

University of M. S. S. A.

Faculty of Mathematics and Computer Science

Department of Computer Science

Contributions of cognitive psychology to HCI Design : HCI laws

Academic Year 2025-2026

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Introduction

- Psychological research provides us with fundamental information about our abilities in the areas of **perception**, **sensorimotor** skills, **reasoning**, **memory**, and **language**. These abilities influence the relationship a user has with a website and allow us to formulate universal rules valid for all sites.

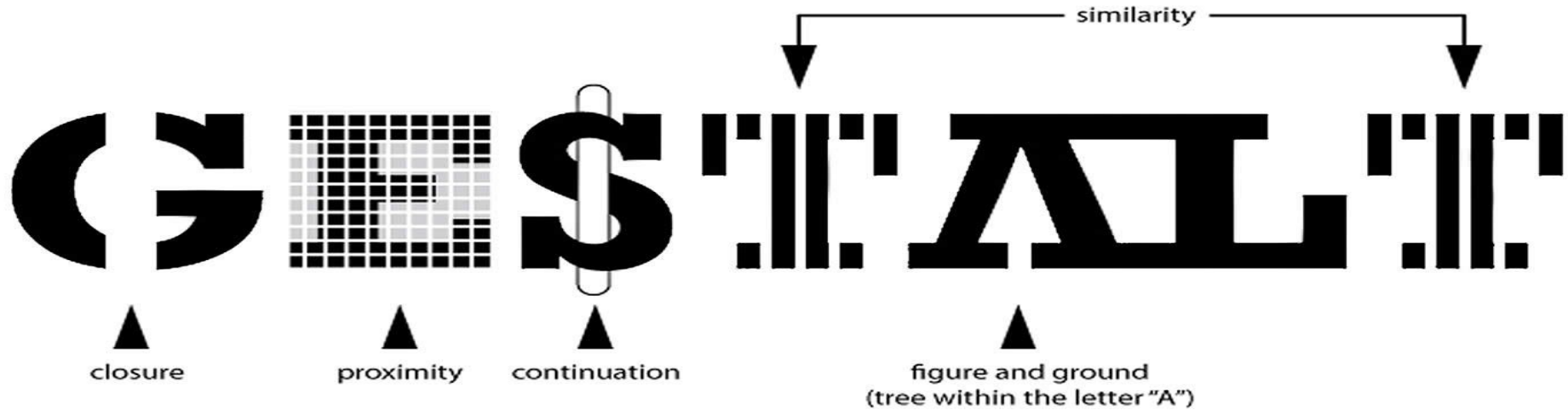
1. Gestalt theories

- Gestalt psychology explains how humans perceive visual elements
- Users don't see isolated elements — they see patterns and groups
- Very important for:
 - Web layout
 - Navigation
 - Usability and clarity

Why Gestalt Matters in Web ergonomics

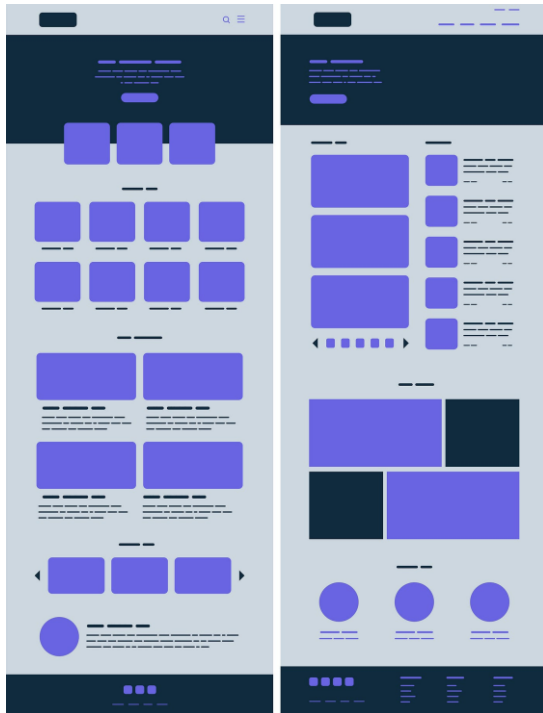
- Gestalt principles help:
 - Reduce cognitive load
 - Improve readability
 - Guide user attention
 - Make interfaces intuitive
- Users instantly understand structure without thinking

Gestalt theories.6 principles



1.1 Gestalt theories: Principle of Similarity

- Elements that look similar are perceived as part of the same group.

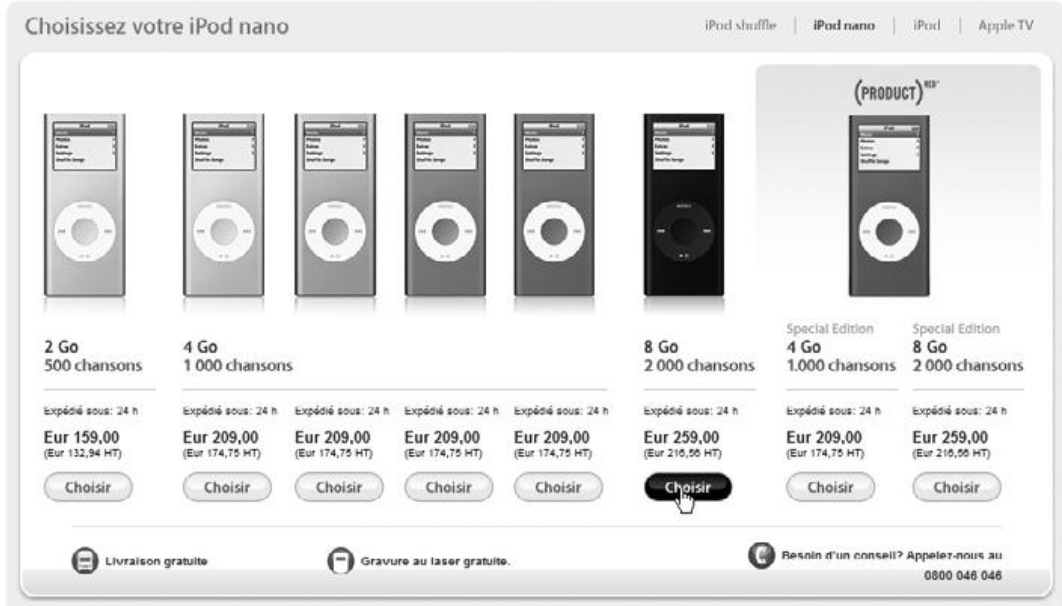
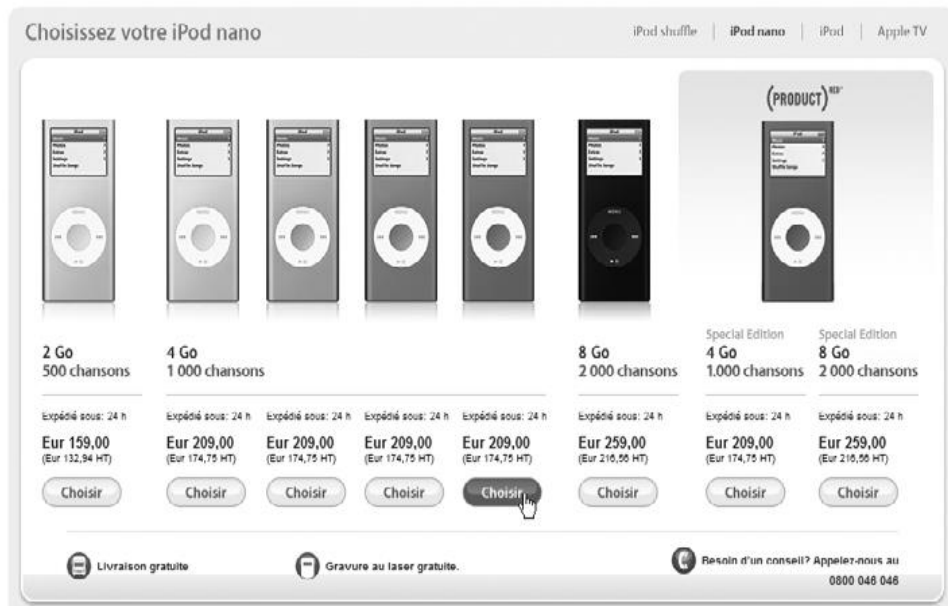


What You're Seeing

- Similar UI elements styled the same (buttons, cards, icons) are visually grouped by users even if they're not placed close together on the layout
- Various visual attributes can contribute to the similarity between two elements, including size, shape, color, content, and behavior.

1.1 Gestalt theories: Principle of Similarity

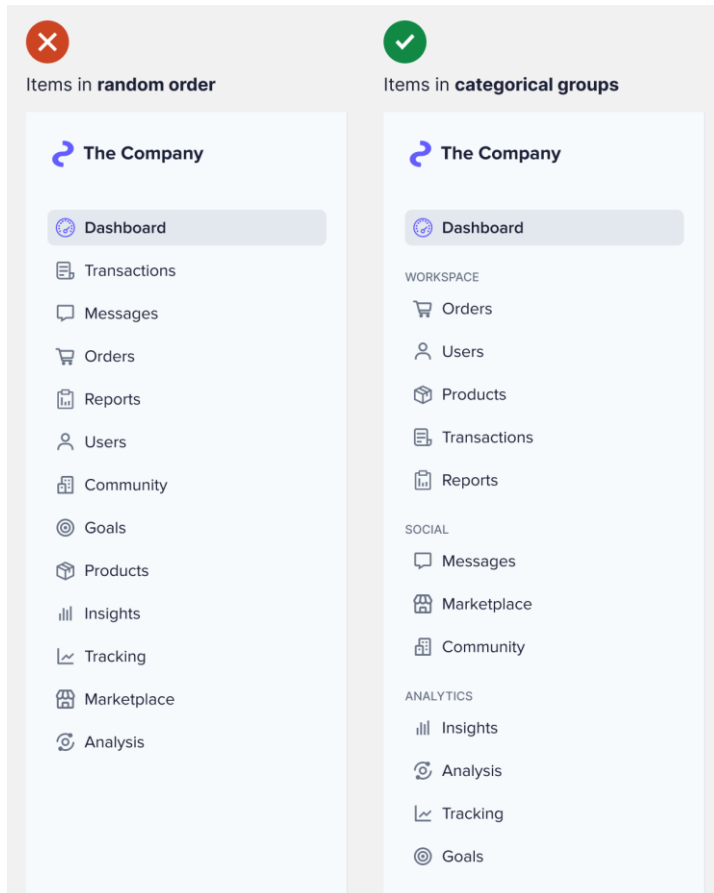
- Example:** When you hover over the Select button corresponding to the gray iPod, the button turns gray. Following the same principle, when you hover over the Select button corresponding to the black iPod, the button turns black.



1.2 Gestalt theories: Principle of proximity

- Elements placed close together are perceived as related.
- **Web Ergonomics Example**
 - Menu items grouped together
 - Labels close to form fields
 - Related content in the same section
-  Helps users understand relationships quickly

1.2 Gestalt theories: Principle of proximity



Sélectionnez la carte de paiement de votre choix:



A failure to consider the proximity principle complicates the mental association of bank card images with the corresponding radio buttons.

1.2 Gestalt theories: Principle of proximity

In this example of the e-commerce site, the proximity law is not respected (confusion between the link, the products and the price)



[Dr. Martens 1460 bleu roi](#)



[Dr. Martens 1460 green milled smooth](#)



[Dr. Martens 1460 noir/fleurs victoriennes](#)



[Dr. Martens 1460 8-Eye fleurs victoriennes taupe](#)

137,31 €
Voir l'offre



[Dr. Martens 1460 gris](#)

110,00 € - 149,95 €
Comparer 2 offres



[Dr. Martens 1460 8-Eye blanc lamper](#)

130,00 € - 139,90 €
Comparer 2 offres



[Dr. Martens 1460 8-Eye rose vernis](#)

90,00 €
Voir l'offre



[Dr. Martens 1460 union noir lisse](#)



78,00 € - 119,95 €
Comparer 10 offres

104,00 € - 140,00 €
Comparer 4 offres

170,68 €
Comparer 2 prix

118,40 € - 150,00 €
Comparer 5 offres

1.3 Gestalt Theories: Principle of Closure

- The principle of closure states that the human brain naturally fills in missing information to perceive a complete, whole object—even when parts of it are absent.
- In simple terms: we see a complete shape even if it's not fully drawn.

1.3 Gestalt Theories: Principle of Closure



1.3 Gestalt Theories: Principle of Closure

Practical Examples on Web Pages

- **Cards without full borders:** Content boxes may have shadows or partial lines instead of full outlines. Users still perceive them as complete sections.
- **Icons and symbols:** Hamburger menus (≡) or minimalist icons are often incomplete shapes, yet users recognize them instantly.
- **Buttons with outline or hover effects:** Buttons may be indicated only by text and spacing. Closure helps users see them as clickable areas.
- **Loading indicators:** Spinners use broken or partial circles, but users interpret them as full loops.
- **Section separation using whitespace:** Pages rely on spacing instead of heavy borders. The brain “closes” the layout into clear sections.

1.4 Gestalt Theories: Principle of continuation

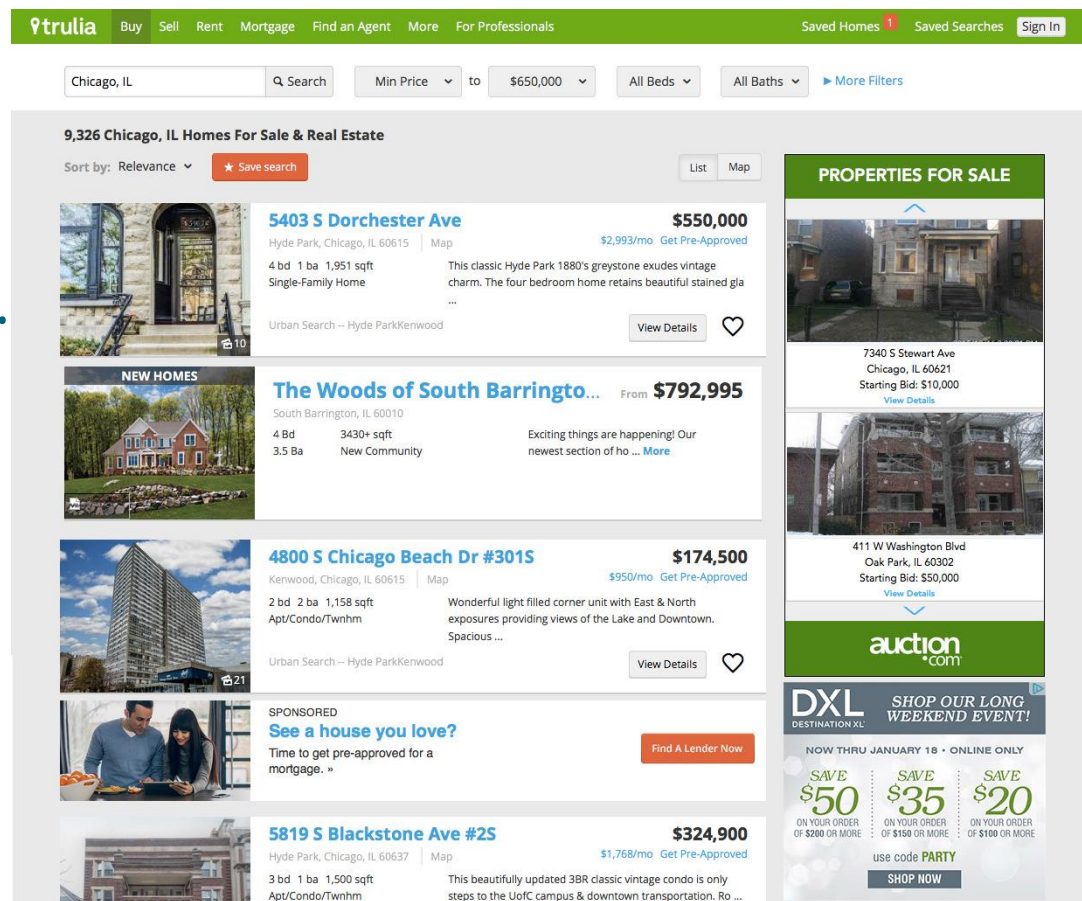
- The principle of continuation (also called good continuation) suggests that our minds prefer to perceive patterns that follow a smooth, continuous form rather than disjointed or broken ones. states that the human eye naturally follows lines, curves, and aligned elements,
- In web page ergonomics, this principle is used to guide the user's eye, making pages easier to scan, understand, and navigate with less effort.



1.4 Gestalt Theories: Principle of continuation

- **Vertical Scrolling**

- Long-scroll landing pages are designed so content blocks are aligned in a straight vertical line. Your eye follows from one section to the next, creating an effortless reading experience.



1.4 Gestalt Theories: Principle of Figure-Ground

- The principle of figure-ground states that humans naturally separate visual elements into a “figure” (the main focus) and a “ground” (background). This helps the brain quickly identify what is important and what is context.
- In web page ergonomics, this principle is crucial for clarity, readability, and usability. Users must immediately distinguish actionable content (buttons, links, images) from the background.



1.4 Gestalt Theories: Principle of Figure-Ground

- Figure-Ground :



1.4 Gestalt Theories: Principle of Figure-Ground

In the iconic Rubin's vase illusion, where you can see either a vase or two faces but not both simultaneously, the mind uses the figure-ground principle to switch between the vase (figure) and faces (ground), or vice versa.



1.4 Gestalt Theories: Principle of Figure-Ground

- **Key Applications**

- The rule which untangles elements on the screen and helps you perceive distinct elements:
- **Highlighting important actions**
 - Buttons like “Submit”, “Buy Now”, “Sign Up” are designed with strong contrast.
 - These elements become the figure, while the page background stays visually neutral (ground).

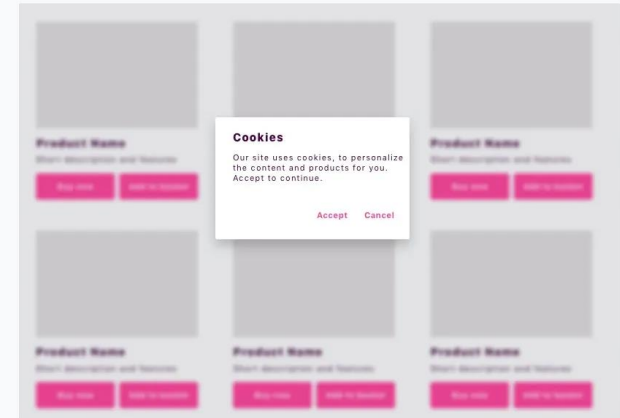
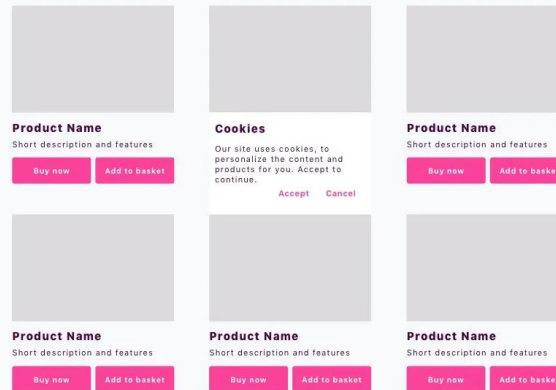
- **Navigation and menus**

- Active menu items are highlighted while others fade into the background.
 - Users know exactly where they are on the site.
-  Reduces cognitive load and navigation errors.

1.4 Gestalt Theories: Principle of Figure-Ground

- Example:

Figure - Ground



1.4 Gestalt Theories: Principle of Figure-Ground

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\$3 Prescriptions

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Learn how to enroll

Activate your account



2. Fitts's Law: The Science of Interaction Design

The time it takes to reach a target is proportional to its distance and size. More precisely, a target is faster to reach the closer and larger it is.

- **1. Clickable elements should be large**
 - 1.1 Increase the real size of clickable elements:



For more details, click [here](#).

For more details, [click here](#).

2. Fitts's Law: The Science of Interaction Design

1.2 Increase the virtual size of clickable elements

- Two techniques allow you to increase the active area of an explicitly clickable element.
 - First, you can take advantage of the significant elements surrounding it and extend this clickability property to them.



- The second technique involves increasing the clickable area around the element:



2. Fitts's Law: The Science of Interaction Design

1.3 The clickable elements should be close

The second part of Fitts's law concerns the geographical proximity of objects: the closer the target object is to the source object, the faster it will be reached.

The screenshot shows the Telemarket.fr website interface. The header includes the logo 'Telemarket.fr Le 1^{er} Supermarché online' and a promotional banner '20€ OFFERTS sur votre 1ère commande automatiquement dès 120€ d'achats'. Navigation links include 'ACCUEIL', 'FRAIS', 'SURGELÉS', 'FRUITS & LÉGUMES', 'ÉPICERIE', 'BOISSONS', 'BÉBÉ', 'HYGIÈNE & BEAUTÉ', 'MAISON', 'ENTRETIEN & ANIMAUX', 'BIQ', 'CASHIER', 'HARD DISCOUNT', 'PROMOTIONS NOUVEAUTÉS', and 'GALERIE MARCHANDISE'. A search bar is located on the right with the text 'Rechercher' and a 'OK' button. Below the header, the main navigation menu lists various categories: 'Epicierie', 'Vous êtes ici: Accueil > Epicierie > Bio et Diététique > Alimentation Bio > Petit-déjeuner', 'Apéritifs', 'Bio et Diététique', 'Biscuits sucrés et Biscottes', 'Boulangerie', 'Cafés', 'Chocolat en poudre et Thés', 'Confiseries et Tablettes de chocolat', 'Confitures et Céréales', 'Conserves', 'Cuisine du monde et d'ailleurs', 'Epicierie fine', 'Gâteaux, Compotes et Desserts', 'Pâtes, Riz et Purées', 'Potages, Soupes et Crouillons', 'Sauces et Condiments', 'Sucres, Farines et Aides à la pâtisserie'. The main content area displays a list of products under the heading '> Petit-déjeuner'. The products are: 'Monoprix Bio Confiture Extra Orange 270 g' (1,45 €), 'Monoprix Bio Confiture Extra Abricot 270 g' (1,75 €), 'Monoprix Bio Confiture de Fraise 270 g' (1,78 €), and 'Monoprix Bio Biscottes Complètes 300 g' (1,87 €). Each product entry includes a small image, the product name, the price, and an 'AJOUTER' button. A sidebar on the right shows a '20€ OFFERTS' banner and a 'MON PANIER' section with a 'VOIR' button and a total of '100,00 €'.

3. Hick's Law: The Psychology of Decision Making

- Hick's law states that the **time** it takes for a user to make a decision increases with the **number** and complexity of choices.
- In web ergonomics, this means reducing options and simplifying navigation prevents user decision fatigue, improves conversion rates, and creates a faster, more intuitive user experience

3. Hick's Law: The Psychology of Decision Making

- **Key Applications of Hick's Law in Web Design**

- **Simplify Navigation and Menus:** Limit the number of menu items to the essentials to reduce cognitive load. Too many options lead to "decision paralysis".
- **Use Progressive Disclosure:** Reveal detailed information only when necessary (e.g., in drop-down menus or on-demand clicks) to avoid overwhelming users.
- **Prioritize Call-to-Action (CTA):** Highlight primary actions (e.g., "Buy Now" or "Sign Up") with visual, distinct, and singular buttons to guide user action.
- **Categorize Content:** Group similar items together, such as in e-commerce filters, to make navigation easier and faster.
- **Streamline Onboarding:** Break down complex processes (like registration or checkouts) into smaller, manageable steps.

3. Hick's Law: The Psychology of Decision Making

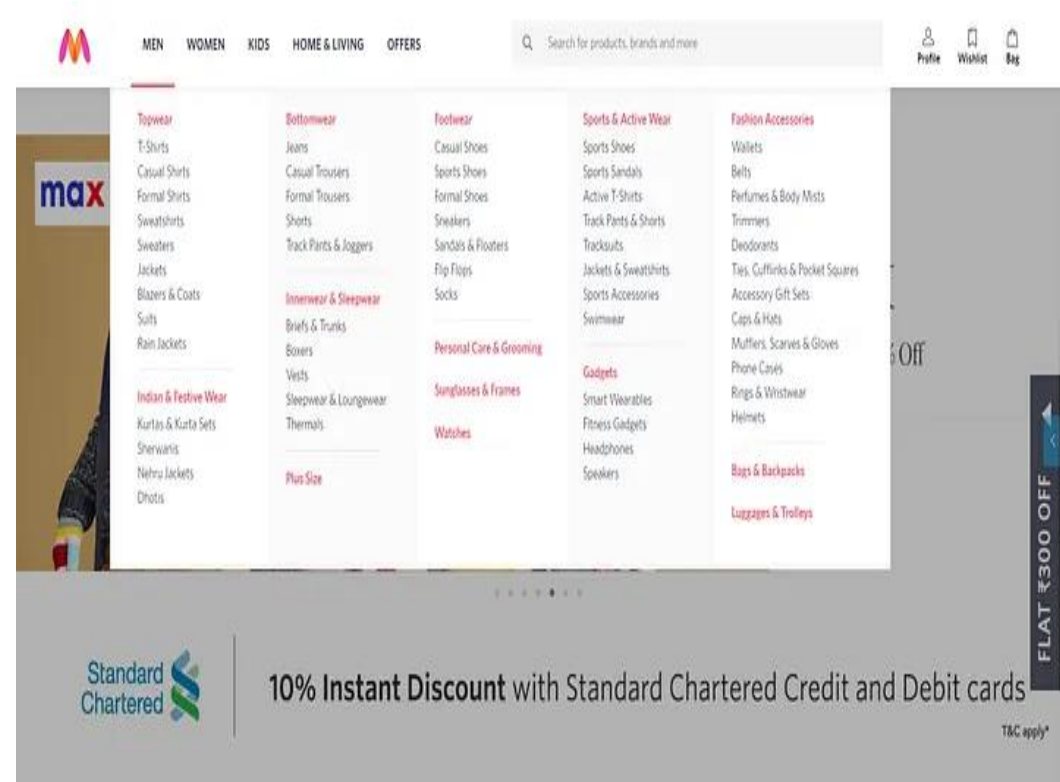
1998 ▶

Too many options,
Crowded page



2020 ▶

Streamlined
Page

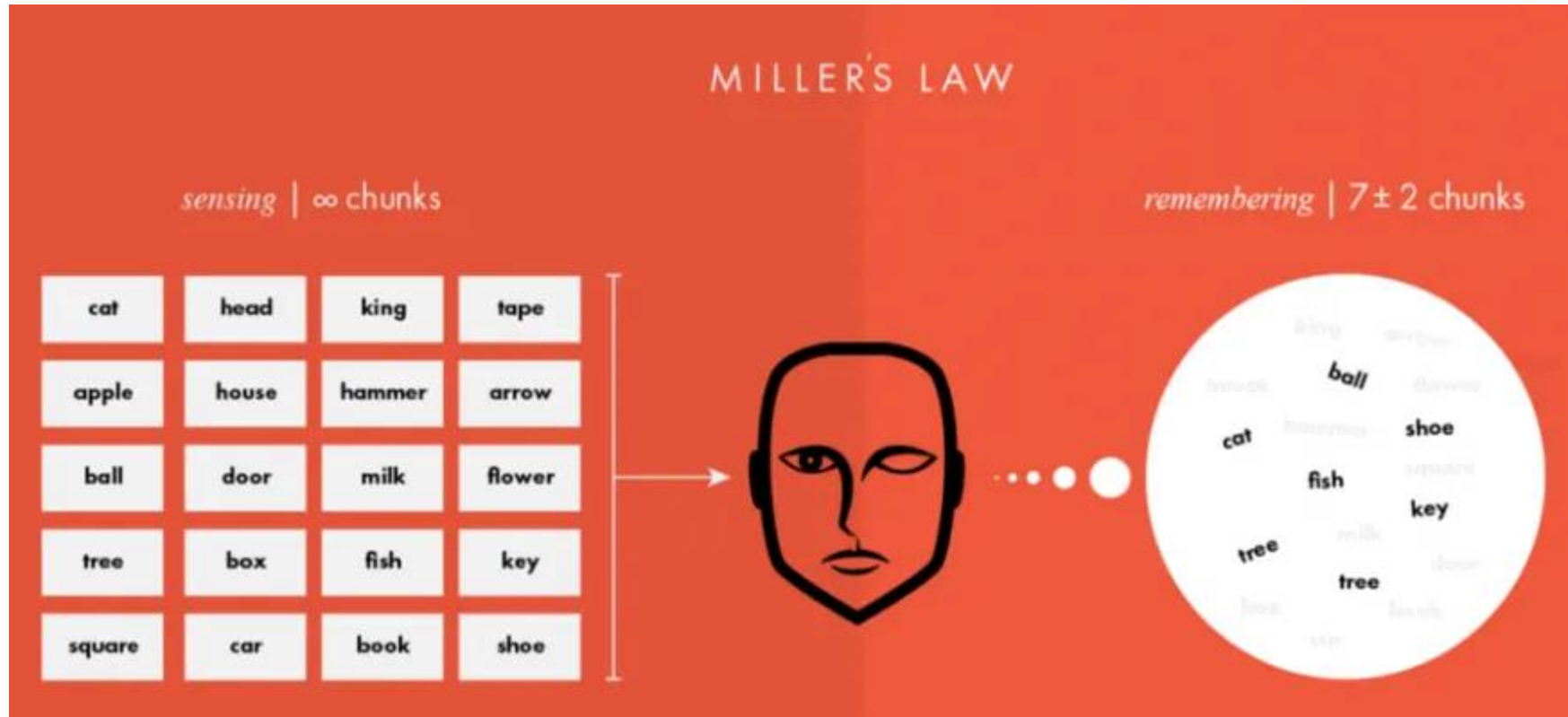


4. Miller's Law: Designing for Memory Span

Miller's Law originated from a seminal paper published by cognitive psychologist George A. Miller in 1956, titled "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information".

The fundamental takeaway from this study is that an average human can hold approximately **seven** items (plus or minus two) in their working memory.

4. Miller's Law: Designing for Memory Span



4. Miller's Law: Designing for Memory Span

- the number 7 of objects that an average human can hold in their working memory doesn't mean only seven items in total, but rather seven chunks or units of information. This concept is known as “chunking”. These chunks can be anything — numbers, letters, faces, or even related concepts that can be lumped into a single unit.
- **Phone number:** 0665878948
- **Phone number:** 066 585 8948

4. Miller's Law: Miller's Law and UX Design

- In UX design, this principle is used to prevent cognitive overload—the point where a user becomes overwhelmed by too many choices or too much information and fails to complete a task.

4. Miller's Law: Core Concept: "Chunking"

- **Navigation Menus:** A navigation menu should ideally have a maximum of 7 entries (or between 5 and 9). Exceeding this makes the structure difficult for the user to quickly understand or remember.
- **Limit the number of options displayed:** Instead of overwhelming the user with too many choices, group similar options together, use smart drop-down menus, or sequential steps.
- **Structure the information :** Highlight the most important elements and place secondary information further back or in dedicated sections.
- **Use "chunking":** Group related information into small, manageable blocks ("chunks"). This explains why telephone numbers are typically shown in groups of digits (e.g., 0476 12 34 56) rather than as a long sequence.
- **Avoid useless information:** Every element on the screen must serve a clear purpose. If it doesn't, it creates noise and reduces clarity.

5. three click rule

- **What is a three click rule?**
 - The three-click rule is an informal principle in UX design that suggests that users should be able to find the information or complete a task on a website within three clicks or fewer. The rule emphasizes the importance of keeping navigation paths short and intuitive to enhance the user experience and prevent frustration.

6. What is the Zeigarnik Effect?

- The **Zeigarnik Effect** is a psychological phenomenon where people remember unfinished or interrupted tasks better than completed ones. When we start a task but don't finish it, our brain creates "cognitive tension" that keeps the task active in our working memory until it is resolved.

6. Zeigarnik Effect: Applications in UX Design

- UX teams use this effect to drive engagement and ensure users finish what they started:
 - **Progress Bars & Checklists:** Seeing a bar at "75% complete" creates the psychological tension needed to push users to finish a profile or checkout.
 - **Continue Watching:** Platforms like Netflix and Disney Plus show unfinished episodes to trigger the desire for closure.
 - **Gamification:** Daily streaks (like in Duolingo) and level progress encourage return visits to "close the loop".
 - **Content Teasers:** Showing the first half of an article (e.g., Medium) motivates users to sign up or pay to see the resolution.

6. Zeigarnik Effect: Applications in UX Design



7. Peak-End Rule



7. Peak-End Rule

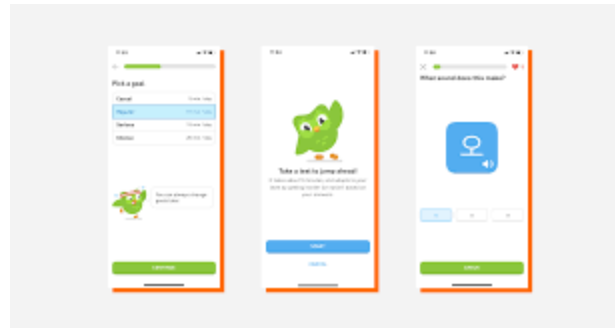
- The Peak-End Rule is a psychological heuristic where people judge an experience largely based on how they felt at its **most intense point (peak)** and its **conclusion (end)**, rather than the total average or duration. this means memories are formed by emotional highs/lows and recent events, often ignoring the duration

7. Peak-End Rule: Origins

- A 1993 study titled “When More Pain Is Preferred to Less: Adding a Better End” by Kahneman, Fredrickson, Charles Schreiber, and Donald Redelmeier.
- In the first trial, individuals held their hands in the cold water for a straight 60 seconds.
- For the second trial, they kept their hand submerged for 60 seconds, just like the first trial, but this time added an extra 30 seconds where the water was gradually warmed
- Although the second trial entailed a longer duration of discomfort, the participants retrospectively rated it as less painful

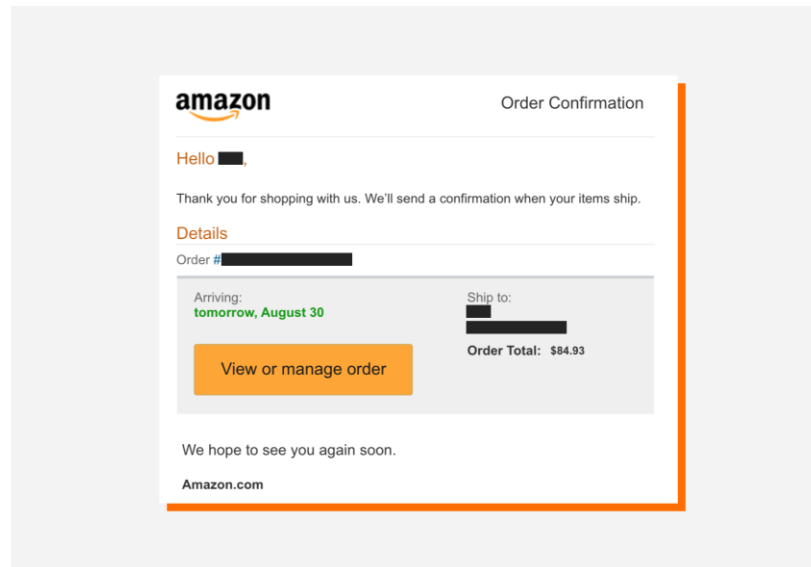
8. Peak-End Rule for UX designer

- Real Examples for UX Designers:
- Duolingo creates a "peak" through gamification (sounds, streak animations) and ensures a positive, encouraging "end" with congratulatory messages, making the overall learning experience feel rewarding.



8. Peak-End Rule for UX designer

- Real Examples for UX Designers:
- Amazon



9. The bigger the difference, the easier to remember

- In the 1930s, a German psychiatrist, Hedwig von Restorff, set out on a study that would eventually shed light on a fascinating quirk of human memory.
- When multiple similar objects are present, it is the one that differs from the rest that most captures our attention.
- When multiple similar items are presented, the one that differs from the rest is more likely to be remembered.
- Example: Ahmed , Ibrahim , Mohamed , Ridha, Rami , Cristophe



9. The bigger the difference, the easier to remember

Hedwig von Restorff effects and UX design

- The Von Restorff Effect helps designers:
 - Direct attention : Error message
 - Emphasize key actions: Call-to-Action (CTA) Buttons: “Buy Now”, “Sign Up”
 - Improve usability
 - Strengthen visual hierarchy: Large headline , small sub-heading- CTA button

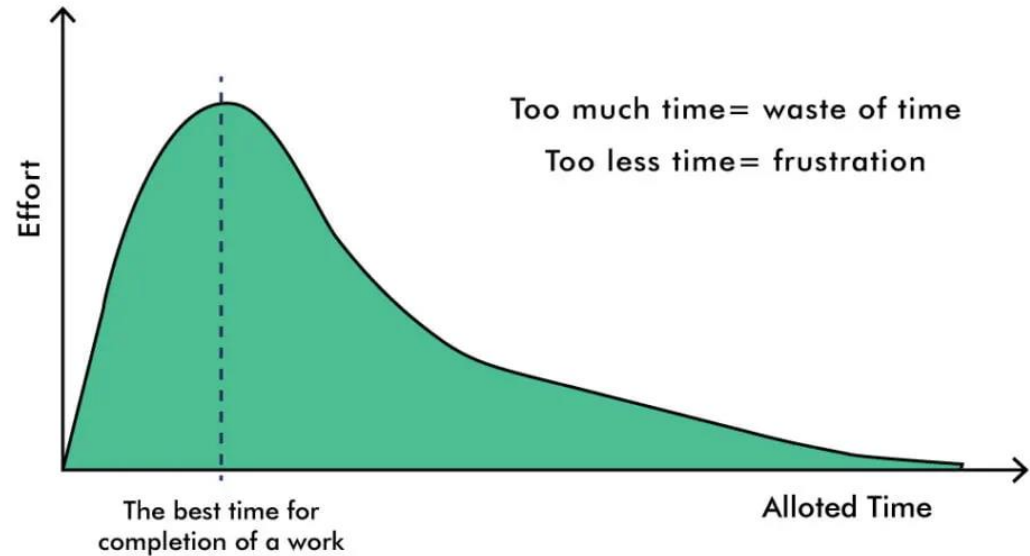
10. Parkinson's law

In 1955, Cyril Northcote Parkinson(a renowned British historian) introduced Parkinson's Law, which states:

“Work expands to fill the time available for its completion.”

Originally about bureaucracy, this principle strongly applies to user behavior in digital products

Parkinson's Law



10. Parkinson's law

How Parkinson's Law Applies to UX

The more time and complexity you give users, the more friction they experience.

Great UX compresses effort and simplifies action.

- 1) Long forms → feel harder → lower completion
- 2) Too many menu options → slower decisions
- 3) Complex checkout → more abandonment
- 4) Endless customization → user hesitation

11. Serial Position Effect

The Serial Position Effect is a memory principle discovered by Hermann Ebbinghaus.

It states:

- People tend to remember the first and the last items in a sequence better than the middle ones.
- This effect has two parts:
 - **Primacy Effect** → We remember the first items best.
 - **Recency Effect** → We remember the last items best.

11. Serial Position Effect

Why This Happens

Memory has two strengths:

- First items → encoded into long-term memory (Primacy)
- Last items → still in short-term memory (Recency)
- Middle items compete for attention.

11. Serial Position Effect

Design Strategies:

- Use the First Position For:
 - Brand message
 - Key value proposition
 - Critical navigation item
 - First onboarding impression
- Use the Last Position For:
 - Primary CTA
 - Final confirmation message
 - Contact / conversion action
 - Strong emotional closing

12.Postel's Law

Postel's Law was introduced by Jon Postel in the context of internet protocols.

It states:

“Be conservative in what you send, be liberal in what you accept.”

What Postel's Law Means in UX

In user experience terms:

- Be strict in what your system outputs.
- Be flexible in what you accept from users.

12. Postel's Law

How It Applies to UX

- **Form Inputs:**
 - Bad UX: Rejects input because of small formatting differences.
 - Good UX: Accepts different formats. Automatically cleans and standardizes input
- **Search Systems**
 - Detects typo :Shows “Did you mean xxxxxxxxxxxx?”
- **Password Rules :**
 - Allow password managers, Allow paste, Don't block copy/paste unnecessarily

13. Occam's Razor in UX Design

- Occam's Razor is a philosophical principle attributed to William of Ockham (14th century).
- It states:
 - "Entities should not be multiplied without necessity."
- In simple terms:
 - The simplest solution that works is usually the best one.
- In simpler terms, if you have multiple explanations for a phenomenon, the one that requires the least number of assumptions should be chosen; Ex: if u find a wet umbrella and a pair of wet shoes at home. You immediately think it's raining outside. You didn't need to look out of the window or check a weather app.

13. Occam's Razor in UX Design

- **What Occam's Razor Means in UX**
 - Remove unnecessary complexity.
 - Choose the simplest effective design.
 - Users prefer:
 - Clear interfaces
 - Fewer steps
 - Minimal distractions
 - Straightforward flows
- Complexity increases friction.

14.Repetition law

- Repetition law was introduced by a German psychologist named Hermann Ebbinghaus. His work was revolutionary in understanding human memory :
- It states
 - repeated exposure to information dramatically affects our ability to remember it. Essentially, repetition reinforces recall.
- The Repetition Principle comes from design theory and is strongly associated with visual design systems
- Repeating visual elements creates consistency, unity, and clarity.

14.Repetition law

- **The Law of Repetition and UX**
- **Navigation Consistency:**
 - If the main menu: Is always in the header, Uses the same labels, Looks the same on every page
- **Button Styles**
 - If all primary buttons: Have the same color, Same shape, Same hover behavior

Users instantly recognize them as clickable actions.

- **Layout Structure**
 - Consistent page structure;; Title at top, Content below, CTA at bottom
 - Repetition makes scanning easier.
- **Icons & Visual Language**
 - Using the same icon style: Same line weight, Same color system, Same size scale Creates visual harmony.

14.Repetition law

- The Law of Repetition and UX



The sun icon consistently stands for a sunny day, the cloud for a cloudy day, and so on. This consistent use of icons across the app builds an instinctive understanding for the user, creating a seamless user experience.

14.Repetition law

- **The Law of Repetition and UX**

Be it Google Docs, Google Sheets, or Gmail, all these applications share the same design elements, from icons to color palettes. This consistent experience across different platforms makes it easier for users to adapt and use Google's wide range of applications.



15. Law of Past Experience: Designing for Familiarity

- The Law of Past Experience comes from Gestalt psychology.

It states:

“People interpret new experiences based on what they have experienced before.”

- In UX terms:

Users understand your interface by comparing it to interfaces they’ve already used.

Example: Google Search: Google has retained the same search box layout for over two decades.

The Law of Readability: Designing for Typography

- the readability of a text is influenced by several factors such as typeface, font size, line spacing, color, contrast, and much more.
- **Readable typography reduces:**
 - Cognitive load
 - Eye strain
 - Misinterpretation
 - Bounce rates

The Law of Readability: Designing for Typography

- **Rules for Typography**

- **1. Font Selection:** Choose fonts that are easy to read. Sans-serif fonts like Arial, Helvetica, or Verdana are more legible for screen use
- **2. Hierarchy and Scale:** Users scan before they read. Use different font sizes to establish a hierarchy of information.
 - Body text: 16px minimum
 - Headings: clear hierarchy (H1 > H2 > H3)
- **3. Contrast:** Ensure there's sufficient contrast between the text and its background.
 - - WCAG (Web Content Accessibility Guidelines) recommends: 4.5:1 for normal text, 3:1 for large text
- **4. Line Length (Measure):** Optimal line length: 45–75 characters per line
- **5. Line Height (Leading):** Recommended: 1.4–1.6× font size

The Law of Readability: Designing for Typography

- **Standards for Contrast Checking (UX & Accessibility)**

- Contrast checking ensures that text is readable against its background — especially for users with low vision or color-vision deficiencies.

- **WCAG Contrast Ratio Requirements**

- WCAG defines contrast ratios between foreground (text) and background colors.
- Contrast is measured as a ratio from 1:1 (no contrast) to 21:1 (maximum contrast).

-

The Law of Readability: Designing for Typography the law

- **Standards for Contrast Checking (UX & Accessibility)**
 - **WCAG 2.1 Level AA (Minimum Legal Standard in Many Countries)**
 - For normal text (under 18pt regular / 14pt bold): 4.5:1 minimum
 - For large text (18pt+ regular or 14pt+ bold): 3:1 minimum
 - For UI components (buttons, form fields, icons): 3:1 minimum
 - **WCAG 2.1 Level AAA (Enhanced Accessibility)**
 - For normal text: 7:1
 - For large text: 4.5:1

