

Human Computer Interaction

# INTERACTION STYLE

By: Nguyễn Công Hoan

# Reference

- Donald Norman, **The Design of Everyday Things**, MIT Press, 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

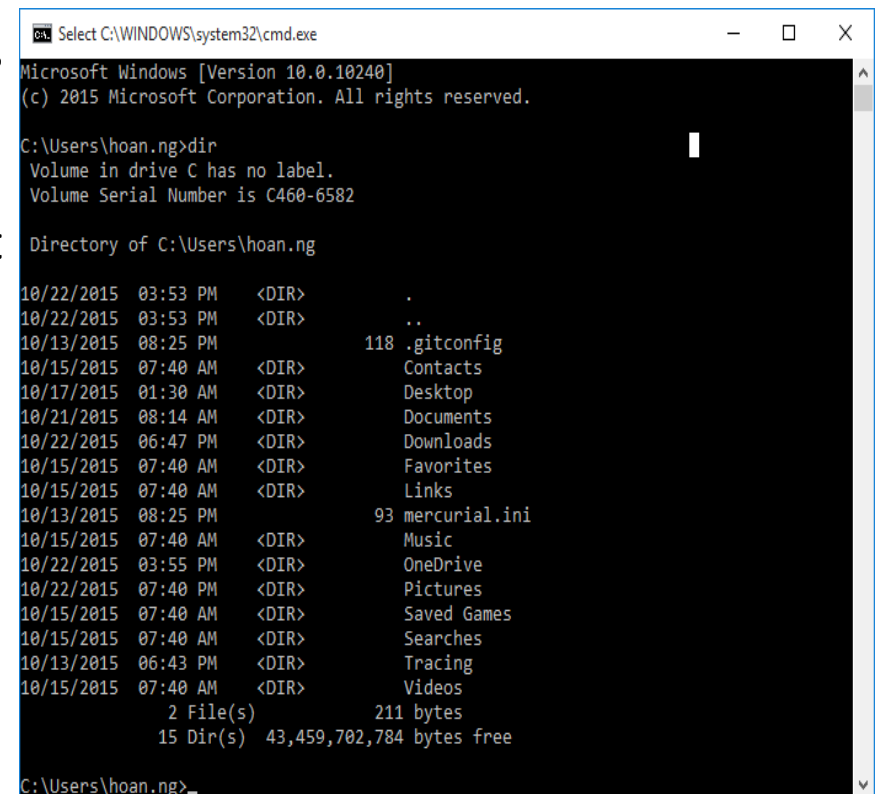
- Interaction refers to a dialogue generated by the command and data, input to the computer and the display, output of the computer and the sensory/perceptual input to the human and motor response output of the human.
- There are number of ways in which the user can communicate with the system, batch 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



```
Select C:\WINDOWS\system32\cmd.exe
Microsoft Windows [Version 10.0.10240]
(c) 2015 Microsoft Corporation. All rights reserved.

C:\Users\hoan.ng>dir
Volume in drive C has no label.
Volume Serial Number is C460-6582

Directory of C:\Users\hoan.ng

10/22/2015  03:53 PM  <DIR>          .
10/22/2015  03:53 PM  <DIR>          ..
10/13/2015  08:25 PM                118 .gitconfig
10/15/2015  07:40 AM  <DIR>          Contacts
10/17/2015  01:30 AM  <DIR>          Desktop
10/21/2015  08:14 AM  <DIR>          Documents
10/22/2015  06:47 PM  <DIR>          Downloads
10/15/2015  07:40 AM  <DIR>          Favorites
10/15/2015  07:40 AM  <DIR>          Links
10/13/2015  08:25 PM                93 mercurial.ini
10/15/2015  07:40 AM  <DIR>          Music
10/22/2015  03:55 PM  <DIR>          OneDrive
10/22/2015  07:40 PM  <DIR>          Pictures
10/15/2015  07:40 AM  <DIR>          Saved Games
10/15/2015  07:40 AM  <DIR>          Searches
10/13/2015  06:43 PM  <DIR>          Tracing
10/15/2015  07:40 AM  <DIR>          Videos
                2 File(s)                211 bytes
               15 Dir(s)  43,459,702,784 bytes free

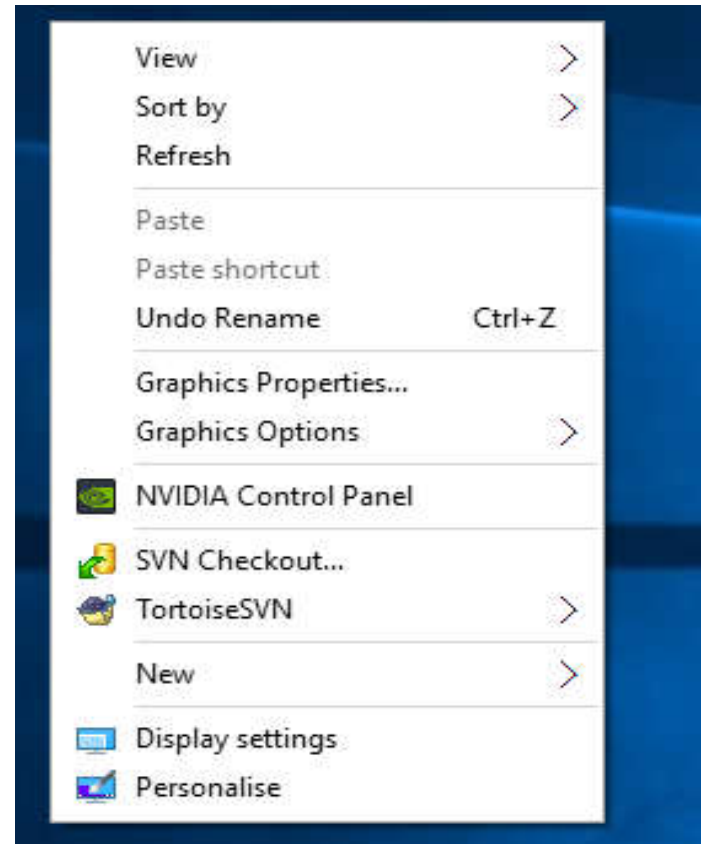
C:\Users\hoan.ng>
```

# Menu Driven

A menu-driven interface refers to programs whose interfaces employ 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 menu is 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*

*Cultures*

*Disabilities*

*Accessibilities*

# Age

A person's age greatly influences the adaptations 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

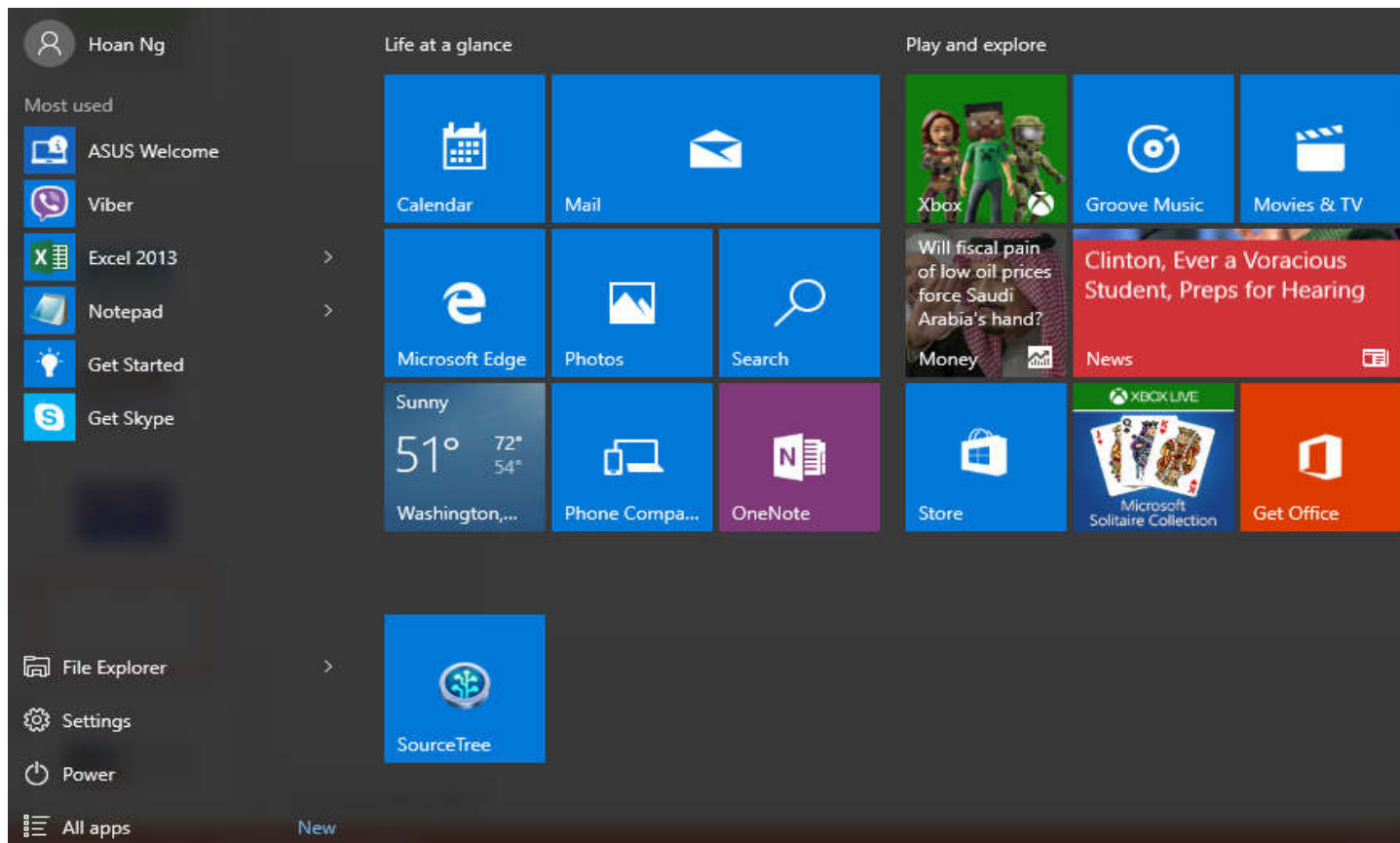


- ✓ Icons are large (for people with poor vision)
- ✓ Colours have to have a matching scheme
- ✓ Menus should not appear too childish
- ✓ Interface should be designed to facilitate customisation

# Age (cont.)

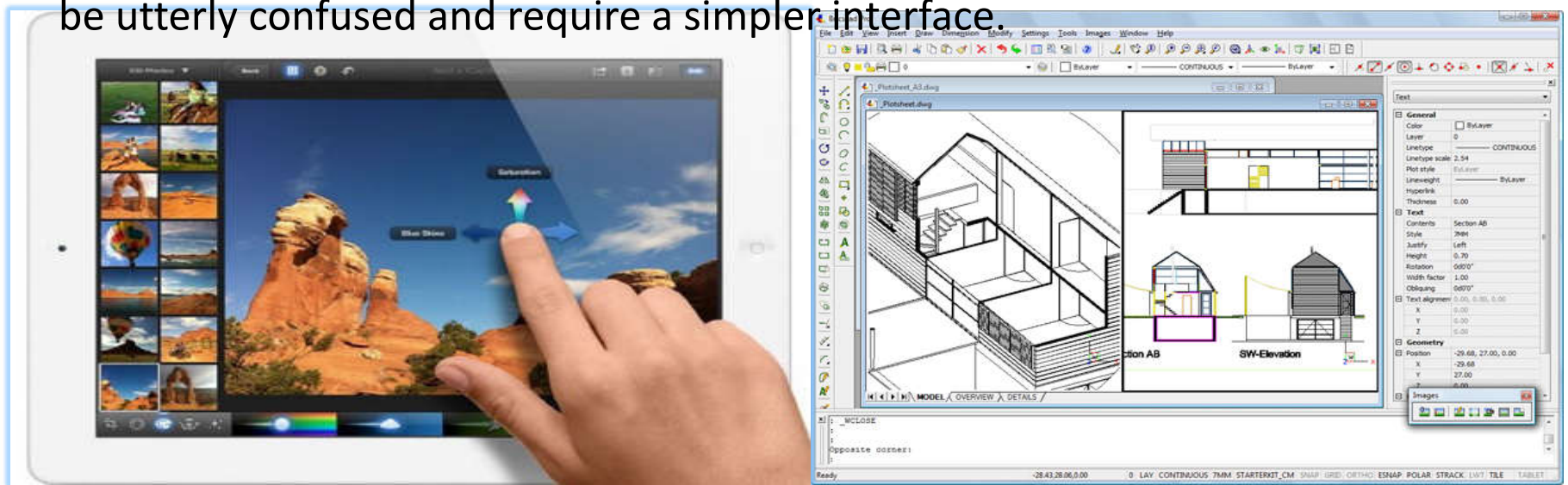


# Age (cont.)



# 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

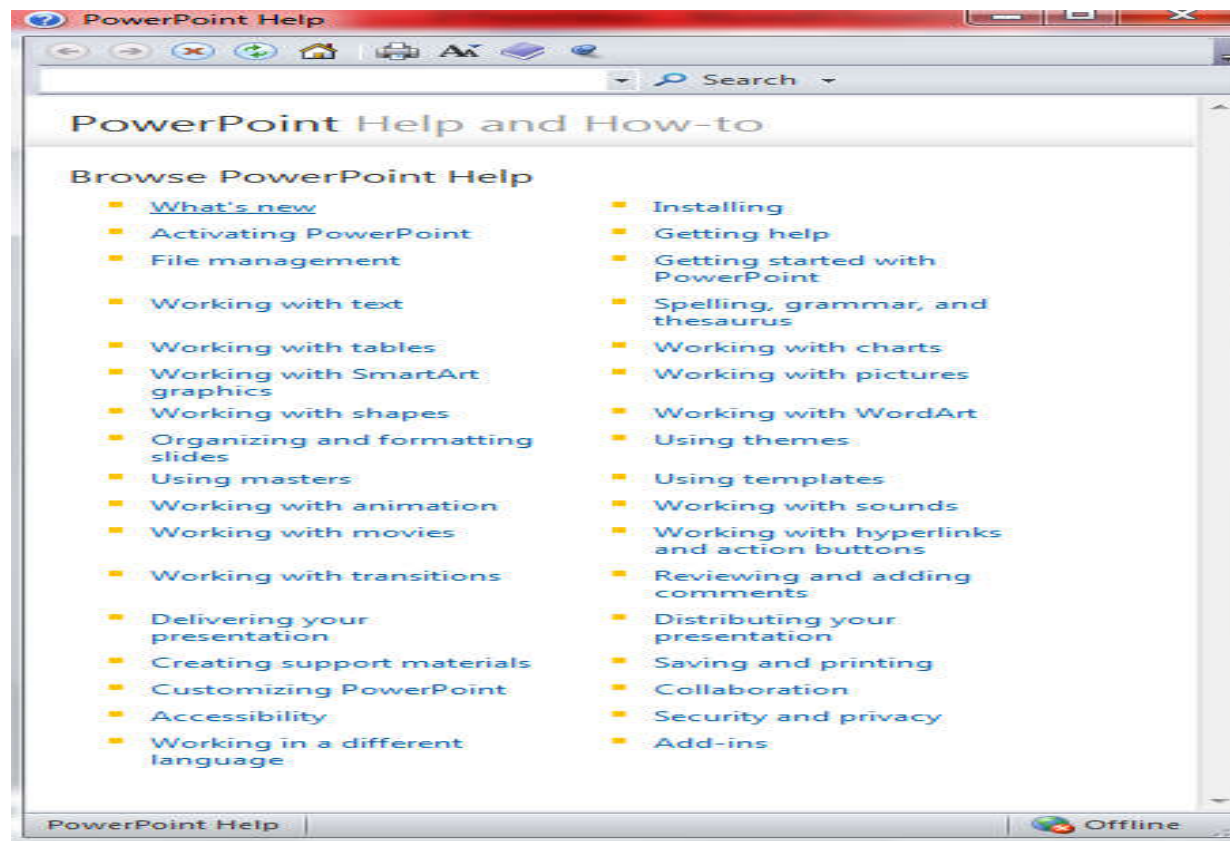
A user's culture may sometimes govern how an interface is designed. We can analyse this by contrasting interfaces for English and Arabic users.

<i>English Interface</i>	<i>Arabic Interface</i>
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

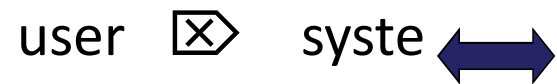


# The Interaction

- 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



but is that all ... ?

- see “language and action” in chapter 4 ...

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 ...

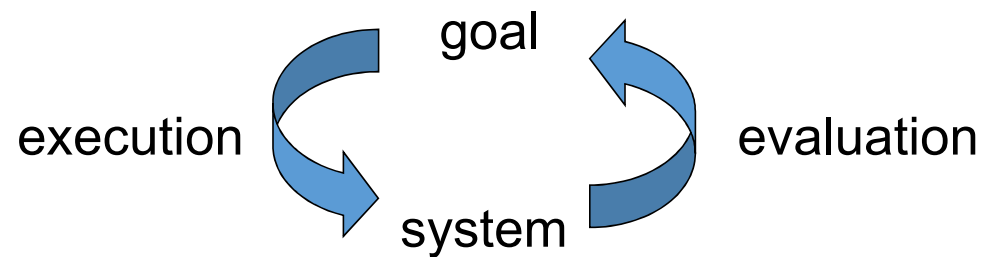
- traditional interaction ...
- use of terms differs a lot especially task/goal !!!



# Donald Norman's model

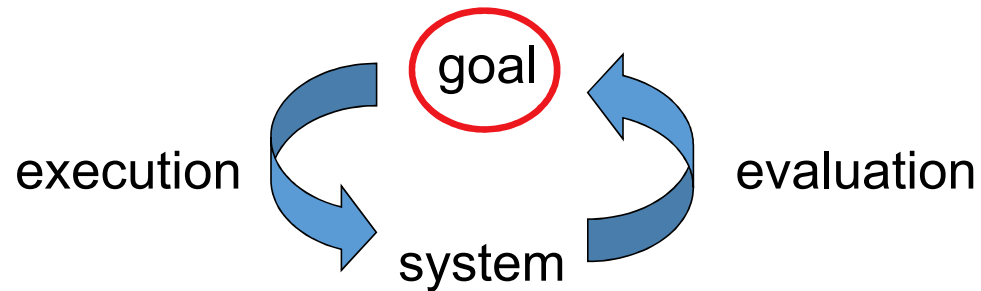
- Seven stages
  - user establishes the goal
  - formulates intention
  - specifies actions at interface
  - executes action
  - perceives system state
  - interprets system state
  - evaluates system state with respect to goal
- Norman's model concentrates on user's view of the interface

# execution/evaluation loop



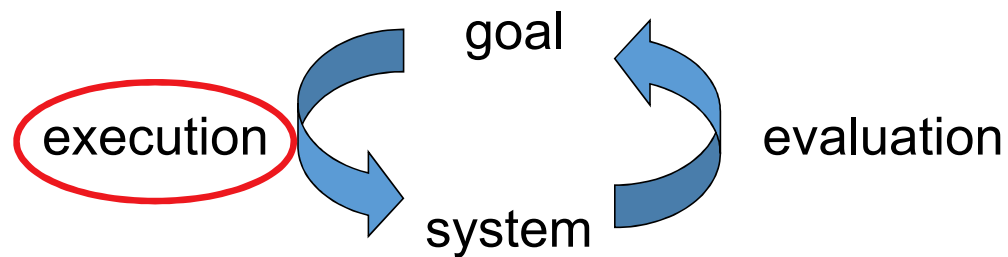
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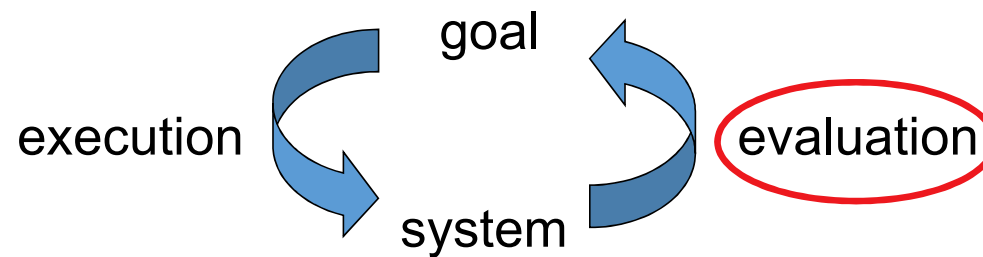
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# execution/evaluation loop



- user establishes the goal
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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

# Abowd and Beale framework

extension of Norman...

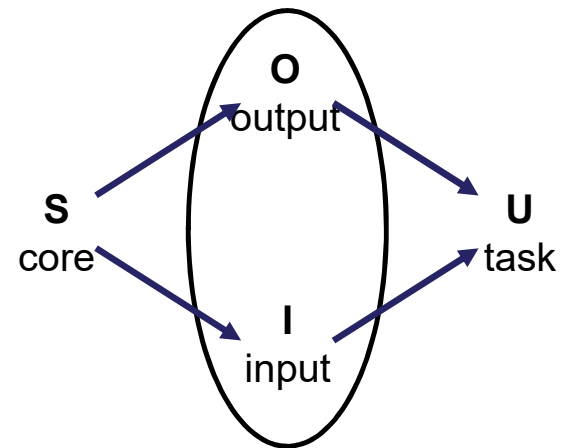
their interaction framework has 4 parts

- 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?

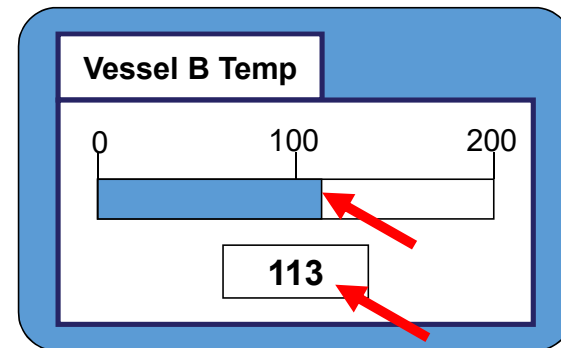
Context matters!

	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

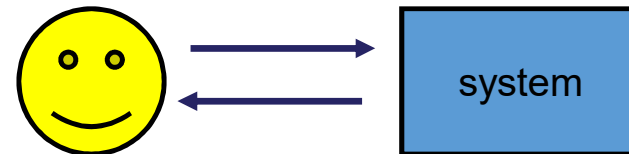


multiple representations  
of same information

# Indirect manipulation

- office– direct manipulation

- user interacts  
with artificial world

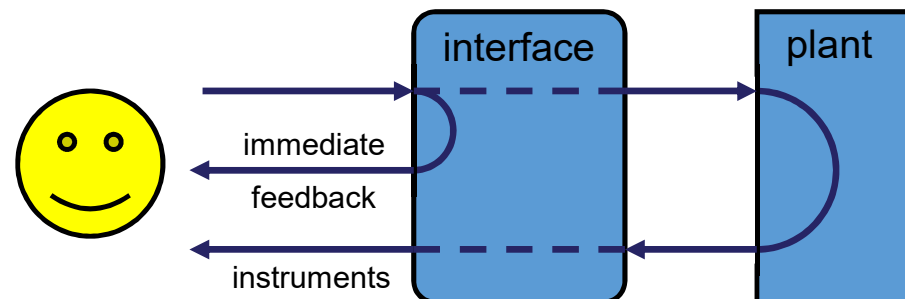


- industrial – indirect manipulation

- 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

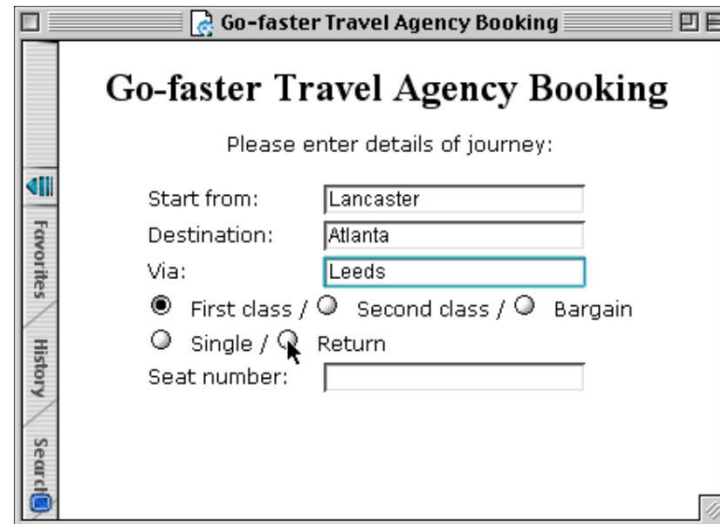
- Familiar to user
- speech recognition or typed natural language
- Problems
  - vague
  - ambiguous
  - hard to do well!
- Solutions
  - try to understand a subset
  - pick on key words

# 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



The screenshot shows a web browser window with the title "Go-faster Travel Agency Booking". The main heading is "Go-faster Travel Agency Booking". Below it, the text "Please enter details of journey:" is displayed. The form contains the following fields and options:

- Start from: Lancaster
- Destination: Atlanta
- Via: Leeds
- First class / Second class / Bargain (radio buttons)
- Single / Return (radio buttons)
- Seat number: [empty text box]

A vertical sidebar on the left contains the following links: Favorites, History, and Search.

# 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

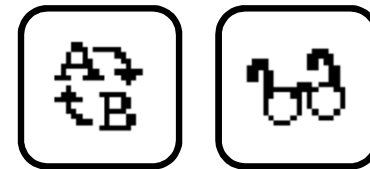


# Point and click interfaces

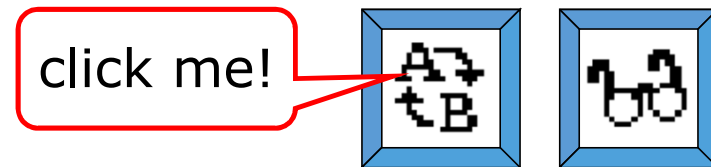
- used in ..
  - multimedia
  - web browsers
  - hypertext
- just click something!
  - icons, text links or location on map
- minimal typing

# 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 ...



... 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

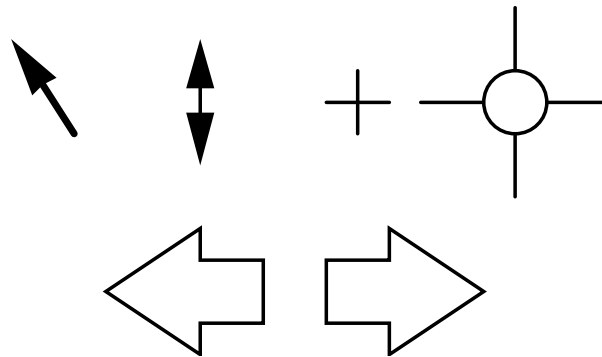
- Areas of the screen that behave as if they were independent
  - can contain text or graphics
  - can be moved or resized
  - can overlap and obscure each other, or can be laid out next to one another (tiled)
- scrollbars
  - allow the user to move the contents of the window up and down or from side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

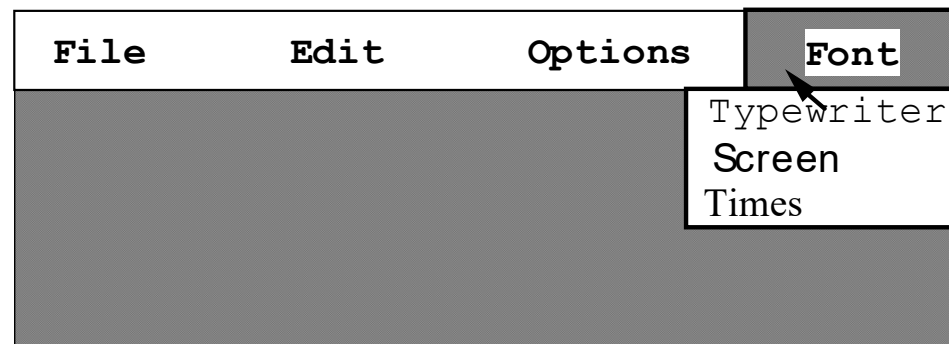
# Pointers

- 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

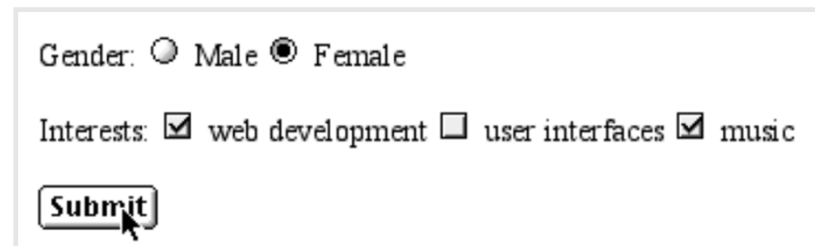
- Cascading menus
    - hierarchical menu structure
    - menu selection opens new menu
    - and so in ad infinitum
  - Keyboard accelerators
    - key combinations - same effect as menu item
    - two kinds
      - active when menu open – usually first letter
      - active when menu closed – usually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



Gender: ☐ Male ☒ Female

Interests: ☒ web development ☐ user interfaces ☒ music

- 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 (Csikszentimihalyi)
  - 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



- real crackers
  - cheap and cheerful!
  - bad joke, plastic toy, paper hat
  - pull and bang

# Designing experience



- virtual crackers
  - cheap and cheerful
  - bad joke, web toy, cut-out mask
  - click and bang

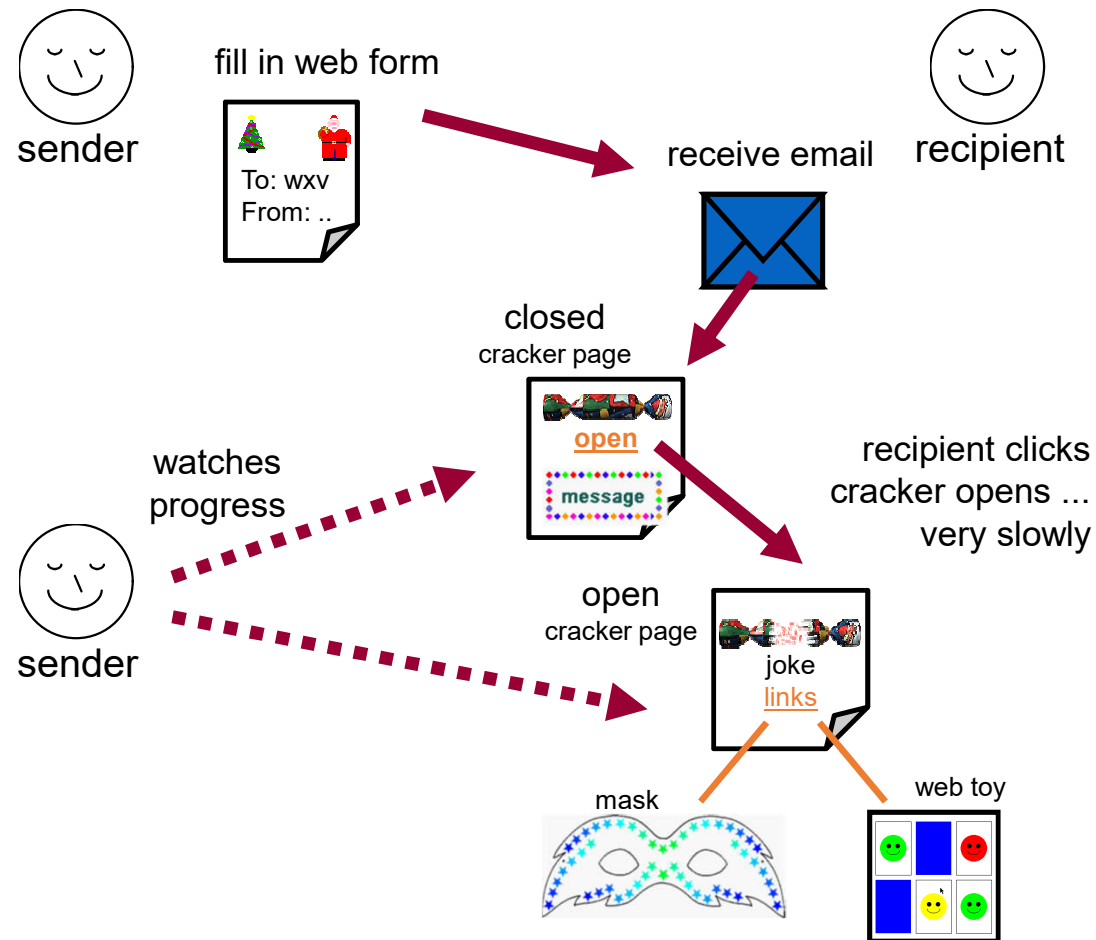


# Designing experience



- virtual crackers
  - cheap and cheerful
  - bad joke, web toy, cut-out mask
  - click and bang

# how crackers work



# The crackers experience

	real cracker	virtual cracker	
Surface elements			
design	cheap and cheerful	simple page/graphics	
play	plastic toy and joke	web toy and joke	
dressing up	paper hat	mask to cut out	
Experienced effects			
shared	offered to another	sent by email message	
co-experience	pulled together	sender can't see content	until opened
by recipient			
excitement	cultural connotations	recruited expectation	
hiddenness	contents inside	first page - no contents	
suspense	pulling cracker	slow ... page change	
surprise	bang (when it works)	WAV file (when it works)	

# 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

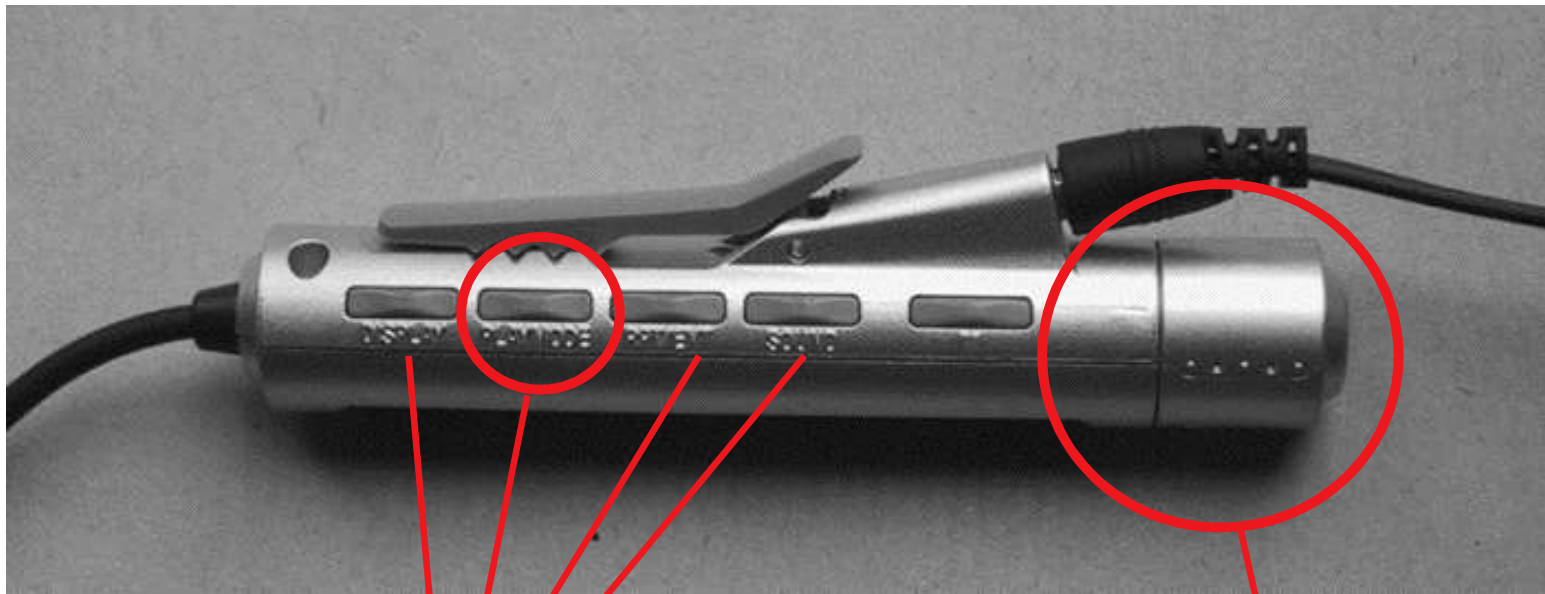
good – large selection sets

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:

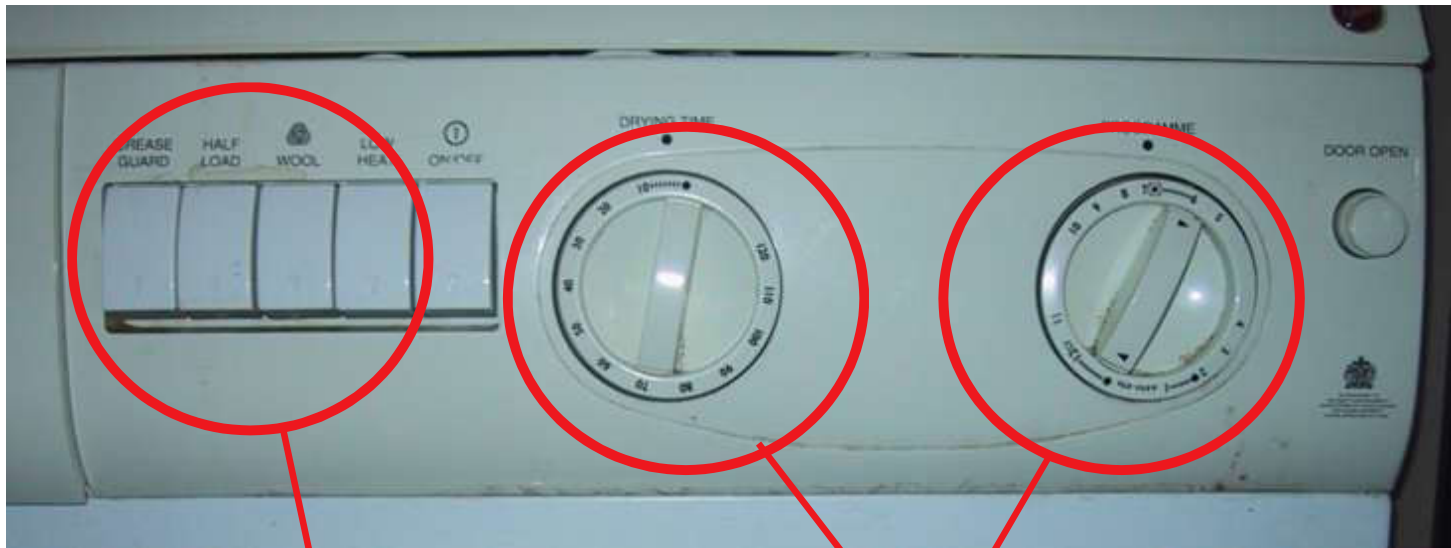
logical relationship

~

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

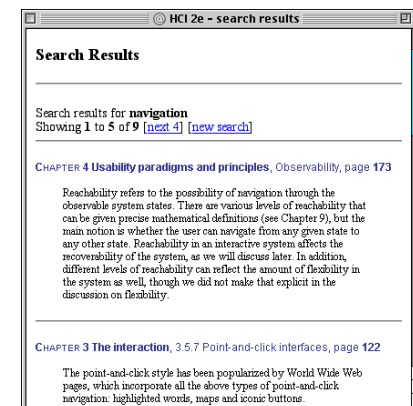
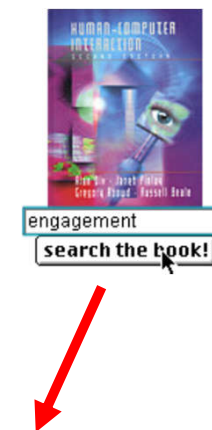
- in economics Net Present Value:
  - discount by  $(1+\text{rate})^{\text{years to wait}}$
- in life people heavily discount
  - future value and future cost
  - hence resistance to learning
  - need low barriers  
and high perceived present value

# 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”!!

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# 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 → organisational value



# General lesson ...

if you want someone to do something ...

- make it easy for them!
- understand their values