Psychology in UI/UX Design

ITS290F

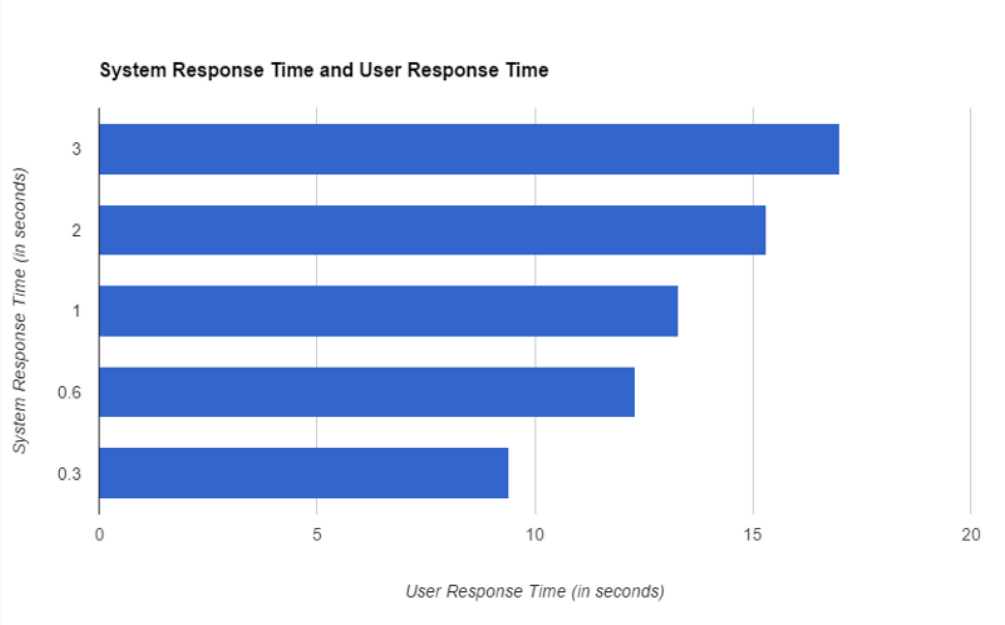
Why Psychology?

Psychology plays a big part in a user's experience with an application. By understanding **how our designs are perceived**, we can **make adjustments** so that the apps we create are **more effective in achieving the goals of the user**.

Doherty Threshold

- In 1982 Walter J. Doherty and Ahrvind J. Thadani published, in the IBM Systems Journal, a research paper that set the requirement for computer response time to be 400 milliseconds, not 2,000 (2 seconds) which had been the previous standard.
- Provide system feedback within 400ms in order to keep users' attention and increase productivity.

System Response Time & User Response Time



The time the computer took to process a request was highly correlated with the user response time (the time it took the user to type in the next command).

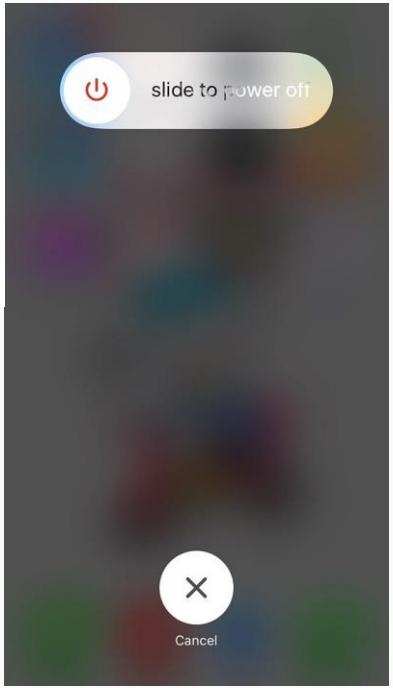
- **The longer the computer took to respond, the longer the user took to think of what he wanted to do next!**
- At a 3 second system response time, it took the user 17 seconds to enter the next command.
- At a 0.3 second response time, it only took the user 9.4 seconds to enter the next command

Source: https://medium.com/@Gugel/the-doherty-threshold-5471ca990de6

Fitts’s Law

Why the brake paddle is larger than the accelerate paddle?

Why some keys are larger and why the “space” bar is the largest?



Why the two buttons are far apart?

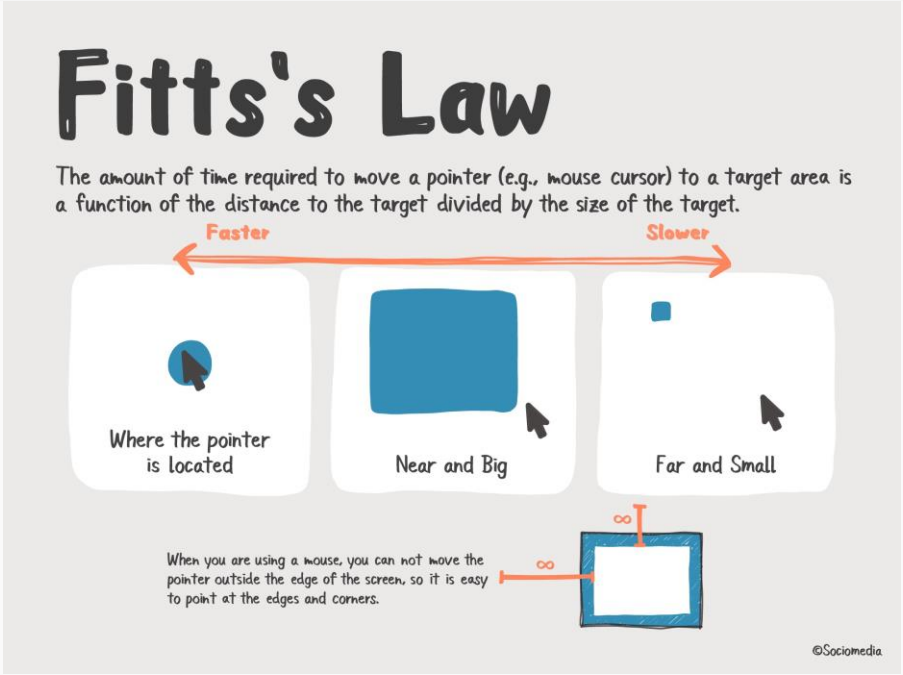
Fitts’s Law

Fitts's Law states that the movement time to a target is dependent on the distance to the target and the size of the target.

This law especially applies to buttons, which the purpose of these elements is to be easy to find and select.

- If accuracy is important, make sure that the target is large and closer to the pointer.
- If you don’t want the target to be frequently used or accidently activated, place the target further away and make it smaller.

Fitts's Law - Index of Difficulty (ID)

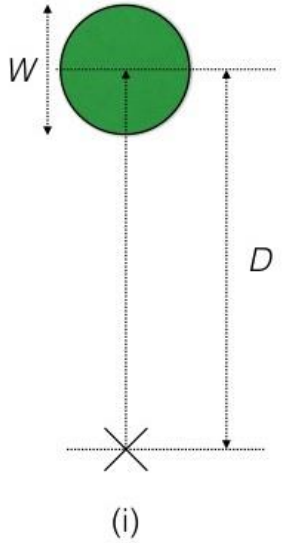


- The ID can be expressed in several ways.
- The following is an ISO standard (ISO 9241-9) for the ID. It is known as the "Shannon formulation"

$$ID = \log_2\left(\frac{D}{W} + 1\right)$$

D = distance to midpoint of target

W = width of target



Visualization of Fitts's Law: http://simonwallner.at/ext/fitts/

Index of Difficulty - Example

Two UI designs (figures a and b).

1. figure a. **Only the text is clickable**
2. figure b. **The whole box is clickable**

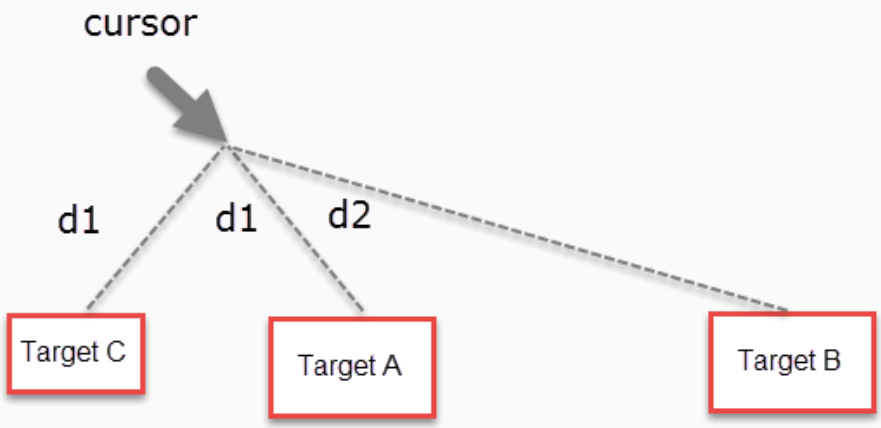
Which UI design has a *higher* ID?

Let's assume the distance (*A*) is 1 in both design. Widths (*W*) of the UI elements in figures a and b are 1 and 2, respectively.

figure a. $log_2\left(\frac{1}{1}+1\right)=1$

figure b. $log_2\left(\frac{1}{2}+1\right)=0.58$

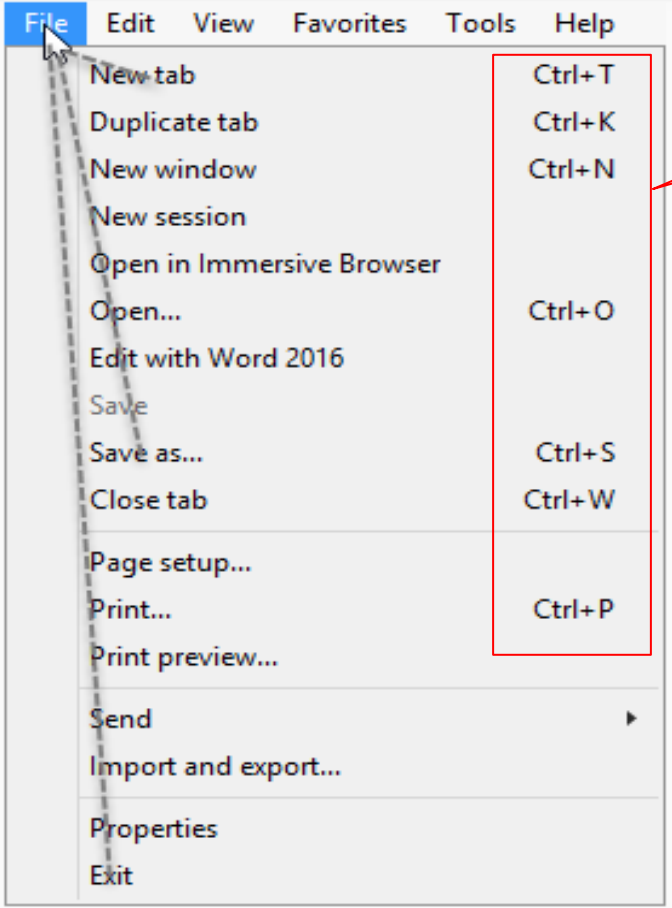
Index of Difficulty - Example



- *Fitts' law says that the time to reach **Target A** is **shorter** than the time to reach any of the other targets.*
- *Although **Targets A** and **B** have the **same size**, the distance from cursor to A (d1) is **shorter** than the distance to B (d2), so movement to A will be **faster**.*
- ***Target C** is placed at the **same distance** (d1) from the cursor as **Target A**, but it's **smaller**, so it will take **longer** to move the cursor to it than to A.*

Source: https://www.nngroup.com/articles/expandable-menus/

Index of Difficulty - Example

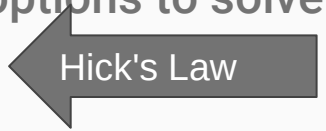


Shortcuts
Which UI principle?

In a linear menu, the time to reach the first item in the menu is shortest and the time to reach the last element is longest because the distance from the cursor (that is, menu handle) to the first element is the shortest and the distance to the last element is the longest.

Source: https://www.nngroup.com/articles/expandable-menus/

How do we make decisions?

1. Identify a problem or goal
2. Access the available options to solve the problem or achieve the goal
3. **Decide on an option** 

4. Implement the option

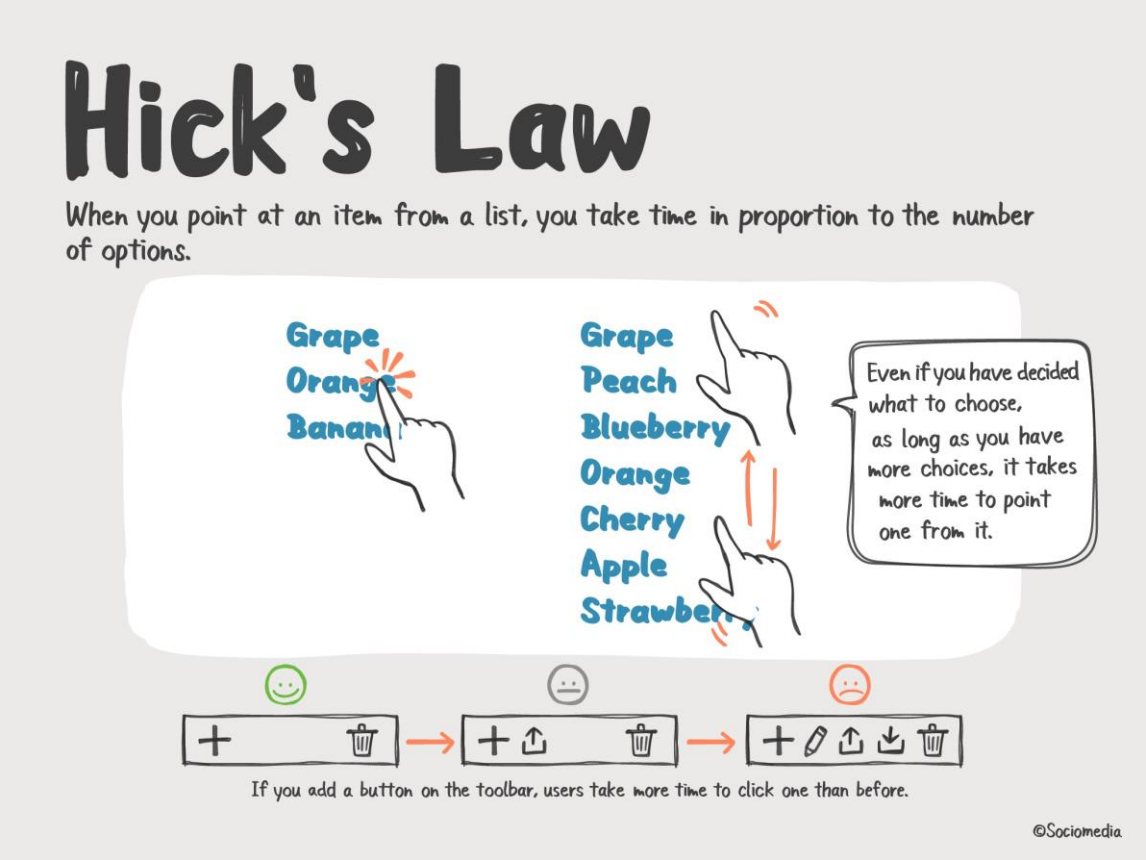
Hick's Law does not apply to decisions that involve significant levels of search, reading, or complex problem solving

Hick’s Law

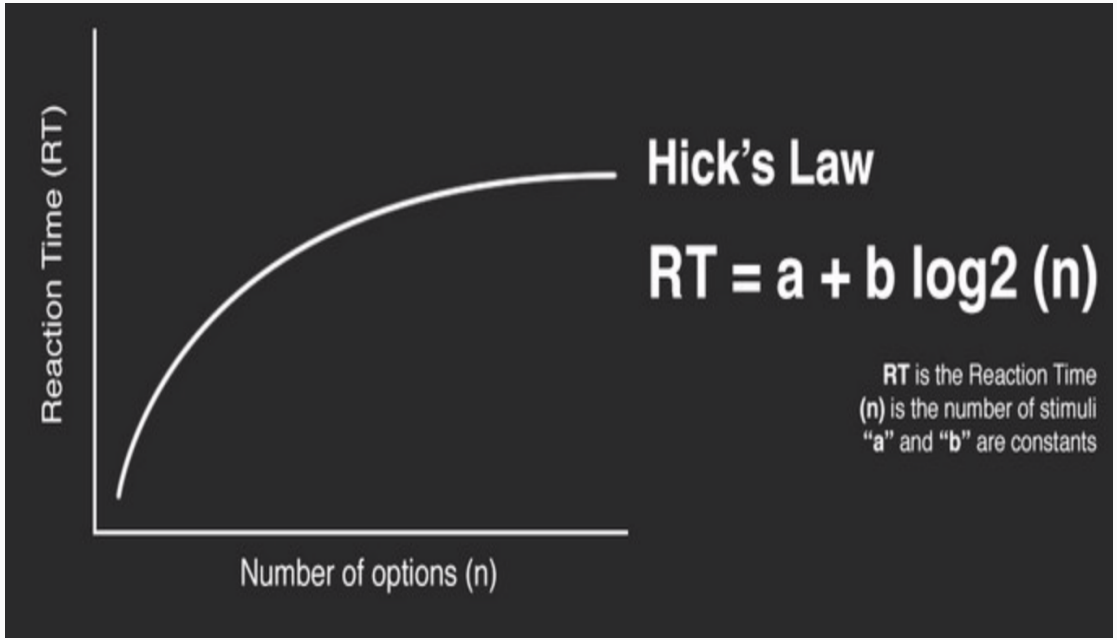
The time it takes to make a decision increases with the number and complexity of choices.

- More choices results in longer to think about these choices and make a decision.
- Simplify choices for the user to ensure by breaking complex tasks into smaller steps.
- Avoid overwhelming users by highlighting recommended options.

Hick's Law: Example



Hick's Law - Response/Reaction Time (RT)



"a" - the total amount of time that is not involved with decision making.

"b" - the cognitive process time for each option.

In the same contextual conditions (for a and b constants), if the number of options grows, so does **reaction time** but in a sub-linear way (non-proportional):

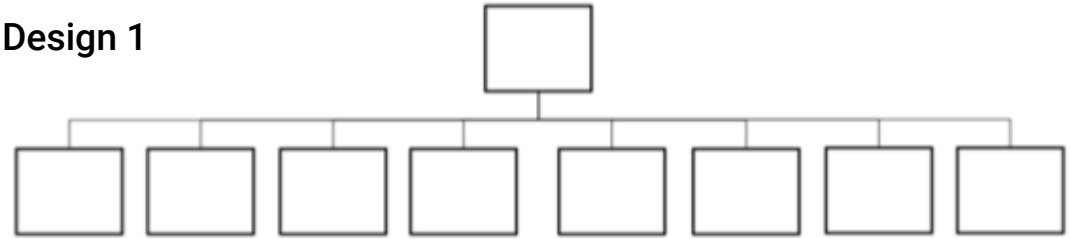
- with 2 options, $\log_2 2 = 1$
- with 4 options, $\log_2 4 = 2$
- with 8 options, $\log_2 8 = 3$

Given an equal number of choices, "a" and "b" influence reaction time.

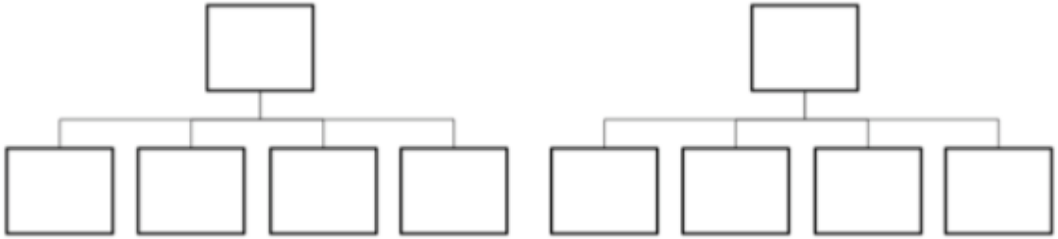
Source: https://www.interaction-design.org/literature/article/hick-s-law-making-the-choice-easier-for-users

Which design is better?

Design 1



Design 2



Assume (1) the contextual conditions are the same for both design and (2) items are organized in a meaningful way, i.e. according to some convenient and significant principle by the user's point of view.

Reaction Time:

Design 1

$a + b \log_2(8) = a + 3b$

Design 2

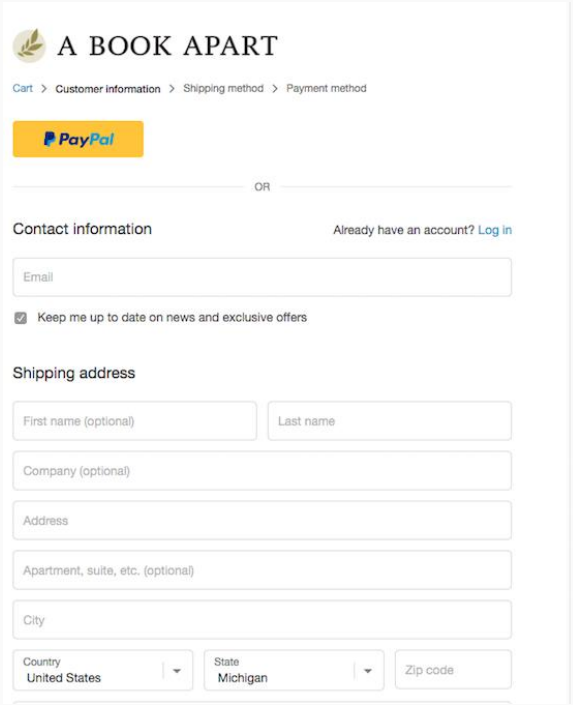
$2 * (a + b \log_2(4)) = 2a + 4b$

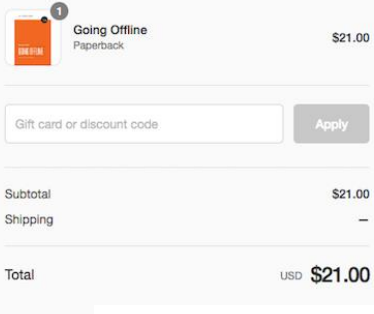
Jakob’s Law

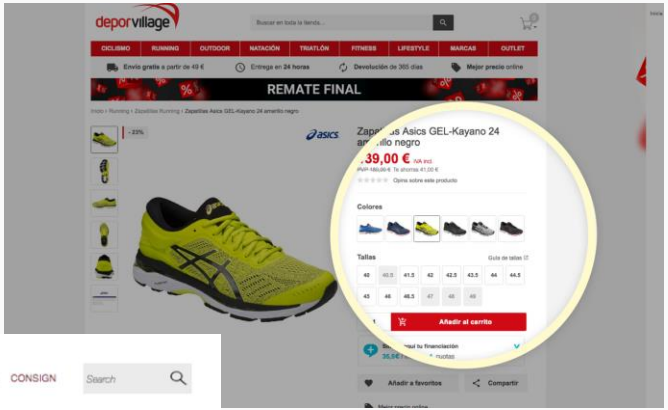
Users spend most of their time on other sites. This means that users prefer your site to work the same way as all the other sites they already know.

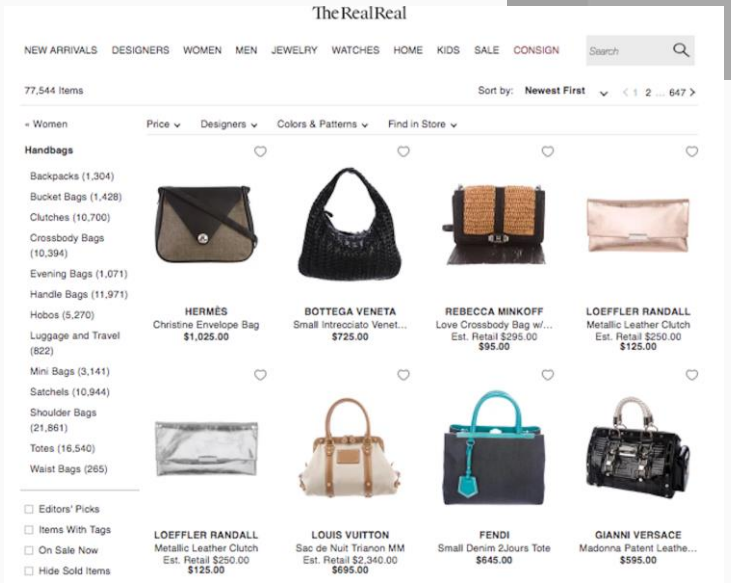
- **You can simplify the learning process for users by providing familiar design patterns.**

Familiar Design Patterns?







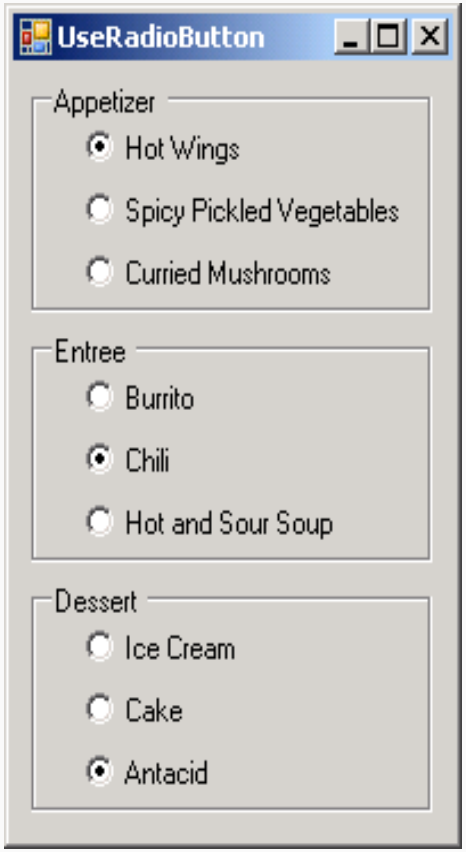


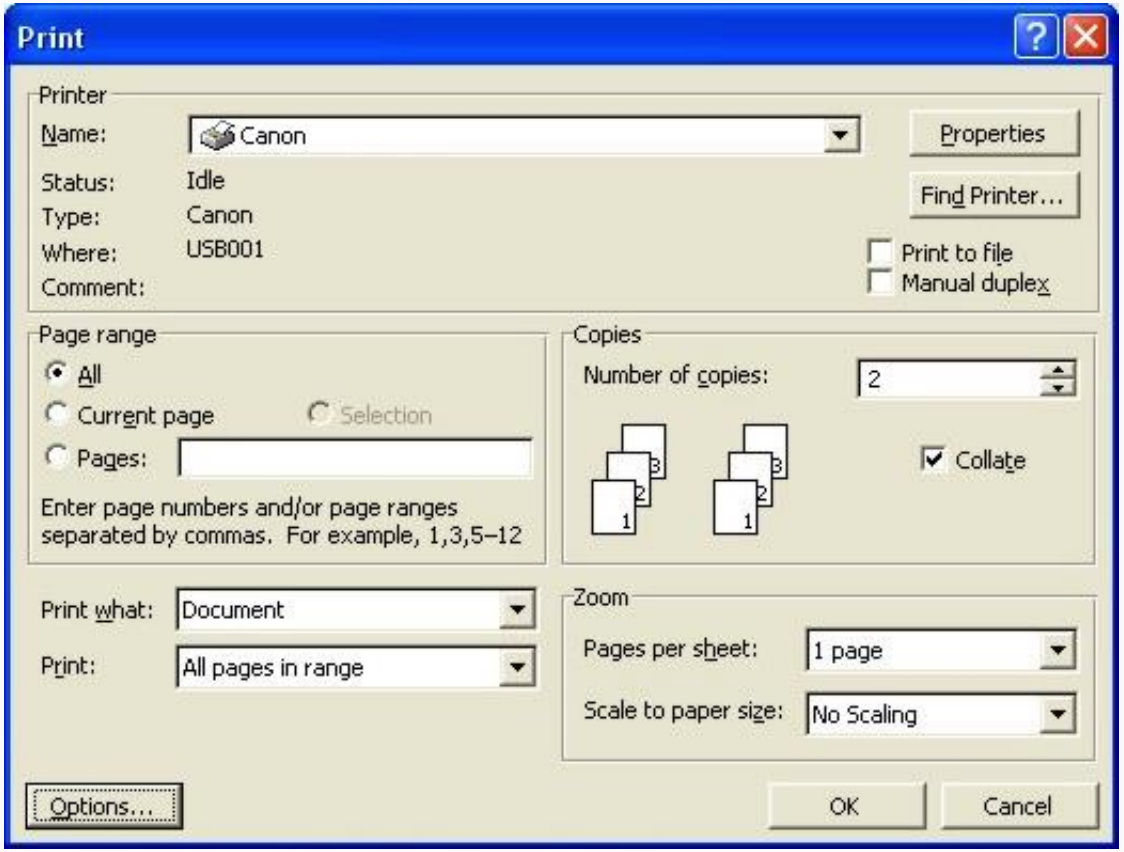
Law of Common Region

Elements tend to be perceived into groups if they are sharing an area with a clearly defined boundary.

- Adding borders (creating common regions) around an element or group of elements is an easy way to create separation from surrounding elements.

Examples


UseRadioButton
Appetizer
Hot Wings
Spicy Pickled Vegetables
Curried Mushrooms
Entree
Burrito
Chili
Hot and Sour Soup
Dessert
Ice Cream
Cake
Antacid


Print
Printer
Name:
Canon
Properties
Status:
Idle
Type:
Canon
Where:
USB001
Comment:
Find Printer...
Print to file
Manual duplex
Page range
All
Current page
Selection
Pages:
Enter page numbers and/or page ranges separated by commas. For example, 1,3,5–12
Copies
Number of copies:
2
Collate
Print what:
Document
Print:
All pages in range
Zoom
Pages per sheet:
1 page
Scale to paper size:
No Scaling
Options...
OK
Cancel

Law of Prägnanz

People will perceive and interpret ambiguous or complex images as the **simplest form possible**, because it is the interpretation that requires the **least cognitive effort** of us.

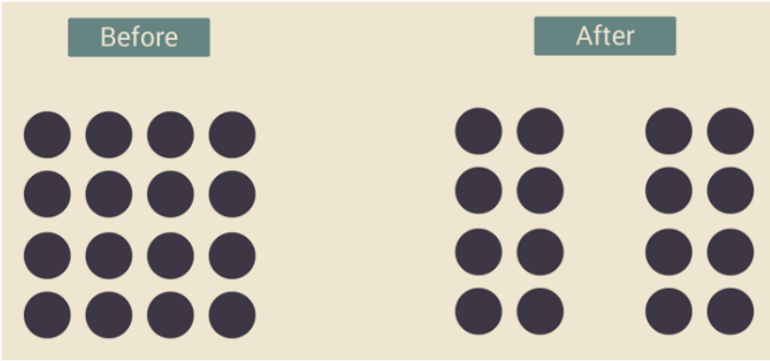
Design implications:

- Be clear and concise
- Keep things simple
- Use familiar patterns and layouts

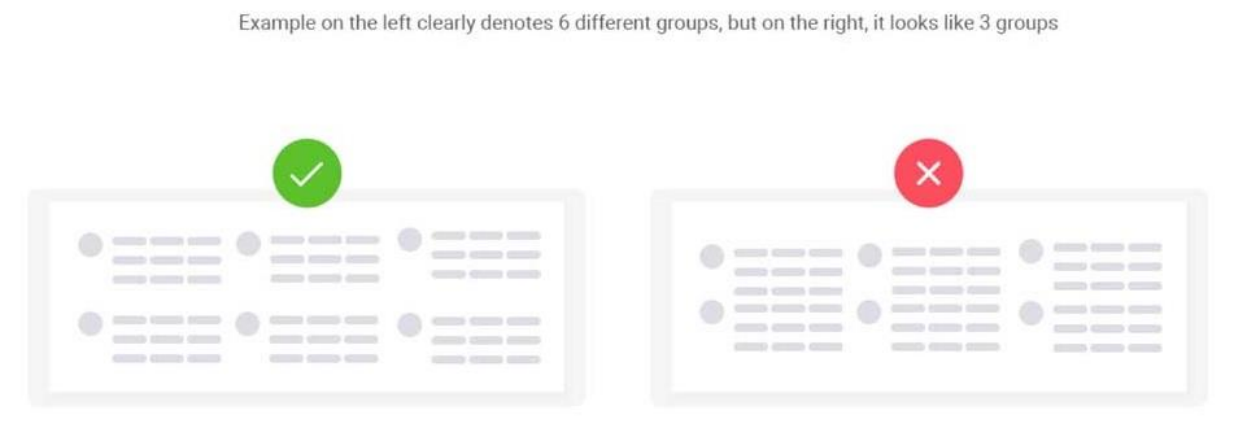
Law of Proximity

Objects that are near, or proximate to each other, tend to be grouped together.

- **The law of proximity is useful by allowing users to group different clusters of content at a glance.**



Law of Proximity - Example



Username	
First Name	
Last Name	
E-mail	
Phone	

vs.

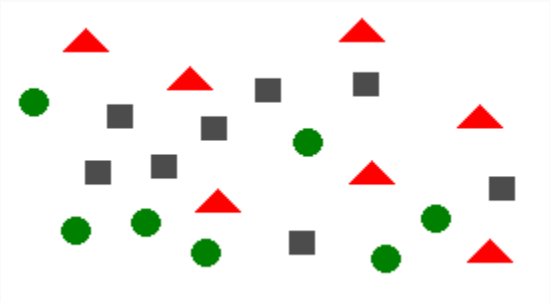
Username	
First Name	
Last Name	
E-mail	
Phone	

Source: http://architectingusability.com/2011/05/26/using-the-gestalt-laws-of-perception-in-ui-design/

Law of Similarity

The human eye tends to perceive similar elements in a design as a complete picture, shape, or group, even if those elements are separated.

- **Ensure that links and navigation systems are visually differentiated from normal text elements, and are consistently styled.**



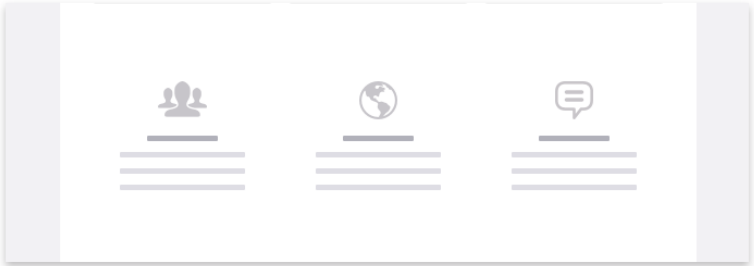
Law of Similarity - Example

Law of similarity

Our goal is to visualise 3 content groups of 1 icon, 1 headline and three lines.

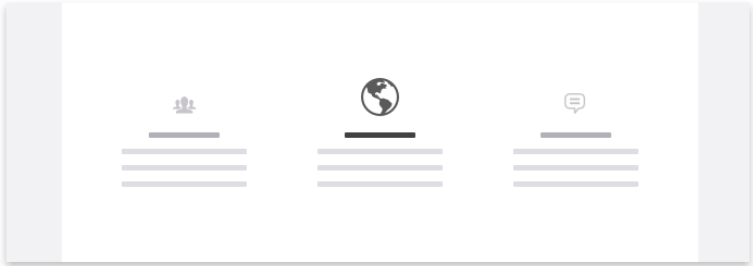
Do

Visual Perception:
1 section containing 3 groups of 1 icon 1 headline and 3 lines each. **There is no hierarchic difference between the groups. (Same size and colors)**

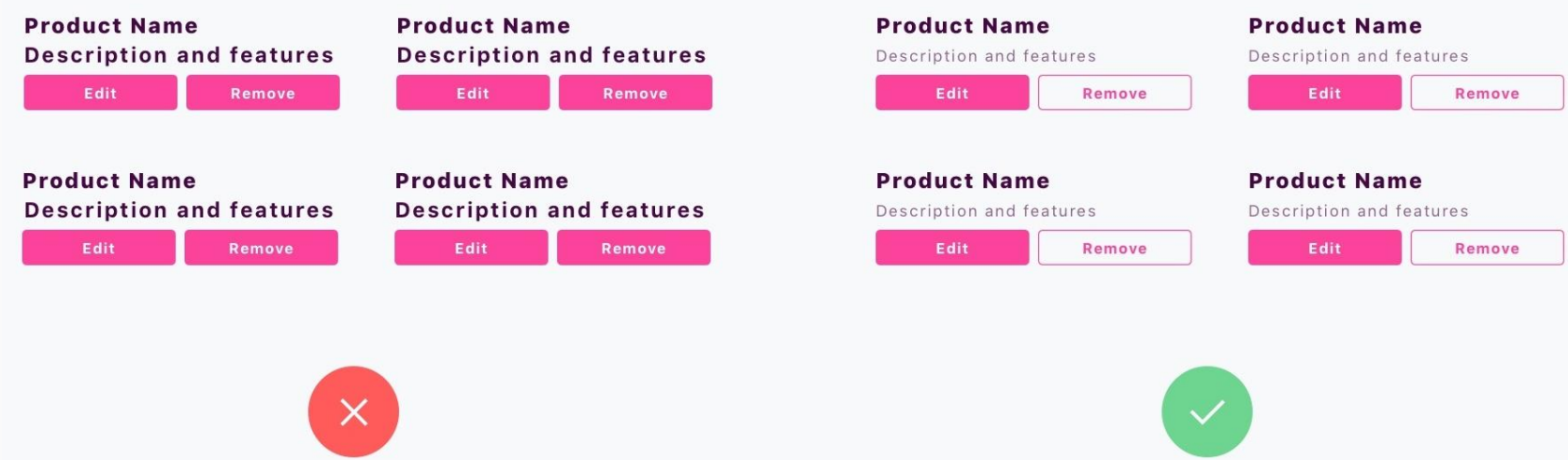


Don't

Visual Perception:
1 section containing 3 groups of 1 icon 1 headline and 3 lines each. **There is hierarchic difference in perception due to the difference in brightness and size of the icons.**



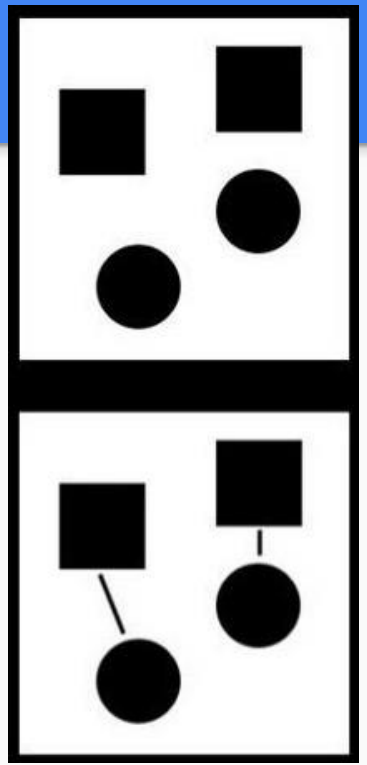
Law of Similarity - Example



Law of Uniform Connectedness (Law of Unity)

Elements that are visually connected are perceived as more related than elements with no connection.

- **Group functions of a similar nature so they are visually connected via colors, lines, frames, or other shapes.**



Miller’s Law

The average person can only keep **7** (plus or minus 2) items in their **working memory**.

- **Chunking** is an effective method of presenting groups of content in a manageable way. Organize content in groups of 5-9 items at a time.

85223818456 

(852) 2381 8456

Miller's Law - Example

MILLER'S LAW

sensing | ∞ chunks

cat	head	king	tape
apple	house	hammer	arrow
ball	door	milk	flower
tree	box	fish	key
square	car	book	shoe

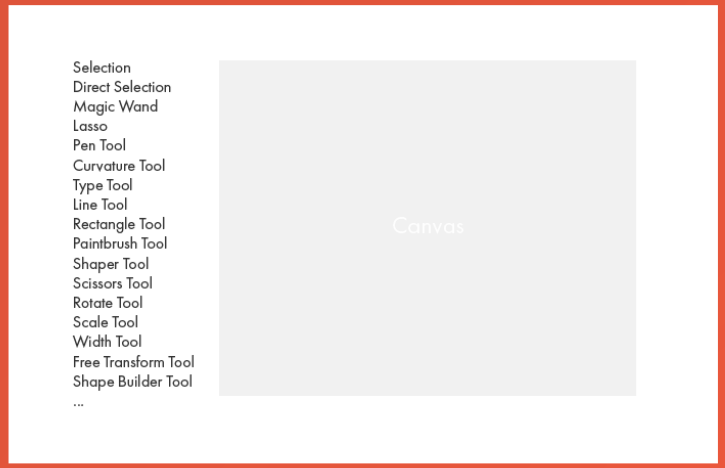
remembering | 7 ± 2 chunks

Person is exposed to numerous bits of information when completing a task. For example, they are shown words on piece of paper.

Information is stored temporarily in the prefrontal cortex for 10—15 seconds. The number of 'bits' one can hold in their working memory, is **5-9** items. This is a universal law and limitation observed in many studies.

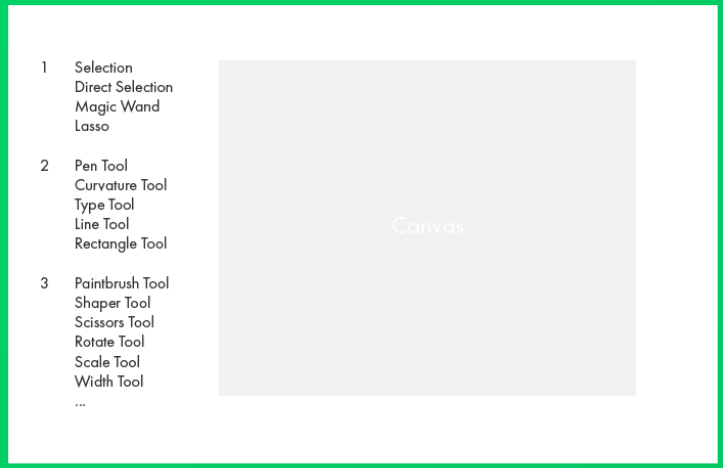
Miller's Law - Example

× Wrong



The functions on the left are organized in chunks that exceed 9. This is a replica interface of Adobe Illustrator. Although one of my favorite tools, they are breaking the rule that Miller's Law has taught us.

✓ Right



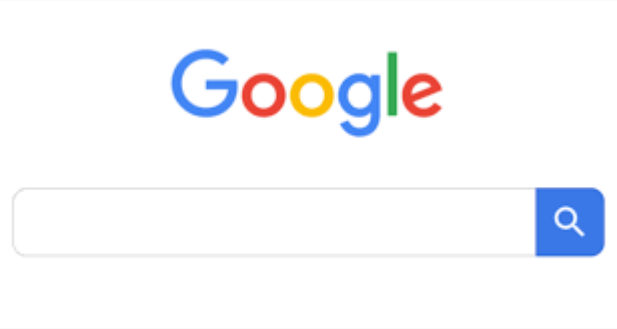
Here we have broken the list using simple line breaks, and reduced the amount of chunks in each category. Each category should be organized by similar functions, tasks, popularity, or another consistent variable you choose.

Occam’s Razor

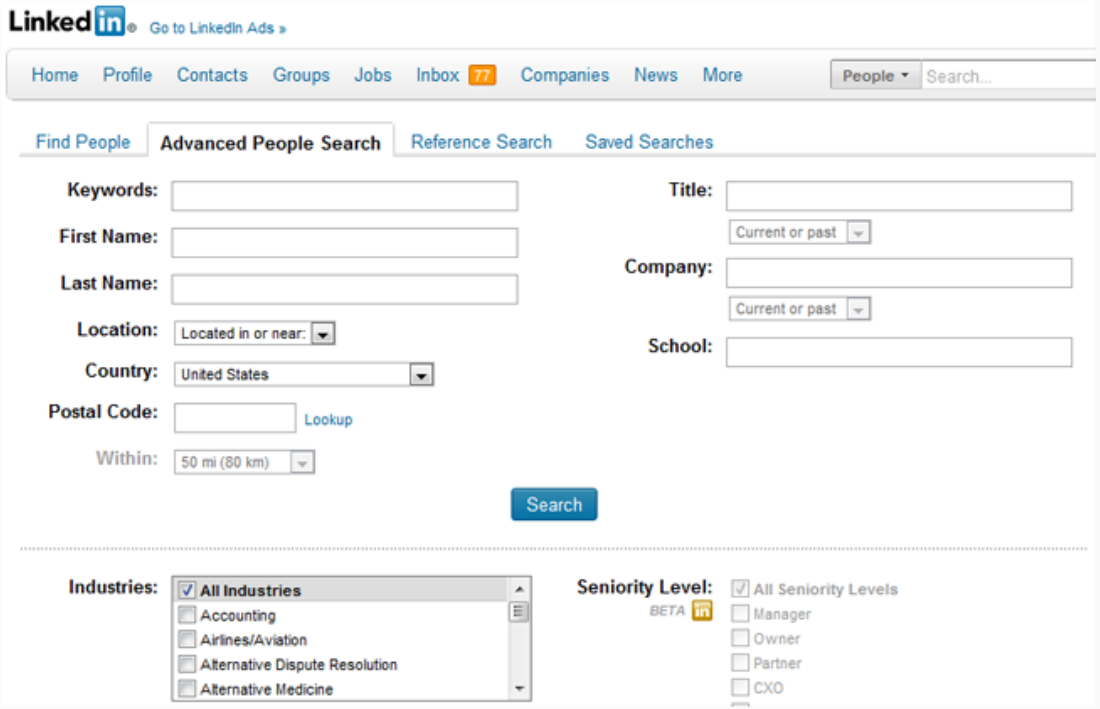
Among competing hypotheses that predict equally well, the one with the fewest assumptions should be selected.

- **The simplest solution is always the best**

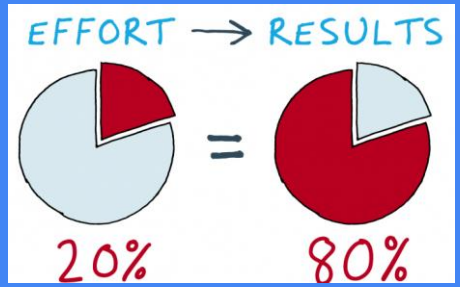
Occam’s Razor - Example



Which one would you choose?



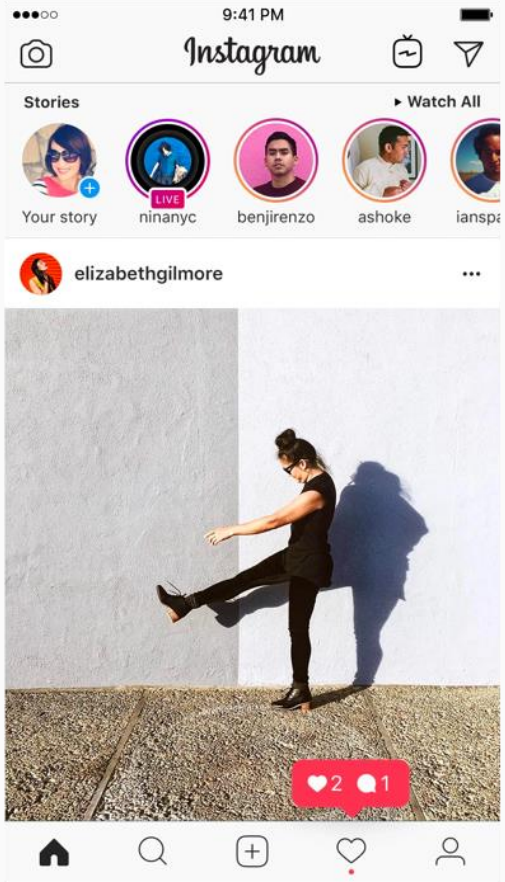
Pareto Principle



The Pareto principle states that, for many events, roughly 80% of the effects come from 20% of the causes.

- 80 / 20 rule helps us recognize the most important features of any product
- 80 / 20 are not fixed numbers of statistics, it is merely an indication of the cause percentage being significantly smaller than the effect percentage

Pareto Principle - Example



80/20 Rule examples:

Menus
20% of the functions that use up 80% of the user's time

Analysis (User Research)
20% of the functions that are used by 80% of the users

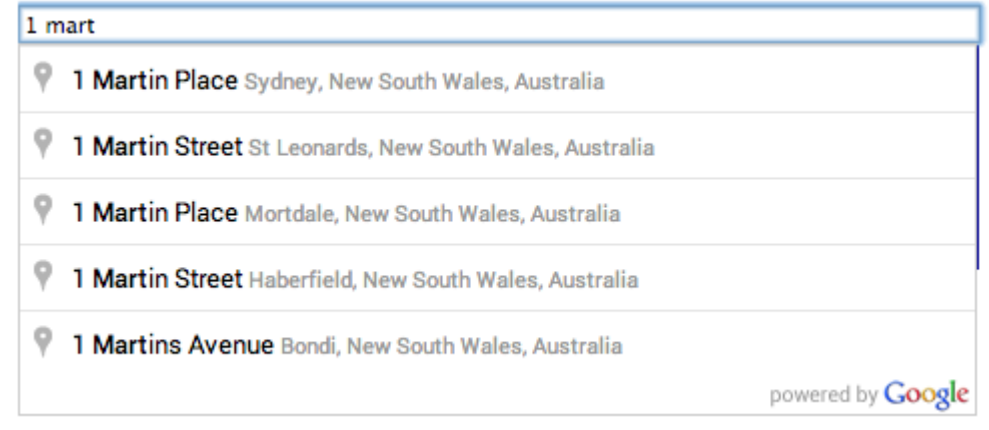
Default Options
20% of the options that are used by 80% of the time

Tabbed menus, (bottom and top nav bars) showcase the top 3–5 functions (20%) of the application which takes up 80% of the user's time on the application.

Parkinson’s Law

Any task will inflate until all of the available time is spent.

- Finish an assignment in **one week** vs. **one month**
- A UX designer can apply this to creating **more efficient interfaces** that help users complete a task in a timely manner.
- For example, you can autofill some data for customers during checkout.



Serial Position Effect

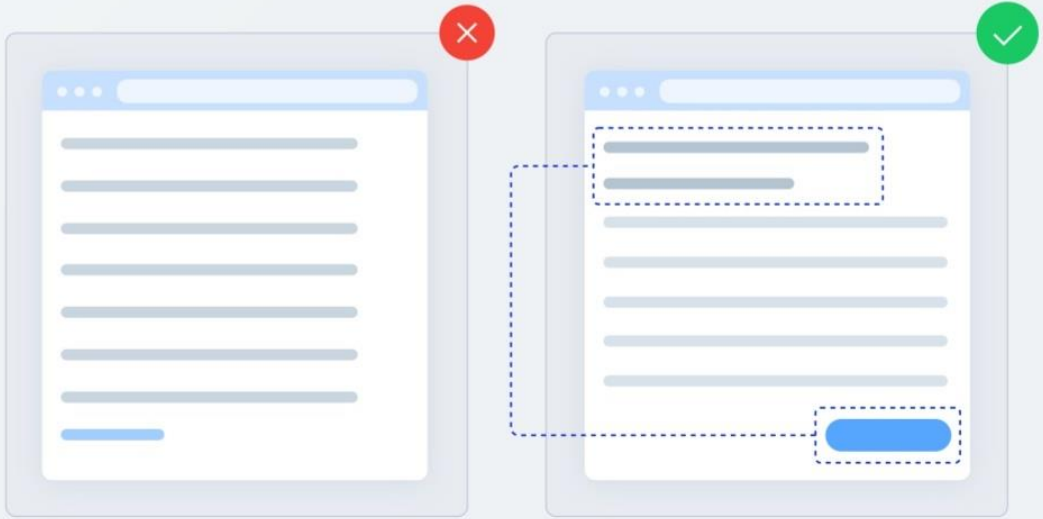
Users have a propensity to best remember the first and last items in a series.

- Placing the least important items in the middle of lists can be helpful because these items tend to be stored less frequently in long-term and working memory.
- Positioning key actions on the far left and right within elements such as navigation can increase memorization.

Serial Position Effect - Example

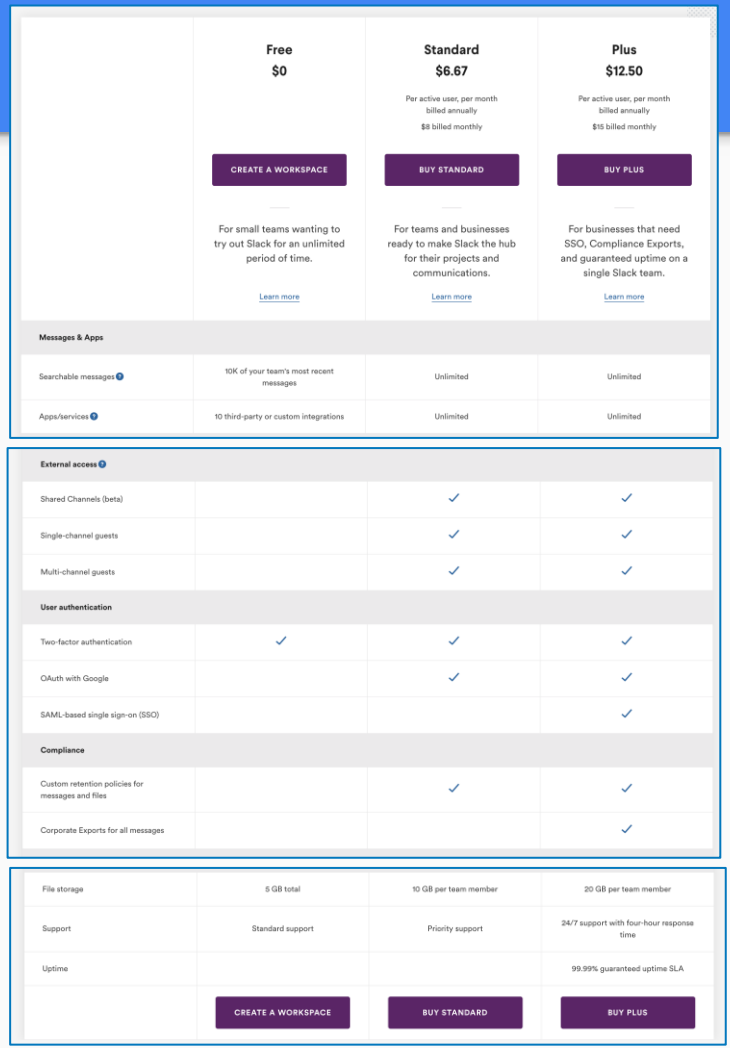
Users have a propensity to best remember the first and last items in a series.

Highlight key information in the beginning and the end, while placing the least important items in the middle of your sequence.



Serial Position Effect - Example

In many websites such as Apple, Amazon, etc. The example on the right is from Slack's Pricing page. Here the **most important features to be compared are placed at top and bottom** and **other features are placed in the middle** of the series.

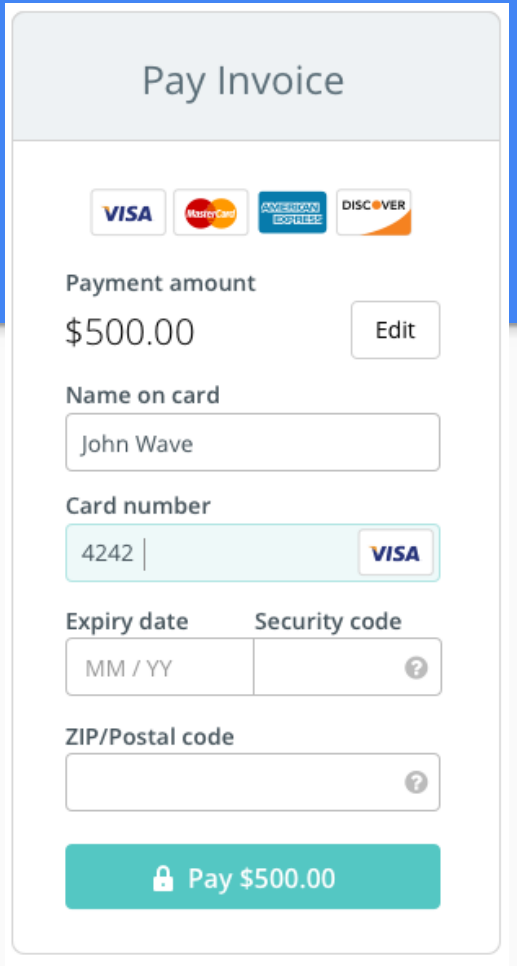


	Free $0	Standard $6.67	Plus $12.50
		Per active user, per month billed annually $8 billed monthly	Per active user, per month billed annually $15 billed monthly
	CREATE A WORKSPACE	BUY STANDARD	BUY PLUS
	For small teams wanting to try out Slack for an unlimited period of time. Learn more	For teams and businesses ready to make Slack the hub for their projects and communications. Learn more	For businesses that need SSO, Compliance Exports, and guaranteed uptime on a single Slack team. Learn more
Messages & Apps			
Searchable messages	10K of your team's most recent messages	Unlimited	Unlimited
Apps/services	10 third-party or custom integrations	Unlimited	Unlimited
External access			
Shared Channels (beta)		✓	✓
Single-channel guests		✓	✓
Multi-channel guests		✓	✓
User authentication			
Two-factor authentication	✓	✓	✓
OAuth with Google		✓	✓
SAML-based single sign-on (SSO)			✓
Compliance			
Custom retention policies for messages and files		✓	✓
Corporate Exports for all messages			✓
File storage	5 GB total	10 GB per team member	20 GB per team member
Support	Standard support	Priority support	24/7 support with four-hour response time
Uptime			99.99% guaranteed uptime SLA
	CREATE A WORKSPACE	BUY STANDARD	BUY PLUS

Tesler’s Law

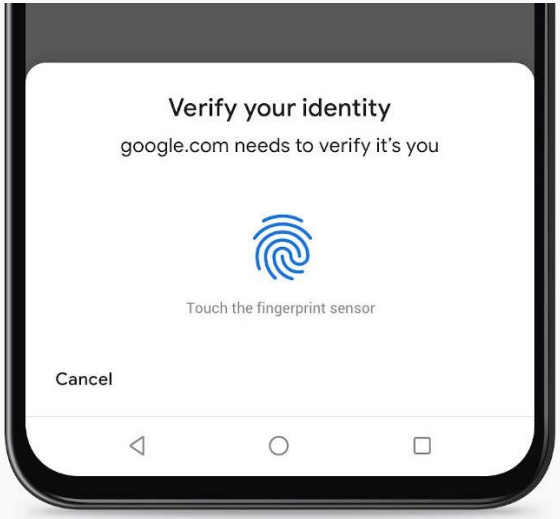
Tesler's Law, also known as ***The Law of Conservation of Complexity***, states that for any system there is **a certain amount of complexity which cannot be reduced**.

- By simplifying something, you inevitably will transfer that complexity onto another area.

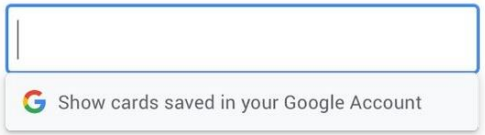


Tesler's Law - Example

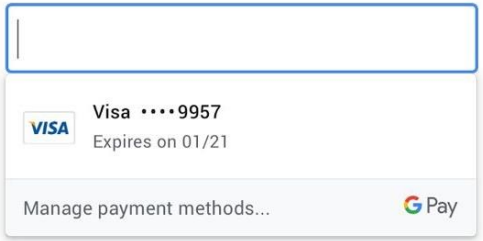
Instead of reducing the complexity, help users to deal with it. E.g., Credit card autofill



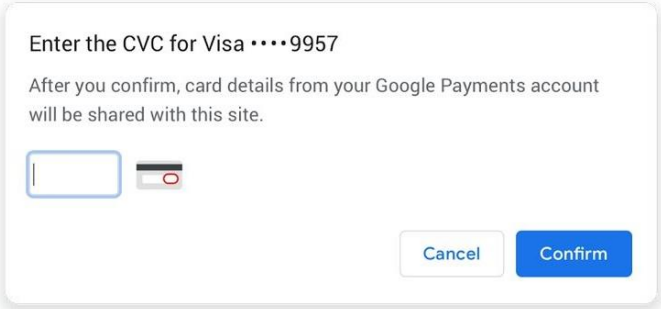
Step 1:
Chrome offers cards saved in your Google Account.



Step 2:
You confirm which card to use.



Step 3:
As a security measure, you will need to fill in the CVC number.

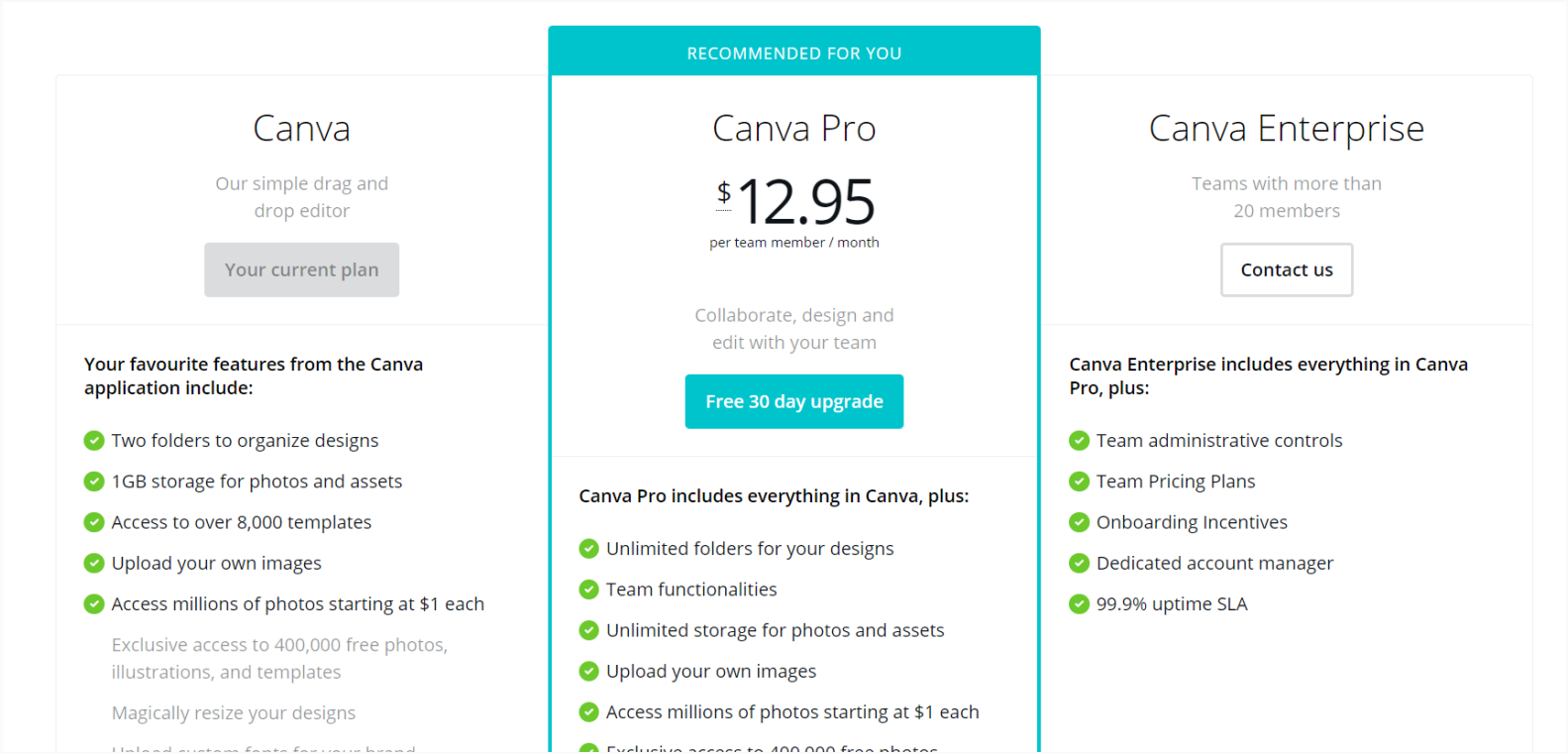


Von Restorff Effect

The Von Restorff effect, also known as **The Isolation Effect**, predicts that when multiple similar objects are present, the one that differs from the rest is most likely to be remembered.

- Make important information or key actions ***visually distinctive***.

Von Restorff Effect - Example



Canva draws your attention to the Pro pricing plan. The bold blue enclosure within which it is placed ensures the pro plan is what you pay attention to initially

Zeigarnik Effect

People remember incomplete or interrupted tasks better than completed tasks. It is **human nature to finish what we start** and, if we don't finish something, we experience dissonance, resulting in an uncomfortable feeling.

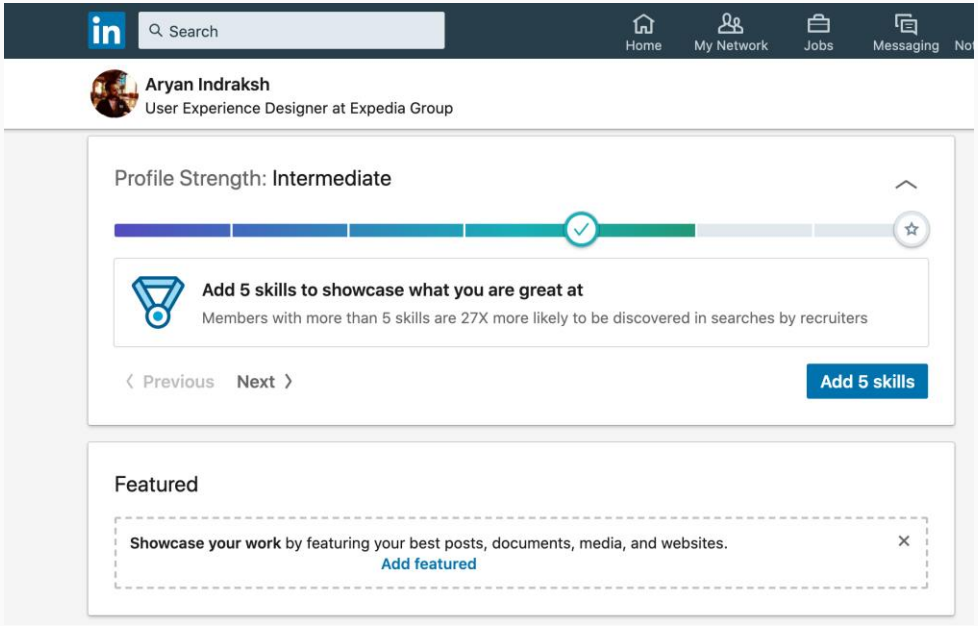
It is a brilliant technique designers use to make users do certain things they wouldn't do otherwise.

You must have observed this in various tv series, how they end that episode.

Zeigarnik Effect

Linkedin is quite famous for using this technique. Instead of presenting the users with an overwhelming and long list of questions, it merely asked to sign up first, and then later collected information is a super smart way.

- **Use progress bars for complex tasks to visually indicate when a task is incomplete, and thus increase the likelihood it will be completed.**



References

- https://lawsofux.com
- https://uxplanet.org/the-psychology-principles-every-ui-ux-designer-needs-to-know-24116fd65778
- https://blog.marvelapp.com/psychology-principles-every-uiux-designer-needs-know/
- https://uxplanet.org/gestalt-theory-for-ux-design-principle-of-proximity-e56b136d52d1
- https://medium.com/@oymanezzat/ui-design-famous-principles-41269344dd7b