

Design of Everyday Things

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Overview

① Design of Everyday Things

② Design Principles

Affordance

Constraints

Consistency

Mapping

Feedback

③ Design Theory

Mental Models

Don't Make Me Think

Sources

- Norman, **The Design of Everyday Things**, Revised and Expanded ed. (2013)
- Shneiderman, **Designing the User Interfaces**, 6th ed. (2016).
- Steve, **Don't Make Me Think: A Common Sense Approach to Web Usability**, 2nd ed. (2006).
- Keith, Chapter 4, 6, 7, **Human Computer Interaction Course Notes**, Graz University (2017) -
<https://courses.isds.tugraz.at/hci/hci.pdf>
- Jeff, **Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines**, 2nd ed. (2014).

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Doors



Doors



Doors



Doors



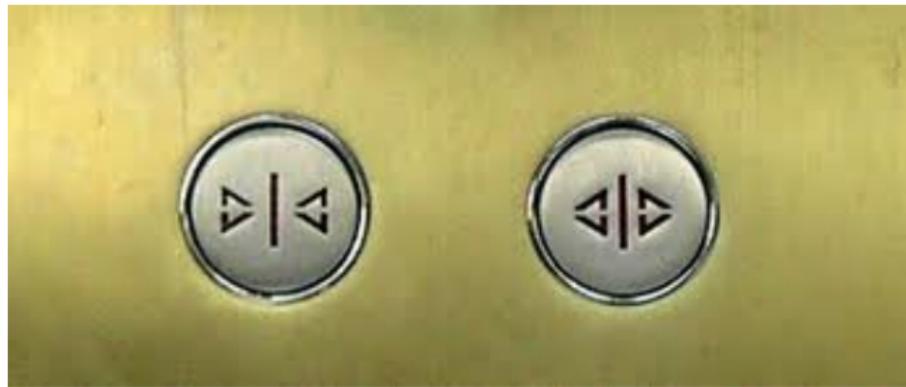
Doors

- Good design is not vague. It has only one **clear meaning**.
- Simple things *should* be simple. **Instructions/explanations for simple things** are a **sign of failure**
- Any better door?

Doors



Elevators



Elevators

In a popular flanker test, the mean accuracy score 0.76 for incongruent trials and 0.98 for congruent trials

Compatible	Incompatible
Congruent	Congruent
>>>>	>>>>
Response Right	Response Left
Compatible	Incompatible
Incongruent	Incongruent
>><>>	>><>>
Response Left	Response Right

Projector



Toilet sign



Desk



Mcdonald



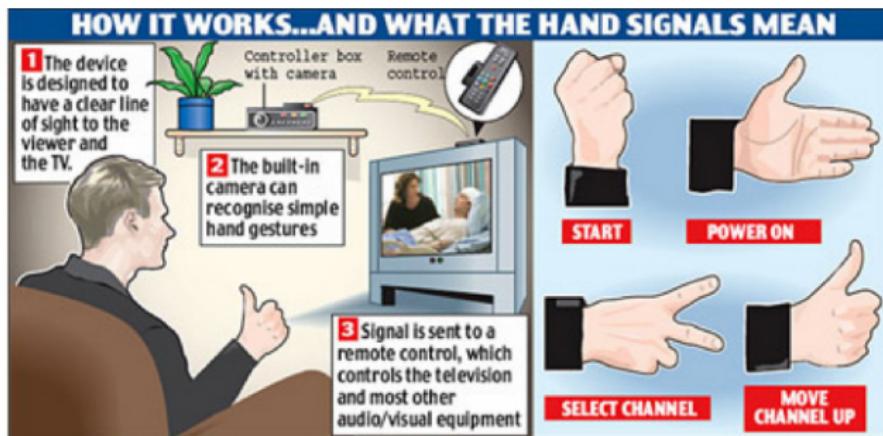
Remote control



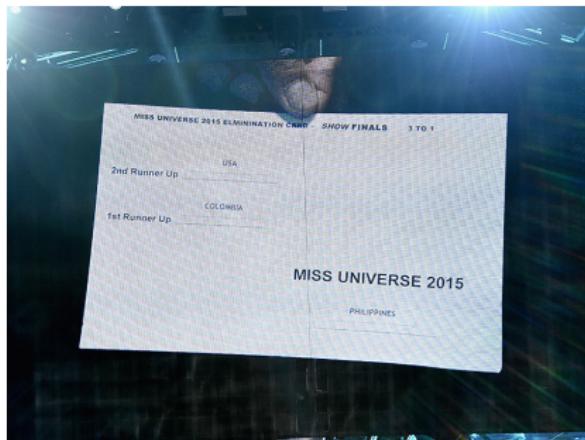
- Some of the buttons on a VCR remote control are easy to understand, but others are unfathomable without the instruction manual
- Remove buttons are not the solution either! (this is in fact 90% of what people will suggest which is wrong! Why?)
- Better question is to ask how we can better support novice and expert users at the same time.

TV gestures

Never a commercial success....why?



List goes on....



- Do you remember **Miss Universe 2015** incident?
- How many times you or your acquaintances forgot to **withdraw your card from ATM**?
- How many times we forgot to **turn off the front lights of the car**?
- Have your mom/grandma go to a hotel and wonder **how to use the shower**?

Stupid design is easy to avoid though



- Of course, this class won't discuss these silly mistakes though

Hmm...so why design goes wrong?

- Most engineers will often make the excuse of “*if the user read the instructions or manual*”, or “*if the user click this before this*”. Preach **NEVER the fault of users, but of designers**
- Many design mistakes can be avoided by learning **design principles**
- Engineering people usually **lack understanding of people**. True?
- We are people ourselves, so we think **we understand people, but in fact, we don't**. True?

Why design is hard?

- Design is hard because of **tradeoffs**
 - Top designers know what makes design good, but the problem is that you cannot always take all the good things
 - Common **tradeoffs** - e.g., security vs convenience? familiarity vs. cool new experience? speed vs accuracy? customizability vs. learnability?
- Design is hard because of **context**
 - Context of use - which tasks the tools/systems are being used
 - Expertise - novice vs. experts
 - Cultural differences
 - User groups (e.g., old vs. young, blind, female)
 - Personal preferences!
 - Difficult to have **one-fits-all** solution

Why design is hard?

- Design is hard because of **human nature**
 - Human **perception** is flawed
 - Human **attention span** is limited
 - Users does not like to **memorize**, nor **read**, nor **think**
 - Users are **impatient**
 - Humans are **NOT rational**
- Design is hard because of **engineer nature**
 - Engineer usually assumes users are same as him/her
 - Engineer usually interested in solving technical challenge
 - Engineers make stuff that only make sense to technical people
 - Engineers make stuffs that usually are very logical and rational, which most users (could be engineers) are not

What are some ways out?

- Understand people **expectations** and **knowledge**; they are not necessarily like you
- **Don't assume** people will read, learn, think, or care about your system
- Remember **diversity** - aged, blind, left-handed, experienced, does not know English etc.
- **Rapid prototyping and failure**
- **Interview** but NOT follow
- NOT making it **simpler** nor **minimal** nor **looking/feeling good**, they are secondary. Primary is about **reaching the goal effectively and efficiently**
- Do **quantitative** user evaluation; don't argue
- Use good **design principles**

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Affordance

- When we see a glass, we know we need to hold it. When we see a knob, we know we need to turn it. The key principle here is **affordances**
- Affordance refers to the **relationship** between a physical object and a person. A chair *affords* support and, therefore, *affords* sitting.
- The notion of affordance comes with J. J. Gibson, an eminent psychologist who studied human perception. He argued that the world contained **clues** what to do, and he called them **direct perception**. In addition, he claimed that physical objects conveyed what actions are possible, which he named “affordance”

Affordance



Affordance

Submit

Submit

Submit

Affordance



Affordance



Affordance



Lack of affordance



Figure: Not sure how to open?

Lack of affordance

Keyboards

[Bluetooth or Wireless Keyboards](#) [Corded Keyboards](#) [TV Keyboards](#) [Tablet Keyboards](#) [Gaming Keyboards](#) [Numberpads](#) [Keyboard and Mice Combos](#)



**K580 Slim Multi-Device
Wireless Keyboard**
Ultra-slim, compact, and
quiet keyboard for
computers, phones or
tablets



**K580 Slim Multi-Device
Wireless Keyboard Chrome
OS Edition**
Ultra-slim, compact, and
quiet keyboard for
computers, phones or
tablets with a special



**MX Keys Wireless
Illuminated Keyboard**
M/N: Y-R0073



**Wireless All-in-One
Keyboard TK820**
M/N: Y-R0039

Figure: Clickable?

Bad affordance

Bad affordance also exists! How many times did your family members put something on top of this similar machine?



Affordance but lack of signifiers

A.



B.



C.



D.

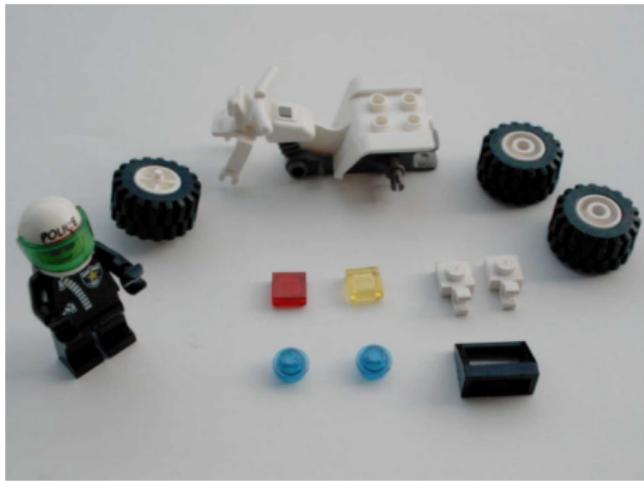


Figure: Source: Fg 1.4 (Norman) - Not sure how to take out!

Constraints

- Constraints is about **limiting what user can do**. Why it is good?
- By **limiting users' options**, user has a better idea what to do
- **Lower** the chance for errors
- Humans also feel good when they see **limited** choices

Constraints



- Motorbike toy with 12 parts. Constraints make its construction simple, even for adults!
 - *Physical*: Front wheel only fits in one place
 - *Semantic*: The rider sits on the seat facing forward
 - *Cultural*: Red is a rear light, yellow a front light
 - *Logical*: Two blue lights, two white pieces, go together

Constraints



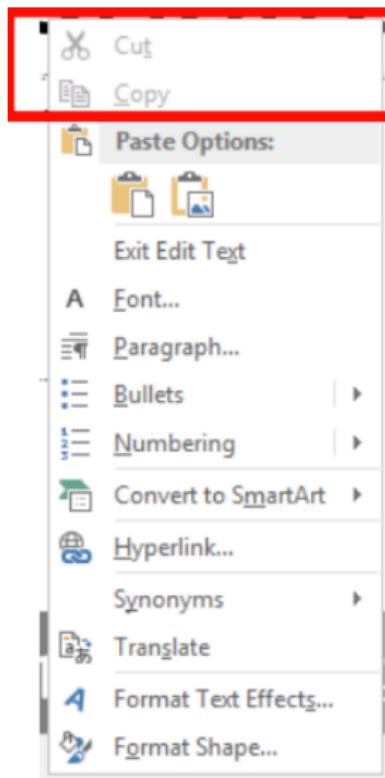
Constraints



FIGURE 4.7. A Lockout Forcing Function for Fire Exit.
The gate, placed at the ground floor of stairways, prevents people who might be rushing down the stairs to escape a fire from continuing into the basement areas, where they might get trapped.

Figure: Source: Fg 4.7 (Norman)

Constraints



Constraints

Amazon.com: Huawei Nexus 6P - Graphite smartphone

Cell Phones & Accessories > nexus 6p

Huawei Nexus 6P - 32 GB Graphite (U.S. Version: NIN-A11) - Unlocked 5.7-inch Android 6.0 smartphone w/ 4G LTE (U.S. Warranty)

by **Huawei**

4.5 out of 5 stars (749 customer reviews)

1,859 answered questions

List Price: \$499.00
Price: \$419.00 **With Prime**
You Save: \$80.00 (16%)

In Stock.
Want it Friday, June 17? Order within 6 hrs 21 mins and choose Two-Day Shipping at checkout. Details
Ships from and sold by Amazon.com.

Color: Graphite

Size: 32GB

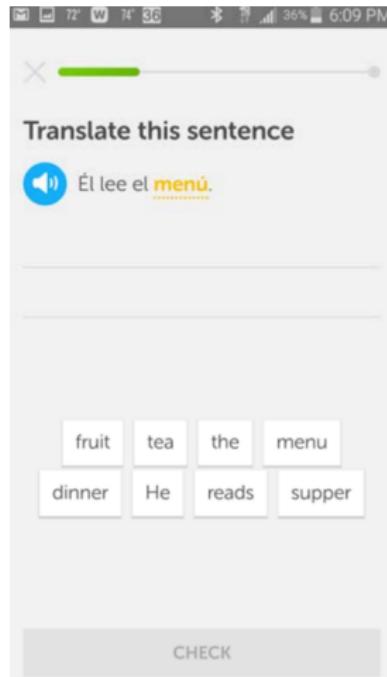
32GB 64 GB 128GB

Add to List

Add a SIM card

- Activation:
- AT&T Micro Adapter for SIM Card
- TracFone SIM Card for iPhone
- H2O SIM Card for iPhone
- Ting Wireless SIM Card

Constraints



Constraints



Undo	Ctrl+Z
Cut	Ctrl+X
Copy	Ctrl+C
Paste	Ctrl+V
Delete	Del
Find...	Ctrl+F
Find Next	F3
Replace...	Ctrl+H
Go To...	Ctrl+G
Select All	Ctrl+A
Time/Date	F5

Undo	Ctrl+Z
Cut	Ctrl+X
Copy	Ctrl+C
Paste	Ctrl+V
Delete	Del
Find...	Ctrl+F
Find Next	F3
Replace...	Ctrl+H
Go To...	Ctrl+G
Select All	Ctrl+A
Time/Date	F5

Constraints



- How to better design this McDonald tray using the constraint concept?

Conventions

Conventions are cultural constraints. They are initially arbitrary, but evolve and become accepted over time. They can vary enormously between cultures.

- Light switches:

America	down is off
Britain	down is on

- Water taps:

America	anti-clockwise is on
Britain	anti-clockwise is off

- The colour red:

America	danger
Egypt	death
India	life
China	happiness

Conventions

- Avoid breaking conventions as it will add **confusion**
- For **website**, there are many conventions - where do you usually place logos in website? Usually what is color of a link in website? Where is the contact menu?
- Never introduce your own psychology!
- Designers have temptation to **reinvent** the wheel, because they **feel** they are hired to do something **new** and **different**
- It IS OK to introduce something new, but it should be with "really really good" reason, and always expect some complaints initially....

Consistency

- **Consistency** in design is virtuous. When things are consistent, it becomes easy for users to catch the pattern, and thus learn.
- Example: Ctrl-S, Cltr-C, Cltr-V (This function is same across all applications)

Consistency

(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

Drag a file icon to:

Result:

Folder on same
physical disk



File is moved

Folder on another
physical disk



File is copied

Trash can



File is discarded

Consistency

Important to allow users to observe any permanent states

Page 1 of 1

122 Words



English (US)



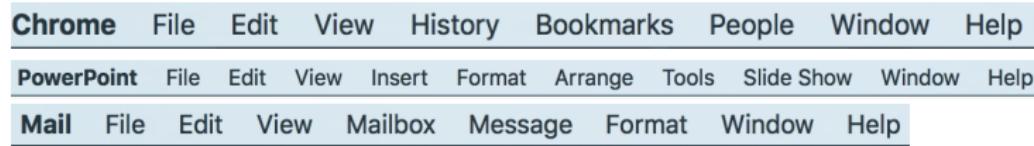
Focus



100%

External consistency

External consistency concerns the consistency with other elements in the same environment (e.g., Mac OS)



Activities

Classwork



- Attempt to redesign the elevator buttons so to *minimize* people accidentally closing the door.
- Submit a screenshot and roughly 300 words arguing why you think your design will solve the problem to Google Classroom.

Discussion

Questions

Mapping

- **Mapping** is the spatial relationship between objects
- When the mapping uses **spatial correspondence**, it is easy to determine how to use them.
- Mappings vary with **culture** - Arabic (right to left), Chinese (top to bottom), Roman (left to right). So how to design an elevator buttons layout depends on **culture**

Mapping

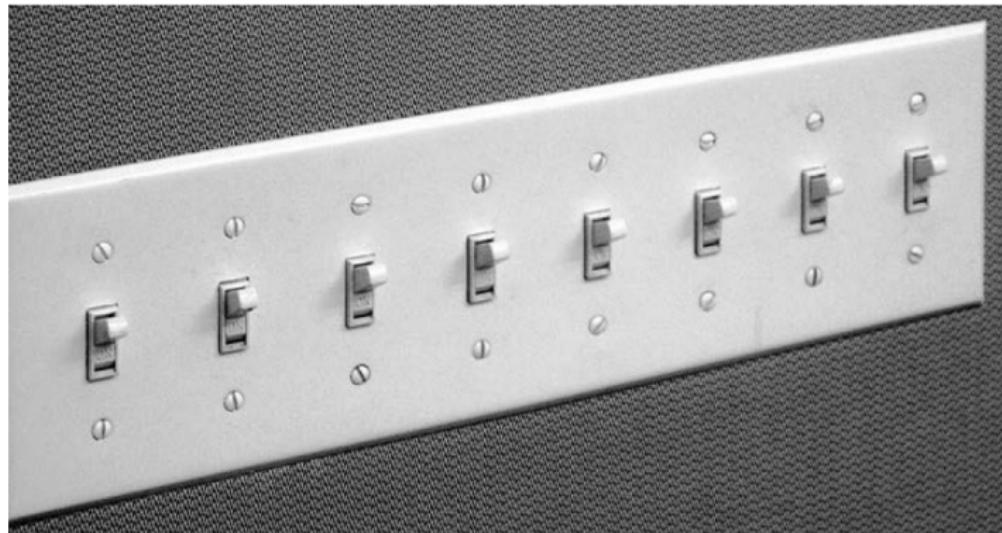


Figure: Source: Fg 4.4 (Norman) - Incomprehensible Light Switches

Mapping

FIGURE 4.5. A Natural Mapping of Light Switches to Lights. This is how I mapped five switches to the lights in my living room. I placed small toggle switches that fit onto a plan of the home's living room, balcony, and hall, with each switch placed where the light was located. The X by the center switch indicates where this panel was located. The surface was tilted to make it easier to relate it to the horizontal arrangement of the lights, and the slope provided a natural anti-affordance, preventing people from putting coffee cups and drink containers on the controls.

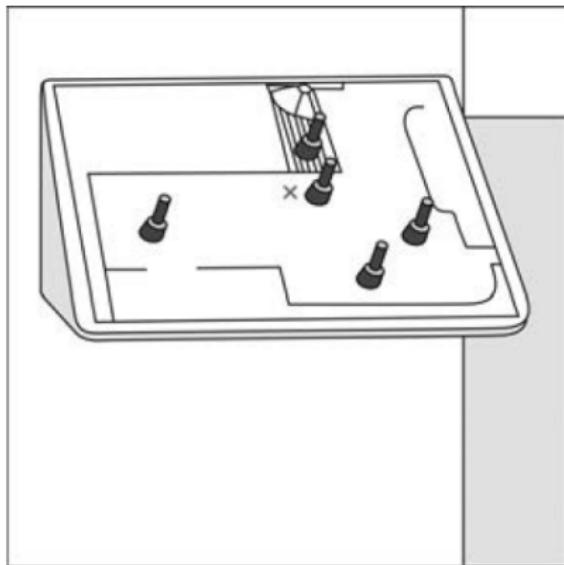


Figure: Source: Fg 4.5 (Norman)

Mapping



Figure: Source: Fg 1.7 (Norman)

Mapping



Mapping



Mapping



Mapping



Mapping



Mapping



Mapping



Mapping



Mapping



Mapping

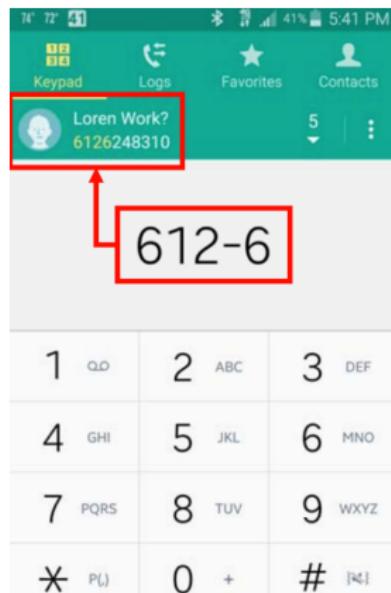


- Oh my....there is a fire on my furnace....I got to turn it off...
-Oh no! which one is off?

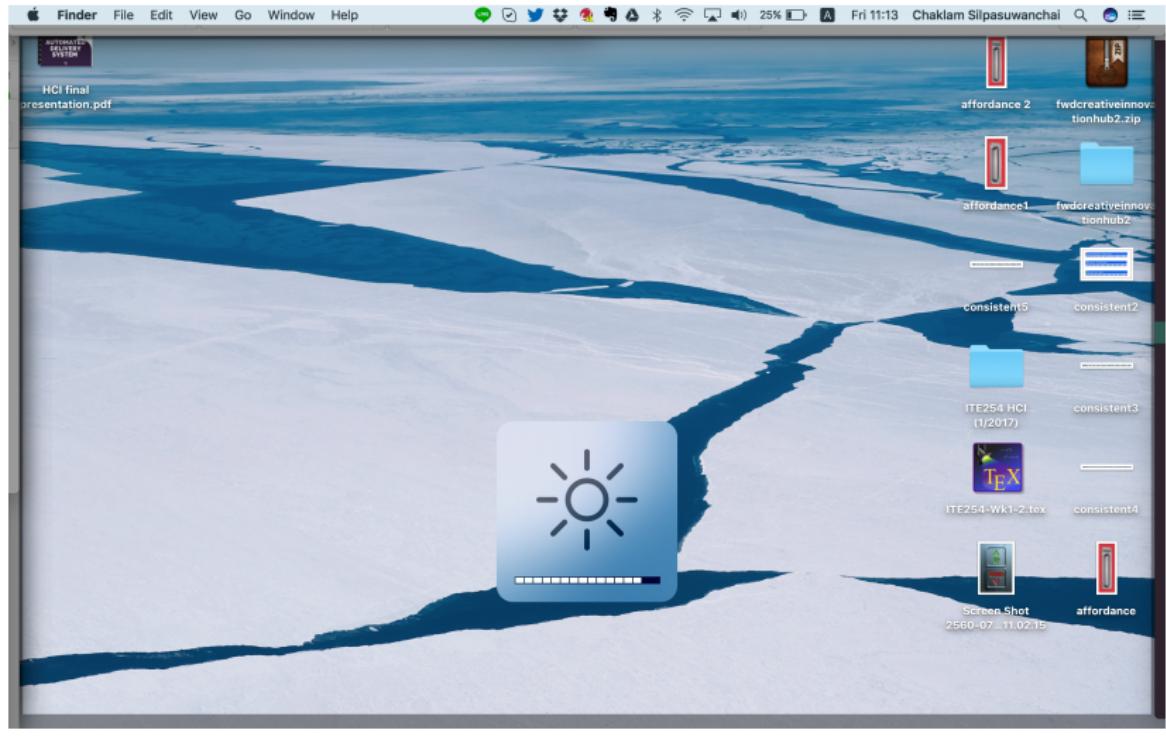
Feedback

- When there is **no feedback**, we get **confused**. Why?
- Feedback must be **immediate**
- Feedback must be **informative** - one flash and two flashes error message isn't very helpful
- **Too much feedback** can be annoying. Why?

Feedback



Feedback



Feedback



Feedback

Every week you will need to complete readings, watch videos, complete projects, or do other things that will take about the same time as a class meeting. Make sure that everything is completed before the next class so you are ready to learn.

- Take a look at the [Week 1-1- Introduction.pdf](#) to be prepared for the next class :)
- Check out the [Course Wiki](#) for resources; if you post a comment adding some useful resources for HCI, you will get one bonus point for each resource! (maximum 3pts). These points can be used to add up if you get a poor score on your homework or quizzes.



LOOKING AHEAD

This is where everything you need to know before the next face to face class will be posted.

Reminders:

1. Complete P0 (0pts) - Due Apr 10

- Blackboard -> Homework -> P0 -> Create Blog Entry (each group posts one)

Path: p » img

Words:305

ATTACHMENTS

You can drag files from your computer to the Attach Files area or use the browse functions. Files are saved in the top-level folder in your course's file repository. If you select a file you do not want, click **Do Not Attach** to remove the attachment from the content item. The file itself is not deleted.

Attach Files Browse My Computer Browse Content Collection

Attached files

File Name

Link Title

File Action

Click **Submit** to proceed. Click **Cancel** to go back.

Cancel

Submit

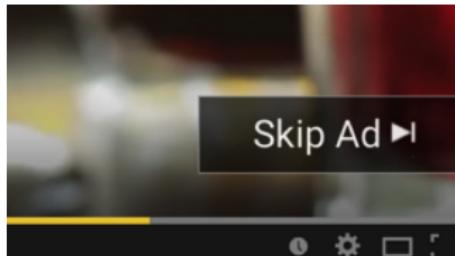


Feedback



- A clever trick Instagram uses to upload photo quick
- Whenever you upload a photo, Instagram will quickly finish uploading
- Trick users to think it finishes already

Feedback



- Human attention span is 8 secs (goldfish has a 12 secs!)
- 0.1 sec - is the limit that humans can wait while **manipulating**
 - Important for direct manipulation, virtual world navigation
- 1 sec - the limit that user's **flow of thoughts** go uninterrupted
 - Display a busy cursor if things take longer than 1 sec
- 10 sec - the limit that user can **wait**
 - Display a progress bar if things take longer than 10 sec

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Mental Models

Don't Make Me Think

So...what's a successful design? - Mental Models

- **Mental model** is how one thinks something works
- **If designer and user mental model matches, it is a successful design**
- **Good** mental model examples:
 - Folder and files icons
 - Scissors
- Matching mental model is **hard**. Novice and experts, for example, have completely different models. Designers and users also have often very different models

Mental Models



FIGURE 1.8. Junghans Mega 1000 Digital Radio Controlled Watch. There is no good conceptual model for understanding the operation of my watch. It has five buttons with no hints as to what each one does. And yes, the buttons do different things in their different modes. But it is a very nice-looking watch, and always has the exact time because it checks official radio time stations. (The top row of the display is the date: Wednesday, February 20, the eighth week of the year.) (Photograph by the author.)

Figure: Source: Fg 1.8 (Norman)

- When users have incorrect mental models, your design fails
- **Watch:** There are five buttons. There are **affordances** of buttons but it does not **signifies** what to do. There are also no clear **mappings** between functions and buttons. **Constraints** are also not applied properly - each button can be pressed or hold or press twice, none of which are explained clearly. Only way to use this watch is to read the manual....too bad

Mental Models

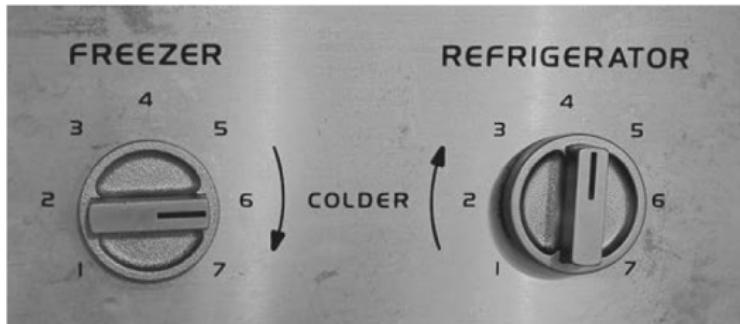


FIGURE 1.9. Refrigerator Controls. Two compartments—fresh food and freezer—and two controls (in the fresh food unit). Your task: Suppose the freezer is too cold, the fresh food section just right. How would you adjust the controls so as to make the freezer warmer and keep the fresh food the same? (Photograph by the author.)

Figure: Source: Fg 1.9 (Norman)

- **Refrigerator:** If the freezer is too cold, what you will do?

Mental Models

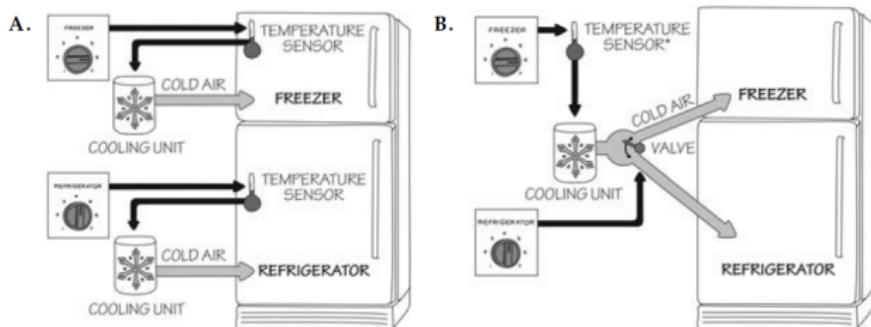


FIGURE 1.10. Two Conceptual Models for a Refrigerator. The conceptual model A is provided by the system image of the refrigerator as gleaned from the controls. Each control determines the temperature of the named part of the refrigerator. This means that each compartment has its own temperature sensor and cooling unit. This is wrong. The correct conceptual model is shown in B. There is no way of knowing where the temperature sensor is located so it is shown outside the refrigerator. The freezer control determines the freezer temperature (so is this where the sensor is located?). The refrigerator control determines how much of the cold air goes to the freezer and how much to the refrigerator.

Figure: Source: Fg 1.10 (Norman)

Don't Make Me Think

- Famous book of Steve Krug's *Don't Make Me Think*
- Key concept of the book is **Don't make users think**
- **Not thinking** means that users should be able to quickly reach their goal without unnecessary cognitive effort

Don't Make Me Think

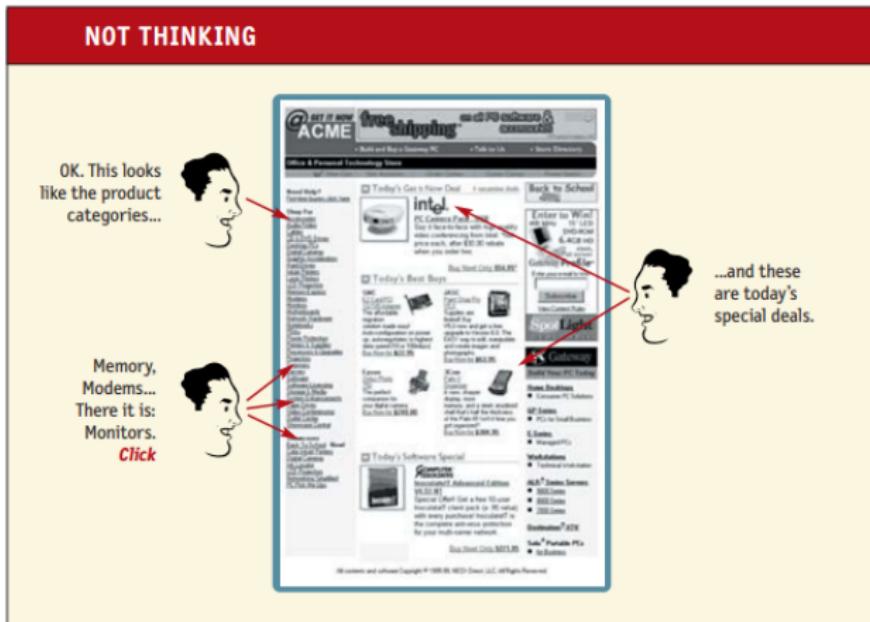


Figure: Source: Pg. 12 (Steve)

Don't Make Me Think

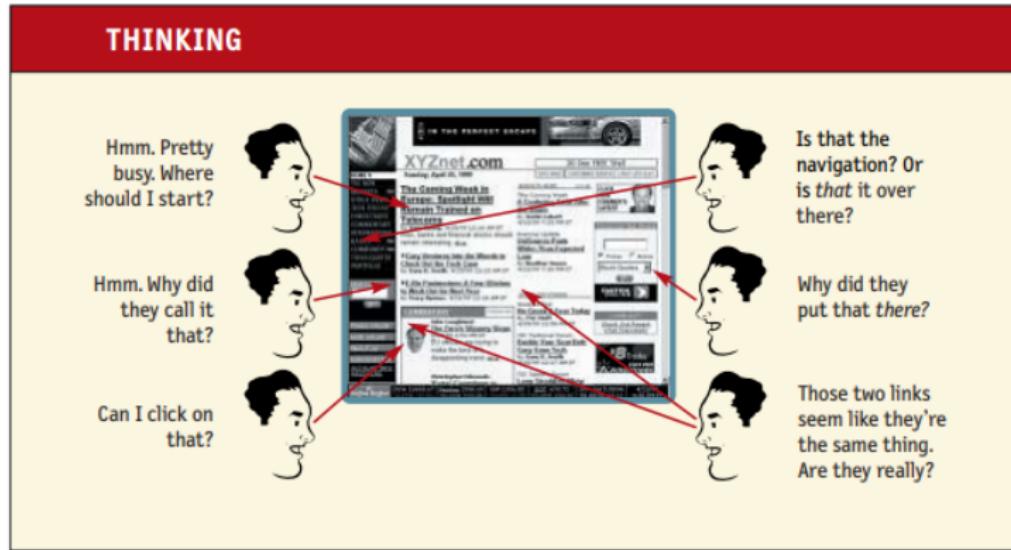


Figure: Source: Pg. 13 (Steve)

Things that Make Us Think - Names

- Typical culprits include cute or clever **names**, marketing-induced names, company-specific names, and unfamiliar names



Figure: Source: Pg. 14 (Steve)

Things that Make Us Think - Links and Buttons

- Needless source of question marks over people's heads is **links and buttons that aren't obviously clickable**. The point is simple things like links should not cause any such headache

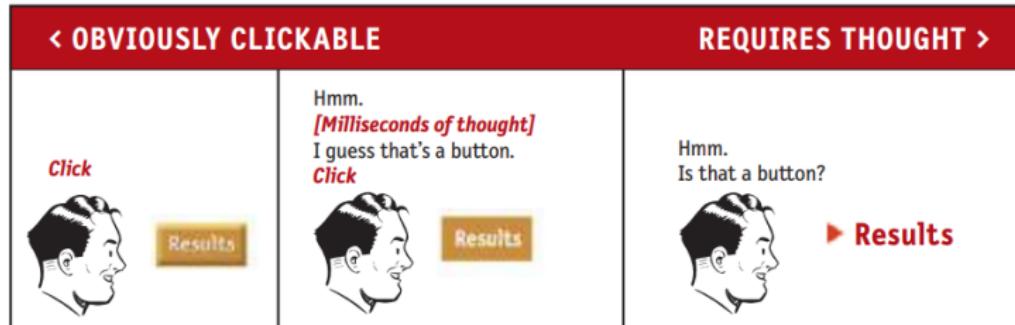


Figure: Source: Pg. 15 (Steve)

Things that Make Us Think - Search

- Many bookstore sites require us to **think how we want to search** which adds up the cognitive effort

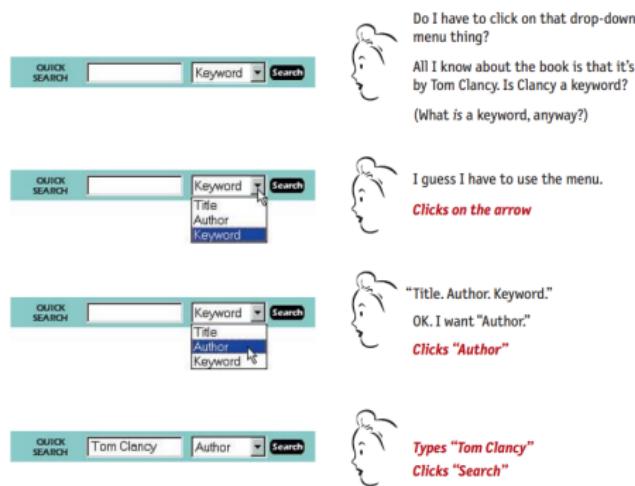


Figure: Source: Pg. 16 (Steve)

How We Really Use the Web

- A gap often between how we think people use Websites and how they actually use them
- In fact, people mostly is **impatient** and usually in hurry, only care about their **goal**, **does not like to think**
- Thus, most people will just **scan** and **click**, within tenth of a second...

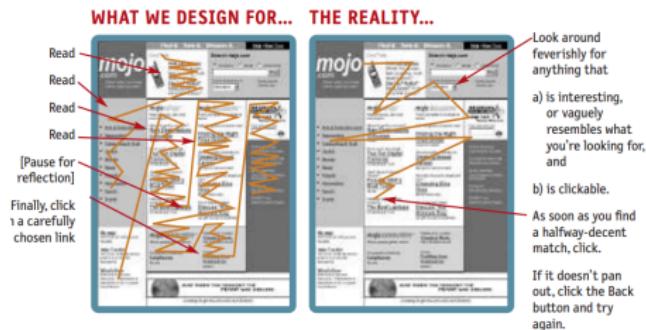


Figure: Source: Pg. 21 (Steve)

Fact of Life I - We scan

- We don't read. We scan. We are smart to know we do not need to read everything



Figure: Source: Pg. 23 (Steve)

Fact of Life II - local optima

- We don't choose the **best** option. We choose the **first reasonable** option because
 - We are usually in a **hurry**
 - The **penalty** for guessing wrong is low with the Back button always available
 - Not to mention guessing is **fun**

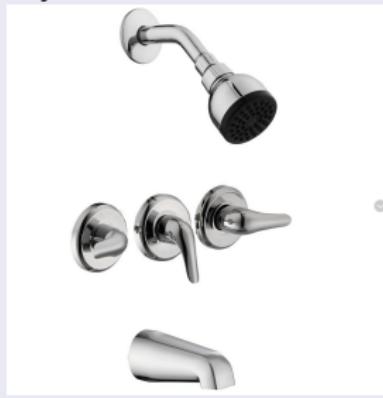
Fact of Life III - We don't like to learn/think

- We don't like to think or learn, we usually just **muddle through**
- If we find something that works, we stick to it, we **hardly change our way**

Activities

Classwork

Shower at hotel is something simple that is often frustrating. Have your encounter relatives where they have difficulty understanding how the shower works? Have you ever turn on the shower with water splash right on your face when it's not intended? Attempt to redesign the shower system.



Discussion

What's next

Read my slide on **Writing**,

- Learning how to actually write
- Perform some reading workshop together

Questions