Designing Visual Interfaces

The Design of Everyday Things
Cognitive Principles for Interface Design

Hall of Fame or Shame

Homework Presentation

Psychology of Everyday Things

Don Norman – POET

Cognitive Principles of Designing Interfaces

- Adequate Visibility
  - Affordances
  - Visible Constraints
  - Natural Mappings
- Good Conceptual Model (Mental Model)
- Feedback – Causality
- Comfort
- Consistency /Cultural Standard
- Transfer Effects

Make the right things visible

What parts operate and how

How the users is to interact with it

Mapping between intended action & actual operation

Crucial distinctions

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Affordances: "~ is for ~"

Perceived and actual properties

- Perceived affordance vs. Actual affordance

Provide strong clues to the operations of things

- A chair affords sitting. = A chair is for sitting.
- Buttons for pushing
- Knobs for turning

Simple things can be used without any need for words, symbols, trial and error

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Visible Constrains

Limit the possible actions by appearance

Prevent errors

pro.corbis.com

http://www.ipadrblog.com/lockandkey.jpg

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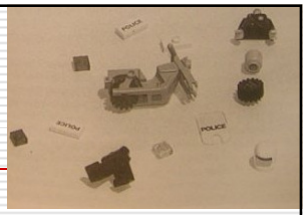
Visible Constrains

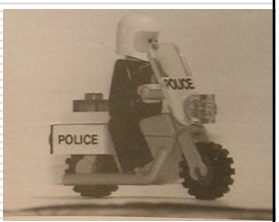


Physical Constraints

- Physical limitation and possible operation

Semantic Constraints

- Depending on our knowledge of situation



Cultural Constraints

- Allowable actions for social situations

Logical Constraints

- “Natural mapping” work by this constraints

Images from Norman, D. A. (2002). The design of everyday things. New York, Basic Books.

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Natural Mapping

Relationship between controls and actions should be apparent to users

Minimize the need for **labels**

Work by “logical constrains”

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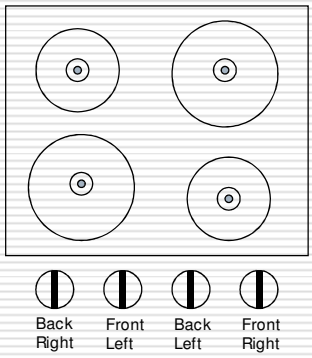
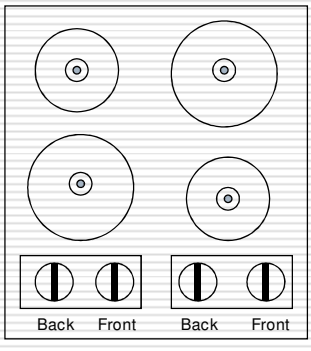
Natural Mapping: Gas Stove



Arbitrary



Paired

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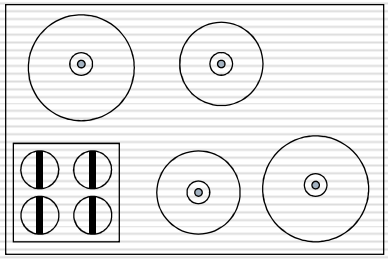
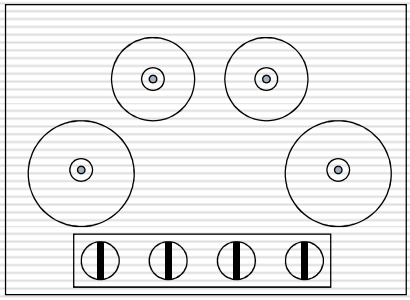
Natural Mapping: Gas Stove





Full natural mapping between controls and burners

- No labels!

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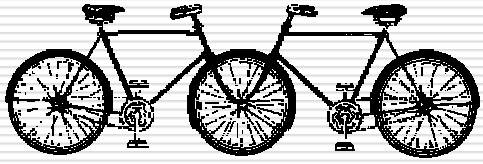
Conceptual Model

Mental model of how things work

Formed by

- Affordances
- Constraints
- Mappings
- Experience
- Training
- Instruction



Convergent Bicycle, Jacques Carelman

Coffeepot for Masochists, Jacques Carelman

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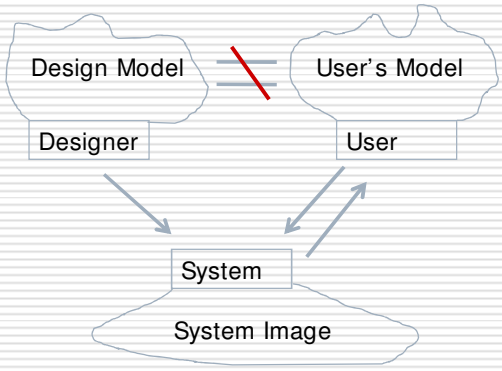
Three Conceptual Models

Three aspects of mental models

- Design model
- User's model
- System image



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Conceptual Model: Scissors

Affordances

- Holes for fingers to be inserted

Mapping by Constraints

- Fingers and holes (different size)

Transfer Effect

- Learnt constraints from adults

=> Good Conceptual Model

- Implication is clear

Wikipedia

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Conceptual Model: Digital watch

Affordances
- Four buttons for pushing

Mapping by Constraints
- No visible relationship

Transfer Effect
- No so similar to analog watch

=> Bad Conceptual Model
- Learning needed, no standard

img.alibaba.com

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Feedback

Inform users of what action's done and what happened

instantaneous response is preferred

Type of feedback
- Visual
- Auditory
- Haptic

Modern telephone : more features and less feedback

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Feedback - Causality

Causality – interpretation of “feedback”

People assume that the thing that happens right after an action be caused by that action

False causality

- incorrect effect
  - causes “superstitious” behaviors
- invisible effect
  - command with no apparent result often re-entered repeatedly
  - e.g., mouse click to raise menu on unresponsive system

Adopted from Saul Greenberg’s slides Jinwook Seo

Comfort – Learning the Technology

People are intimidated by technology

Users are afraid of breaking the system

How do people learn the technology?

→ Support rapid, incremental, reversible actions

→ “Direct Manipulation”

→ Encourage exploration, increase comfort

Adopted from Ben Bederson’s slides Jinwook Seo

Consistency – Cultural Standards

People learn idioms that work in a certain way

- red means danger vs. green means safe

Idioms could be different from culture to culture

- Light switches - America: down is off vs. Britain: down is on
- Faucets - America: anti-clockwise on vs. Britain: anti-clockwise off

Ignoring/changing standards?

- home handyman:light switches installed upside down

Difficulty of changing standards

- Qwerty keyboard vs. Dvorak keyboard

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Cultural Standards

Because a trashcan in Thailand may look like this:

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

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

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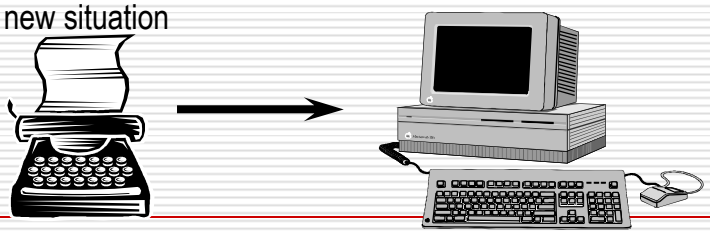
Transfer Effects

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



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Principles of Design, Don Norman

Use both knowledge in the world and knowledge in the head

Simplify the structure of tasks

Make things visible

Get the mapping right

Exploit the power of constraints

Design for error

When all else fails, standardize

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Modeling Human Errors

Categories of Error

- Mistake – from conscious deliberations
- Slips – when subconscious action go astray

Types of Error (Slip)

- Capture errors
- Description errors
- Data-driven errors
- Associative activation errors
- Loss-of-activation errors
- Mode errors

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Capture errors

The intended action is suddenly replaced by a frequent activity

- 1,2,3,4,5,6,7,8,9,10,J,Q,K
- get into your car on Sunday to go to a store and find yourself at the office

Appears when two different action sequences have their initial stages in common

Unfamiliar vs. well-practiced activities

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Description Errors

Intended action is replaced by another that has much in common

Internal description of intended action is not precise

- Throwing dirty shirts to toilet instead of laundry basket
- Pouring Coke into beer glass

Data-driven Errors

Data-driven activities intrude into the current action sequence

- Clerk looking at a hotel room number dial the room number instead of the secretary

Associative Activation Errors

Similar internal thoughts (associations) trigger actions intended by external stimulus

- My office phone rang. I picked up the phone and said "Come in."
- Think something that ought not to be said, and then you say it.

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Loss-of-activation Errors

Why did I do this?

Forget the goal – just forgetting

- When you don't remember why you opened the refrigerator door

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Mode Errors

Mode: a distinct state within a system in which the same user input has a different meaning

- Caps Lock, Insert key
- Vi

Make every mode visible

If impossible, distinctive action in each mode

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Who do you design for?

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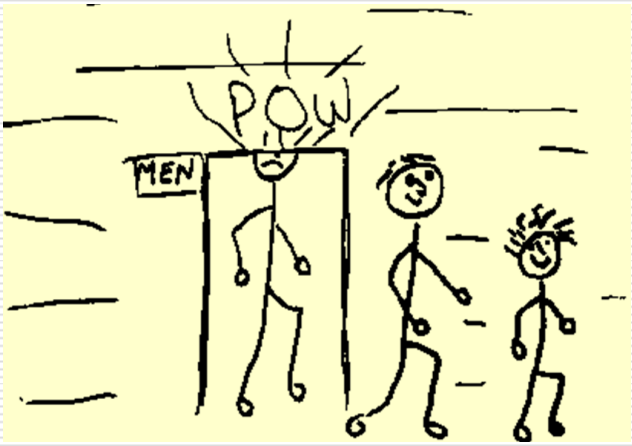
Who do you design for?



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Who do you design for?

People are different

It is rarely possible to accommodate all people perfectly

- design often a compromise
  - ceiling height: 8'
  - but tallest man: 8' 11"!

Rule of thumb:

- cater to 95% of audience (5th or 95th percentile)
  - but means 5% of population may be (seriously!) compromised
- designing for the average 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?

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Why design is hard

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!)
- "paradox of technology"
  - Added functionality => added complexity
  - More features and less (natural) feedback
- errors increasing serious and/or costly

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Why design is hard

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

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Readings

Norman, D. A. (2002). The design of everyday things. New York, Basic Books. Chapter 1.

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