What is Interaction Design?

From Preece, Rogers & Sharp's *Interaction Design*
And Norman's *The Design of Everyday Things*

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Good and Bad Design

- A central concern of interaction design is to develop interactive product that are usable.
  - **Usable = easy to learn + effective to use + enjoyable experience**
- A good way to start to think about how to design a usable interactive product is to compare examples.
- Bad examples are often more instructive
  - www.baddesigns.com
  - Interface Hall of Shame
    http://homepage.mac.com/braster/iarchitect/shame.htm
    (original domain abandoned)
    http://hallofshame.gp.co.at/index.php?file=shame.htm&mode=original

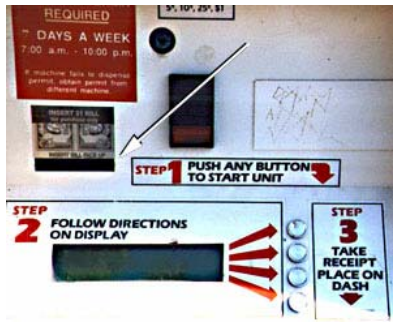
Bad Design: Elevator Controls

- Elevator controls and labels on the bottom row all look the same, so **it is easy to push a label by mistake instead of a control button**

- People do not make same mistake for the labels and buttons on the top row. Why not?

http://www.baddesigns.com/elecon.html

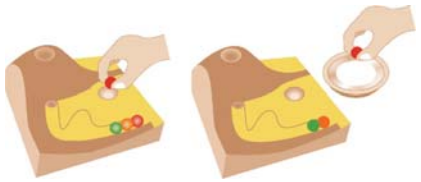
Bad Design: Vending Machine



www.baddesigns.com/parking2.html

- Parking permit machine
- One needs to push button first to activate reader
- Normally, one inserts a bill first before making selection
- Contravenes well known convention

Good Design: Marble Answering Machine



Also see https://vimeo.com/19930744

- Marble answering machine (Bishop, 1995)
  - When one leaves a message, a marble comes out and stays in the tray
  - One can check a message by placing a marble on the speaker.
- Based on how everyday objects behave
- Easy, intuitive and a pleasure to use
- Only requires one-step actions to perform core tasks

Good and Bad Design

- What is wrong with the remote on the right?
- Why is the TiVo remote so much better designed?
  - Peanut shaped to fit in hand
  - Logical layout and color-coded, distinctive buttons
  - Easy to locate buttons

What to Design

- Need to take into account:
  - Who the **users** are
  - What **activities** are being carried out
  - **Where** the interaction is taking place
- Need to optimize the interactions users have with a product
  - So that they match the users' activities and needs
- Design decisions based on **understanding users' needs**
  - Know what people are **good and bad** at
  - Consider what might help people **in the way they currently do things**
  - Think through what might provide **quality user experiences**
  - **Listen** to what people **want** and get them **involved**
  - Use tried-and-tested user-centered methods

What is Interaction Design?

- "Designing interactive products to support the way people communicate and interact in their everyday and working lives"
  - Sharp. Rogers and Preece (2007)
- "The design of spaces for human communication and interaction"
  - Winograd (1997)

Interaction Design?

- Number of other terms used emphasizing what is being designed, e.g.
  - User interface design
  - Software design
  - User-centered design
  - Product design
  - Web design
  - Experience design (UX)
  - Interactive system design
- Interaction design is the umbrella term covering all of these aspects
  - Fundamental to all disciplines, fields, and approaches concerned with researching and designing computer-based systems for people

What do professionals do in the Interaction Design business?

- Interaction designers
  - People involved in the design of all the interactive aspects of a product
- Usability engineers
  - People who focus on evaluating products, using usability methods and principles
- Web designers
  - People who develop and create the visual design of websites, such as layouts
- Information architects
  - People who come up with ideas of how to plan and structure interactive products
- User experience designers (UX)
  - People who do all the above but who may also carry out field studies to inform the design of products

The User Experience

- How a product behaves and is used by people in the real world
  - The way people feel about it and their pleasure and satisfaction when using it, looking at it, holding it, and opening or closing it
  - "Every product that is used by someone has a user experience: newspapers, ketchup bottles, reclining armchairs, cardigan sweaters." (Garrett, 2003)
- Down to the sensual effect small details have on them
  - Such as how smoothly a switch rotates or the sound of a click and the touch of a button
- Cannot design a user experience, only design for a user experience

iOS11 (June 5, 2017)

Also read the iOS11 review http://thegear.co.kr/14631

Why was the iPhone user experience such a success?

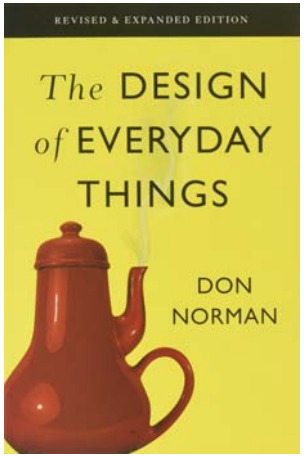
- Quality user experience from the start
- Simple, elegant, distinct brand, pleasurable, must have fashion item, catchy names, cool, etc.,

Design Principles

- Generalizable abstractions for thinking about different aspects of design
- The do's and don'ts of interaction design
- Suggest to designers what to provide and what to avoid at the interface
- Intended to help designers explain and improve the design
- Derived from a mix of theory-based knowledge, experience and common-sense

The Design of Everyday Things

- Don Norman pioneering book [1988]
- Originally published as *The psychology of everyday things*
- Motivates and explains usability principles



Norman, Donald A. (2013). *The Design of Everyday Things*. New York: Basic Books.

5 Design Principles

- Affordance
- Visibility
- Feedback
- Constraints
- Consistency

Explained in Norman, Donald A. The Design of Everyday Things. New York: Basic Books.

Affordances

- Concept from **Gibson**'s ecological psychology [1977]
- **Norman** refers to **"perceived or actual properties of a thing, primarily those fundamental properties that determine just how the thing could possibly be used"** [1988]
  - Refers to an attribute of an object that allows people to know how to use it
  - **Plates (on doors) are for pushing**
  - **Knobs are for turning**
  - **Slots are for inserting things into**
- Since has been much popularised in interaction design to discuss how to design interface objects
  - **Scrollbars to afford moving up and down**
  - **Icons to afford clicking on**

What does 'Affordance' have to offer Interaction Design?

- Interfaces are virtual and do not have affordances like physical objects
- Norman argues it does not make sense to talk about interfaces in terms of 'real' affordances
- Instead interfaces are better conceptualised as **'perceived' affordances**
  - Learned **conventions of arbitrary "mappings between action and effect"** at the interface
  - Some mappings are better than others

Affordances

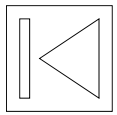
- Physical Affordances
  - How do the following physical objects afford? Are they obvious?





Affordances

- Virtual Affordances
  - How do the following screen objects afford?
  - What if you were a novice user?
  - Would you know what to do with them?




Affordances

- Poor affordances
  - Doors push or pull?
  - Where to push?
- Good affordances
  - Buttons that appear clickable

www.baddesigns.com/doorhand.html
www.baddesigns.com/doors.html

Two Conceptual Models

- Two conceptual models
  - The **designer**'s conceptual model
  - The **user**'s conceptual model
- The **system image** is the visible part of a device (including the physical structure, the documentation, instructions, etc).
  - The designer only talks to the user through the system image.
  - If the system image doesn't make the design model clear then the user will create a different model through their interactions.
- Mental model
  - Conceptual model of the way something works, often constructed from fragmentary evidence.
- Jef Raskin **"To the user the interface is the product."**

Why is the basic Automobile Easy to Figure out?

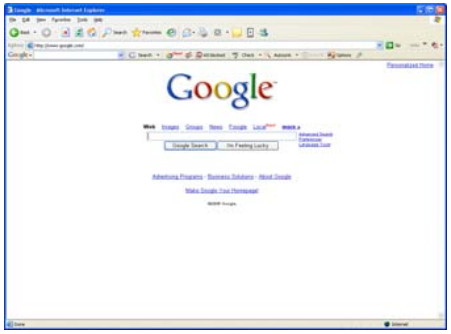
- Things are **visible**
- **Good mappings** between controls and things controlled
  - Easy to determine relationships between actions and results, controls and their effects, system state and what's visible
- **Good conceptual model**
  - User given consistent in presentation of operations and results
- Good **feedback**
  - Immediate and obvious effect

Visibility

- Know state of device and actions available
- Natural design: No explanations needed
- The more visible functions are, the more likely users will be able to know what to do next.
- When functions are "out of sight", it makes them more difficult to find and know how to use.

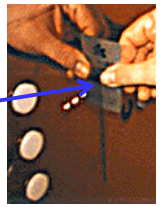
Visibility

- Poor visibility
  - Boeing 757 Flight Management System did not show names of beacons when selecting where to navigate
- Good visibility
  - Google search page makes it clear where you can enter search text



Visibility

www.baddesigns.com/elcard.html



- Getting the elevator to go to your floor
  - This is a control panel for an elevator of a nice hotel in Los Angeles.
  - How does it work?
  - Push a button for the floor you want?
  - Nothing happens. Push any other button? Still nothing. What do you need to do?
  - **It is not visible as to what to do!**
  - **You need to insert your room card in the elevator before it will work.**
  - You think you need to slide the card in the vertical crack?
  - You try sliding the card and pushing the button. It doesn't work.
  - You flip the card over and try again. This time it works!

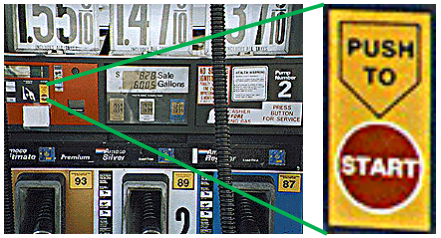
Visibility

www.baddesigns.com/elcard.html

- How would you make this action more **visible?**
  - Make the card reader more obvious
  - Provide an auditory message, that says what to do
  - Provide a big label next to the card reader that flashes when someone enters
  - **Make relevant parts visible**
  - **Make what has to be done obvious**

Visibility

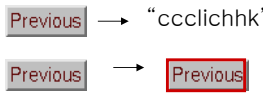
- Here are some things that would have made it **easier to see the "push to start" buttons**
  - Make it larger
  - Using colors that contrasted with the background
  - Removing some of the nearby stickers and decals
  - Making it more centrally located on the gas pump
  - Using a real 3D button



www.baddesigns.com/pushto.html

Feedback

- Sending information back to the user about what action has been done and what has been accomplished
- Includes tactile, verbal, sound, highlighting, animation and combinations of these
  - E.g. when screen button clicked on provides **sound** or **red highlight feedback**



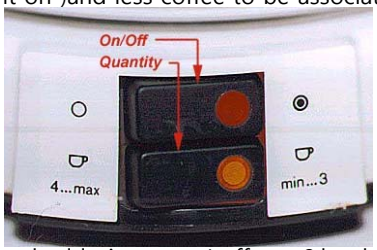
- Needs to be **immediate**
  - Imagine writing with a pen and waiting for the ink to show up on paper?
- Helps users detect errors
- Helps users explore technologies

Feedback

- Poor feedback
  - Boeing 757 Flight Management System provided no feedback on what beacon was selected
- Good feedback
  - Typing on keyboard (assuming no delays)

Feedback

- Controls with **conflicting feedback**. More coffee or less?
  - The top switch turns the coffee maker on/off.
    - When it's on, its light goes on. No light appears when the coffee maker is off.
  - The bottom switch selects the quantity of coffee desired.
    - The problem is with the light on this bottom switch. When its light goes on, for the smaller quantity or for the larger quantity?
    - People naturally expect more coffee to be associated with more light (light on)and less coffee to be associated with less light (light off)



www.baddesigns.com/coffee_rs2.html

Constraints

- Restricting the possible user actions that can be performed
- Helps prevent user from selecting incorrect options and thereby reduces the chance of making a mistake
- Three main types (Norman, 1999)
  - **Physical**
  - **Cultural**
  - **Logical**

Physical Constraints

- Refer to the way physical objects restrict the movement of things
  - E.g. only one way you can insert a key into a lock
- How many ways can you insert a CD or DVD disk into a computer?
- How physically constraining is this action?
- How does it differ from the insertion of a floppy disk into a computer?

Physical Constraints

- Labels that look like push buttons
  - Elevator controls and labels on the bottom row all look the same. So, it is easy to push a label by mistake instead of a control button
  - **People do not make same mistake for the labels and push buttons on the top row. Why not?**

www.baddesigns.com/elecon.html

Logical Constraints

- Rely on people's understanding of the way the world works
- Exploits people's everyday common sense reasoning about the way the world works
- Making actions and their effects obvious enables people to logically deduce what further actions are required
- E.g. Disabling menu options when not appropriate for the task in hand

Logical Constraints

- Things that don't work the way you expect. Out of order?
  - Need to push button first to activate the bill reader
  - Normally insert money first before making selection
  - Printed instructions, even obvious ones, aren't going to be read by some people.
  - Contravenes well known convention

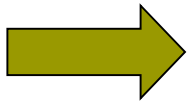
www.baddesigns.com/parking2.html

Cultural Constraints

- Learned arbitrary conventions like red triangles for warning

- Which are universal or which are culturally specific?






Cultural Constraints

- What do these signs mean? Road sign in Mexico

- What do these symbols mean? Controls on a rental car (intended to imitate European designs)

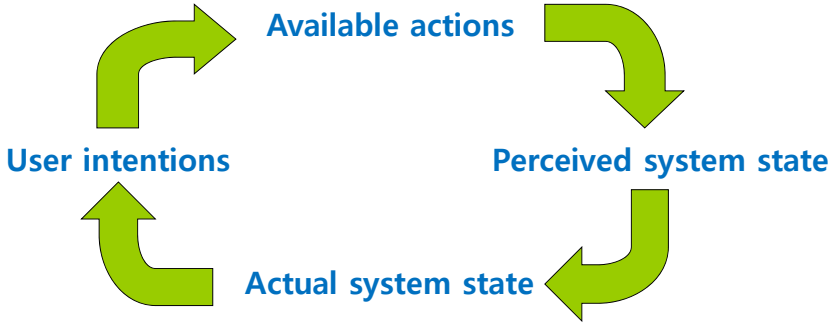
www.baddesigns.com/autoicons.html

Constraints

- Poor use of constraints
  - Tokyo Stock Exchange software did not prevent trader from making an outrageous trade
  - Command line systems force you to remember spelling and syntax of commands
- Good use of constraints
  - Click on icons to invoke commands
  - Gray out unavailable actions

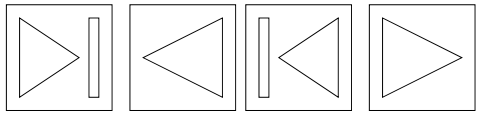
Mappings

- Natural mappings: No explanations needed

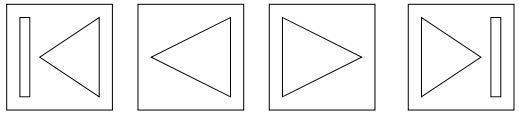


Mappings

- Relationship between controls and their movements and the results in the world
- Why is this a poor mapping of control buttons?



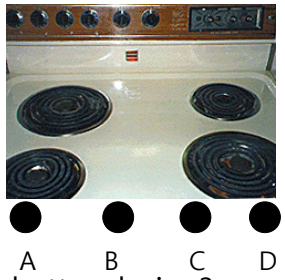
- Why is this a better mapping?



- The control buttons are mapped better onto the sequence of actions of fast rewind, rewind, play and fast forward

Mappings

- Which controls go with which burners?

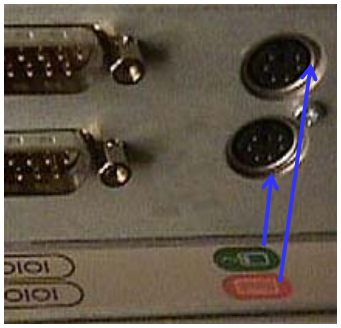


- Why is this a better design?

www.baddesigns.com/ranges.html

Mappings

- Where do you plug in the mouse & keyboard?
- Top or bottom connector?
- Do the color coded icons help?



http://www.baddesigns.com/mouseconnector.html

Mappings

- How to design them more logically?
  - A provides direct adjacent mapping between icon and connector

  - B provides color coding to associate the connectors with the labels

Mappings

- User **intentions** to available **actions**
  - Is there a natural mapping between what users want to do and what appears possible?
  - Do users stare at technology for sometime before they take action?
  - Or do they immediately know what to do?
  - Simplicity can help
- Poor mapping
  - Stove top controls
  - Clustered light switches
- Good mapping
  - Consistent play, rewind, fast forward, stop controls on media devices
  - Clearly visible and labeled power buttons

Mappings

- Available **actions** to perceived system **state**
  - The user should not be surprised with what happened after they completed an action
  - Technologies should behave in expected ways
  - Quick feedback is very important
  - Problems more likely if the mappings between user intentions and available actions were not good
- Poor mapping
  - Pull from a door knob when you were supposed to push
  - Try to close an application that won't close
- Good mapping
  - Press gas pedal, feel car accelerate

Mappings

- **Perceived system state** to **actual system state**
  - Perceived system state to actual system state
  - Users think the technology is doing one thing when it really is doing something else
  - Users unlikely to quickly detect problems
- Poor mapping
  - 757 Flight Management System had pilots thinking they were traveling towards different beacon
- Good mapping
  - Well-implemented progress bars

Mappings

- **Actual system state** to user **intentions**
  - Does the system allow states that users would never want?
  - Difficult to implement
  - Important for critical systems
- Poor mapping
  - 757 Flight Management System did disengage brakes when accelerating and pulling up to clear mountain
  - Tokyo Stock Exchange software sold stocks far below market prices (and more than were available)
- Good mapping
  - Voting systems that allow you to select only one candidate for President

Consistency

- Design interfaces to have **similar operations** and use **similar elements** for achieving **similar tasks**
- For example,
  - always use ctrl key plus first initial of the command for an operation – ctrl+C, ctrl+S, ctrl+O
- Main benefit is consistent interfaces are **easier to learn and use**
  - Users have to learn only a single mode of operation that is applicable to all objects

When Consistency Breaks Down

- What happens if there is more than one command starting with the same letter?
  - E.g. save, spelling, select, style
- Have to find other initials or combinations of keys, thereby breaking the consistency rule
  - E.g. ctrl+S, ctrl+Sp, ctrl+shift+L
- Increases learning burden on user, making them more prone to errors
- A design solution is to create categories of commands that can be mapped into subsets of operations
  - E.g. All commands that are concerned with file operations (save, open, close) are placed together in the same file menu

Internal and External Consistency

- Internal consistency refers to designing operations to behave the same within an application
  - But, difficult to achieve with complex interfaces
- External consistency refers to designing operations, interfaces, etc., to be the same across applications and devices
  - Very rarely the case, based on different designer's preference

Keypad Numbers Layout

- A case of external inconsistency

(a) phones, remote controls

1	2	3
4	5	6
7	8	9
	0	

(b) calculators, computer keypads

7	8	9
4	5	6
1	2	3
0		

Consistency

- Poor consistency
  - Boeing 757 Flight Management System almost always selected intended beacon when entering first letter
- Good consistency
  - Home button in web browsers always takes you home, no matter what page you are looking at

Heuristics

- Design principles commonly referred to as heuristics
  - Interpreted in the design context, drawing on past experience of, how to design feedback and what it means for something to be consistent
- Usability Principles [Nielsen, 2001]
  - Visibility of system status
  - Match between system and the real world
  - User control and freedom
  - Consistency and standards
  - Help user recognize, diagnose, and recover from errors
  - Error prevention
  - Recognition rather than recall
  - Flexibility and efficiency of use
  - Aesthetic and minimalist design
  - Help and documentation

Heuristics

- Visibility of system status
  - Keep users informed about what is going on, through providing appropriate feedback within reasonable time
- Match between system and real world
  - Speak user's language rather than system-oriented language
- User control and freedom
  - User should feel in control
  - Stop technology from doing something
  - Undo
- Consistency and standards
  - Avoid making users wonder whether different words, situations or actions mean the same thing

Heuristics

- Help users recognize, diagnose, recover from errors
  - Use feedback, visible system status, undo
- Error prevention
  - Make it difficult for errors to occur
- Recognition rather than recall
  - Make objects, actions, options visible
- Flexibility and efficiency of use
  - Provide shortcuts for experts

Heuristics

- Aesthetic and minimalist design
  - Give more prominence to information and options more likely to be used
  - Don't waste space showing rarely needed information
  - Use technology to reduce task complexity
- Help and documentation
  - Easy to search
  - Provide concrete steps

Reference

- Preece, Rogers & Sharp, Interaction Design: Beyond Human-Computer Interaction (Ch1)
- Norman, The Design of Everyday Things
- http://www.evl.uic.edu/aej/422/week01.html
- http://www.baddesigns.com/
- https://www.amazon.com/dp/0465050654?tag=useitcomusablein