The Psychology of Everyday Things

Don Norman - POET

There are several basic cognitive principles to be aware of while designing interfaces:

- Affordances => Visibility
- Constraints
- Mappings
- Causality => Feedback
- Transfer effects
- Consistency / Cultural standards
- Mental Models / Conceptual Models
- Comfort => Undo
Understand How the Brain Works

http://www-bcs.mit.edu/people/adelson/checkershadow_illusion.html

Making things work: Visual Structure (I)

Visual Affordances
- the perceived and actual fundamental properties of the object that determine how it could possibly be used

- appearance indicates how the object should be used
  - chair for sitting
  - table for placing things on
  - knobs for turning
  - slots for inserting things into
  - buttons for pushing
  - computers for ???

- complex things may need explaining, but simple things should not
  - when simple things need pictures, labels, instructions, then design has failed
Making things work: Visual Structure (II)

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

Push or pull?  Which side?  Can only push, side to push clearly visible

Making things work: Visual Structure (III)

Mappings
- the set of possible relations between objects
- the natural relationship between two things
  - eg control-display compatibility
  - visible mapping and mimic diagrams: stove and controls
  - cause and effect: steering wheel-turn right, car turns right

arbitrary  paired  full mapping

24 possibilities, requires:
- visible labels
- memory

2 possibilities per side = 4 total possibilities
Making things work: Understandable action (I)

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
    - starting up an unfamiliar application just as computer crashes causes “superstitious” behaviors
  - invisible effect
    - command with no apparent result often re-entered repeatedly
e.g., mouse click to raise menu on unresponsive system

Making things work: Understandable action (II)

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
Cultural Standards (I)

Consistency - Populations learn idioms that work in a certain way
- red means danger
- green means safe

• But idioms vary in different cultures!
  - Light switches
    America: down is off
    Britain: down is on
  - Faucets
    America: anti-clockwise on
    Britain: anti-clockwise off

• Ignoring/changing standards?
  - home handyman: light switches installed upside down
  - calculators vs. phone number pads: which should computer keypads follow?

• Difficulty of changing standards
  - Qwerty keyboard: designed to prevent jamming of keyboard
  - Dvorak keyboard (’30s): provably faster to use
Cultural Standards (II)

Because a trashcan in Thailand may look like this:

![Trashcan Image]

a Thai user is likely to be confused by this image popular in Apple interfaces:

![Trashcan Image]

Sun found their email icon problematic for some American urban dwellers who are unfamiliar with rural mail boxes.

Cultural Standards (III)

A Mac user might find a Windows system only somewhat familiar...

![Mac and Windows Comparison]
Conceptual model

People have “mental models” of how things work

conceptual models built from:
• affordances
• causality
• constraints
• mapping
• positive transfer
• population stereotypes/cultural standards
• instructions
• interactions
• familiarity with similar devices (positive transfer)

models may be wrong, particularly if above attributes are misleading

models allows people to mentally simulate operation of device

From The Design of Everyday Things

What are your initial impressions of these items?
Comfort / Learning the Technology

People are often intimidated by technology

Users are often afraid of breaking the system or losing data

Given these two issues, how do people learn the technology?

Examples:
- Support rapid, incremental, reversible actions
- Don’t use dialogs to report normalcy.
- If it’s worth asking the user, it’s worth the program remembering

Implemented through “Direct Manipulation”, or at least “Undo”

Encourages experimentation, increases comfort

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Example (I)

Good: Scissors

affordances:
holes for something to be inserted

constraints:
big hole for several fingers, small hole for thumb

mapping:
between holes and fingers suggested and constrained by appearance

positive transfer and cultural idioms
learnt when young
constant mechanism

conceptual model:
implications clear of how the operating parts work
**Example (II)**

**Bad: Digital watch**

affordances:
- four push buttons to push, but not clear what they will do

constraints and mapping unknown
- no visible relation between buttons, possible actions and end result

transfer of training
- little relation to analog watches

-cultural idiom
- somewhat standardized core controls and functions
  but still highly variable

conceptual model:
- must be taught

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**Two guidelines for design**

1. **Provide a good conceptual model**
   - allows user to predict the effects of our actions
   - problem:
     - designer’s conceptual model communicated to user through system image:
       - appearance, written instructions, system behaviour through interaction,
         transfer, idioms and stereotypes
     - if system image does not make model clear and consistent, user will develop wrong conceptual model
Two guidelines for design (continued)

2. Make things visible
   • relations between user’s intentions, required actions, and results are
     - sensible
     - non arbitrary
     - meaningful
   • visible affordances, mappings, and constraints
   • use visible cultural idioms
   • reminds person of what can be done and how to do it

Who do you design for?

The person of medium height is able to see the mirror.
The taller person must slouch.
The shorter person is out of luck.
Who do you design for?

People are different

It is rarely possible to accommodate all people perfectly
  • design often a compromise
    - eg ceiling height: 8'
    but tallest man: 8' 11''!

Rule of thumb:
  • design should cater for 95% of audience (ie for 5th or 95th percentile)
    - but means 5% of population may be (seriously!) compromised
  • Designing specifically for the average is generally a mistake
    - may exclude half the audience

Examples:
  • cars and height: headroom, seat size
  • computers and visibility:
    - font size, line thickness, color for color blind people?
Why design is hard (I)

Over the last century

- the number of things to control has increased dramatically
  - car radio: AM, FM1, FM2, 5 pre-sets, station selection, balance, fader, bass, treble, distance, mono/stereo, dolby, tape eject, fast forward and reverse, etc (while driving at night!)

- display is increasingly artificial
  - red lights in car indicate problems vs flames for fire

- feedback more complex, subtle, and less natural
  - is your digital watch alarm on and set correctly?

- errors increasing serious and/or costly
  - airplane crashes, losing days of work...
Why design is hard (II)

Marketplace pressures

- adding functionality (complexity) now easy and cheap
  - computers
- adding controls/feedback expensive
  - physical buttons on calculator, microwave oven
  - widgets consume screen real estate
- design usually requires several iterations before success
  - product pulled if not immediately successful
- people often consider cost and appearance over human factors design
- design is an art - usability testing does not replace design!

What You Now Know

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