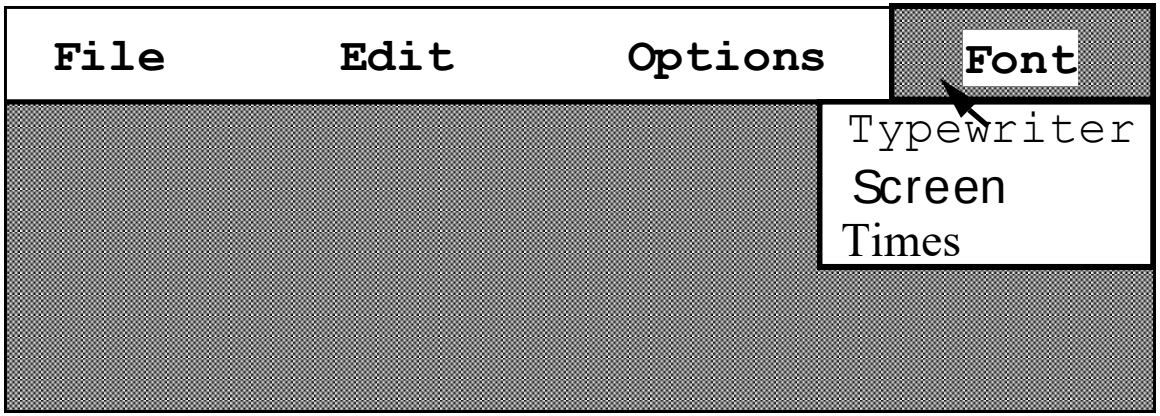
Pointers

- important component
  - WIMP style relies on pointing and selecting things
- uses mouse, trackpad, joystick, trackball, cursor keys or keyboard shortcuts



Menus

- Choice of operations or services offered on the screen
- Required option selected with pointer



problem – take a lot of screen space

solution – pop-up: menu appears when needed

Kinds of Menus

- Menu Bar at top of screen (normally)
- Menu drags down of screen
  - pull-down menu - mouse hold and drag down menu
  - drop-down menu - mouse click reveals menu
  - fall-down menus - mouse just moves over bar!
- Contextual menu appears where you are
  - pop-up menus
  - pie menus
    - easier to select item (larger target area)
    - quicker (same distance to any option)

    … but not widely used!

Menus Design Issues

- which kind to use
- what to include in menus at all
- words to use (action or description)
- how to group items
- choice of keyboard accelerators

Buttons

- Buttons is individual and isolated regions within a display that can be selected to invoke an action

- Special kinds
  - radio buttons
    - set of mutually exclusive choices
  - check boxes
    - set of non-exclusive choices

Toolbars

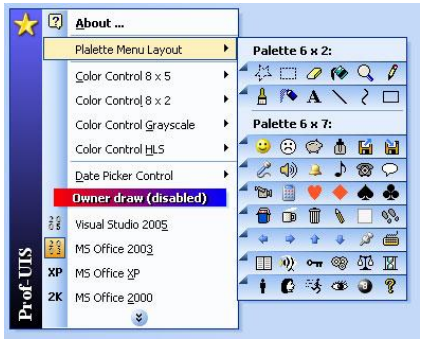
- Toolbars is long lines of icons …
  … but what do they do?
- fast access to common actions
- often customizable:
  - choose *which* toolbars to see
  - choose *what* options are on it

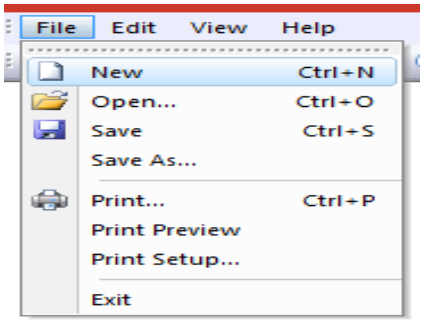
Palettes and tear-off Menus

- Problem

  menu not there when you want it

- Solution
  - palettes menus(little windows of actions)
    - shown/hidden via menu option
  - tear-off and pin-up menus
    - menu 'tears off' to become palette

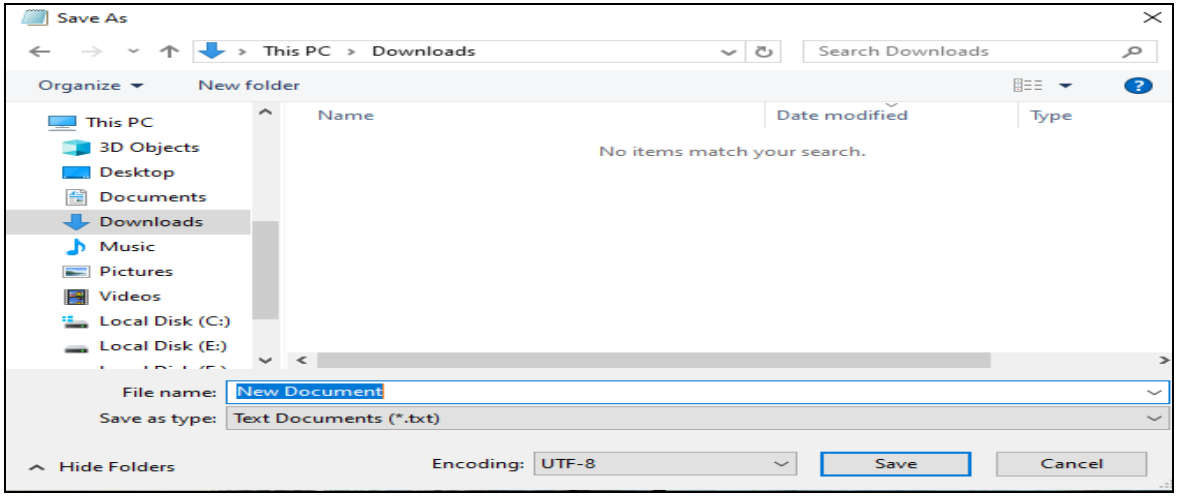




Dialogue Boxes

- information windows that pop up to inform of an important event or request information.

e.g: when saving a file, a dialogue box is displayed to allow the user to specify the filename and location. Once the file is saved, the box disappears.



Interaction Design

stages, usability, software life cycle

Interaction Design

- Interaction design is about creating interventions in often complex situations using technology of many kinds including PC software, the web and physical devices.
- The design process has several stages and is iterative and never complete.

- The design involves:
  - Achieving goals within constraints
  - Understanding the raw materials
    - computer and human
  - Accepting limitations of humans and of design.

Interaction Design- Design Process

- Often HCI professionals complain that they are called in too late.

- A system has been designed and built, and only when it proves unusable do they think to ask how to do it right!
- In other companies usability is seen as equivalent to testing
  - checking whether people can use it
  - fixing problems
- rather than making sure they can from the beginning.

- In the best companies, however, usability is designed in from the start.

Interaction Design- Design Process

- Within computer science there is already a large subdiscipline that addresses the management and technical issues of the development of software systems – called software engineering.
- One of the cornerstones of software engineering is the software life cycle.

- software life cycle is describes the activities that take place from the initial concept formation for a software system up until its eventual phasing out and replacement.

Interaction Design- Design Process

- The important point that we would like to draw out is :
  - that issues from HCI affecting the usability of interactive systems are relevant within all the activities of the software life cycle.
- Therefore, software engineering for interactive system design is not simply a matter of adding one more activity that slots in nicely
  - it involves techniques that span the entire life cycle

- See the following figure which shows a simplified view of interaction design process

Interaction Design- Design Process

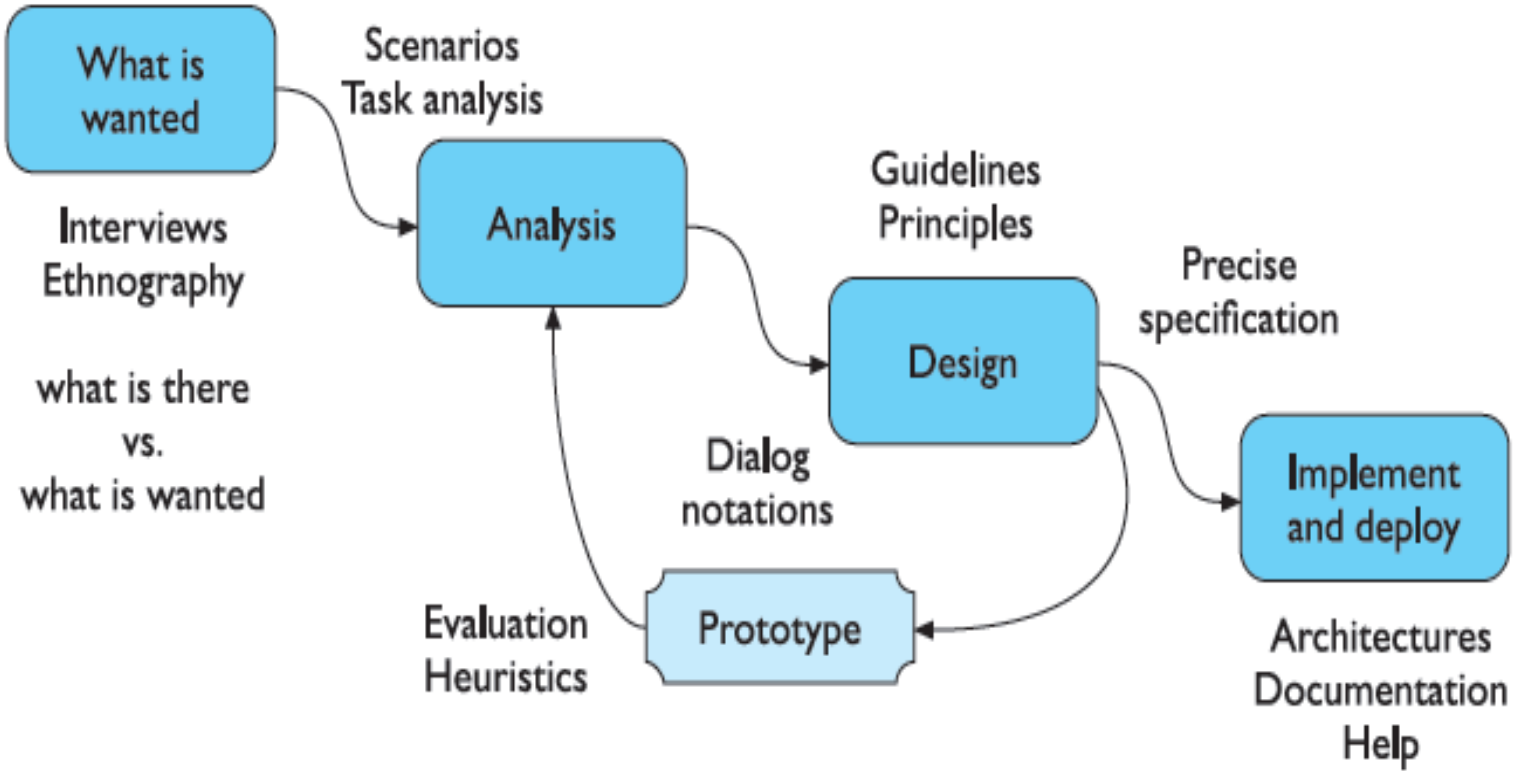


Figure (Interaction Design Process)

Questions

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