

# Psychology in UI/UX Design

ITS290F

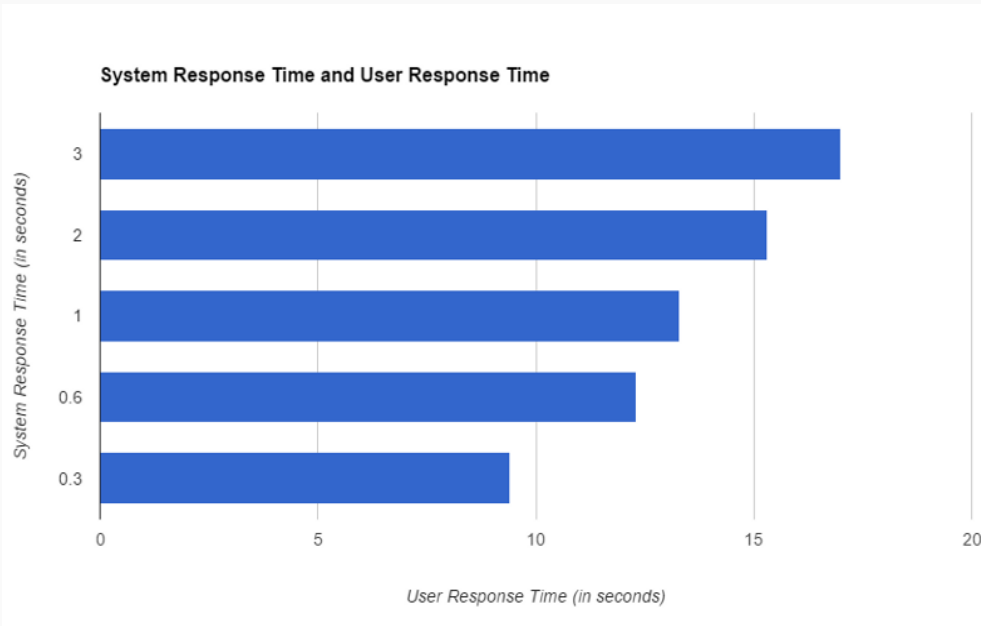
# Why Psychology?

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

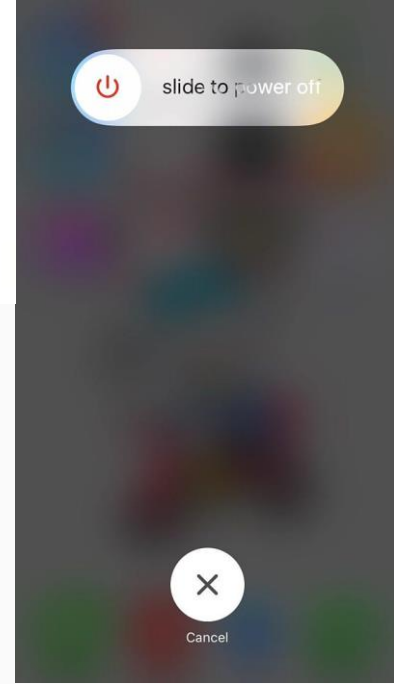
# Fitts's Law

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 accidentally activated, place the target further away and make it smaller.

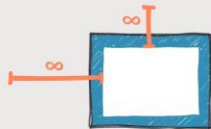
# Fitts's Law - Index of Difficulty (ID)

## Fitts's Law

The amount of time required to move a pointer (e.g., mouse cursor) to a target area is a function of the distance to the target divided by the size of the target.



When you are using a mouse, you can not move the pointer outside the edge of the screen, so it is easy to point at the edges and corners.



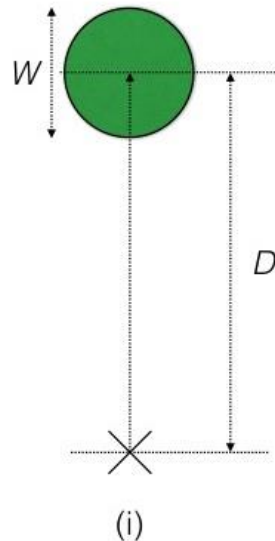
©Sociamedia

- 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.

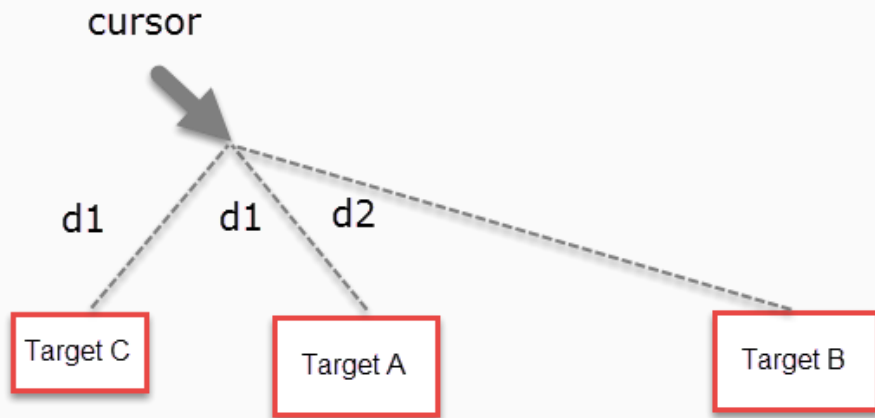
figure a.  $\log_2 \left( \frac{1}{1} + 1 \right) = 1$

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



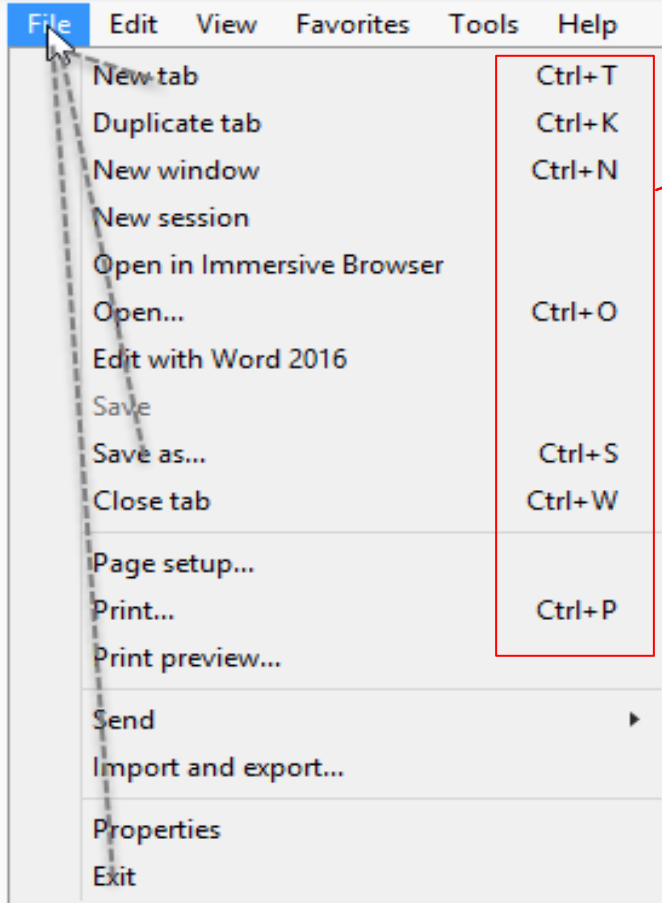


# Index of Difficulty - Example



- 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.

# 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

*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

When you point at an item from a list, you take time in proportion to the number of options.

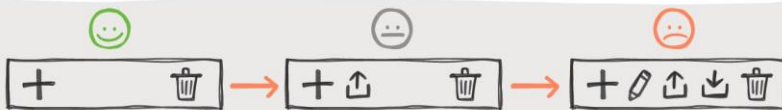
Grape  
Orange  
Banana



Grape  
Peach  
Blueberry  
Orange  
Cherry  
Apple  
Strawberry



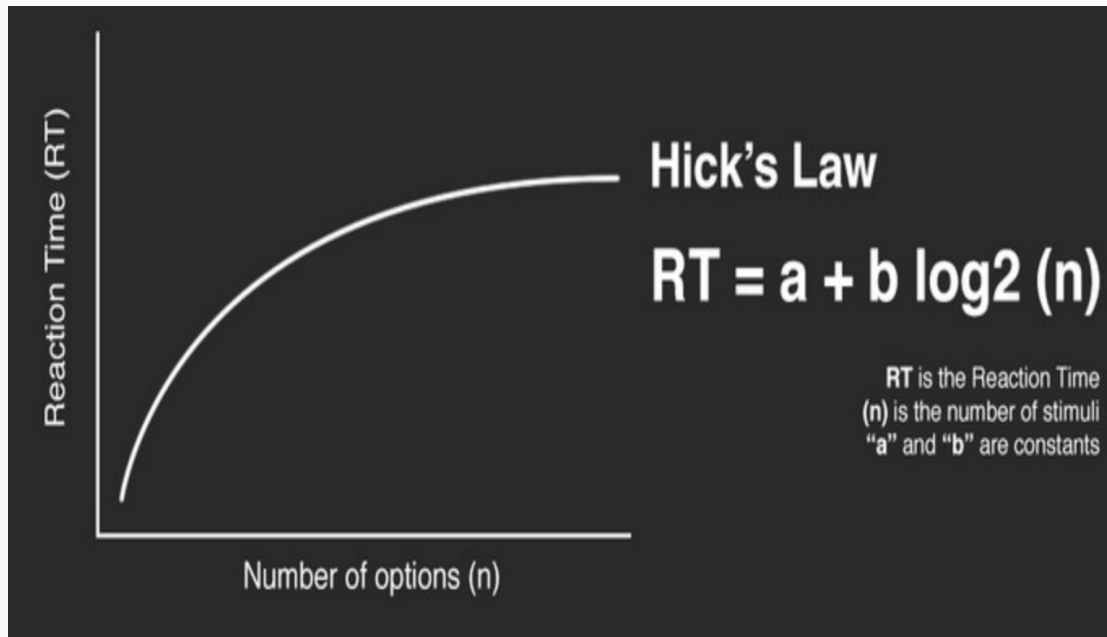
Even if you have decided what to choose, as long as you have more choices, it takes more time to point one from it.



If you add a button on the toolbar, users take more time to click one than before.



# 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.

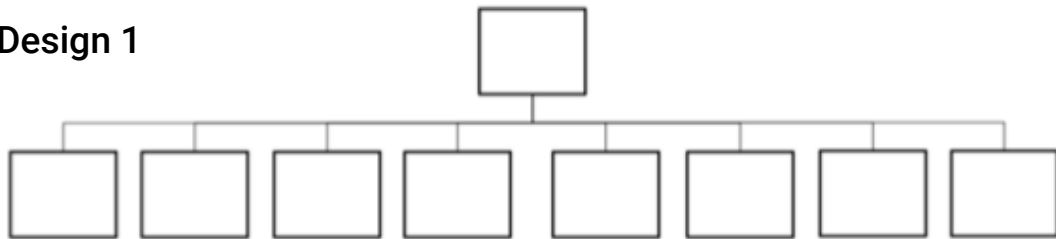
In the same contextual conditions (for a and b constants), if the number of options grows, so does **reaction time** but in a sub-linear way (non-proportional):

- 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.

# 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?

 A BOOK APART

Cart > Customer information > Shipping method > Payment method



OR

Contact information Already have an account? [Log in](#)

Email

☒ Keep me up to date on news and exclusive offers

Shipping address

First name (optional) Last name


Company (optional)

Address

Apartment, suite, etc. (optional)

City

Country United States State Michigan Zip code

 **Going Offline**  
Paperback

\$21.00

Gift card or discount code

Subtotal \$21.00

Shipping —

Total USD **\$21.00**

The RealReal

NEW ARRIVALS DESIGNERS WOMEN MEN JEWELRY WATCHES HOME KIDS SALE CONSIGN

77,544 Items

Sort by: **Newest First** < 1 2 ... 647 >

Women

Backpacks (1,304)

Bucket Bags (1,428)

Clutches (10,700)

Crossbody Bags (10,394)

Evening Bags (1,071)

Handle Bags (11,971)

Hobos (5,270)

Luggage and Travel (822)

Mini Bags (3,141)

Satchels (10,944)

Shoulder Bags (21,861)

Totes (16,540)

Waist Bags (265)

HERMÈS

Christine Envelope Bag

\$1,025.00

BOTTEGA VENETA

Small Intrecciato Venet...

\$725.00

REBECCA MINKOFF

Love Crossbody Bag w/...

Est. Retail \$295.00

\$95.00

LOEFFLER RANDALL

Metallic Leather Clutch

Est. Retail \$250.00

\$125.00

LOEFFLER RANDALL

Metallic Leather Clutch

Est. Retail \$250.00

\$125.00

LOUIS VUITTON

Sac de Nuit Tricolor MM

Est. Retail \$2,340.00

\$695.00

FENDI

Small Denim 2Jours Tote

\$645.00

GIANNI VERSACE

Madonna Patent Leathe...

\$595.00

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Asics Asics GEL-Kayano 24 gris y negro

39,00 €

Colores

Tallas

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# 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 Find Printer...

Type: Canon

Where: USB001 ☐ Print to file

Comment: ☐ Manual duplex

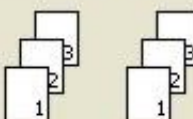
Page range

- ☒ 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:

 ☒ Collate

Print what:

Print:

Zoom

Pages per sheet:

Scale to paper size:

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:

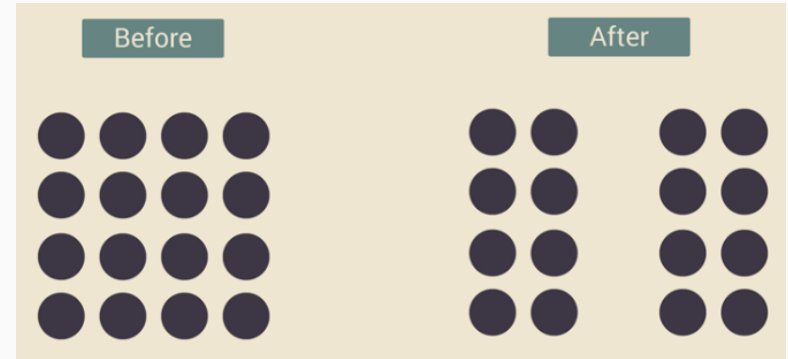
- Be clear and concise
- Keep things simple
- Use familiar patterns and layouts



# Law of Proximity

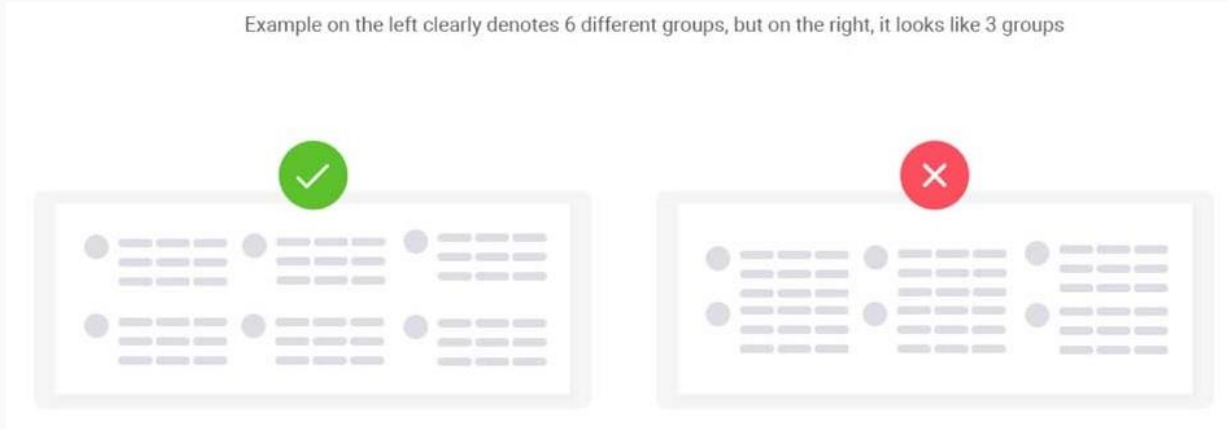
Objects that are near, or proximate to each other, tend to be grouped together.

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



# Law of Proximity - Example

Example on the left clearly denotes 6 different groups, but on the right, it looks like 3 groups



Username   
First Name   
Last Name   
E-mail   
Phone

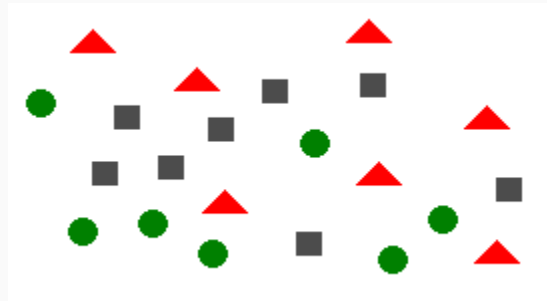
**VS.**

Username   
First Name   
Last Name   
E-mail   
Phone

# 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.



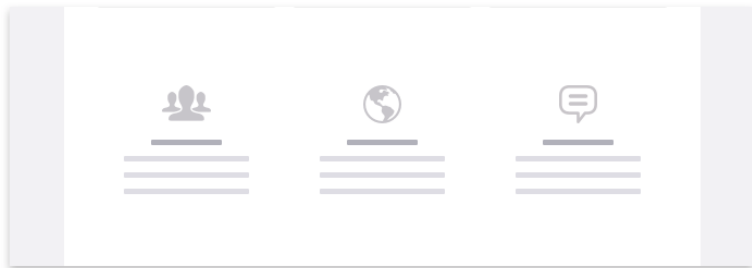
## Law of similarity

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

### Do

#### Visual Perception:

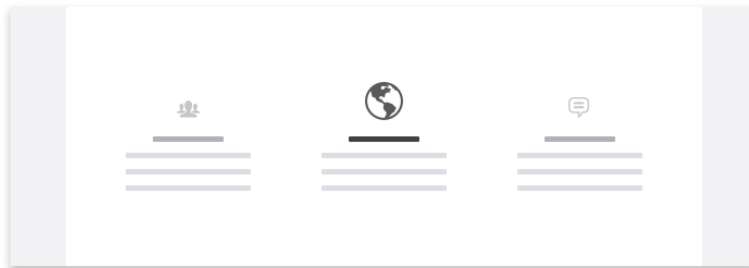
1 section containing 3 groups of 1 icon 1 headline and 3 lines each. There is no hierarchic difference between the groups. (Same size and colors)



### 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

**Product Name**  
Description and features

Edit

Remove

**Product Name**  
Description and features

Edit

Remove

**Product Name**  
Description and features

Edit

Remove

**Product Name**  
Description and features

Edit

Remove



**Product Name**

Description and features

Edit

Remove

**Product Name**

Description and features

Edit

Remove

**Product Name**

Description and features

Edit

Remove

**Product Name**

Description and features

Edit

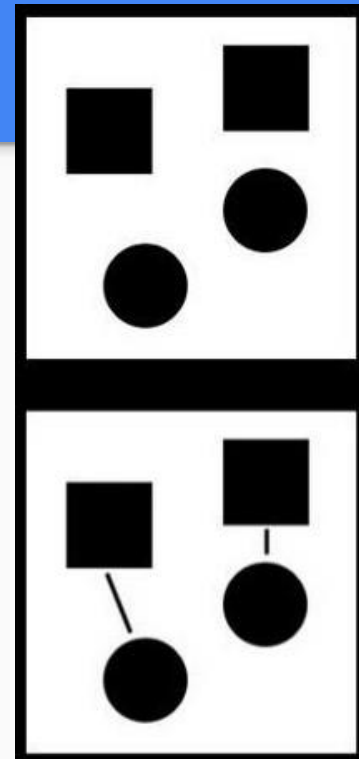
Remove



# 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* |  $\infty$  chunks

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

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



*remembering* |  $7 \pm 2$  chunks

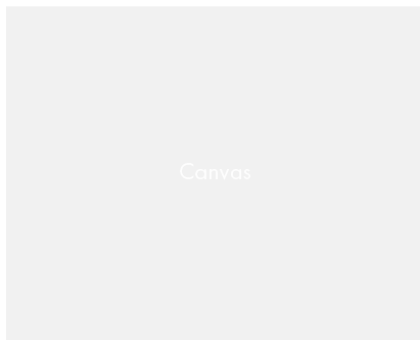


Information is stored temporarily in the prefrontal cortex for 10—15 seconds. The number of 'bits' one can hold in their working memory, is **5-9** items. This is a universal law and limitation observed in many studies.

# Miller's Law - Example

× Wrong

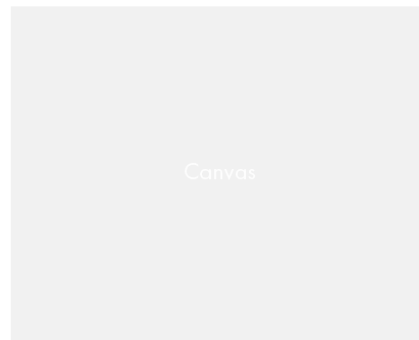
Selection  
Direct Selection  
Magic Wand  
Lasso  
Pen Tool  
Curvature Tool  
Type Tool  
Line Tool  
Rectangle Tool  
Paintbrush Tool  
Shaper Tool  
Scissors Tool  
Rotate Tool  
Scale Tool  
Width Tool  
Free Transform Tool  
Shape Builder Tool  
...



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

1 Selection  
Direct Selection  
Magic Wand  
Lasso  
2 Pen Tool  
Curvature Tool  
Type Tool  
Line Tool  
Rectangle Tool  
3 Paintbrush Tool  
Shaper Tool  
Scissors Tool  
Rotate Tool  
Scale Tool  
Width Tool  
...

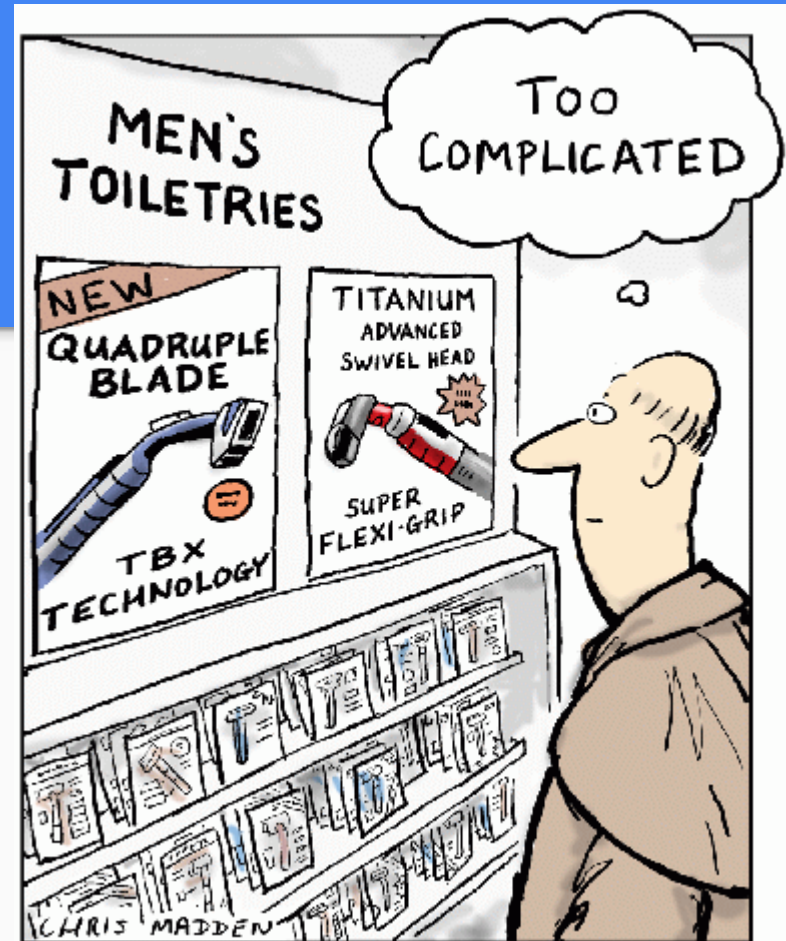


Here we have broken the list using simple line breaks, and reduced the amount of chunks in each category. Each category should be organized by similar functions, tasks, popularity, or another consistent variable you choose.

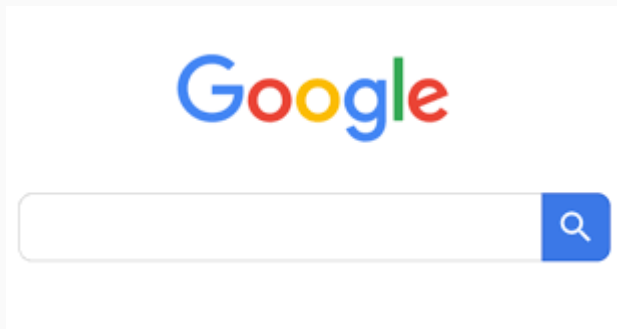
# Occam's Razor

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

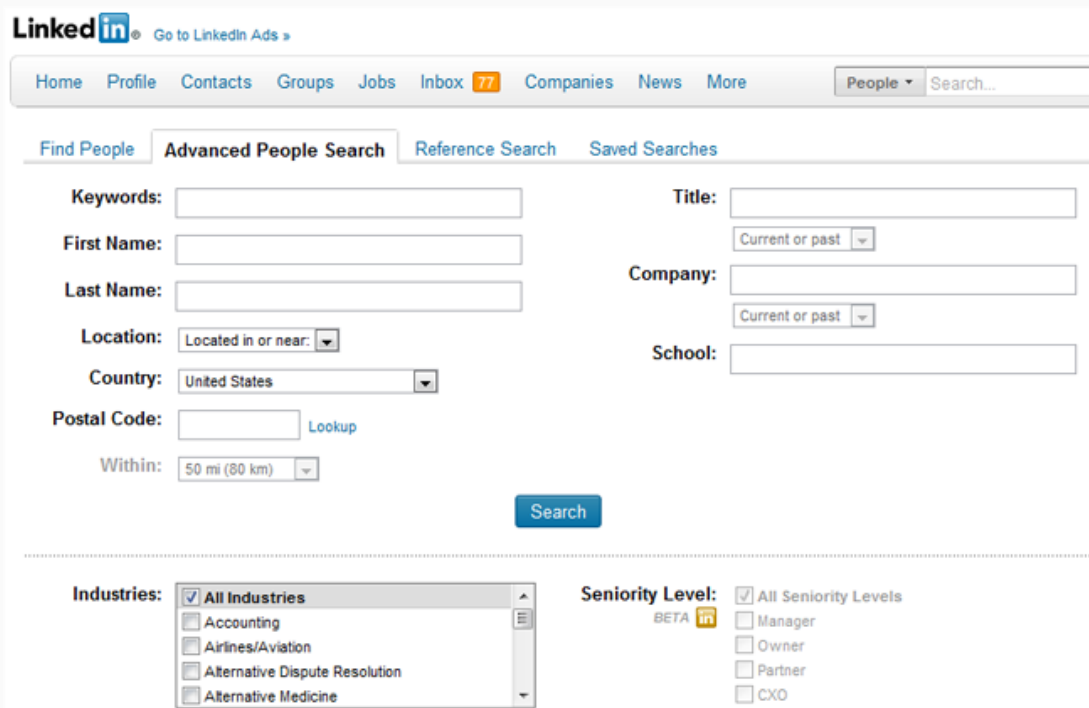
- The simplest solution is always the best



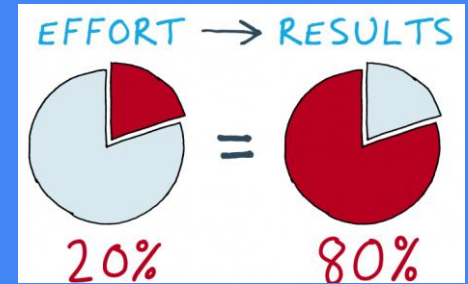
# Occam's Razor - Example



Which one would you choose?

A screenshot of the LinkedIn 'Advanced People Search' form. The form is titled 'LinkedIn' with a logo and a link to 'Go to LinkedIn Ads'. It has a navigation bar with links: Home, Profile, Contacts, Groups, Jobs, Inbox (77), Companies, News, and More. A search bar on the right says 'People' and 'Search...'. Below the navigation bar are tabs: 'Find People', 'Advanced People Search' (selected), 'Reference Search', and 'Saved Searches'. The form contains several input fields: 'Keywords', 'First Name', 'Last Name', 'Location' (with a dropdown for 'Located in or near:'), 'Country' (with a dropdown for 'United States'), 'Postal Code' (with a 'Lookup' link), 'Within' (with a dropdown for '50 mi (80 km)'), 'Title' (with a dropdown for 'Current or past'), 'Company' (with a dropdown for 'Current or past'), and 'School'. A blue 'Search' button is at the bottom right. Below the search fields, there are two sections: 'Industries' and 'Seniority Level'. The 'Industries' section has a list of checkboxes: 'All Industries' (checked), 'Accounting', 'Airlines/Aviation', 'Alternative Dispute Resolution', and 'Alternative Medicine'. The 'Seniority Level' section has a list of checkboxes: 'All Seniority Levels' (checked), 'Manager', 'Owner', 'Partner', and 'CXO'. There is also a 'BETA' label and a LinkedIn logo in the 'Seniority Level' section.

# 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

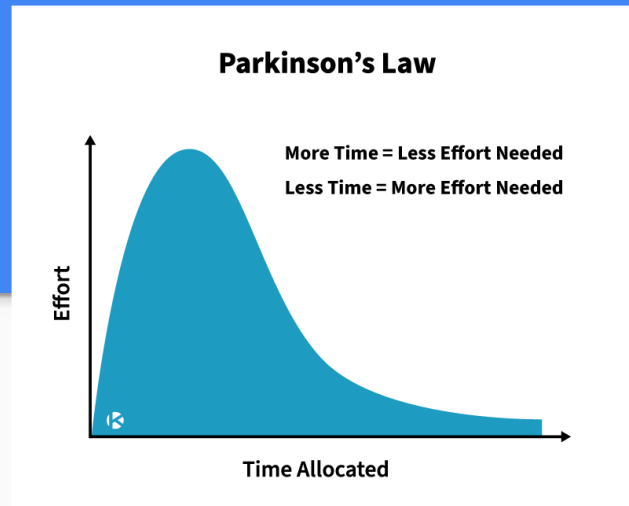
20% of the options that are used by 80% of the time

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.



1 mart

1 Martin Place Sydney, New South Wales, Australia

1 Martin Street St Leonards, New South Wales, Australia

1 Martin Place Mortdale, New South Wales, Australia

1 Martin Street Haberfield, New South Wales, Australia

1 Martins Avenue Bondi, New South Wales, Australia

powered by Google

# Serial Position Effect

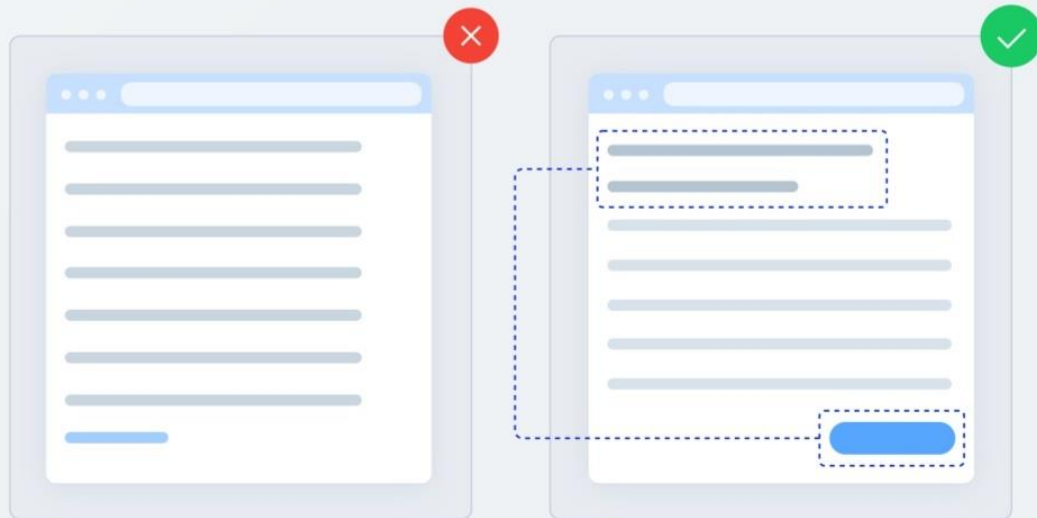
Users have a propensity to best remember the first and last items in a series.

- 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
	<a href="#">CREATE A WORKSPACE</a>	<a href="#">BUY STANDARD</a>	<a href="#">BUY PLUS</a>
	For small teams wanting to try out Slack for an unlimited period of time. <a href="#">Learn more</a>	For teams and businesses ready to make Slack the hub for their projects and communications. <a href="#">Learn more</a>	For businesses that need SSO, Compliance Exports, and guaranteed uptime on a single Slack team. <a href="#">Learn more</a>
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			
Support	Standard support	Priority support	24/7 support with four-hour response time
Uptime			99.99% guaranteed uptime SLA
	<a href="#">CREATE A WORKSPACE</a>	<a href="#">BUY STANDARD</a>	<a href="#">BUY PLUS</a>

# 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.

## Pay Invoice




Payment amount

\$500.00 Edit


Name on card

John Wave


Card number


4242 | 

Expiry date      Security code

MM / YY      

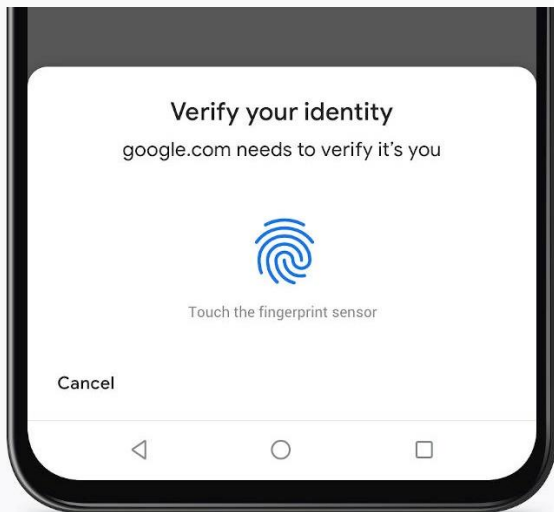
ZIP/Postal code



 Pay \$500.00


# 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.

  
 Show cards saved in your Google Account

## Step 2:

You confirm which card to use.


  
 **Visa** ••••9957  
Expires on 01/21  
Manage payment methods... 

## Step 3:

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

Enter the CVC for Visa ••••9957

After you confirm, card details from your Google Payments account will be shared with this site.



# 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

The image shows a pricing comparison for Canva. It features three columns representing different plans. The first column is for 'Canva', described as a 'simple drag and drop editor' and labeled 'Your current plan'. The second column is for 'Canva Pro', priced at '\$12.95 per team member / month', and is highlighted with a teal border and a 'RECOMMENDED FOR YOU' header. The third column is for 'Canva Enterprise', for teams with more than 20 members, with a 'Contact us' button. Each plan lists its features, with Canva Pro and Enterprise including everything from the base Canva plan plus additional team-oriented features.

Canva	Canva Pro	Canva Enterprise
<p>Our simple drag and drop editor</p> <p>Your current plan</p>	<p>RECOMMENDED FOR YOU</p> <p>Canva Pro</p> <p>\$12.95 per team member / month</p> <p>Collaborate, design and edit with your team</p> <p>Free 30 day upgrade</p>	<p>Teams with more than 20 members</p> <p>Contact us</p>
<p><b>Your favourite features from the Canva application include:</b></p> <ul style="list-style-type: none"><li>✓ Two folders to organize designs</li><li>✓ 1GB storage for photos and assets</li><li>✓ Access to over 8,000 templates</li><li>✓ Upload your own images</li><li>✓ Access millions of photos starting at \$1 each</li></ul> <p>Exclusive access to 400,000 free photos, illustrations, and templates</p> <p>Magically resize your designs</p> <p>Upload custom fonts for your brand</p>	<p><b>Canva Pro includes everything in Canva, plus:</b></p> <ul style="list-style-type: none"><li>✓ Unlimited folders for your designs</li><li>✓ Team functionalities</li><li>✓ Unlimited storage for photos and assets</li><li>✓ Upload your own images</li><li>✓ Access millions of photos starting at \$1 each</li><li>✓ Exclusive access to 400,000 free photos</li></ul>	<p><b>Canva Enterprise includes everything in Canva Pro, plus:</b></p> <ul style="list-style-type: none"><li>✓ Team administrative controls</li><li>✓ Team Pricing Plans</li><li>✓ Onboarding Incentives</li><li>✓ Dedicated account manager</li><li>✓ 99.9% uptime SLA</li></ul>

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.**

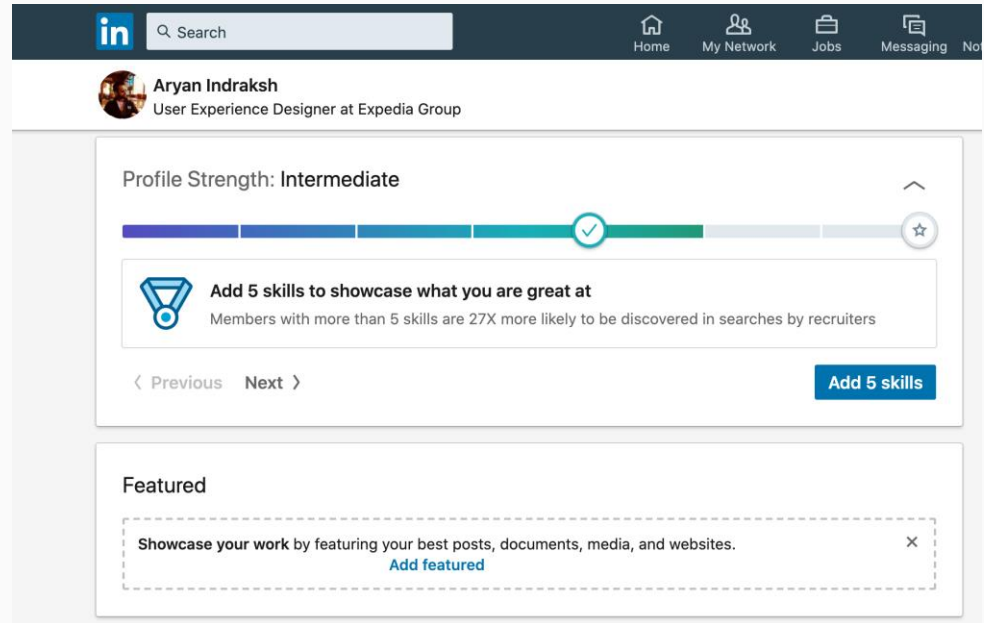
You must have observed this in various tv series, how they end that episode.



# 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/@oymanezzatzat/ui-design-famous-principles-41269344dd7b>