Human Computer Interaction

INTERACTION STYLE

By: Nguyễn Công Hoan

Reference

- DonaldNorman, **The Design of Everyday Things, MITPress, 23 Dec 2013**
- **Tutorial Teaching** of Prof. Dr. Keith Andrews, Graz University of Technology

Agenda

- What is Interaction?
- Menu Driven
- Command Line
- Natural Language
- Graphical User Interface (GUI)
- Voice Control

What is Interaction?

communication

user  system

- Interaction refers to a dialogue generated by the command and data, input to the computer and the display, output of the computer and the sensory/perceptual input to the human and motor response output of the human.

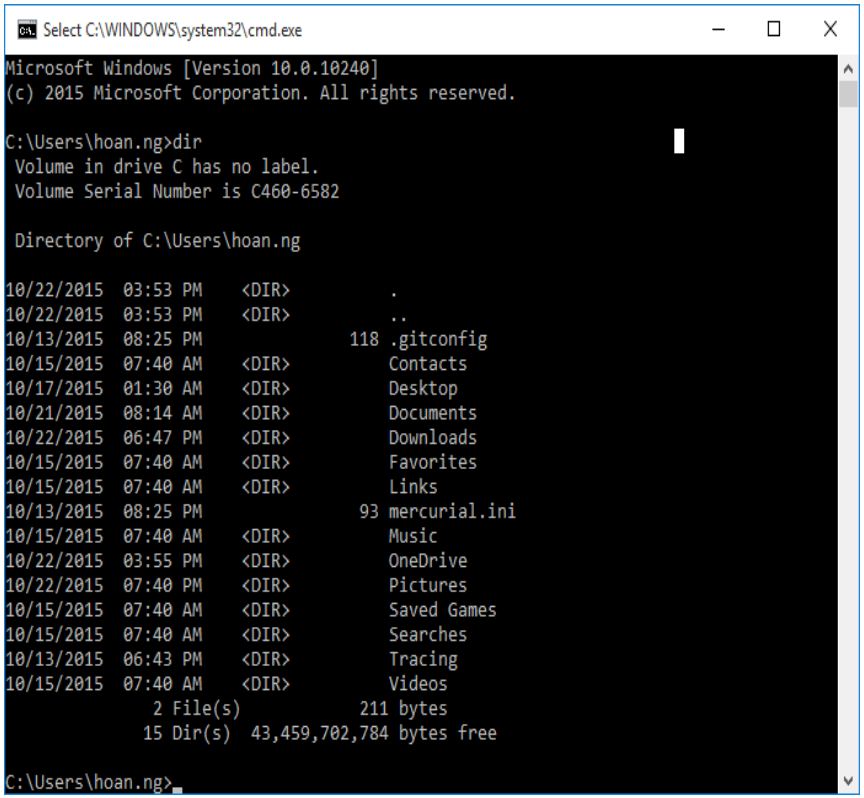
- There are number of ways in which the user can communicate with the system, batch input, direct manipulation etc.

Command Line

A command line interface is one which is navigated by a human by the use of special commands at prompts. It does not require a mouse and uses only a keyboard to input commands

Advantage: Can be used to solve difficult task that can't be done with a GUI

Disadvantage: Several commands have to be memorized. User has to be well trained

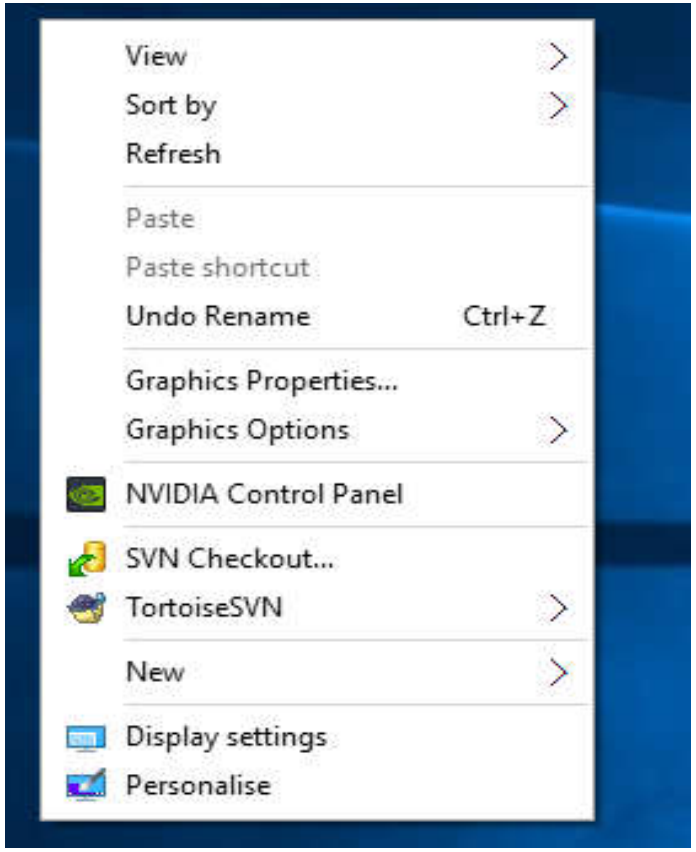


Menu Driven

A menu-driven interface refers to programs whose interfaces employs menus. This interface consists of a series of screens which are navigated by choosing options from lists. “Menus” are sorted into two classes: Pull down and Pop-up

Advantage: They are very simple to use. For example, they are suitable for kiosks and ATMs.

Disadvantage: It may become confusing if too much menus are used.



Graphical User Interface (GUI)

A graphical interface refers to an interface that takes advantage of the graphics capabilities of the system to enable ease of use. GUI's consist of windows (frames of text), icons (small image representations of programs), menus and pointers (such as a mouse).

Advantage: Ease of use. It eliminates the need to learn complex commands.

Disadvantage: It is not capable of doing certain tasks, such as re-naming 100+ files simultaneously.

Natural Language

A natural language allows the user to interact with a program by means of natural human characteristics such as voice communication. The single most problem for computer engineers is to make a computer that can understand natural languages such as English or French. Certain strides have been made as programs exist that can execute commands based on user voice.

How Are The HCI Interfaces Different?

Menu-Driven	Command Line	Natural Language	Graphical User Interface (GUI)
Uses drop down or pull up menus for navigation	Uses specially written commands for navigation	Uses natural commands, such as voice for navigation	Uses icons are clicked to navigate the user (folder to folder)
Easy to use because of contextual menus	Difficult to use because a special language is required	Confusing to use since voices vary in pitch	Very easy to use because user points and clicks
Partly customisable; only some items are movable	Not customisable; no changes to interface appearance	Not customisable; changes can't be made to mic sensitivity	Highly customisable; 98% of interface elements are changeable
User friendly	Not user friendly	User friendly	User friendly
Attractive	Not attractive	Attractive	Highly attractive

HCI Interface Adaptations For Humans With Differing:

Ages

Education

Cultur es

Disabilities

Accessibilities

Age

A person's age greatly influences the adaptions of an interface, to illustrate this, we can note the following table:

CHILD ADAPTED INTERFACE

✓ Colours are bright and blend various degrees of high contrast colours ✓ Icons are easily placed ✓ Menus are kept as simple as possible ✓ Big buttons are used for most options

Age (cont.)

ADULT (YOUNG & ELDERLY) ADAPTED INTERFACE

- ✓ Icons are large (for people with poor vision)
- ✓ Colours have to have a matching scheme
- ✓ Menus should not appear too childish
- ✓ Interface should be designed to facilitate customisation

Age (cont.)


Hart County Highscool Raider Team Rocks
Froot Loops
Preschool
Kindergarten
Random Game!
1st
2nd
Grownup Stuff
Parent Street
Funschool Galactica
Interactive Partnerships
Game Guide
Newsletter
Zoobooks Games
FREE Educational Software
funschool.com
Puzzle & Board Games
Arcade
Frog Palace
5th & 6th
3rd & 4th
Gator's Choice
Preschool Kindergarten 1st Grade 2nd Grade 3rd/4th Grades 5th/6th Grades Arcade Puzzle/Board Games
Getting Started Gator's Choice Silly Stories Joke Page Fan Mail! Help Desk
Game Guide Press Interactive Partnerships Contact Us Site Map Home
Privacy Policy
Everyone E1 ESRB Interactive
Cyber Angels Safe Site
This Site Is Safe For Kids
funschool.com's site is best viewed with a 800x600 screen resolution.
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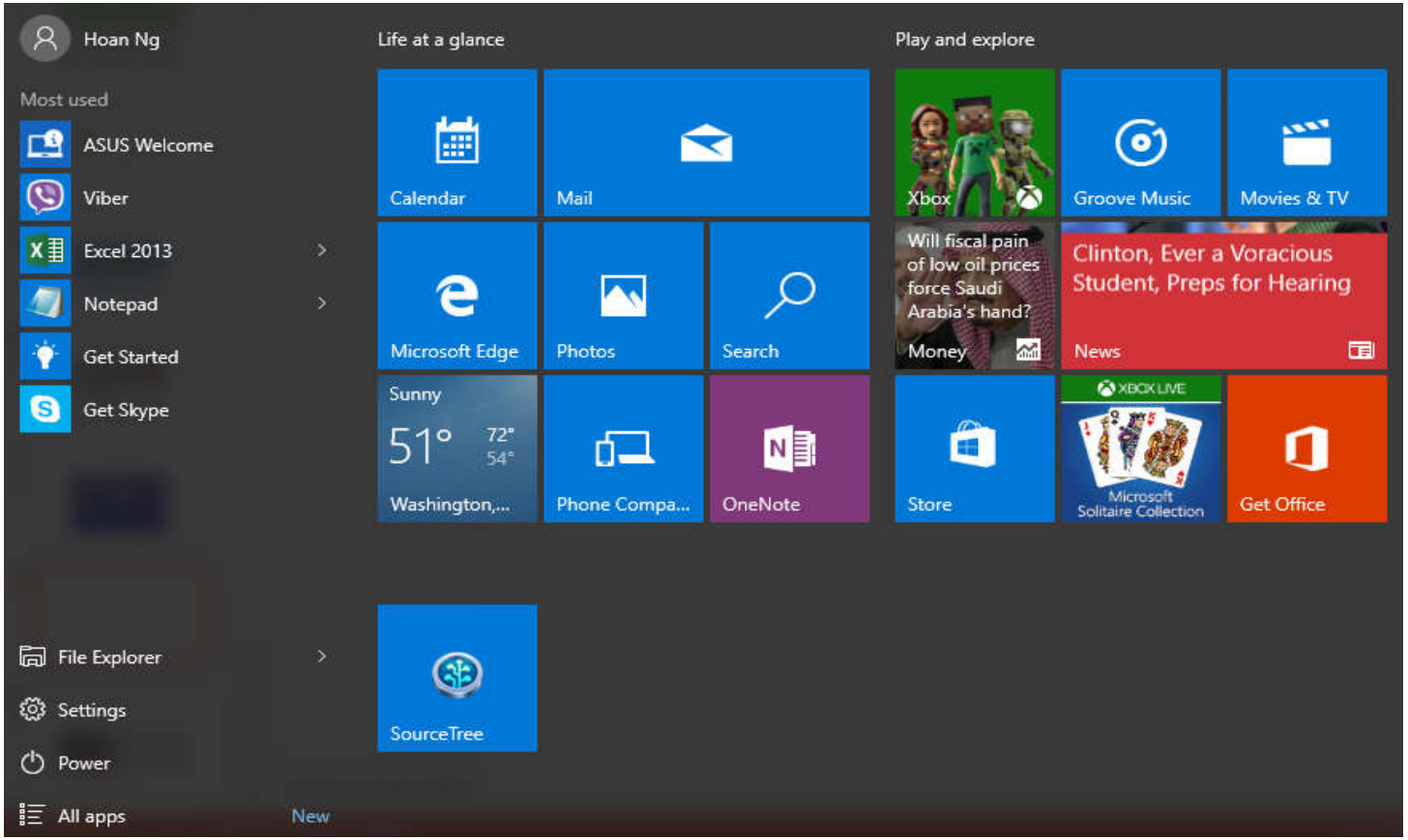
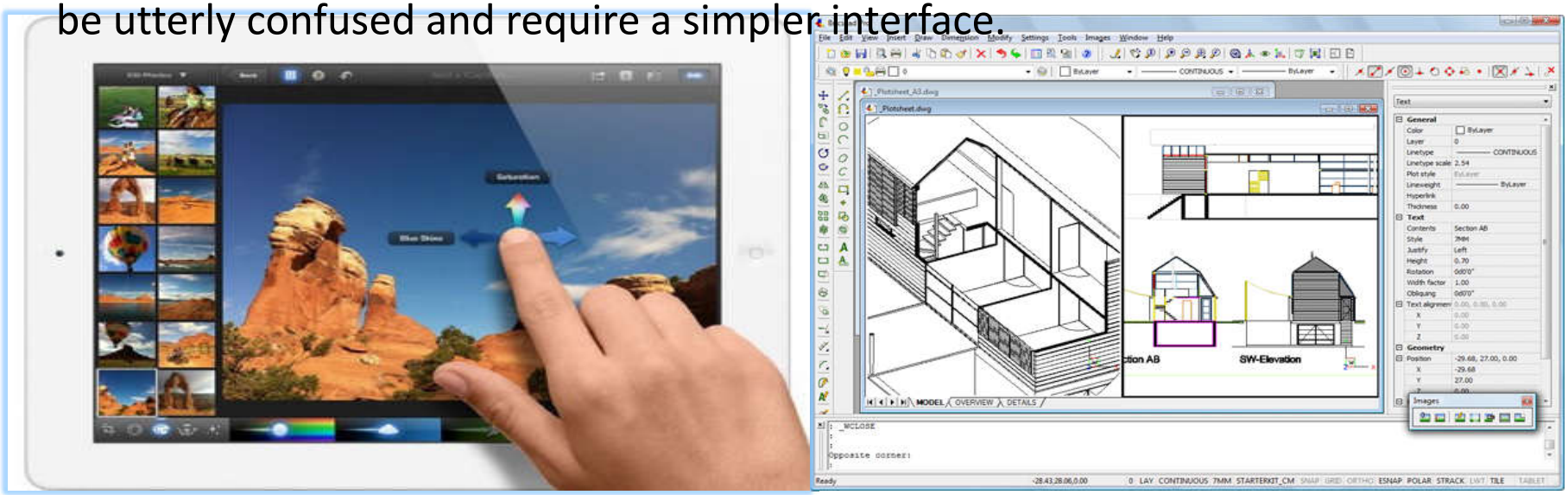
Age (cont.)


Hoan Ng
Most used
ASUS Welcome
Viber
Excel 2013
Notepad
Get Started
Get Skype
File Explorer
Settings
Power
All apps
New
Life at a glance
Calendar
Mail
Microsoft Edge
Photos
Search
Sunny
51°
72°
54°
Washington,...
Phone Compa...
OneNote
SourceTree
Play and explore
Xbox
Groove Music
Movies & TV
Will fiscal pain of low oil prices force Saudi Arabia's hand?
Money
Clinton, Ever a Voracious Student, Preps for Hearing
News
Store
XBOX LIVE
Microsoft Solitaire Collection
Get Office

Education

- How educated a person is might influence how well certain interfaces are designed.
- For example a highly educated engineer and designer might understand the complex interface of Adobe Photoshop and Turbo CAD while an amateur would be utterly confused and require a simpler interface.



Disabilities

- A person's disability might cause issues when using interfaces. HCI studies try to make the interface as comfortable and safe for the user as possible.

- For example, an interface uses less flashing light in case a user has epilepsy and larger images and icons if the user has poor sight.

Culture

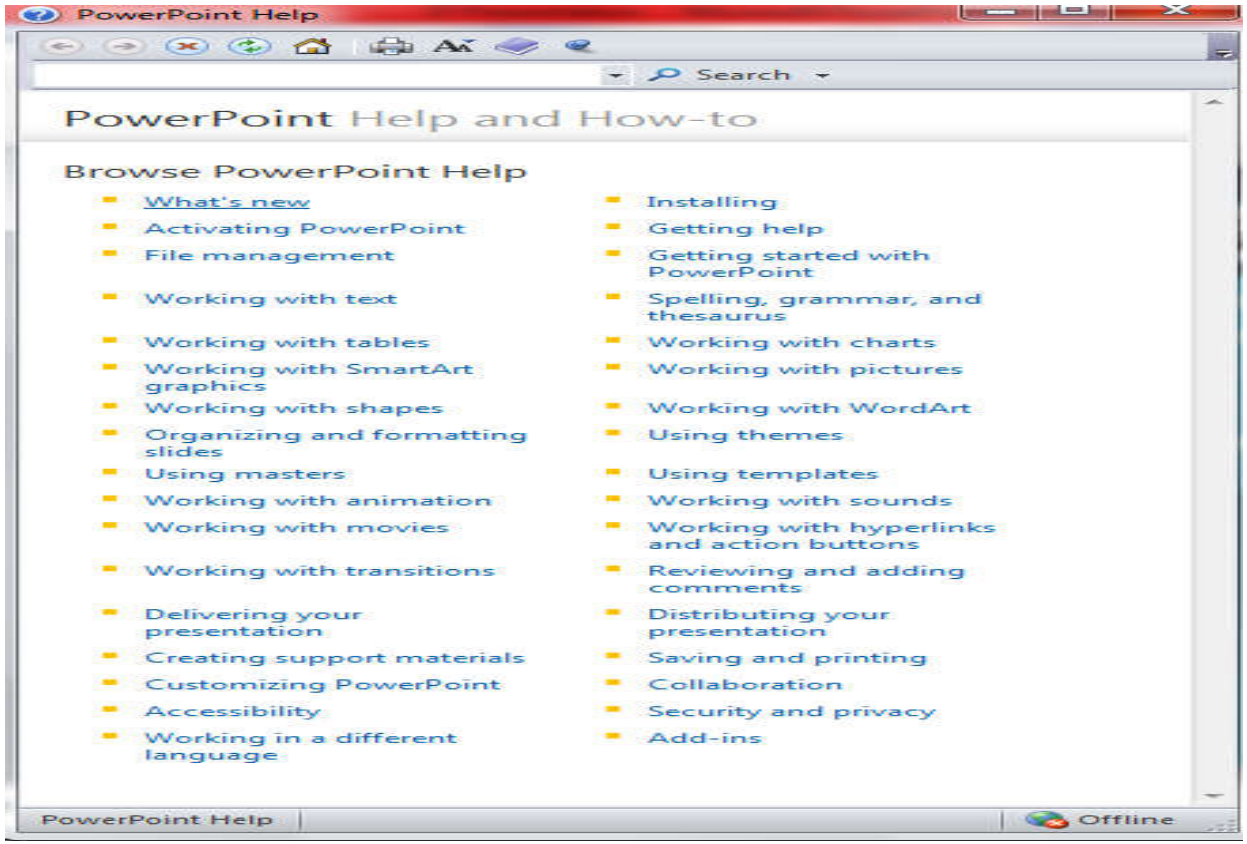
A user's culture may sometimes govern how an interface is designed. We can analyse this by contrasting interfaces for English and Arabic users.

English Interface	Arabic Interface
Language reads left to right	Language reads right to left
In case of GUI, icons are easily and ideally placed	Icons are oddly placed and require a working knowledge of the interface to operate efficiently
Offers more colour	Offers significantly less colour, interface may even appear to be bare

Accessibility

- In HCI, the term accessibility refers to how easily an interface provides help for its users.
- Help can be in the form of contextual or non-contextual tips built into the interface or by trouble-shooters.
- Accessibility also refers to how helpful these help methods really are, whether they are online, offline or a combination of both.

Accessibility (Cont.)



Voice Control

The interaction

- Interaction models
  - Translations between user and system
- Ergonomics
  - Physical characteristics of interaction
- Interaction styles
  - The nature of user/system dialog
- Context
  - Social, organizational, motivational

What is interaction?

communication

user system

but is that all … ?

- “language and action” …

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 …

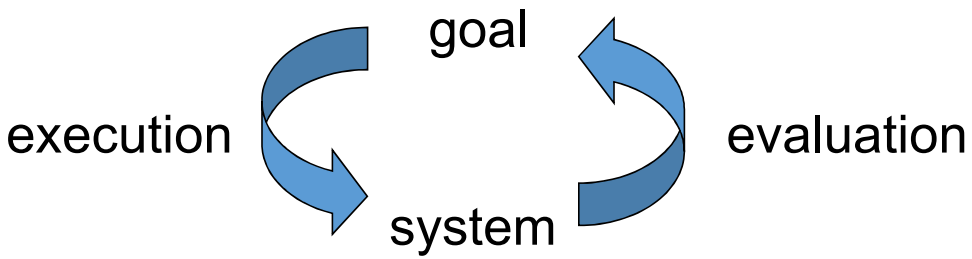
- Traditional interaction …
- Use of terms differs a lot especially task/goal !!!

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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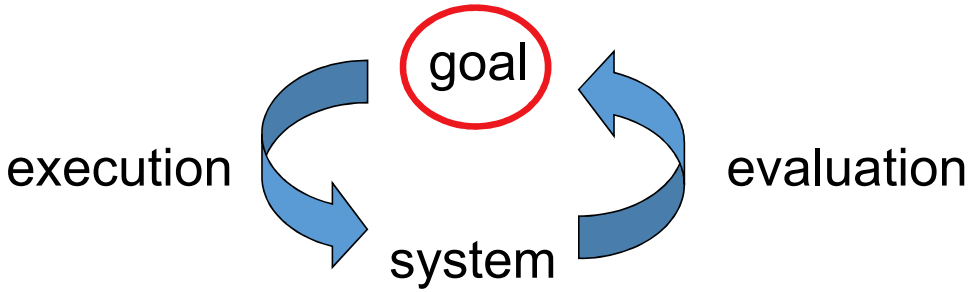
execution/evaluation loop



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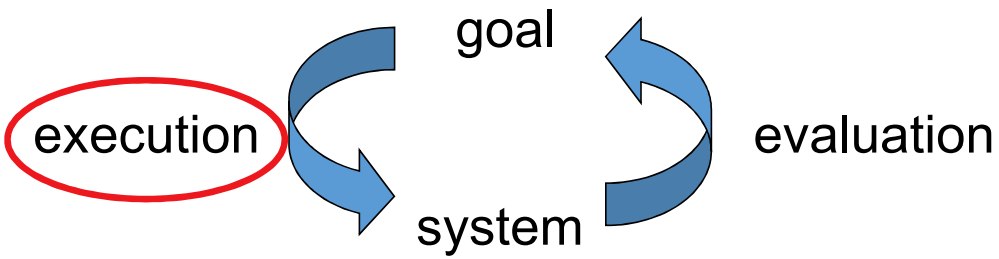

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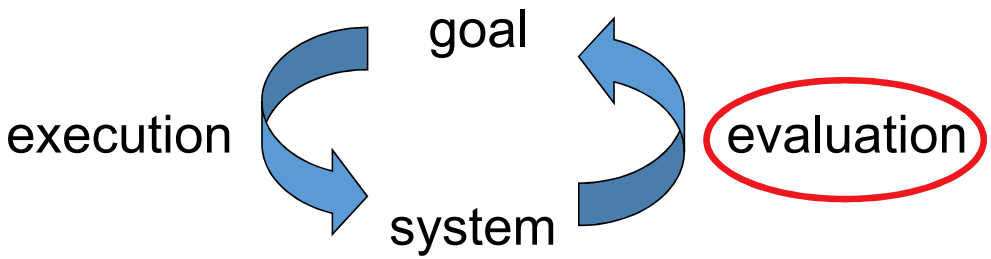

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- formulates intention
- specifies actions at interface
- executes action
- perceives system state
- interprets system state
- evaluates system state with respect to goal

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

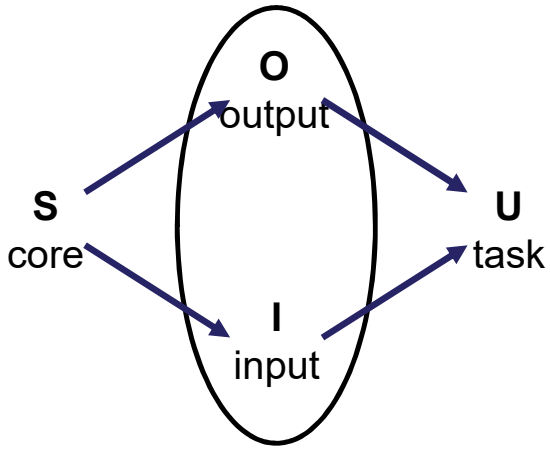
Mistake – better understanding of system

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
→ translated into actions at the interface
→ translated into alterations of system state
→ reflected in the output display
→ 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

- 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?

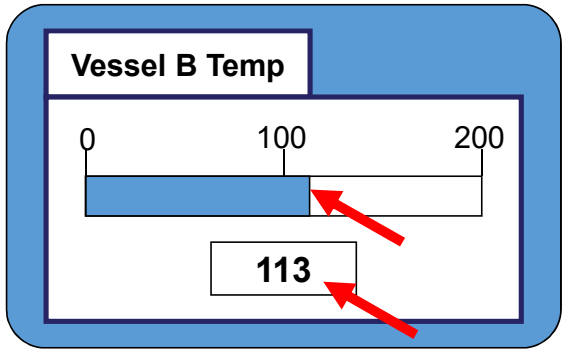
Context matters!

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

… the oil soaked mouse!

Glass interfaces ?

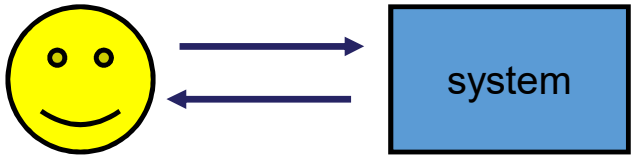
- Industrial interface:
  - Traditional … dials and knobs
  - Now … screens and keypads
- Glass interface
  - \+ Cheaper, more flexible, multiple representations, precise values
  - Not physically located, loss of context, complex interfaces
- May need both



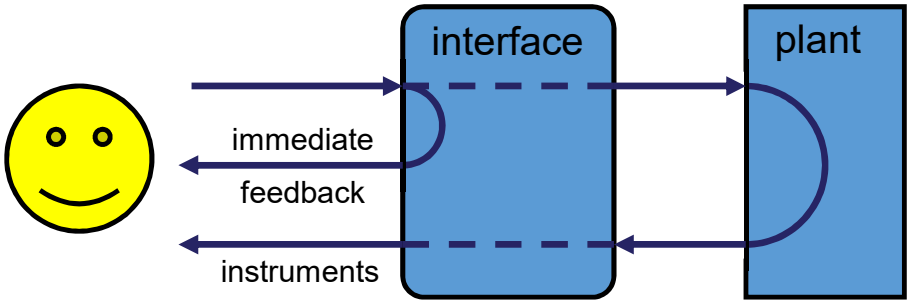
multiple representations
of same information

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

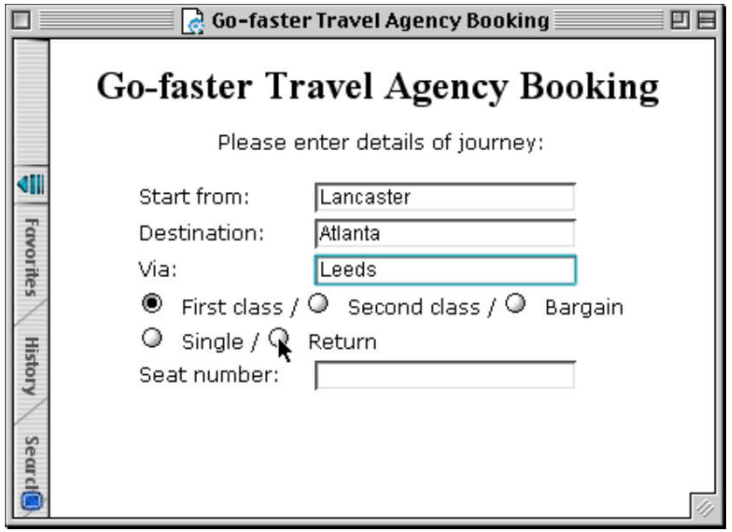
Query interfaces

- 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!

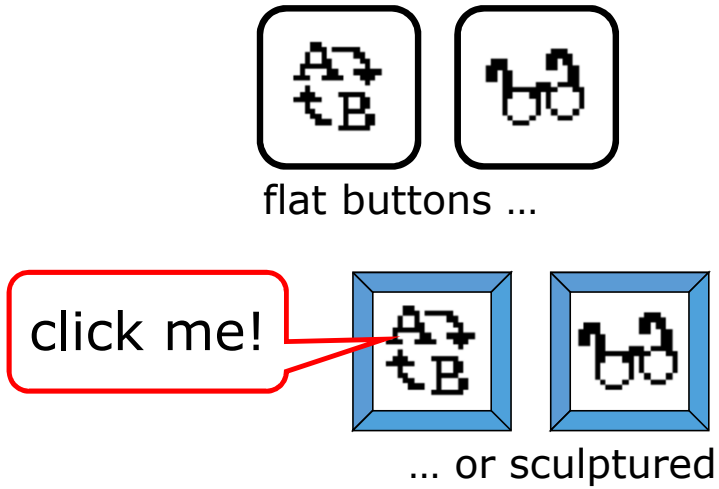
- Default style for majority of interactive computer systems, especially pcs and desktop machines

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



Elements of the wimp interface

- Windows, icons, menus, pointers
- Buttons, toolbars, palettes, dialog boxes

also see supplementary material
on choosing wimp elements

Windows

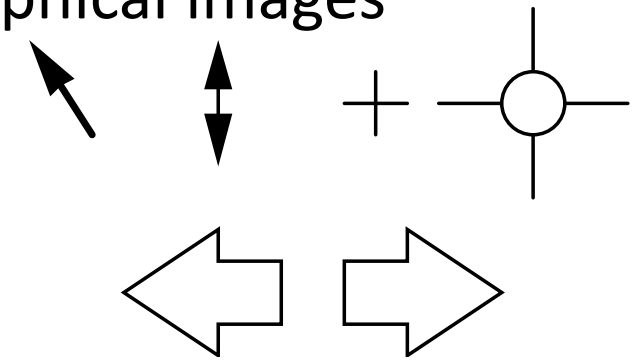
- Areas of the screen that behave as if they were independent
  - Can contain text or graphics
  - Can be moved or resized
  - Can overlap and obscure each other, or can be laid out next to one another (tiled)
- Scrollbars
  - Allow the user to move the contents of the window up and down or from side 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 many accessible windows
- Icons can be many and various
  - Highly stylized
  - Realistic representations.

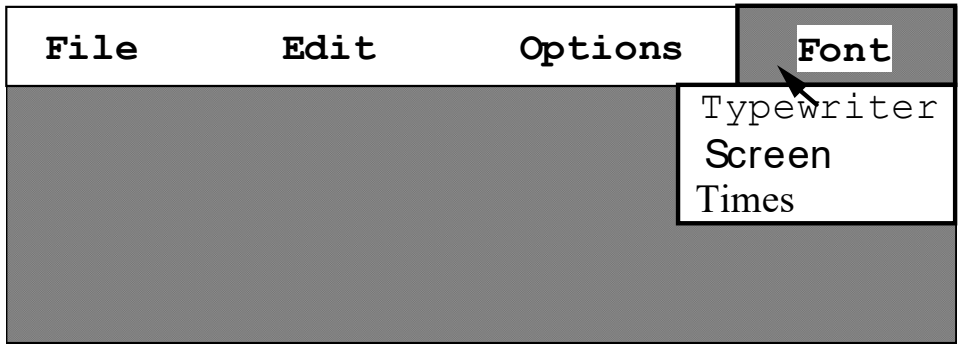
Pointers

- 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 - 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 - 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

  usually different !!!

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

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.

Interactivity

- Easy to focus on look
- What about feel?

Speech–driven interfaces

- Rapidly improving …
  … but still inaccurate

- How to have robust dialogue?
  … Interaction of course!

E.G. Airline reservation:
reliable “yes” and “no”
+ system reflects back its understanding
“you want a ticket from new york to boston?”

Look and … feel

- WIMP systems have the same elements:
  windows, icons., Menus, pointers, buttons, etc.

- But different window systems
  … *behave* differently

  E.G. Macos vs windows menus

Appearance + behaviour = look and feel

Initiative

- Who has the initiative?
  Old question–answer – computer
  WIMP interface – user

- Wimp exceptions …
  pre-emptive parts of the interface

- Modal dialog boxes
  - Come and won't go away!
  - Good for errors, essential steps
  - But use with care

Error and repair

Can’t always avoid errors …
… but we can put them right

Make it easy to *detect* errors
… then the user can *repair* them

hello, this is the Go Faster booking system
what would you like?
(user) *I want to fly from New York to London*
you want a ticket from New York to Boston
(user) *no*
sorry, please confirm one at a time
do you want to fly from New York
(user) yes
… … …

Context

Interaction affected by social and organizational context

- Other people
  - Desire to impress, competition, fear of failure
- Motivation
  - Fear, allegiance, ambition, self-satisfaction
- Inadequate systems
  - Cause frustration and lack of motivation

Experience, engagement and fun

designing experience
physical engagement
managing value

Experience?

- Home, entertainment, shopping
  - Not enough that people can use a system
  - They must want to use it!
- Psychology of experience
  - Flow ()
  - Balance between anxiety and boredom
- Education
  - Zone of proximal development
  - Things you can just do with help
- Wider ...
  - Literary analysis, film studies, drama

Designing experience

Physical design

- Many constraints:
  - Ergonomic – minimum button size
  - Physical – high-voltage switches are big
  - Legal and safety – high cooker controls
  - Context and environment – easy to clean
  - Aesthetic – must look good
  - Economic – … and not cost too much!

Design trade-offs

Constraints are contradictory … need trade-offs

Within categories:

- E.G. Safety – cooker controls
  - Front panel – safer for adult
  - Rear panel – safer for child

Between categories

- E.G. Ergonomics vs. Physical – minidisc remote
  - Ergonomics – controls need to be bigger
  - Physical – no room!
  - Solution – multifunction controls & reduced functionality

Fluidity

- Do external physical aspects reflect logical effect?
  - Related to affordance (chap 5)

Logical state revealed in physical state?

E.G. On/off buttons

Inverse actions inverse effects?

E.G. Arrow buttons, twist controls

Inverse actions

- Yes/no buttons
  - Well sort of
- ‘Joystick’
- Also left side control

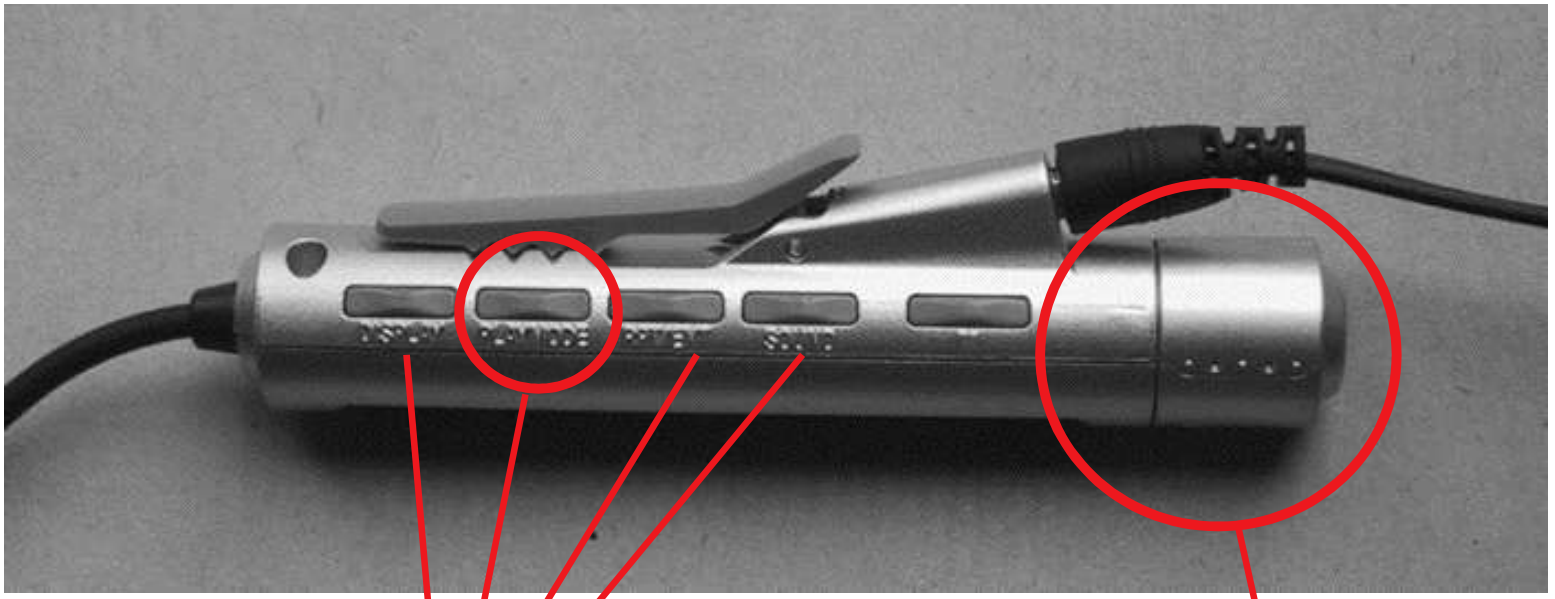
Spring back controls

- One-shot buttons
- Joystick
- Some sliders

Good – large selection sets

Bad – hidden state

A minidisk controller



Series of spring-back controls
Each cycle through some options
–Natural inverse back/forward

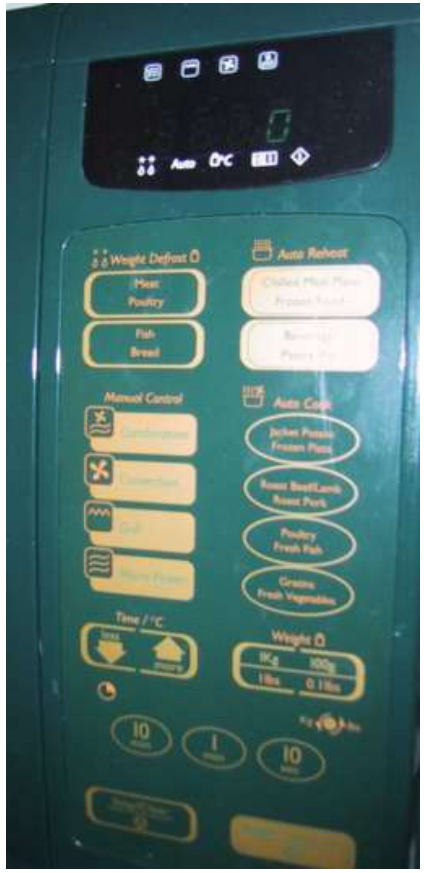
Twist for track movement
Pull and twist for volume
– Spring back
– Natural inverse for twist

Physical layout

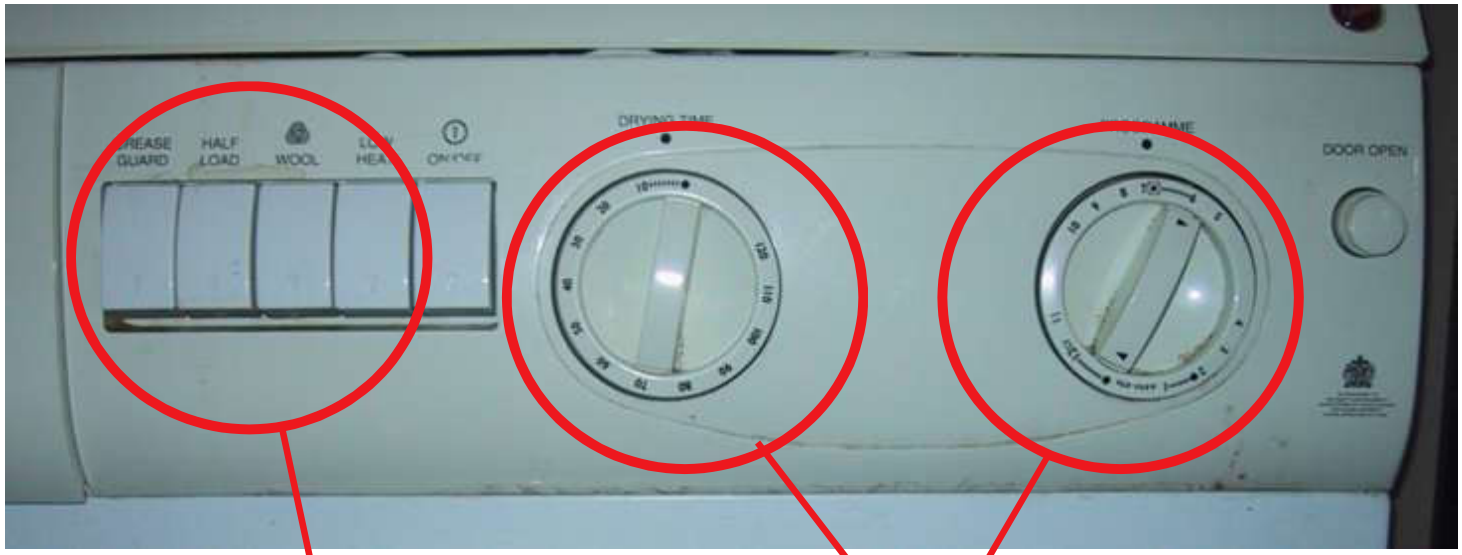
Controls:

Logical relationship

~ spatial grouping



Compliant interaction



State evident in mechanical buttons

Rotary knobs reveal internal state and can be controlled by both user and machine

Managing value

People use something

ONLY IF

it has perceived value

AND

value exceeds cost

But note

- Exceptions (e.G. Habit)
- Value **NOT** necessarily personal gain or money

Weighing up value

Value

- Helps me get my work done
- Fun
- Good for others

Cost

- Download time
- Money £, $, €
- Learning effort

Discounted future

- In economics net present value:
  - Discount by $(1+\text{rate})^{\text{years to wait}}$
- In life people heavily discount
  - Future value and future cost
  - Hence resistance to learning
  - Need low barriers
    and high perceived present value

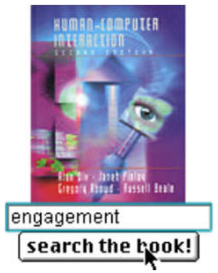
Example – HCI book search

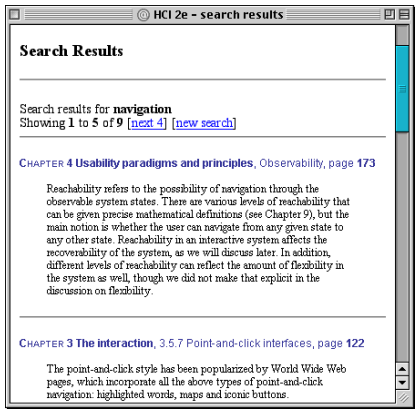
- Value for people *who have* the book
  helps you to look up things
  - Chapter and page number

- Value for those *who don't* …
  sort of online mini-encyclopaedia
  - Full paragraph of context

… But also says "buy me"!!

… But also says "buy me"!!





Value and organisational design

- Coercion
  - Tell people what to do!
  - Value = keep your job
- Enculturation
  - Explain corporate values
  - Establish support (e.G share options)
- Emergence
  - Design process so that individuals value $\rightarrow$ organisational value

General lesson …

if you want someone to do something …

- make it easy for them!
- understand their values