# The Interaction

# Intended Learning Outcomes

At the end of the lesson, students should be able to

1. Understand how the user must communicate his requirements to the computer;
2. Discuss some models of interaction;
3. Survey different styles of interaction that consider how well they support the user.

# The Interaction

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

# What is interaction?

communication

user ⟺ system

# 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

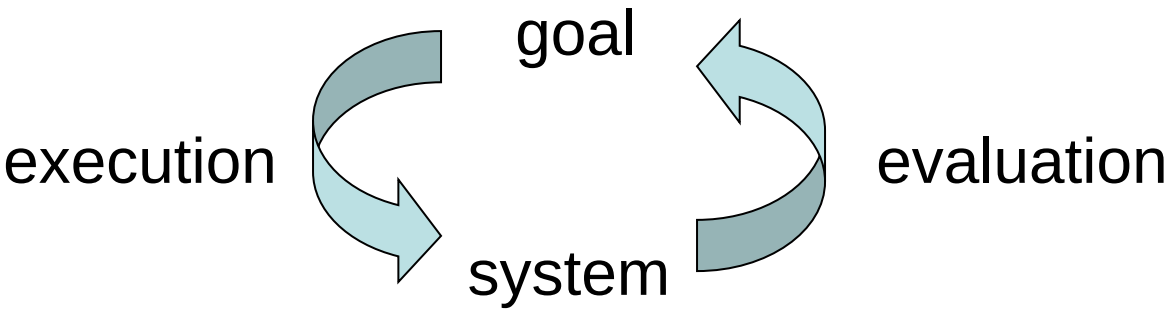
e.g. … select fill tool, click over triangle

**Intention** - is a specific action required to meet the goal.

# Donald Norman's model

- Seven stages of actions
  - 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

# This led to formulation of Stages of Execution and Evaluation

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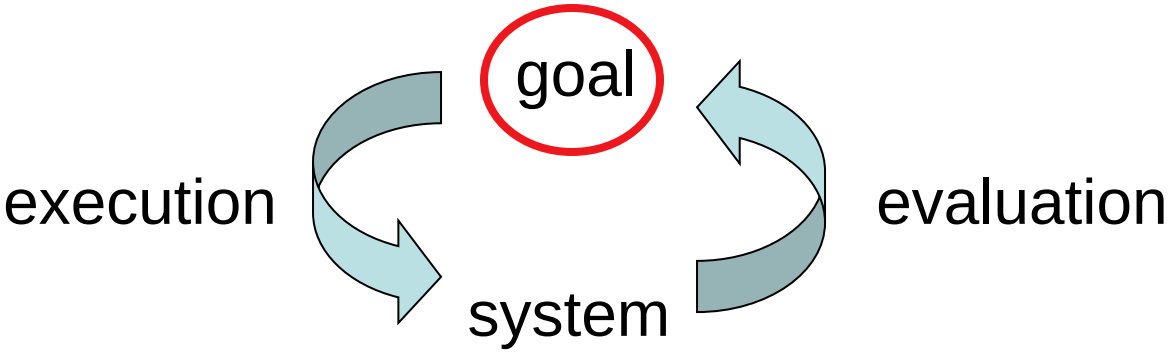


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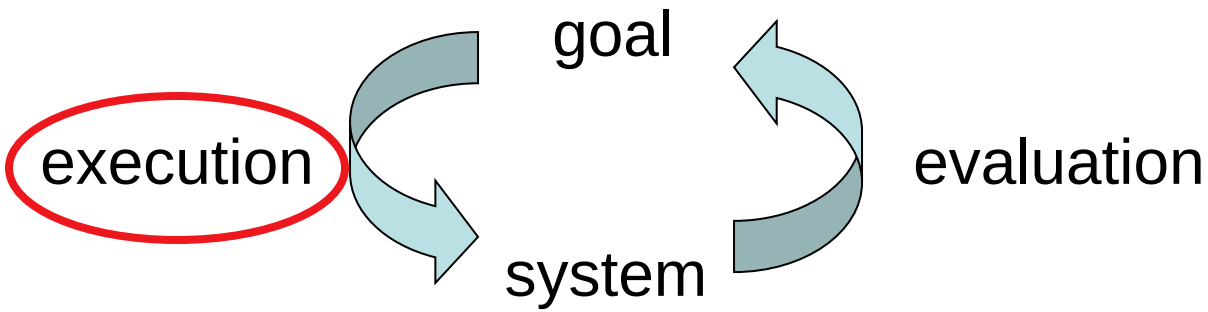


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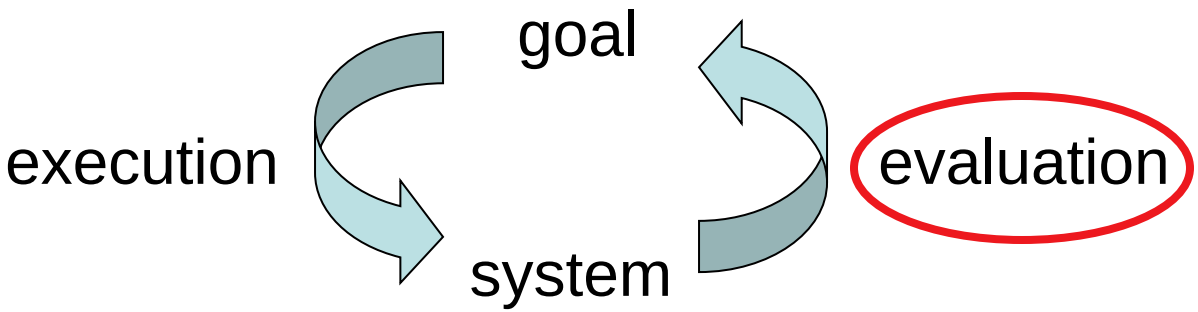


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# Using Norman's model

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

# Slip

- People do know what to do, in fact that may have successfully done this thing before many times, but they still make an error


accidentally typing a wrong word when you're writing a text, even though you know how to spell it

**WRONLGY**

leaving your change in a chocolate vending machine

# Mistakes

- people don't know what to do because they haven't learned or been taught to use something properly

trying to use an old Xbox game controller like a motion-sensitive Wiimote and gesturing with it in the air when you need to press the buttons

# Abowd and Beale framework

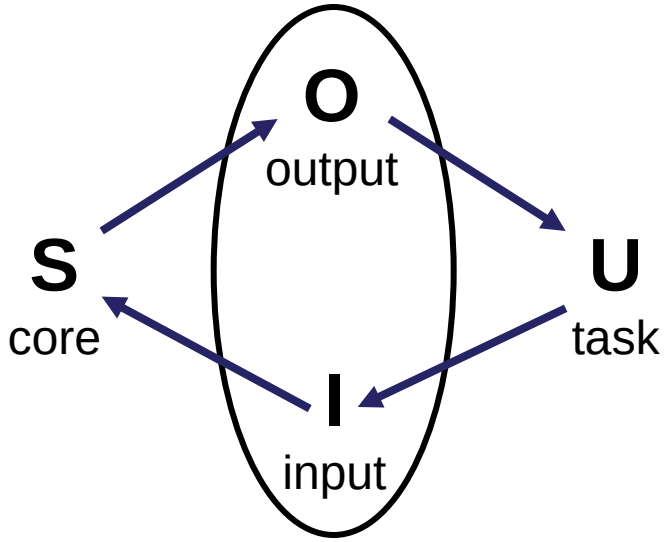
extension of Norman…

The node represent the four major components of an interactive system
- user
- input
- system
- output

Each component has its own unique language

interaction ⇒ translation between languages

problems in interaction = problems in translation




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

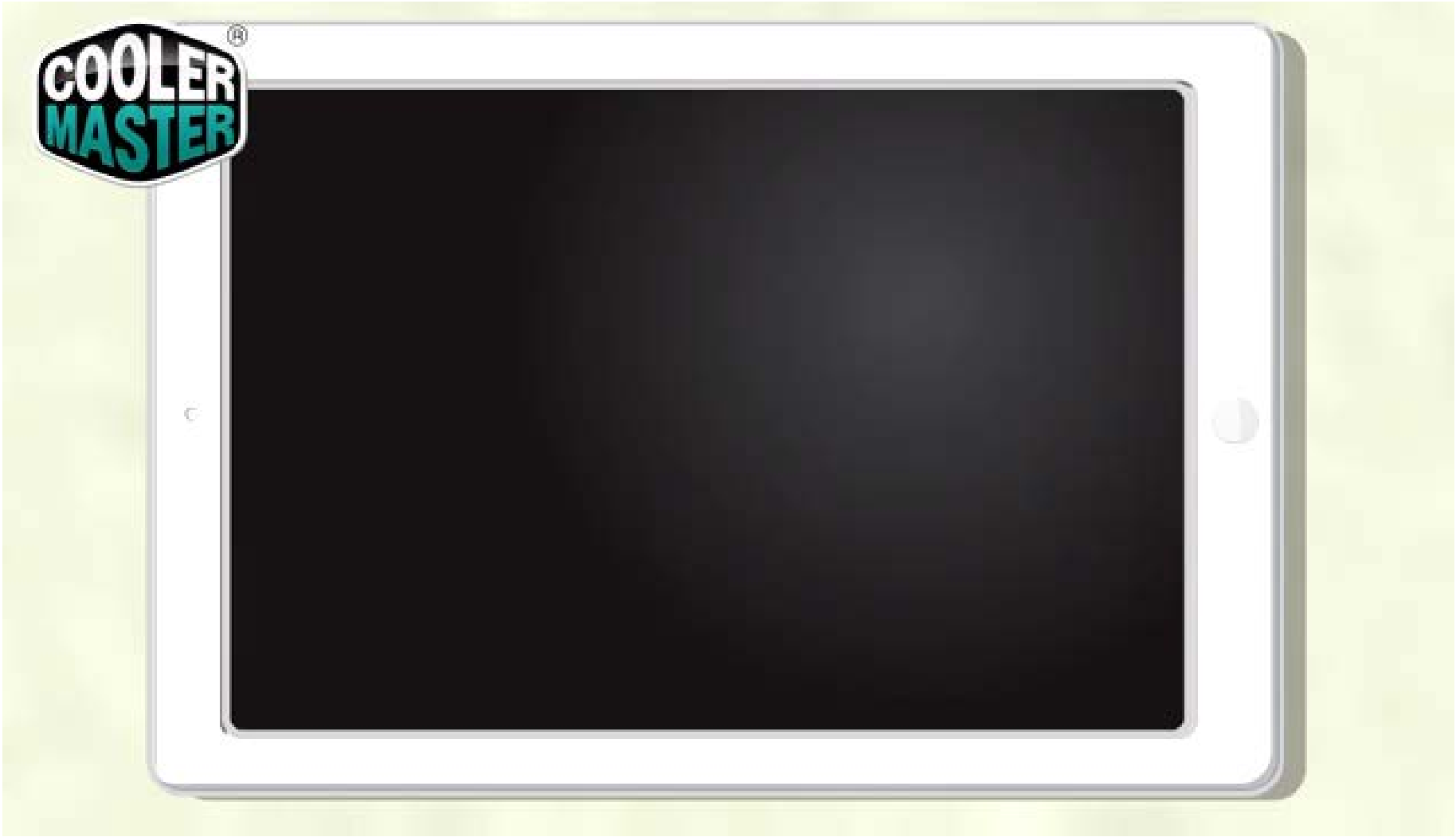
# ergonomics

physical aspects of interfaces

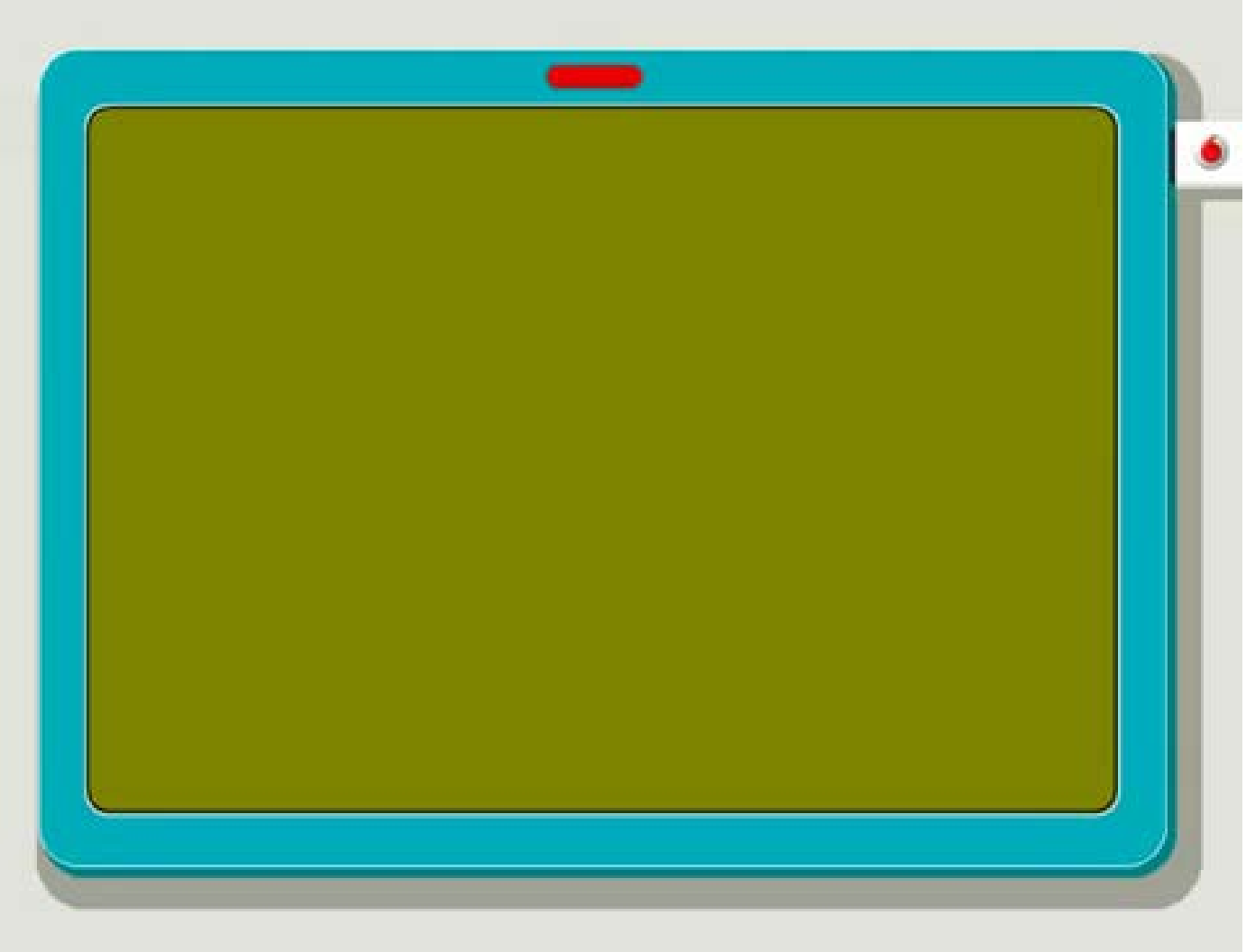
industrial interfaces

https://www.youtube.com/watch?v=LAKlmdMHpdE

# Ergonomics



# Laptop Ergonomics - Basic Tips - Adult or Child Laptop Use at Home, Work or School



# Ergonomics

Ergonomics 101

https://www.youtube.com/watch?v=PZWSc5EWDoA

Laptop Ergonomics - Basic Tips - Adult or Child Laptop Use at Home, Work or School

https://www.youtube.com/watch?v=ZLwIP8cBaWA

# 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?

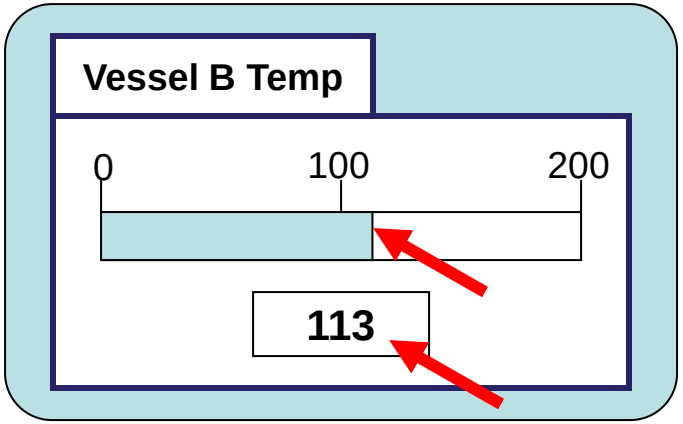
Environment matters!

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

... the oil soaked mouse!

# Glass interfaces ?

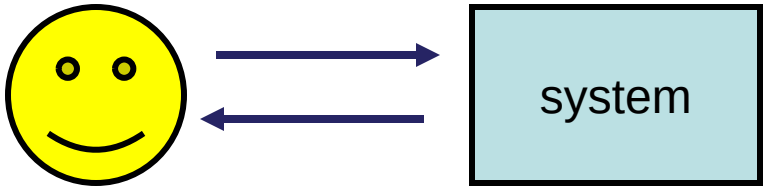
- industrial interface:
  - traditional ... dials and knobs
  - now ... screens and keypads
- glass interface
  - \+ cheaper, more flexible, multiple representations, precise values
  - – not physically located, loss of context, complex interfaces
- may need both



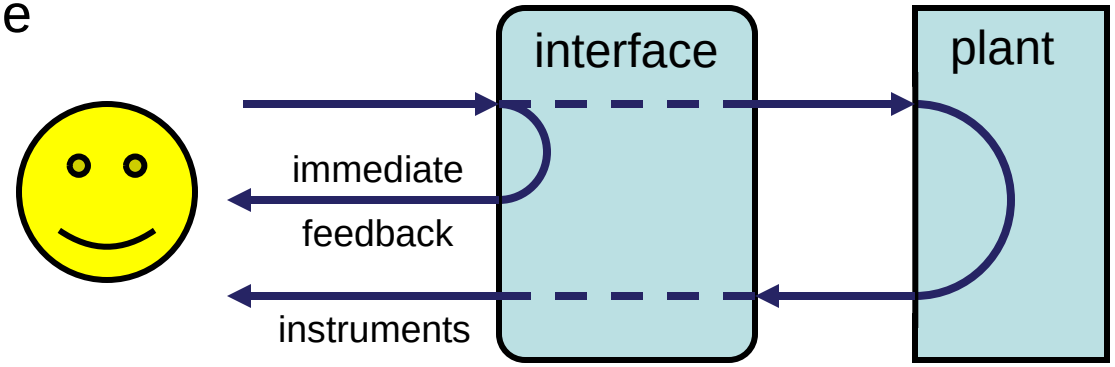

multiple representations of same information

# 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

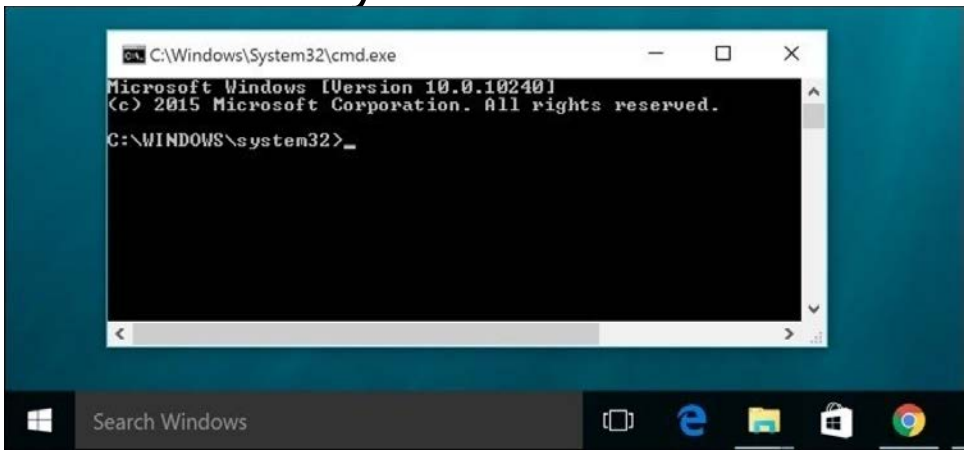
- command line interface
- menus
- natural language
- question/answer and query dialogue
- form-fills and spreadsheets
- WIMP
- point and click
- three–dimensional interfaces

# Command line interface

- Way of expressing instructions to the computer directly
  - function keys, single characters, short abbreviations, whole words, or a combination

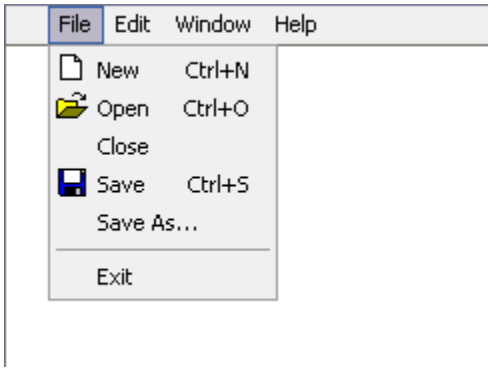
- suitable for repetitive tasks
- better for expert users than novices
- offers direct access to system functionality
- command names/abbreviations should be meaningful!

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

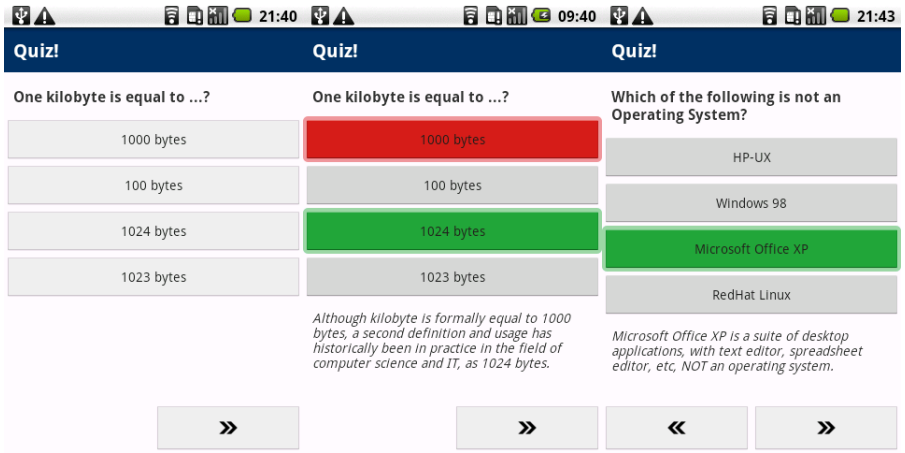


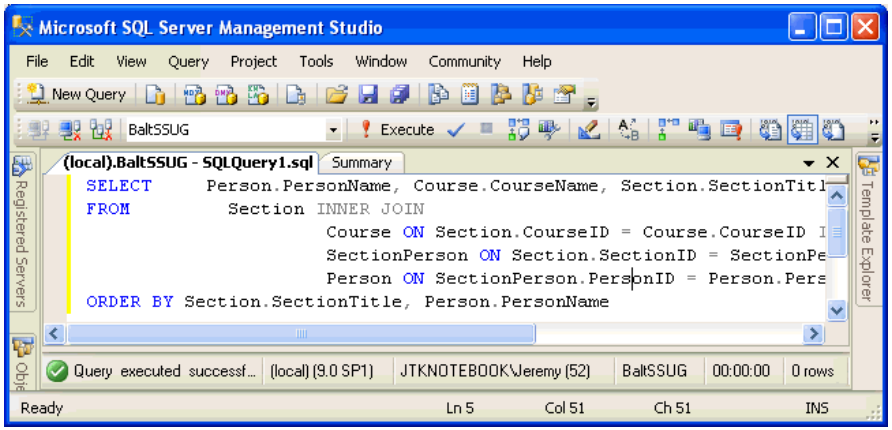
# Natural language

- 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

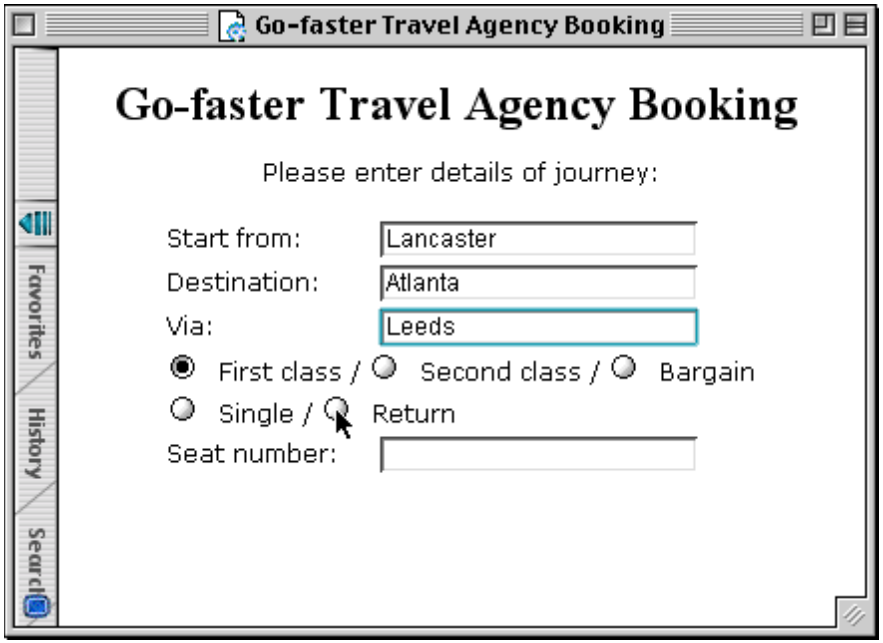
- Question/answer interfaces
  - user led through interaction via series of questions
  - suitable for novice users but restricted functionality
  - often used in information systems
- Query languages (e.g. SQL)
  - used to retrieve information from database
  - requires understanding of database structure and language syntax, hence requires some expertise



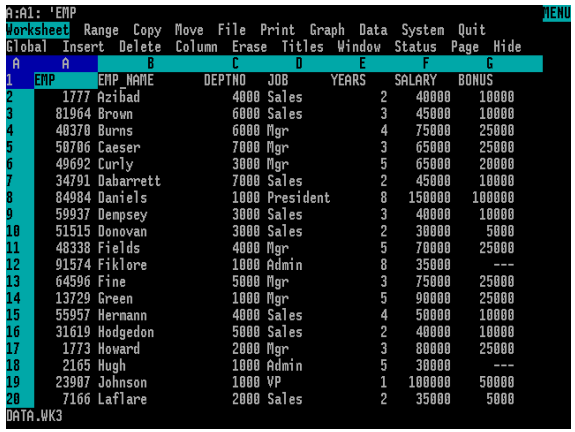
# Form-fills

- 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


Lotus 1-2-3

# WIMP Interface

Windows

Icons

Menus

Pointers

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

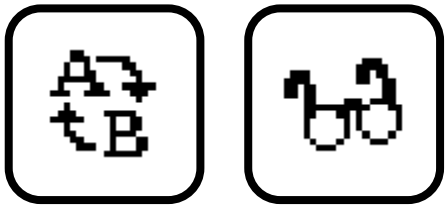
- default style for majority of interactive computer systems, especially PCs and desktop machines

# Point and click interfaces

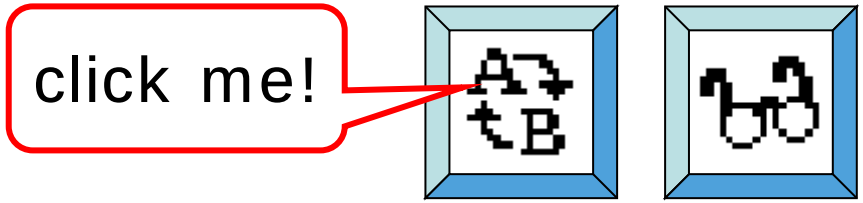
- used in ..
  - multimedia
  - web browsers
  - hypertext
- just click something!
  - icons, text links or location on map
- minimal typing

# 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

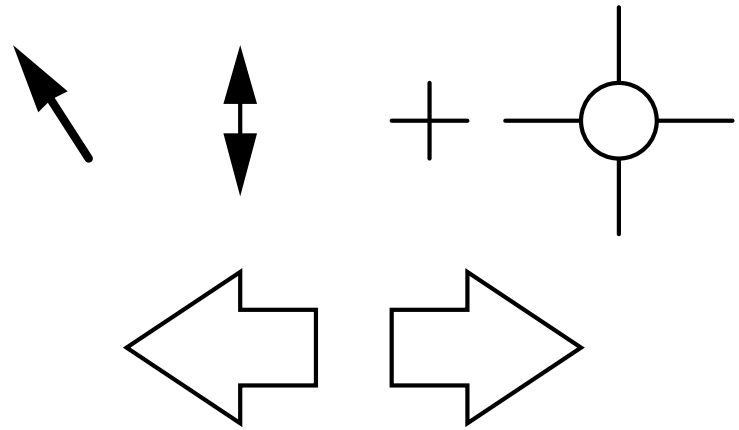
- Areas of the screen that behave as if they were independent
  - can contain text or graphics
  - can be moved or resized
  - can overlap and obscure each other, or can be laid out next to one another (tiled)
- scrollbars
  - allow the user to move the contents of the window up and down or from side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

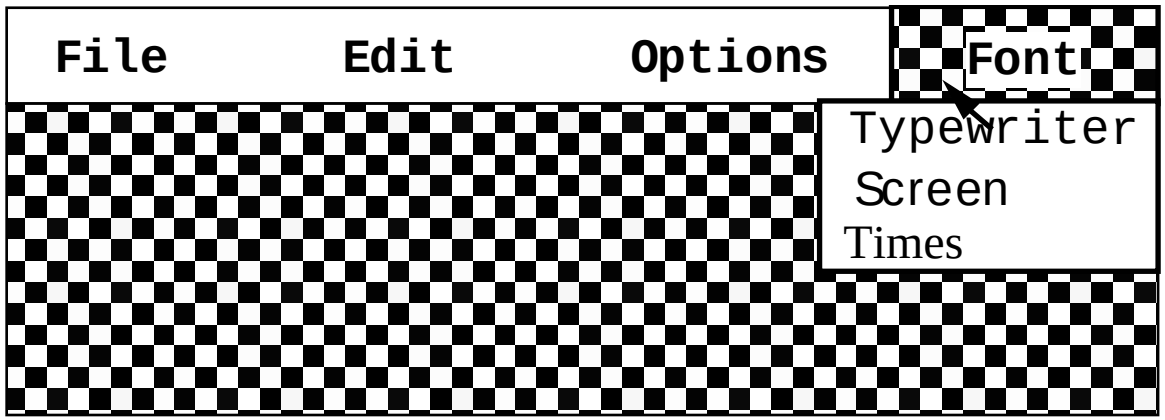
# Pointers

- 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



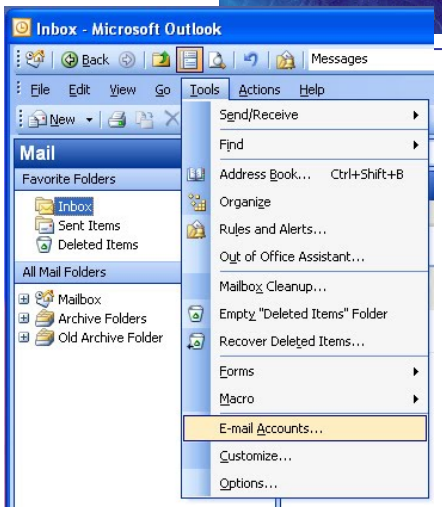

problem – take a lot of screen space

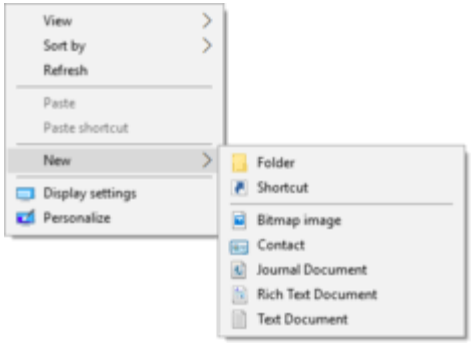
solution – pop-up: menu appears when needed

# 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!
- Context menu appears upon user interaction, such as a right-click mouse operation
  - 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)

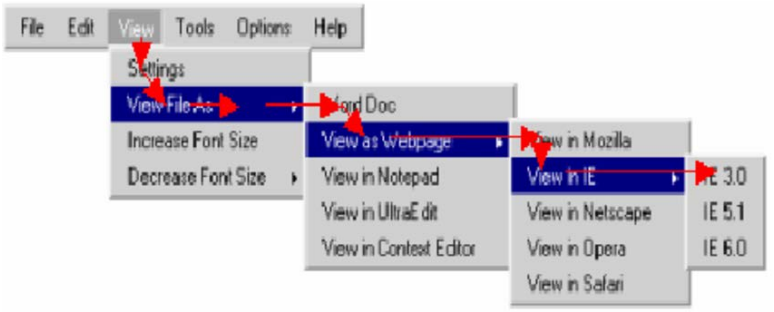
    … but not widely used!



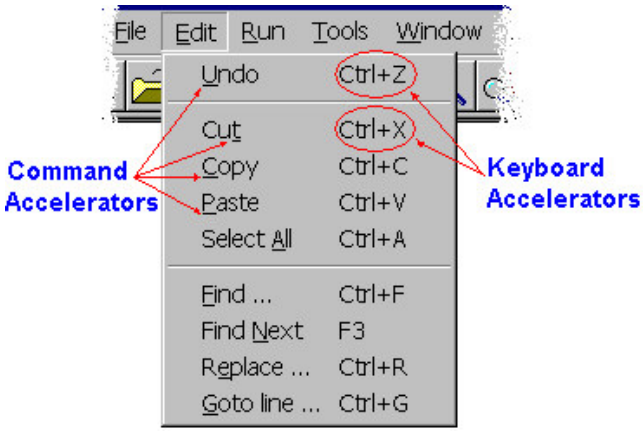

# Menus extras

- 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 !!!

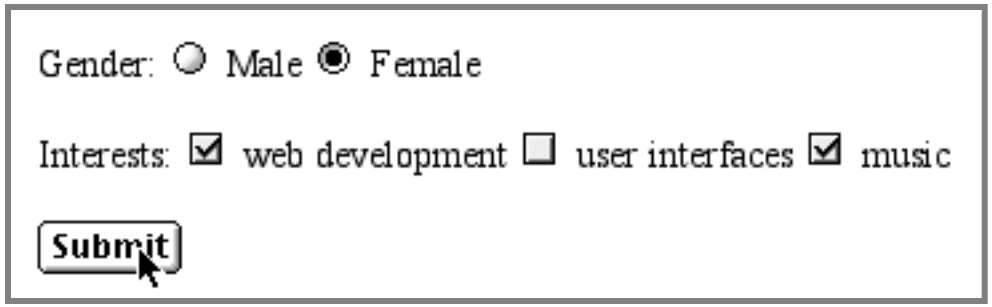


# Menus design issues

- 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

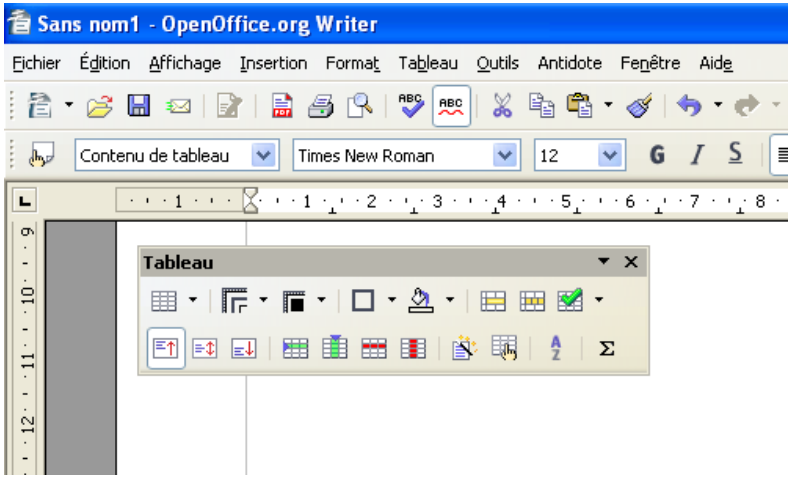
- individual and isolated regions within a display that can be selected to invoke an action




- 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

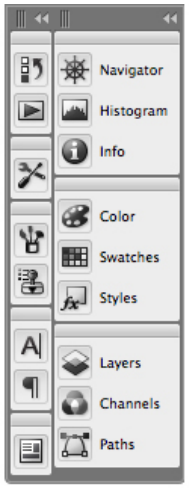


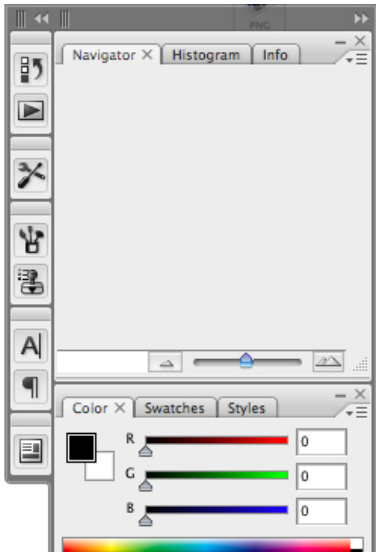
# Palettes and tear-off menus

- 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

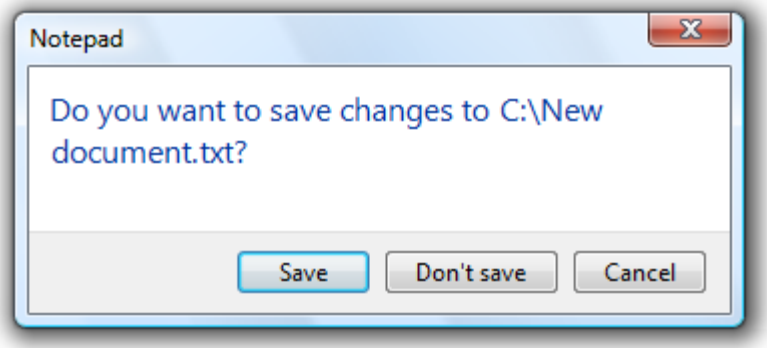


# Dialogue boxes

- 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.



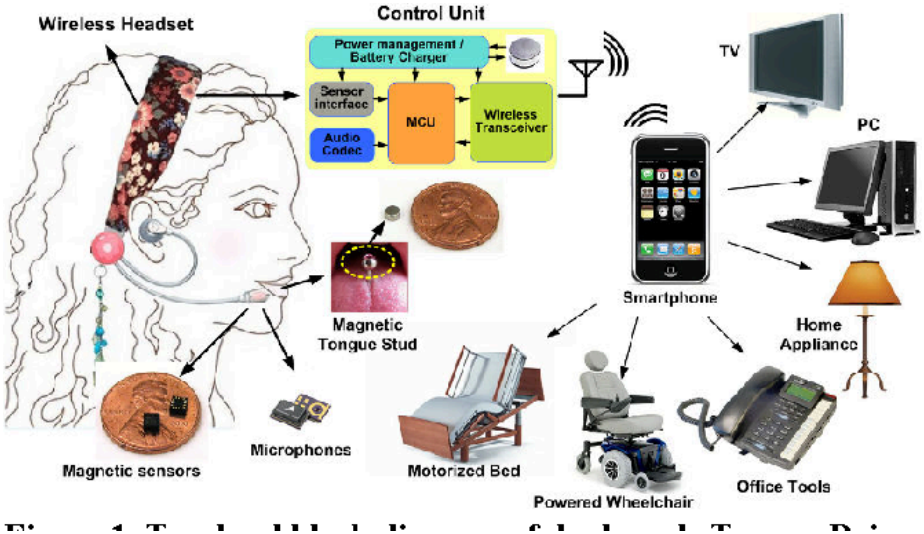
# interactivity

easy to focus on look

what about feel?

# Speech-driven interfaces

- rapidly improving …
  … but still inaccurate
- how to have robust dialogue?
  … interaction of course!



# 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

# Experience, engagement and fun

designing experience

physical engagement

managing value

# 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
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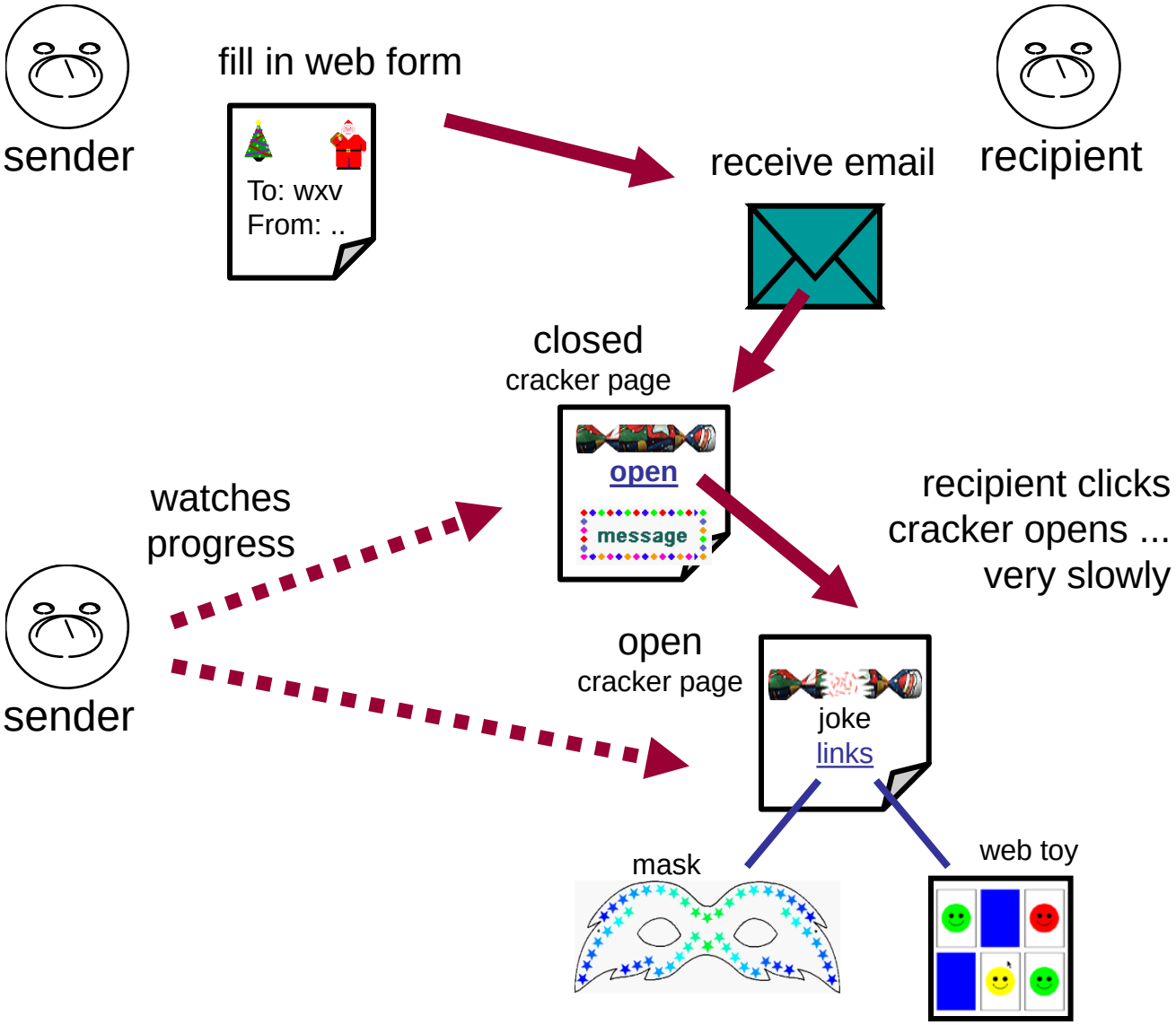
# how crackers work



# 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 meanings | 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

Designers are faced with many constraints

- **Ergonomic** You cannot physically push buttons if they are too small or too close.
- **Physical** The size or nature of the device may force certain positions or styles of control, for example, a dial like the one on the washing machine would not fit on the MiniDisc controller; high-voltage switches cannot be as small as low-voltage ones.
- **Legal and safety** Cooker controls must be far enough from the pans that you do not burn yourself, but also high enough to prevent small children turning them on.
- **Context and environment** The microwave's controls are smooth to make them easy to clean in the kitchen.
- **Aesthetic** The controls must look good.
- **Economic** It must not cost too much!


# Managing value

people use something

**ONLY IF**

it has perceived value

**AND**

value exceeds cost

# Weighing up value

value

- helps me get my work done
- fun
- good for others

# General lesson …

if you want someone to do something …

- make it easy for them!
- understand their values