

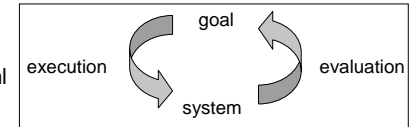
The Interaction

- Interaction models
- Ergonomics
- Interaction styles

Donald Norman's model of interaction

• 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

- What problem solving strategy is this?

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

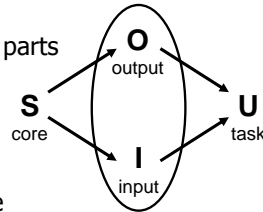
- ☹ may not even have right goal!

Fixing things?

- slip – better interface design
- mistake – better understanding of system

Abowd and Beale framework

- extension of Norman...
- their 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

Using Abowd & Beale's model

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

- 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.

Some ergonomic No-No's

- Lack of back support (or required standing position) for long periods – e.g., worker on a stool
 - Related – worker needing to reach awkwardly for keyboard, mouse or other regularly access device (e.g., access system box under a table to plug-unplug media regularly)
 - Can cause worker pain and eventual disability
- Extreme temperature – hot or cold workplace will affect concentration and (esp. cold and damp) ultimately health
- Glare on screen (esp. CRT) creates eye-strain – higher error rates from fatigue and inability to read screen correctly
 - Direct sun on screen is an eye strain problem too
- Excessive noise – prolonged exposure causes hearing damage; are relevant alarm bells noticeable?
- Excessive shift duration – humans simply can't monitor accurately for long periods ('dead man switch' is one primitive precaution, but can't beat reducing shift length or redesigning task/system)

Industrial interfaces

Office interface vs. industrial interface?

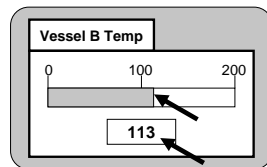
Context matters!

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

Are we just talking about dust and dirt?

Glass interfaces ?

- industrial interface:
 - traditional ... dials and knobs
 - now ... screens and keypads
- glass interface (computer screen)
 - cheaper, more flexible, multiple representations, precise values
 - not physically located, loss of context, complex interfaces
- may need both
- Analogue/digital



multiple representations of same information

Sometimes it's hard to find the people among the robots

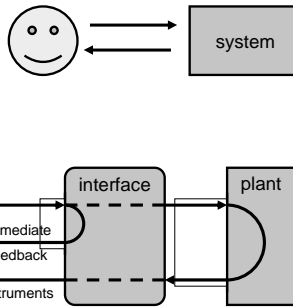
- Mercedes assembly line



Man about to be squashed by angry robot

Indirect manipulation

- office- direct manipulation
 - user interacts with artificial world
- industrial – indirect manipulation
 - user interacts *with* real world *through* interface
- issues ..
 - feedback
 - Delays
 - Things HAPPEN in real world



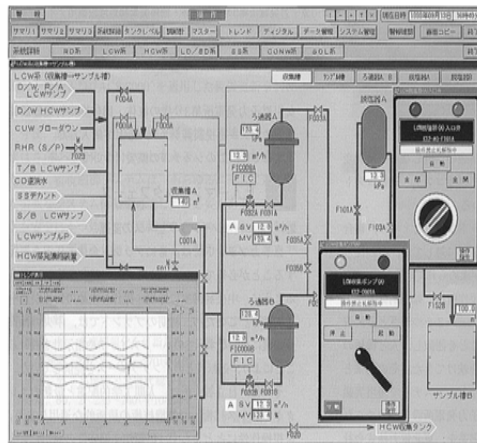
The real 'Homer Simpson' workplace

Seems to be mostly specialized hardware controls in this Japanese Pressurized Water Reactor facility



Here's a more modern CRT-based control display

Fig. 2—Example CRT Operation Display. By clicking with the mouse on the control equipment (pumps, air-operated valves, etc.) at the top of the system diagram, an operation switch window modeled after an actual hand switch appears in a pop-up display. Multiple displays can be shown with this switch window. In addition, trend graphs can be displayed on the same CRT, enabling operations such as valve opening and closing to be performed while monitoring the tank level.



Hitachi Review Vol. 49 (2000), No. 2

Command Line Interfaces

- Scripting/macro language (typically textual)
- Command name + args
- Feedback from invoking command
- Sometimes "batch" style processing



Advantages:

Disadvantages:

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 Interaction

- Natural language queries
- Speech recognition
- Handwriting recognition & pen interaction (next lecture)
- 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
- Examples?

Form-fills

- Primarily for data entry or data retrieval
- Screen like paper form
- Data put in relevant place
- Requires
 - good design
 - obvious correction facilities
- Excellent reference – Caroline Jarrett
 - <http://www.formsthatwork.com/>

The screenshot shows a web form for 'Go-faster Travel Agency Booking'. The form is titled 'Please enter details of journey:' and contains the following fields and options: 'Start from:' with a text box containing 'Lancaster'; 'Destination:' with a text box containing 'Adanta'; 'Via:' with a text box containing 'Leeds'; three radio buttons for 'First class / Second class / Bargain', with 'First class' selected; two radio buttons for 'Single / Return', with 'Return' selected; and a 'Seat number:' text box.

Spreadsheets

- 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 Interfaces

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

WIMP Interfaces

- Iconic
- Direct manipulation/graphical interactors
- Visual/audio feedback
- Windows, menus, buttons, etc.
- Incremental process invocation
- Point and Click interface



Advantages:

Disadvantages:

WWW-based Interfaces

- Usual GUI elements
- Usually form-based metaphors
- Uses web browser interface capabilities
- HTML, Java, Plug-ins

Advantages:

Disadvantages:



- Comparing browsers "Beyond IE Four Alternatives"
- <http://www.nzherald.co.nz/storydisplay.cfm?thesection=technology&thesubsection=&storyID=3581149>

RealThings (IBM) – Design Style

- Simulate the real world
- Interface is familiar
- Interaction is more natural



Advantages:

Disadvantages:

RealPlaces (IBM) - 3D/VR Environments

- Interact with an “immersive world”
- Complex geometrical visualisation/interaction
- Navigation is complex
- Interact with objects in world



Advantages:

Disadvantages:

Augmented Reality Interfaces

- “wear” computer/hold computer/computer built into everyday things
- May be groupware/distributed
- Interact with in (un)“natural” ways



Advantages:

Disadvantages:

Interactivity

- Remember the context of the interaction
- Support an experience
- Allow user engagement
- Manage personal values
 - Offer gains, e.g., Net present value
- General lesson
 - If you want someone to do something
 - Make it easy for them
 - Understand their values