Introduction to Usability and User Interface Design

What is usability?

Usability is a measure of the **effectiveness**, **efficiency** and **satisfaction** with which specified users can achieve specified goals in a particular environment.

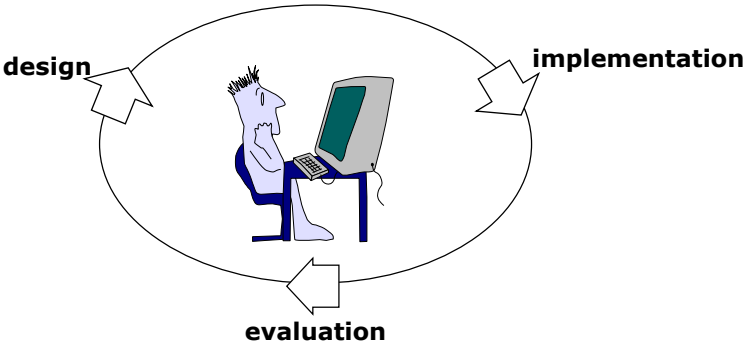
- ISO 9241

Why is usability important?

- poor usability results in
  - anger and frustration
  - decreased productivity in the workplace
  - higher error rates
  - physical and emotional injury
  - equipment damage
  - loss of customer loyalty
  - costs money

Human Computer Interaction

- A discipline concerned with interactive computing systems for human use



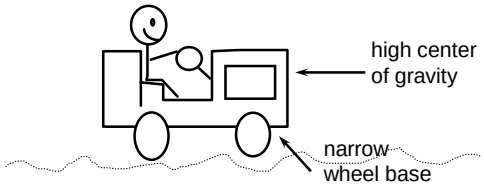
User and Task Descriptions

- First Goal: Articulate who the users are and what their tasks are
- This is the problem of collecting **requirements**
- Some Methods
  - Participatory Design
  - User-Centered Design
- Poor design can make an otherwise working system unusable

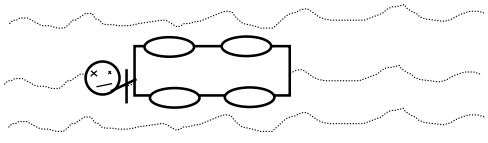
Early tractors

- Original design

  Terrain
  - un-surfaced
  - rough
  - hilly



Result

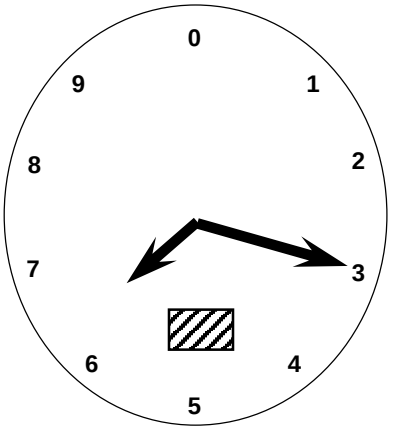


Used to be called **driver's error** *but*
accidents now infrequent as designs now have low center of gravity, wider wheel bases

Lessons Learned

- Lesson 1
  - Most failures of human-machine system are due to poor designs that don't recognize peoples' capabilities and fallibilities
  - This leads to apparent machine misuse and "human error"
- Lesson 2
  - Good design always accounts for human capabilities.

Pathological Design Example – What's the Altitude?



- Early days (< 1000'):
  - only one needle needed
- As ceilings increased over 1000'
  - small needle added
- As they increased beyond 10,000'
  - box indicated 10,000' increment through color change

< 10,000'

> 10,000'

Airspeed Indicator

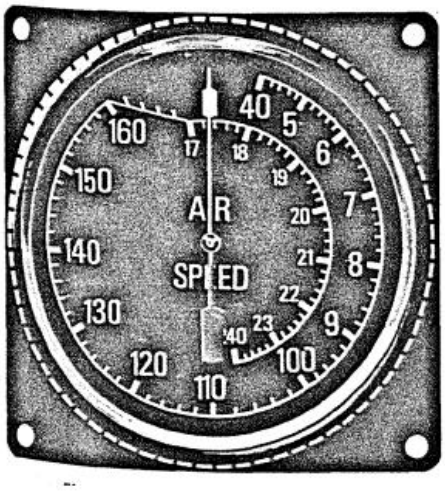
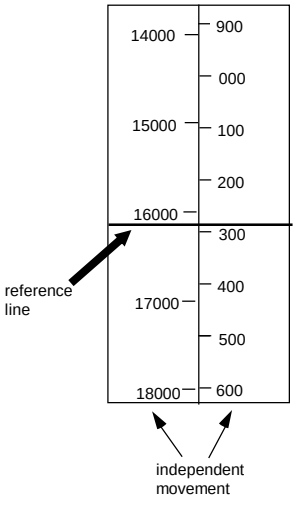


Figure 5: 1930's Airspeed Indicator, reproduced from Chorley, 1976

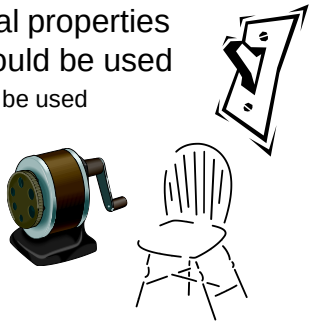
Tape altimeter



- Human factors test showed:
  - eliminated reading errors
  - was faster to read

Visual Affordance

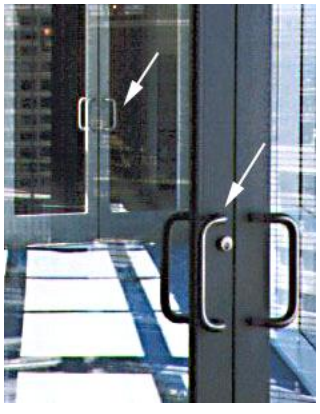
- the perceived and actual fundamental properties of the object that determine how it could be used
  - Appearance indicates how the object should be used
    - chair for sitting
    - knobs for turning
    - slots for inserting things into
    - buttons for pushing
  - Just by looking the user should know
    - State of the system
    - Possible actions
    - Don't violate these principles to make something "look cool"!
  - Complex things may need explaining but simple things should not
    - when simple things need labels & instructions, then design has failed



Many ideas in this deck are adapted from Don Norman's book: The Design of Everyday things

Poor Visual Affordance

- Trapped between doors!
- Handles **afford** pulling
- Using a flat plate would **constrain** the user to push



The well-trodden path

Fedex Dropbox

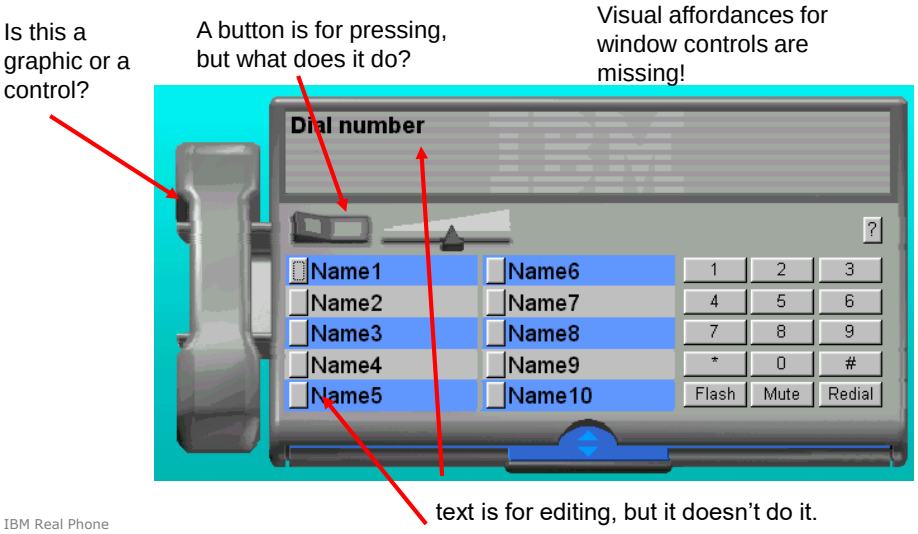
Supplies “box” is taped shut!

The unusual urinal

Visual affordance

- needs familiar idiom and metaphor to work

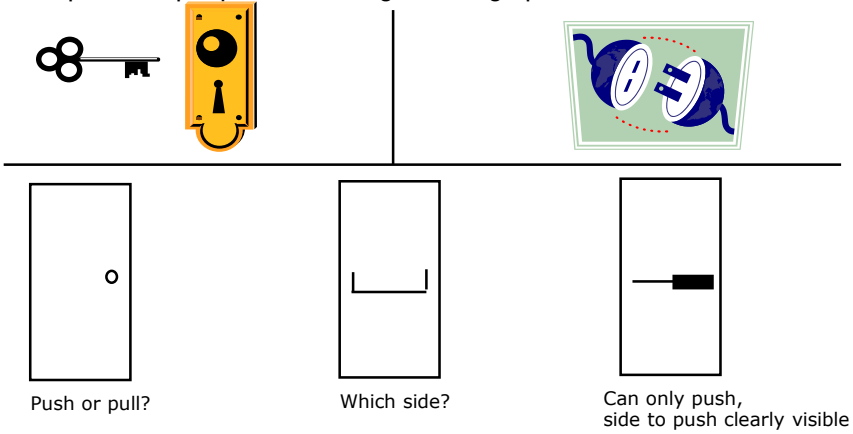
Visual affordance problems



IBM Real Phone

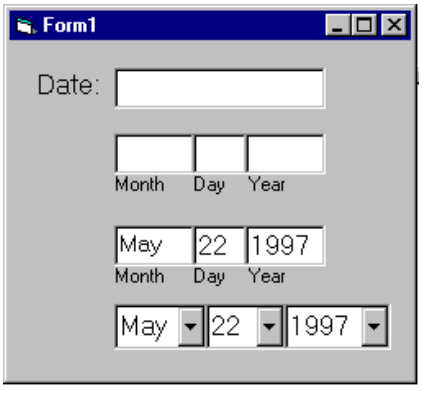
Visible constraints

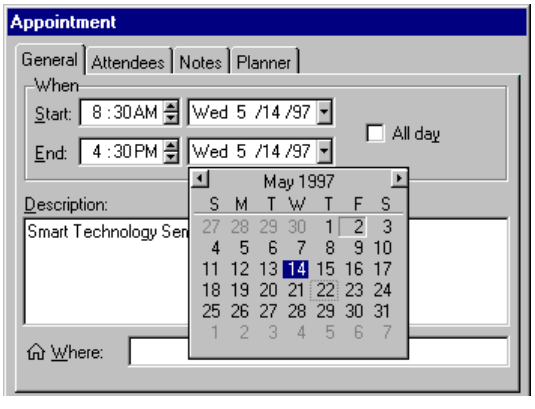
- limitations of the actions possible perceived from object's appearance
  - provides people with a range of usage possibilities



Which Way?

Visible constraints: Entering a Date



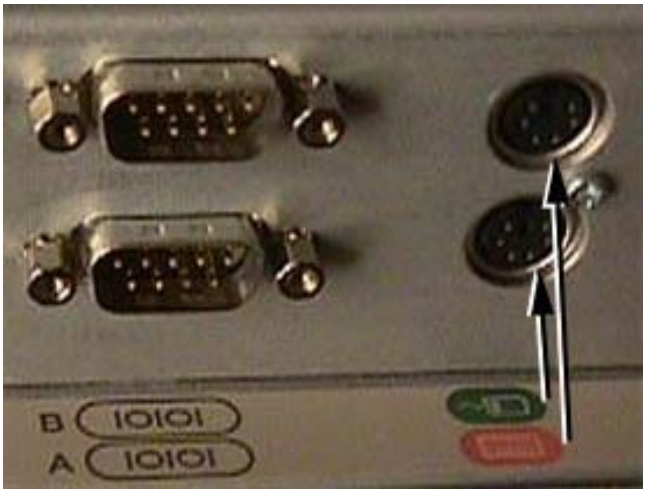


Controls constructed in Visual Basic

Mapping

- Controls and displays should exploit natural mapping
- Natural mapping takes advantage of physical analogies and cultural standards
  - Physical: Steering wheel
  - Cultural: red means stop, green means go

Mouse or Keyboard?



What Knob Goes Where?

Exploiting Natural Mapping

Good or bad mapping?

Causality

- the thing that happens right after an action is assumed by people to be caused by that action
  - interpretation of “feedback”
  - false causality
    - incorrect effect
      - invoking unfamiliar function just as computer hangs
      - causes “superstitious” behaviors
    - invisible effect
      - command with no apparent result often re-entered repeatedly
      - e.g., mouse click to raise menu on unresponsive system
  - Can be responsive (show causality) but still take time to process

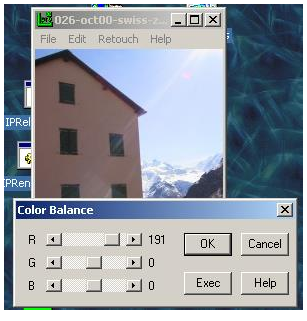
Feedback Examples

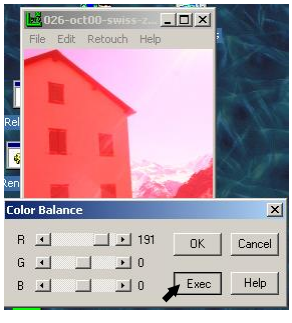
- Telephone button press tones
  - Telephone clicks
- Buzz typing virtual keys on a slate/tablet
- Clicker on your turn signal
- Animated icon while waiting for a web page to load

- Lack of feedback
  - Compiler – did it work? Entering password?

Poor Feedback in LViewPro

Effects visible only after Exec button is pressed
- Ok does nothing!
- awkward to find appropriate color level





Transfer effects

- people transfer their learning/expectations of similar objects to the current objects
  - positive transfer: previous learning's also apply to new situation
  - negative transfer: previous learning's conflict with the new situation

Conceptual model

- People have “mental models” of how things work, built from
  - affordances
  - causality
  - constraints
  - mapping
  - positive transfer
  - population stereotypes/cultural standards
  - instructions
  - interactions
- models allow people to mentally simulate operation of device
- models may be wrong
  - particularly if above attributes are misleading
- We can design interfaces to more closely match the mental models people are most likely to have
- Usability testing can reveal many design deficiencies