chapter 3

the interaction

The Interaction: communication between user and system

- interaction models
  - translations between user and system
- ergonomics
  - physical characteristics of interaction
- interaction styles
  - the nature of user/system dialog

models of interaction

terms of interaction
Norman model
interaction framework

Some terms of interaction

domain – the area of work under study

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

Note …

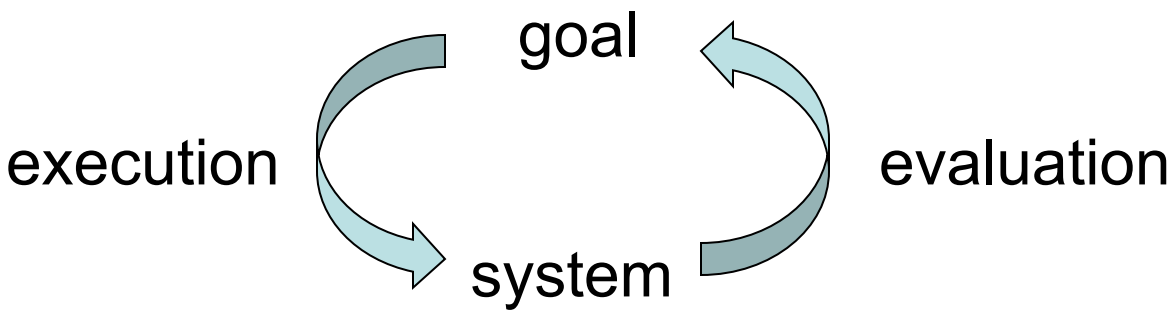
- traditional interaction …
- use of terms differs a lot especially task/goal !!!

Donald Norman's model

- Seven stages
  - 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

execution/evaluation loop



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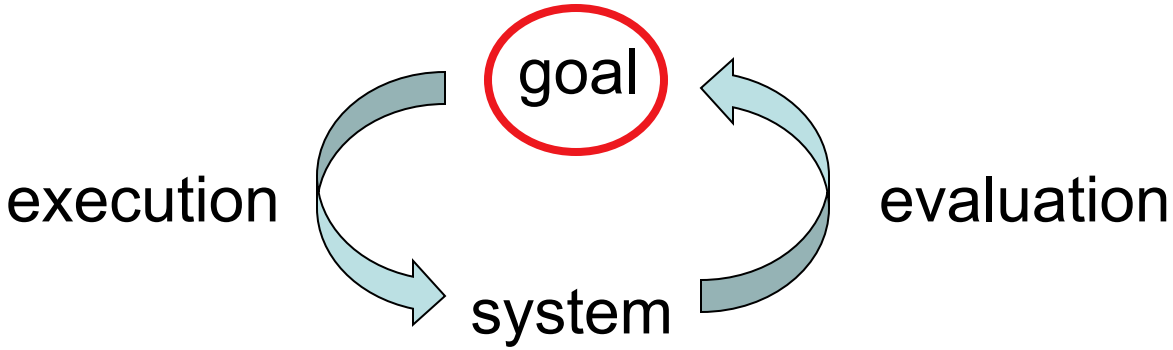

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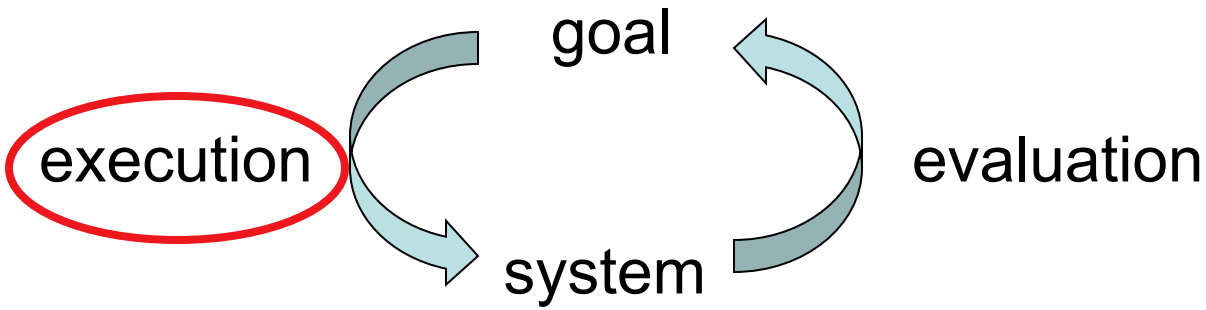

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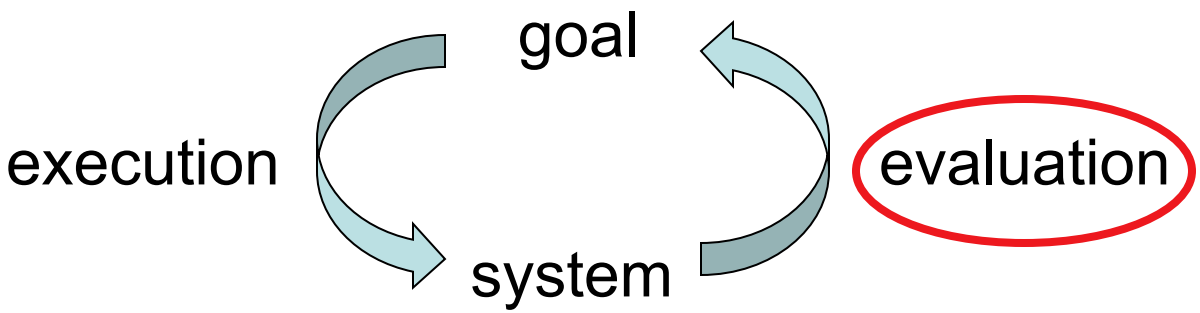

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Using Norman's model

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!

Can be better explained using Norman's gulf of execution

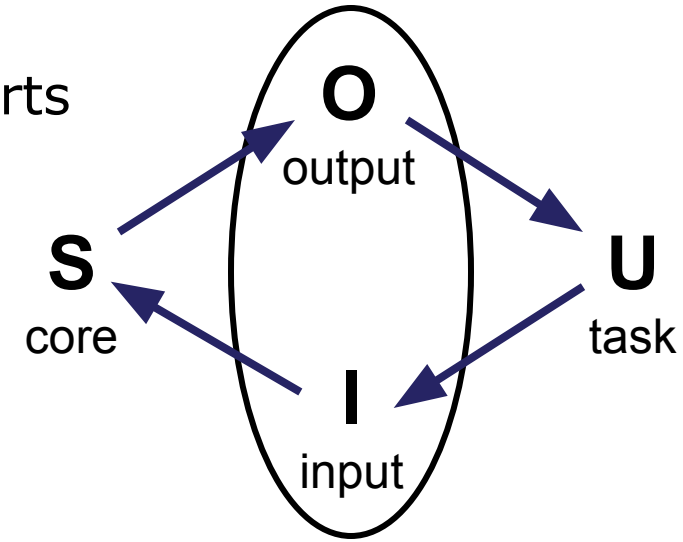
slip – better interface design

mistake – better understanding of system

Abowd and Beale framework

extension of Norman…
their interaction framework has 4 parts

- user
- input
- system
- output



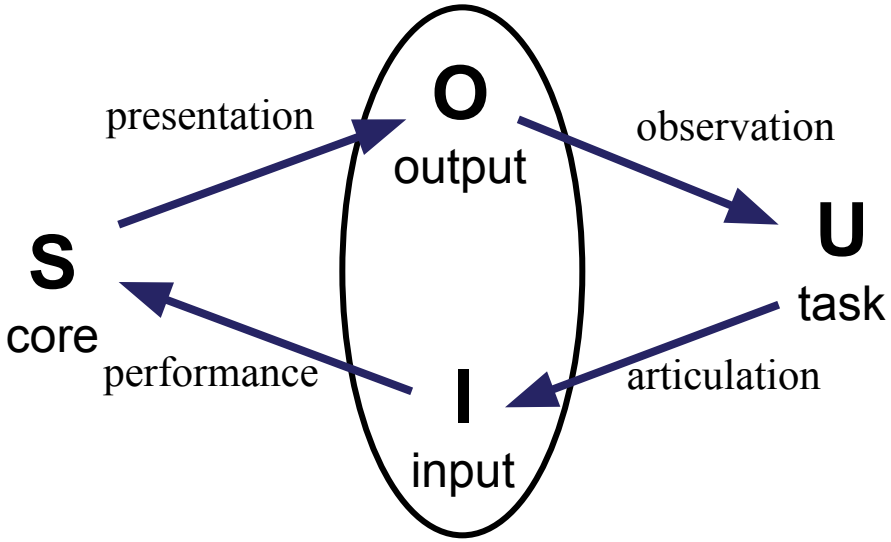
each has its own unique language

interaction ⇒ translation between languages

problems in interaction = problems in translation

Abowd and Beale framework

user intentions
→ translated into actions at the interface
→ translated into alterations of system state
→ reflected in the output display
→ interpreted by the user



Using Abowd & Beale's model

General framework for understanding interaction

- not restricted to electronic computer systems
- identifies all major components involved in interaction
- allows comparative assessment of systems
- an abstraction

ergonomics

physical aspects of interfaces
industrial interfaces

Ergonomics

- Study of the physical characteristics of interaction
- Also known as human factors – but this can also be used to mean much of HCI!
- Ergonomics good at defining standards and guidelines for constraining the way we design certain aspects of systems

Ergonomics - examples

- arrangement of controls and displays
  - e.g. controls grouped according to function or frequency of use, or sequentially
- 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, awareness of colour-blindness etc.

Industrial interfaces

Office interface vs. industrial interface?

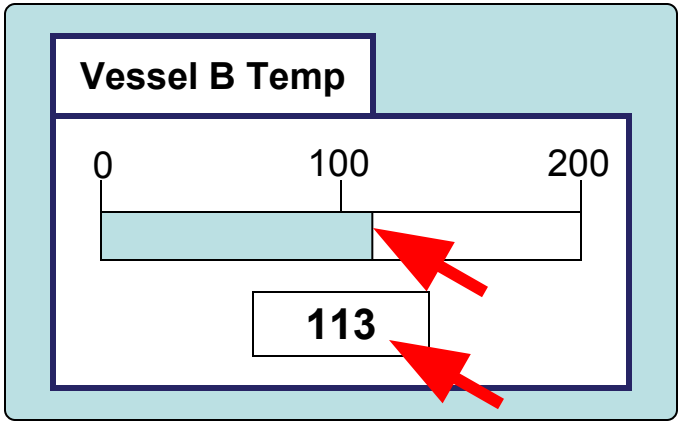
Context matters!

	office	industrial
type of data	textual	numeric
rate of change	slow	fast
environment	clean	dirty

… the oil soaked mouse!

Industrial Interfaces

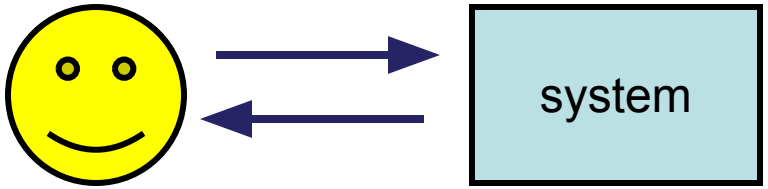
- industrial interface:
  - traditional … dials and knobs
- glass interface
  - now … screens and keypads
  - cheaper, more flexible, multiple representations, precise values
  - not physically located, loss of context, complex interfaces
- may need both



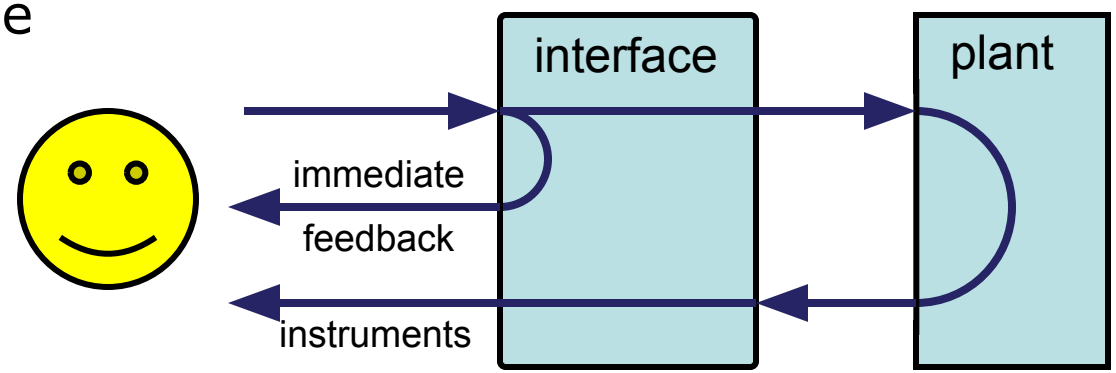
multiple representations of same information

Indirect manipulation

- office– direct manipulation
  - user interacts with artificial world



- industrial – indirect manipulation
  - user interacts *with* real world *through* interface
- issues ..
  - feedback
  - delays



interaction styles

dialogue … computer and user

distinct styles of interaction

Common interaction styles

- 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

- 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

- Set of options displayed on the screen
- Options visible
  - less recall - easier to use
  - rely on recognition so 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

- Familiar to user
- speech recognition or typed natural language
- Problems
  - vague
  - ambiguous
  - hard to do well!
- Solutions
  - try to understand a subset
  - pick on key words

Query interfaces

- Question/answer interfaces
  - user led through 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

- Primarily for data entry or data retrieval
- Screen like paper form.
- Data put in relevant place
- Requires
  - good design
  - obvious correction facilities

Spreadsheets

- 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

Windows

Icons

Menus

Pointers

… or windows, icons, mice, and pull-down menus!

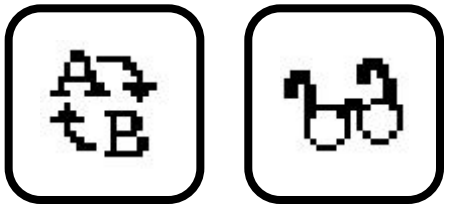
- default style for majority of interactive computer systems, especially PCs and desktop machines

Point and click interfaces

- used in ..
  - multimedia
  - web browsers
  - hypertext
- just click something!
  - icons, text links or location on map
- minimal typing

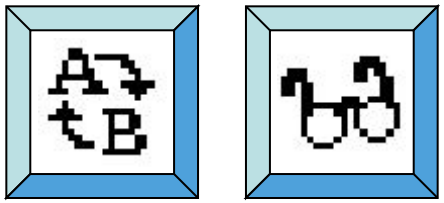
Three dimensional interfaces

- virtual reality
- 'ordinary' window systems
  - highlighting
  - visual affordance
  - indiscriminate use just confusing!
- 3D workspaces
  - use for extra virtual space
  - light and occlusion give depth
  - distance effects



flat buttons …

click me!



… or sculptured

elements of the wimp interface

windows, icons, menus, pointers

+++

buttons, toolbars,
palettes, dialog boxes

also see supplementary material
on choosing wimp elements

Windows

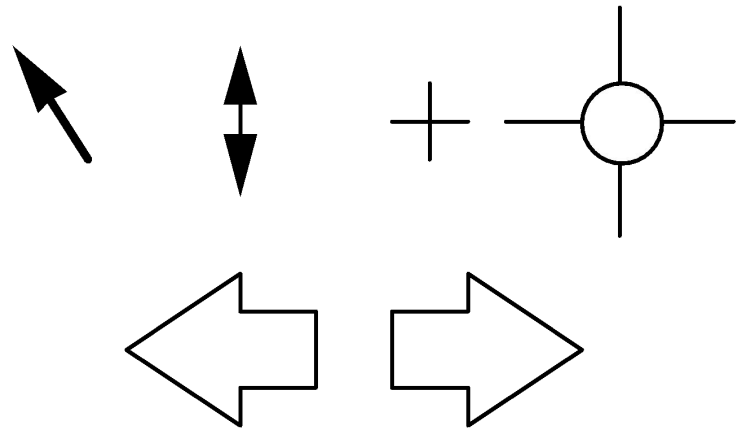
- Areas of the screen that behave as if they were independent
  - can contain text or graphics
  - can be moved or resized
  - can overlap and obscure each other, or can be laid out next to one another (tiled)
- scrollbars
  - allow the user to move the contents of the window up and down or from side to side
- title bars
  - describe the name of the window

Icons

- 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.

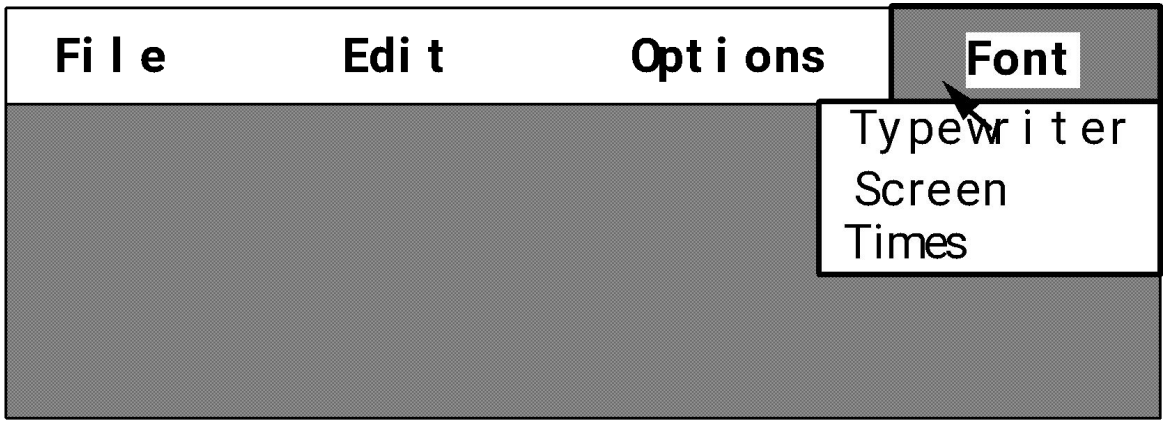
Pointers

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



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
  - pull-down menu or drop-down menu - mouse click reveals menu
  - fall-down menus - mouse just moves over bar!
- Contextual menu appears where you are
  - pop-up menus - actions for selected object
  - pie menus - arranged in a circle
    - easier to select item (larger target area)
    - quicker (same distance to any option)

    … but not widely used!

Menus extras

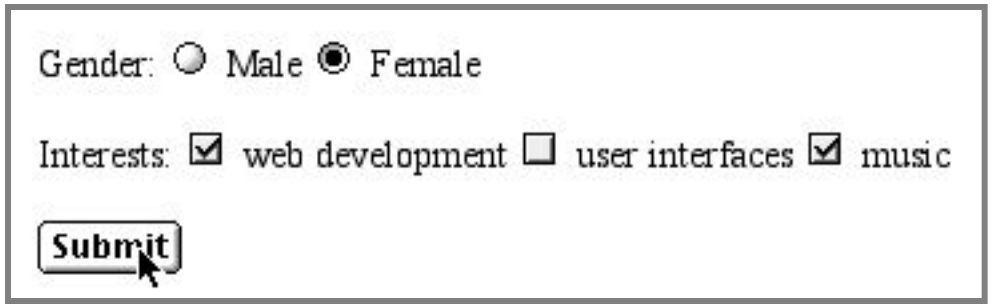
- Cascading menus
  - hierarchical menu structure
  - menu selection opens new menu
  - and so in ad infinitum
- Keyboard accelerators
  - key combinations - same effect as menu item
  - two kinds
    - active when menu open – usually first letter
    - active when menu closed – usually Ctrl + letter

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

- 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

- 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
- Nowadays "ribbons" are also used
  - Tabs to expose different set of controls
  - Eliminates the need for many parallel toolbars
  - Example: Microsoft Word

Palettes and tear-off menus

- Problem
  menu not there when you want it

- Solution
  palettes – little windows of actions
    - shown/hidden via menu option
      e.g. available shapes in drawing package

  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.