

Human Factors

Chaklam Sil-
pasuwanchai

Perception

Biases
Structure
Limitations
Visual search
Reading
Design implications

Memory

Design implications

Cognition

Attention
Learning
Reasoning
Design implications

Human Factors

Chaklam Silpasuwanchai

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Overview

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- **Project leaders:** You will receive feedback from your first draft shortly. Then please start your second round paper reading and check the deadline.

Sources

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- Jeff, **Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines**, 2nd ed. (2014).
- Mackenzie, Chapter 2, **Human Factors**, Human Computer Interaction: An Empirical Research Perspective, 1st ed. (2013)

HCI challenge

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- **Human variability** is the biggest challenge of HCI
- Obviously, understanding humans increase our success
- Here, we discuss human **perception, memory and cognition**

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- **First stage of processing** in the brain, occurs when sensory signals are received as input. It is at this stage human makes meanings
- Perception has been studied in a area of experimental psychology known as **psychophysics** - examines the relationship between perception and physical phenomena

Facts about Perception

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① Our perception is biased by

- our goals
- our belief
- our experience
- the context

② Our vision is optimized to see structure

③ Our color vision is limited

④ Our peripheral vision is poor

⑤ Visual search is linear unless target "pops"

⑥ Reading is unnatural

Our perception is biased...

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Exactly same character



Our perception is biased...

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But our perception can be changed based on the **context**

THE CHT

Our perception is biased...

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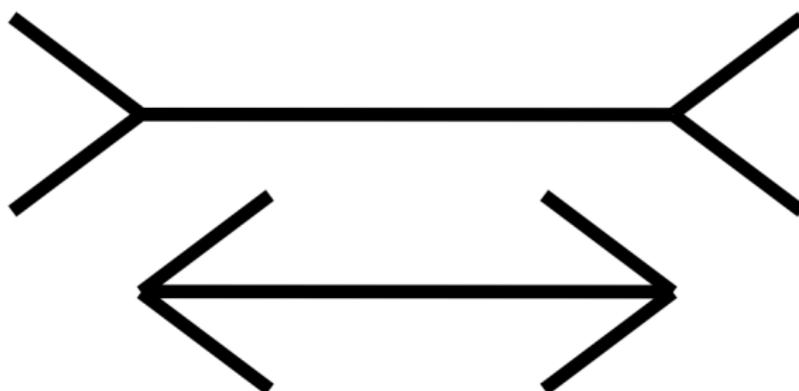
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Muller-Lyer illusion



Our perception is biased...

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Muller-Lyer illusion

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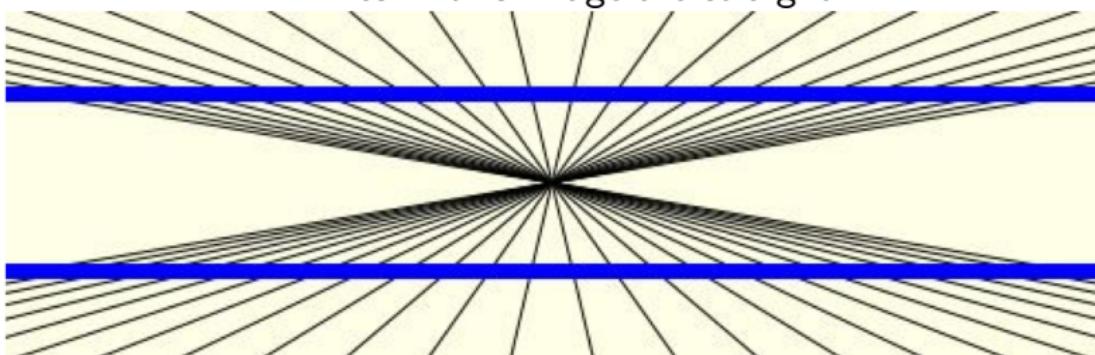
Limitations

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All lines in this image are straight!



Memory

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Our perception is biased...

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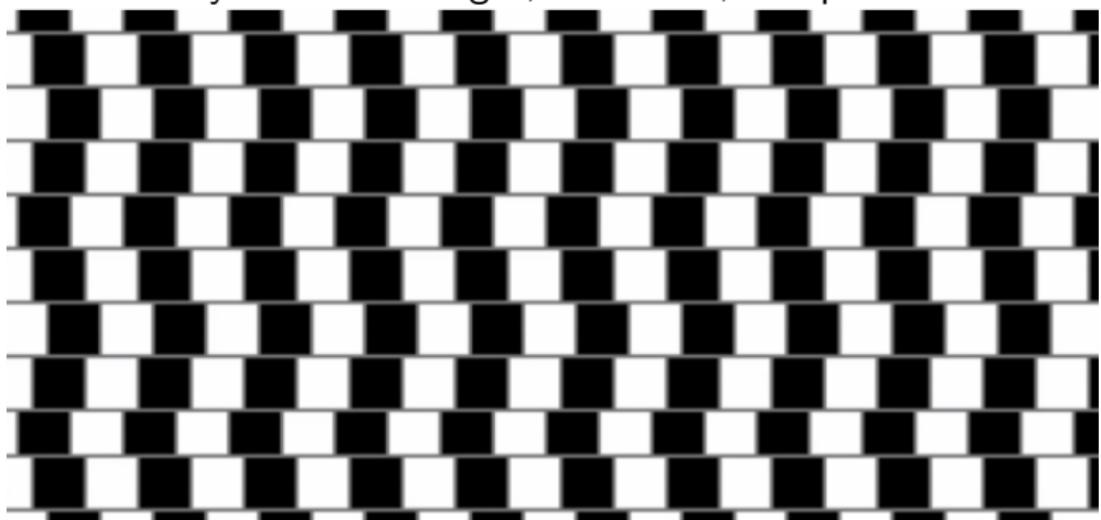
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Gray lines are straight, horizontal, and parallel!



Our perception is biased by goals

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- Our perception is biased toward our **goals**
- Tend not to notice things unrelated to goals

Our perception is biased by goals

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The screenshot shows the University of Canterbury's website homepage. At the top, there is a navigation bar with links to Study, Courses, Departments, Students, Research, Teaching, Contact, a Search bar, and a magnifying glass icon. Below the navigation bar, there are several large, colorful boxes. From left to right, the first box contains the UC logo and the word "Courses". The second box contains the word "International". The third box contains the word "Liaison". The fourth box contains the word "Scholarships". The fifth box contains the word "Postgraduate". The sixth box contains the text "Nau mai, haere mai ki te Whare Wānanga o Waitaha". Below these boxes, there are three main sections: "Information for" (Prospective Students, International Students, Postgraduate Students, Current Students, Visitors and Community, Business and Industry, Alumni and Friends, Prospective Staff), "NEWS" (News Feature: Expert to talk about captive elephants, 6 May 2013 | Erin Ivory, one of the world's leading), and "WHAT'S HAPPENING" (Events: Introducing the UC Careers Kit, Explore over 70 major subjects and discover where a UC degree can take you. Congratulations! You have been randomly selected to win \$100! Claim at Bursars' Office, with Reward Code 03D4X).

Our perception is biased by goals

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The image shows the homepage of the University of Canterbury's website. At the top, there is a navigation bar with links for Study, Courses, Departments, Students, Research, Teaching, Contact, a Search bar, and a magnifying glass icon. Below the navigation bar, there are several sections: 'Courses' (with a video thumbnail), 'International' (with a video thumbnail), 'Nau mai, haere mai ki te Whare Wānanga o Waitaha' (with a video thumbnail), 'Liaison' (with a video thumbnail), 'More Engineering' (with a video thumbnail), 'Scholarships' (with a video thumbnail and a 'more' button), and 'Postgraduate' (with a video thumbnail). The 'Departments' link in the navigation bar is circled in blue.

The image shows a sidebar and a news section from the University of Canterbury website. The sidebar on the left has a 'Information for' dropdown menu with options: Prospective Students, International Students, Postgraduate Students (which is circled in blue), Current Students, Visitors and Community, Business and Industry, Alumni and Friends, and Prospective Staff. Next to it is a 'Quick Links' section. The main content area features a 'NEWS' section with a 'News Feature' about Erin Ivory talking to captive elephants, and a 'WHAT'S HAPPENING' section with an event about new careers ahead. The 'Postgraduate Students' link in the sidebar is circled in blue.

Information for

Prospective Students

International Students

Postgraduate Students

Current Students

Visitors and Community

Business and Industry

Alumni and Friends

Prospective Staff

Quick Links

NEWS

Postgraduate Students

WHAT'S HAPPENING

New CAREER AHEAD!

What can I do with a degree from UC?

Expert to talk about captive elephants

6 May 2013 | Erin Ivory, one of the world's leading

Congratulations!
You have been randomly selected to win \$100!
Claim at Bursars' Office,
with Reward Code 03D4X

Wednesday night

Explore over 70 major subjects and discover where a UC degree can take you.
Photo: Supplied

Our vision is optimized to see structures

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Gestalt Principles of Visual Perception

- Proximity
- Similarity
- Continuity
- Closure
- Symmetry
- Figure/ground
- Common fate

Proximity

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Items that are closer appear grouped



Proximity

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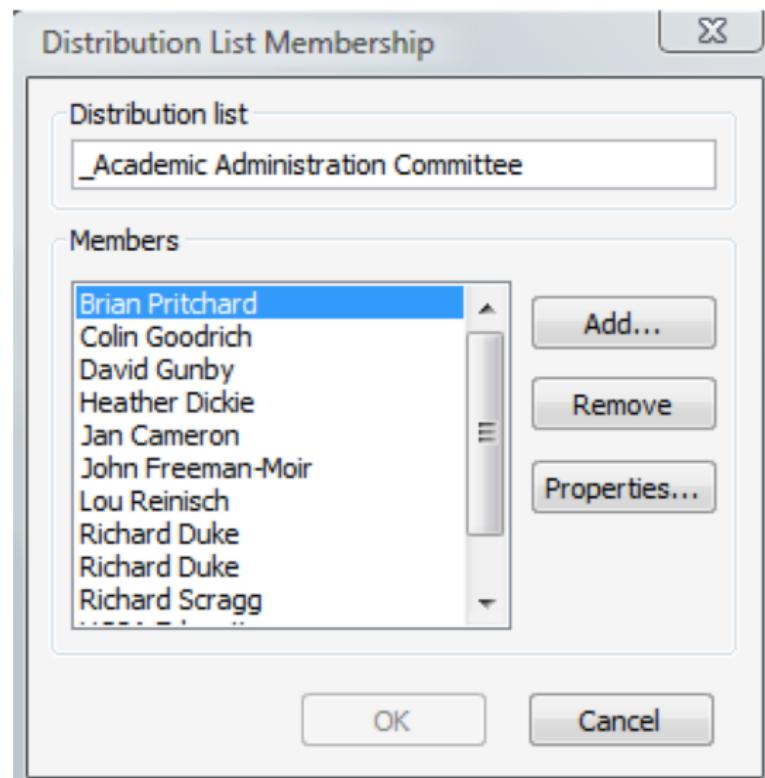
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[Orchidaceae - Wikipedia, the free encyclopedia](#)

[en.wikipedia.org/wiki/Orchidaceae](#) ▾

Orchids are easily distinguished from other plants, as they share some very evident apomorphies. Among these are: bilateral symmetry (zygomorphism), many ...

[Etymology](#) - [Distribution](#) - [Taxonomy](#) - [Characteristics](#)

[orchids, gift orchids, hobby growing](#)

[www.orchids.com/](#) ▾

Orchids.com Logo, Login | Home | My Account | Customer Service · Sign In or Register | Shopping Cart. 1-888-4ORCHID (1-888-467-2443) - 9 am-5 pm (Pacific) ...

[Pacific Orchid Exposition - San Francisco Orchid Society](#)

[www.orchidsanfrancisco.org/poe.html](#) ▾

The San Francisco Orchid Society would like to express its thanks to the Taiwan Tourist Bureau CBS and KCBS for their continued support in production and ...

[Orchids in the Park - San Francisco Orchid Society](#)

[www.orchidsanfrancisco.org/orchidsinthepark.html](#) ▾

Thanks to all volunteers and attendees for a successful "Orchids In The Park" event. -- Images by Jeff Harris. --Images by Jeff Harris. <back to top> ...

Proximity

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Limited time

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iPhone X®

All-screen design. Longest battery life ever in an iPhone.

Fastest performance. Studio-quality photos.

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Closure

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We tend to see whole, closed objects, not collections of fragments



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We tend to see whole, closed objects, not collections of fragments



Simplicity

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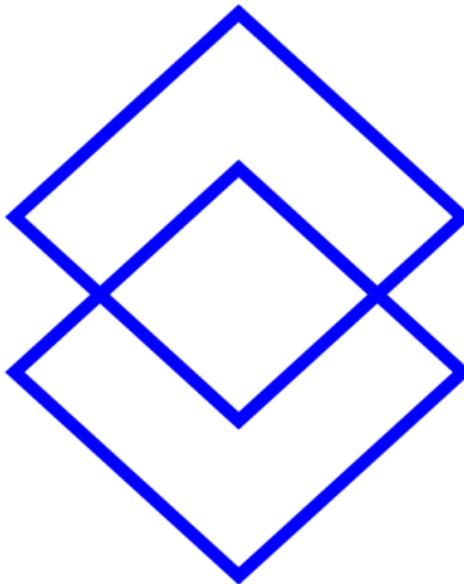
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We tend to see simple figures rather than complex ones



Figure/Ground

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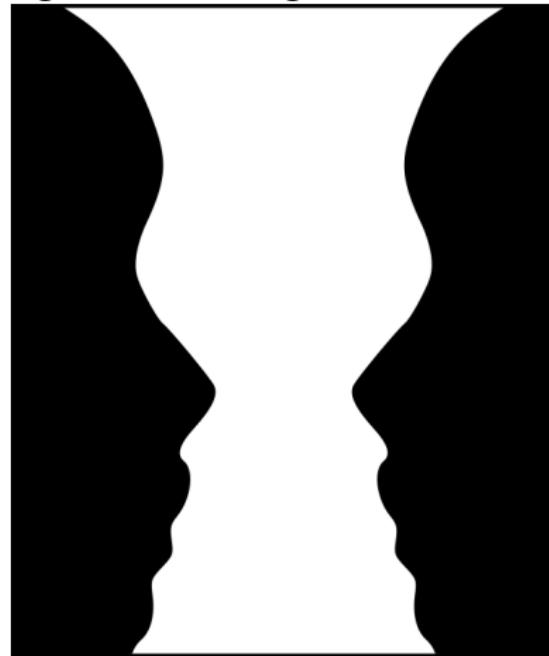
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The tendency of our visual system to simplify a scene based on the figures and the grounds



We seek and use visual structure

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■ Unstructured:

You are booked on United flight 237, which departs from Auckland at 14:30 and arrives at San Francisco at 11:40 Tuesday 15 Oct.

■ Structured:

Flight: UA 237, Auckland => San Francisco

Depart: 14:30 Tue 15 Oct

Arrive: 11:40 Tue 15 Oct

We seek and use visual structure

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Human loves hierarchy...for some reasons...

Create a Clear Visual Hierarchy

Organize and prioritize the contents of a page by using size, prominence and content relationships. Let's look at these relationships more closely: The more important a headline is, the larger its font size should be. Big bold headlines help to grab the user's attention as they scan the Web page. The more important the headline or content, the higher up the page it should be placed. The most important or popular content should always be positioned prominently near the top of the page, so users can view it without having to scroll too far. Group similar content types by displaying the content in a similar visual style, or in a clearly defined area.

Create a Clear Visual Hierarchy

Organize and prioritize the contents of a page by using size, prominence and content relationships.

Let's look at these relationships more closely:

- **Size**

The more important a headline is, the larger its font size should be. Big bold headlines help to grab the user's attention as they scan the Web page.

- **Prominence**

The more important the headline or content, the higher up the page it should be placed. The most important or popular content should always be positioned prominently near the top of the page, so users can view it without having to scroll too far.

- **Content Relationships**

Group similar content types by displaying the content in a similar visual style, or in a clearly defined area.

We seek and use visual structure

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Structured numbers are easier to see...

Bad: SFGov.org

Payment Information

Credit Card Number:

Good: Democrats.org

Credit Card Number:

1234 5678 9012 3456

Our color vision is limited...

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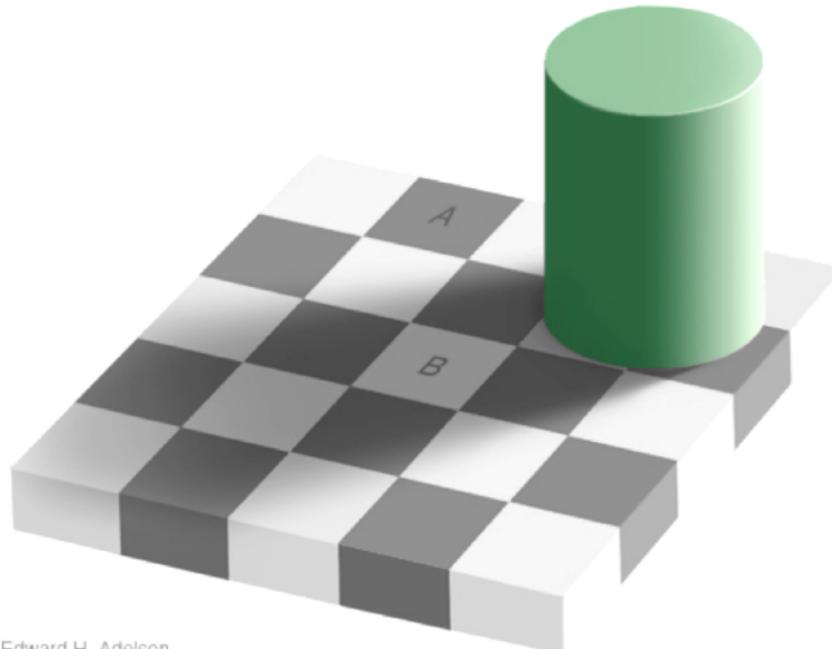
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Our vision is optimized to see contrasts, edges, and changes,
not absolute levels



Edward H. Adelson

Our color vision is limited...

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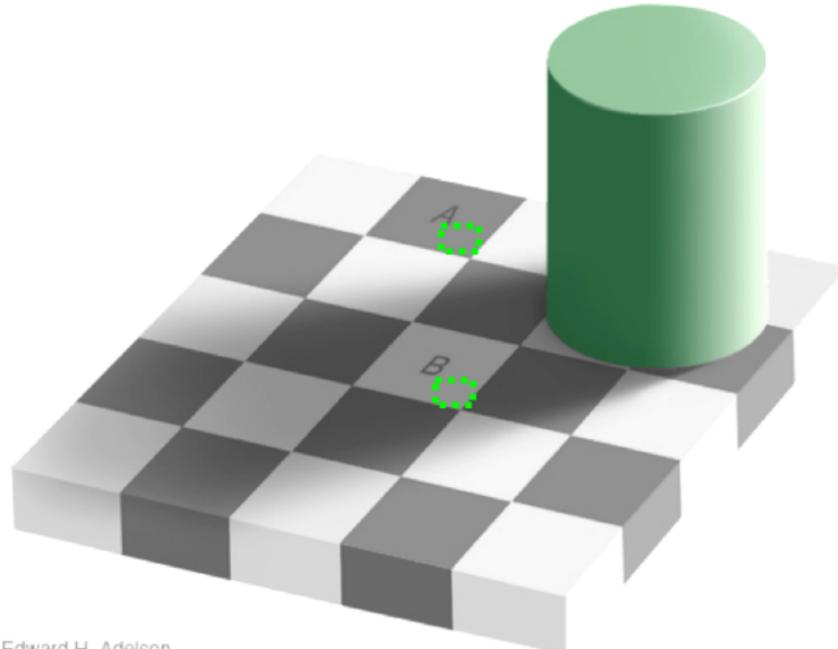
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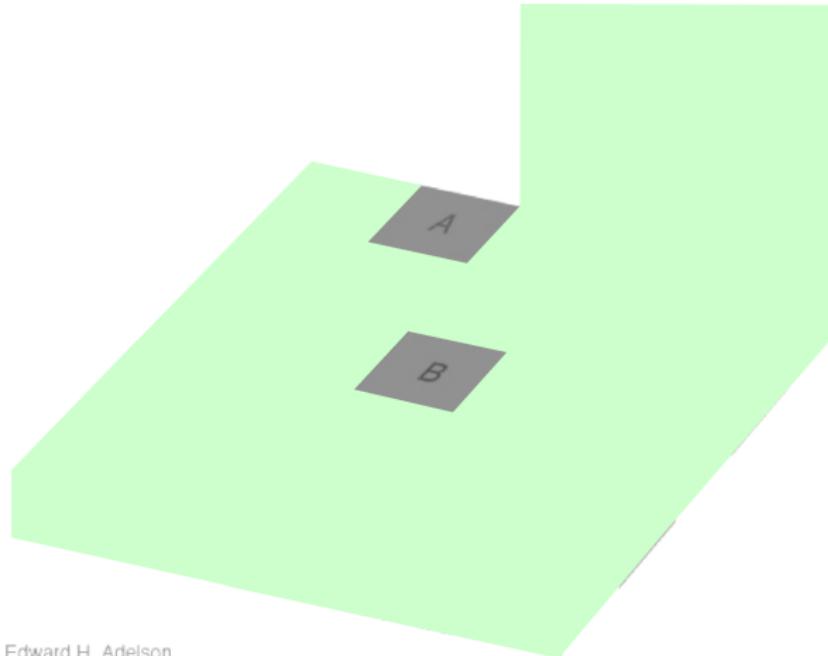
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not absolute levels



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We have trouble discriminating - pale colors, small color patches, separated patches...



Our color vision is limited...

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Our color vision is limited...

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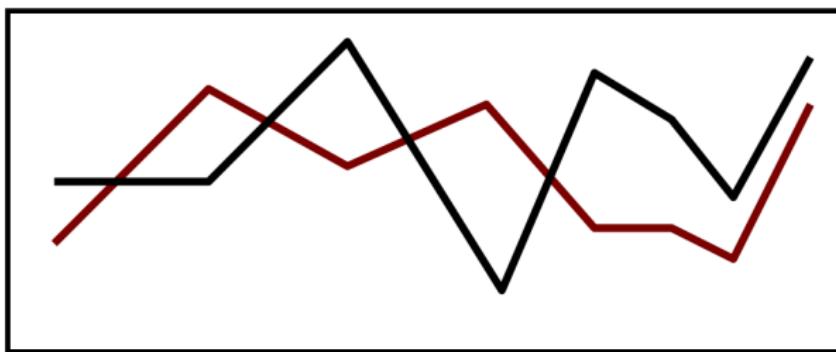
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Some people have color blindness

- 8% of males
- 0.5% of females

colors that would be hard for red-green colorblind people to distinguish



Our color vision is limited...

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Most common forms of color blindness - red-green called deuteranopia

Google: normal



Google: deuteranopia



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Don't use colors only! Also rely on other things like shapes or cues

E.g., Let's improve ITN.net



How *they* improved it:



Our color vision is limited...

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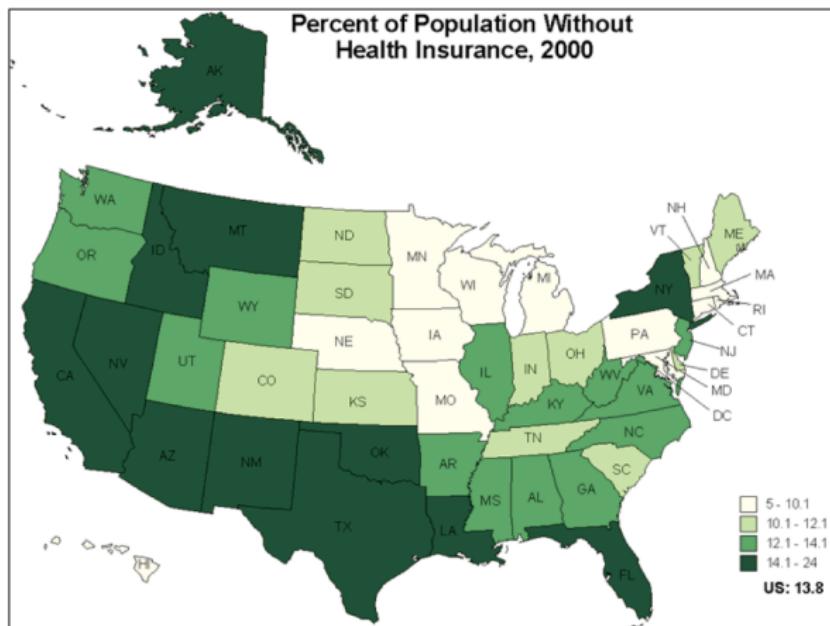
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Don't use subtle color differences. Should still look different in gray scales. Bad examples below....



Our color vision is limited...

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Use distinctive colors when possible.

Most distinctive colors: 

Other distinctive colors: 

Our peripheral vision is poor...

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Our view of vision is actually narrow...

Invalid Pin No. Please try again.

Login

For best results, Netscape Navigator 3.x or higher is recommended.

ID

Pin No

[Change your PIN](#)

Our peripheral vision is poor...

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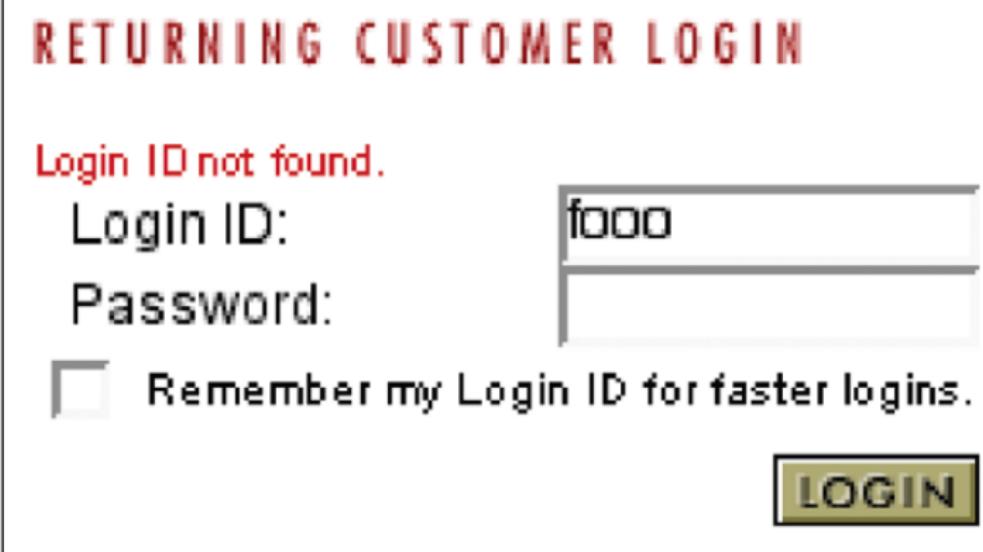
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Bad design...



Our peripheral vision is poor...

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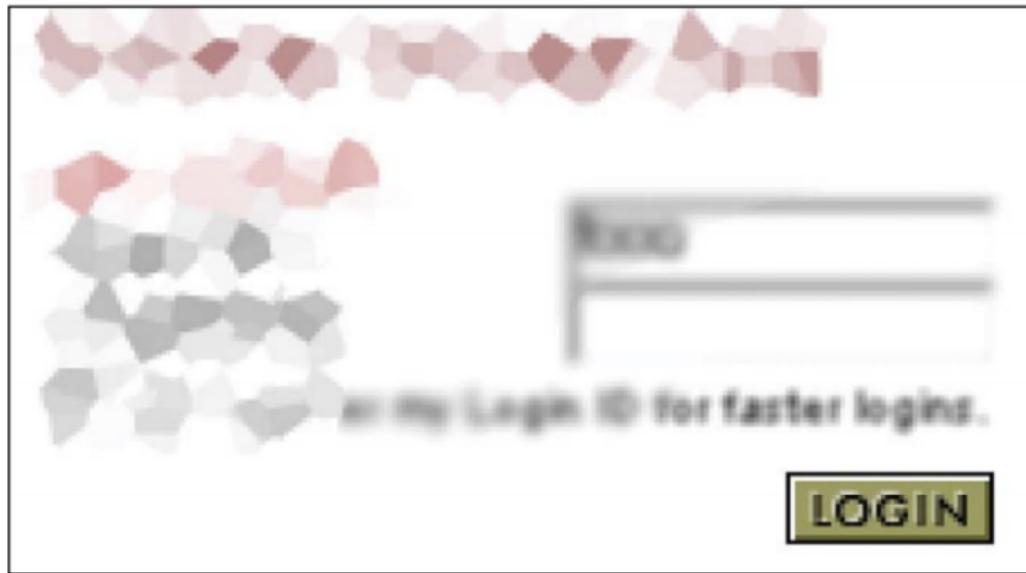
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Simulating the fovea...



Our peripheral vision is poor...

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Better design...

The screenshot shows the Informaworld website's registration page. At the top, there is a navigation bar with links for eBooks, Journals, Reference Works, and Abstract Databases. Below this is a header featuring the Taylor & Francis logo and links for HOME, ABOUT US, and CONTACT US. The main search bar allows users to search "entire site" or "informaworld". To the right, there are links for Browse Publications A-Z, Browse Subjects A-Z, and Advanced Search. Below the header, there are buttons for SIGN IN, Register, Why Register?, and Got a Voucher?. On the left, a sidebar lists account management options: My Account, Register, Subscriptions, Purchases, Shopping Cart, Alerts, Marked Lists, and Saved Searches. The main content area is titled "Register" and includes sections for Personal Registration and Institutional Registration. It also features a "Sign in" form with fields for Username and Password, and a note about already registered users. A red error message at the bottom right states: "⚠ Username/password combination was not recognised." The footer contains standard website links like HELP, PUBLISH WITH US, LIBRARIANS, and a navigation menu.

Our peripheral vision is poor...

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Better design...

Create a Free Email Address

[Already a Member? Click here](#)

* First Name: 

* Last Name: 

* Desired Email Address: @aol.com
3-16 letters or numbers. It must start with a letter.

* Password: Password Strength 
Please enter a Password that is 6-16 characters using only letters and numbers.
6-16 letters or numbers.
[Help for creating a secure password.](#)

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- Put where users are looking
- Put near the errors
- Use red for errors
- Use error symbols
- Being redundant is good!!!
- Heavy design choices (Use sparingly!):
 - Pop up dialogs
 - Audio beep
 - Flash and wiggle....

Visual search is linear...unless the target "pops"

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Where's Waldo?



Visual search is linear...unless the target "pops"

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Nonlinear: Find font-style in pile of letters

G T H U J L U 9 J V Y I A
L Q R B T J P L F B M R W S
3 L C T V B H U S E M U K
F R N Q S P D C H K U T
W Q E L F G H B Y I K D 9
G V N G R Y J G Z S T 6 S
E X C F T Y N H T D O L L 8

Visual search is linear...unless the target "pops"

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The more important a headline is, the larger its font size should be. Big bold headlines help to grab the user's attention as they scan the Web page.

- **Prominence**

The more important the headline or content, the higher up the page it should be placed. The most important or popular content should always be positioned prominently near the top of the page, so users can view it without having to scroll too far.

- **Content Relationships**

Group similar content types by displaying the content in a similar visual style, or in a clearly defined area.

Visual search is linear...unless the target "pops"

Human Factors

Perception

Icons help....arranging by alphabet also helps



Visual search is linear...unless the target "pops"

Human Factors

Chaklam Sil-pasuwanchai

Perception

Biases

Structure

Limitations

Visual search

Reading

Design implications

Memory

Design implications

Cognition

Attention

Learning

Reasoning

Design implications

Visual search slows down by age...

amazon Try Prime Your Amazon.com Today's Deals Gift Cards Sell Help Hello, Sign in Your Account Try Prime Cart Wish List Sponsored by SanDisk

Shop by Department Search All Go

Instant Video MP3 Store Cloud Player Kindle Cloud Drive Appstore for Android Digital Games & Software Audible Audiobooks

Introducing kindle fire HDX And the revolutionary "Mayday" button From \$229 > Shop now

The Perfect Clip Year-End Deals Top Movies and TV

Return or replace a gift Extended holiday returns until January 31 > Go to the Returns Center

New Year's Eve Deals > Shop now

Up to 70% OFF CLOTHING > See more

LifeProof Cases for iPhone 4 & 5 > Learn more

Holiday Favorites from Marketplace Sellers > Shop now

Included with Prime Membership at No Additional Cost

HD HD HD HD

THE CHRISTMAS SECRET FIDELITY IN FLAMES SKYFALL 007: SKYFALL SCHROEDER

= \$30 Off Instantly

The screenshot shows the Amazon homepage with a prominent 'Year-End Deals' banner at the top. Below it, there are several promotional sections: 'Return or replace a gift', 'New Year's Eve Deals', 'Up to 70% OFF CLOTHING', 'LifeProof Cases for iPhone 4 & 5', 'Holiday Favorites from Marketplace Sellers', and 'Included with Prime Membership at No Additional Cost' featuring movie posters for 'The Christmas Secret', 'Fidelity in Flames', 'Skyfall', and '007: Skyfall'. The page also features a 'Mayday' button for the Kindle Fire HDX.

Reading is unnatural

Human Factors

Chaklam Sil-pasuwanchai

Perception

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Design implications

- We're pre-wired for **language**
- We are pre-wired for **pictures**
- We are NOT pre-wired for **reading** - reading requires practice!

Length helps reading

Human Factors

Chaklam Sil-pasuwanchai

Perception

Biases

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This block of text can get a little bit tedious to read after a while, and this may be due to the long line lengths. These sentences have an average of about 57 characters (including) spaces in them whereas the sweet spot is at about 30-40.

too long

too short

On the other hand, this block of text has an average of about 18 characters per line, which is too short, making the sentences choppy and a bit awkward to read.

just right

This block of text averages about 34 characters per line and around 6 words per line, making it the most comfortable line length for the eye to read. Keep your line lengths short, people.

Space helps reading

Human Factors

Chaklam Sil-pasuwanchai

Perception

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Design implications



HCI and vision

Human Factors

Chaklam Sil-pasuwanchai

Perception

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Visual search

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Design implications

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Design implications

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Design implications

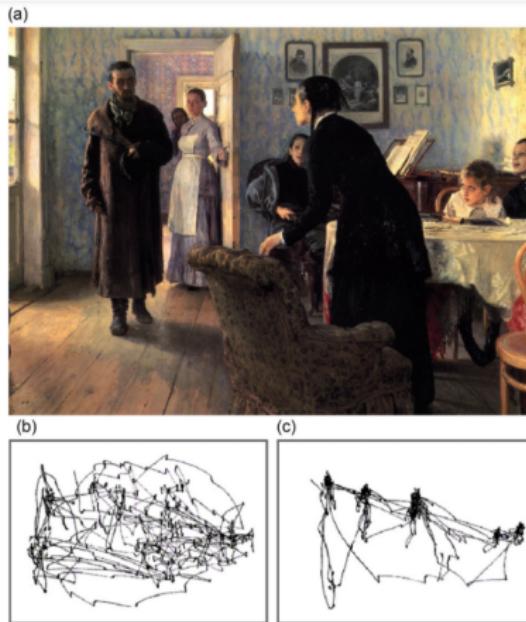


FIGURE 2.6

Yarbus' research on eye movements and vision (Tatler et al., 2010). (a) Scene. (b) Task: Remember the position of the people and objects in the room. (c) Task: Estimate the ages of the people.

Figure: Source: Fg 2.6 (Mackenzie)

HCI and vision

Human Factors

Chaklam Sil-pasuwanchai

Perception

Biases

Structure

Limitations

Visual search

Reading

Design implications

Memory

Design implications

Cognition

Attention

Learning

Reasoning

Design implications

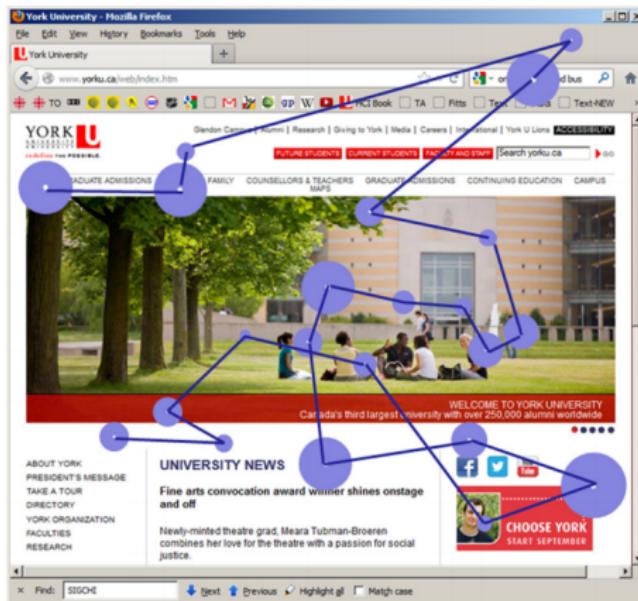


FIGURE 2.7

Scanpath for a user locating content on a web page.

Figure: Source: Fg 2.7 (Mackenzie)

HCI and vision

Human Factors

Chaklam Sil-pasuwanchai

Perception

Biases

Structure

Limitations

Visual search

Reading

Design implications

Memory

Design implications

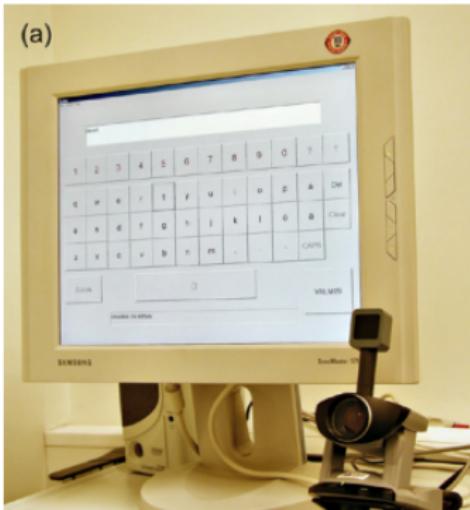
Cognition

Attention

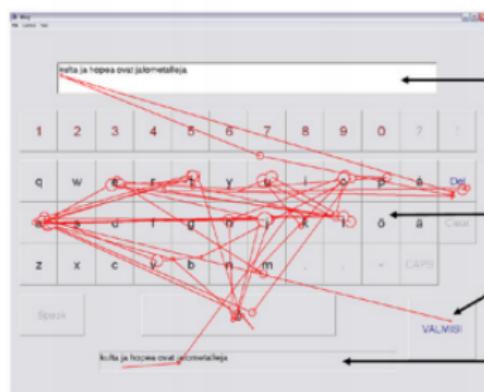
Learning

Reasoning

Design implications



(a)



(b)

Figure: Source: Fg 2.13 (Mackenzie)

Design implications

Human
Factors

Chaklam Sil-
pasuwanchai

Perception

Biases

Structure

Limitations

Visual search

Reading

Design implications

Memory

Design implications

Cognition

Attention

Learning

Reasoning

Design implications

- **Don't believe what users say**; instead understand their goals and knowledge (and what they don't know)
- Use **hierarchy** and **smart spacing**
- Use **color** very carefully
- Humans can focus only at **very tiny spot**
- Use **affordance, convention, constraints, mapping** can increase visual search speed; use **sound/highlights cautiously** since they are not natural

Activities

Human Factors

Chaklam Sil-pasuwanchai

Perception

Biases

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Design implications

Memory

Design implications

Cognition

Attention

Learning

Reasoning

Design implications

Classwork

Download latest PEBL from

<http://pebl.sourceforge.net/download.html>

Perform the Muller-Lyer experiment.

Try to do some interesting analysis.

Reminders

Human Factors

Chaklam Sil-pasuwanchai

Perception

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Visual search

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Design implications

Memory

Design implications

Cognition

Attention

Learning

Reasoning

Design implications

- **Project leaders** - Second paper reading summary due soon. Hard copy on the shelf, and soft copy in Google classroom.

Our memory is imperfect

Human Factors

Chaklam Sil-pasuwanchai

Perception

Biases
Structure
Limitations
Visual search
Reading
Design implications

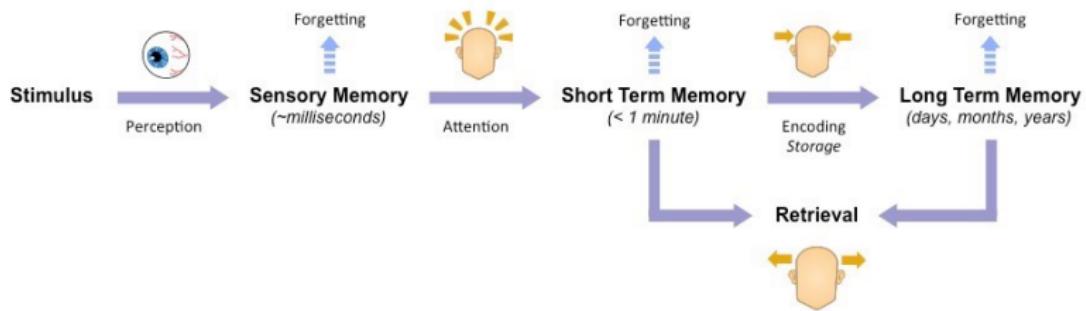
Memory

Design implications

Cognition

Attention
Learning
Reasoning
Design implications

- Short Term Memory (STM or WM)
- Long Term Memory (LTM)



Our memory is imperfect

Human Factors

Chaklam Sil-pasuwanchai

Perception

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Visual search

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Design implications

Memory

Design implications

Cognition

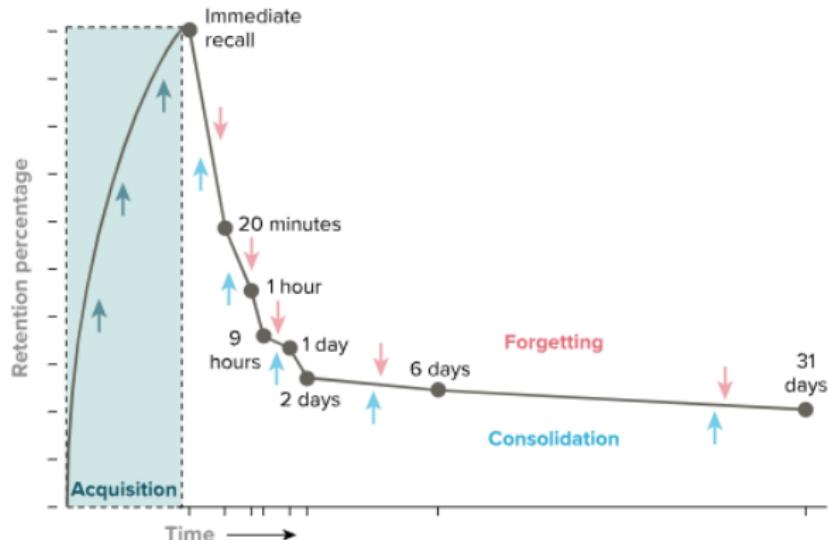
Attention

Learning

Reasoning

Design implications

Memory strength over time



SOURCE: R.L. DAVIS & Y. ZHONG / NEURON 2017

KNOWABLE MAGAZINE

Short-term memory

Human
Factors

Chaklam Sil-
pasuwanchai

Perception

Biases

Structure

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Visual search

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Reasoning

Design implications

- Also known as working memory
- Can remember around 7 (± 2) unrelated items (3-5 are better estimates, according to Jeff)
- Can stay for around <1 minute
- **Chunking** improves our short-term memory

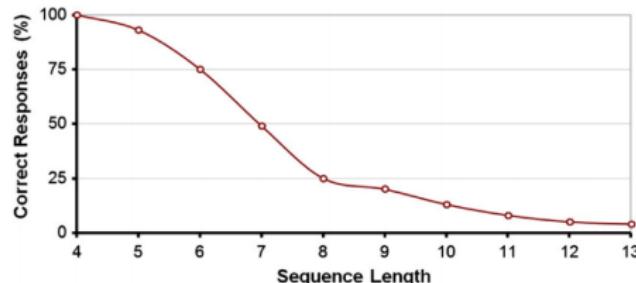


Figure: Source: Figure 2.18 (Mackenzie): Digital lengths and memory

Chunking

Human Factors

Chaklam Sil-pasuwanchai

Perception

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Reading

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Deploy and scale seamlessly

Our optimized configuration process saves your team time when running and scaling distributed applications, AI & machine learning workloads, hosted services, client websites, or CI/CD environments.

Deploy



Cluster deployments

Provision multiple Droplets (virtual machines) in seconds with our control panel, CLI, or directly against our API.



Optimized compute types

Get the compute resources you need with Standard or Optimized Droplets.

Manage

Secure

Scale

Monitor



One-click apps

Skip the install and configuration process with pre-built open source images supporting Rails, Cassandra, Docker, and more.



Global availability

Deploy to any of our data center regions around the world.

Long-term memory

Human
Factors

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pasuwanchai

Perception

Biases

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Memory

Design implications

Cognition

Attention

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Reasoning

Design implications

- Stores life time experience but prone to error and biases
- Similar experience trigger same patterns > **recognition**
- Internal neural activity triggers pattern > **recall**
- Why we forget?
 - **Decay theory:** proposes that memory fades due to mere passage of time - active rehearsing information is believed to counter this temporal decline
 - **Interference theory:** proposes that similar information can make memories less accessible

Provide external memory aids

Human Factors

Chaklam Sil-pasuwanchai

Perception

Biases

Structure

Limitations

Visual search

Reading

Design implications

$$5+6*7/3 =$$

19

Memory

Design implications

Cognition

Attention

Learning

Reasoning

Design implications

Provide external memory aids

Human Factors

Chaklam Sil-pasuwanchai

Perception

Biases

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Visual search

Reading

Design implications

Memory

Design implications

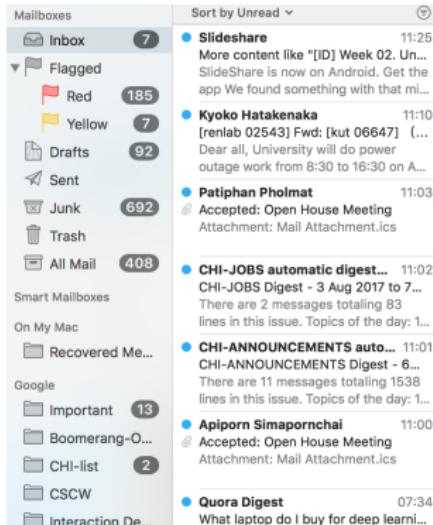
Cognition

Attention

Learning

Reasoning

Design implications



The use of flagging helps...

Apiporn Simapornchai

Declined: Open House Meeting

To: Chaklam Silpasuwanchai



Mail Attachment

Provide external memory aids

Human
Factors

Chaklam Sil-
pasuwanchai

Perception

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Visual search

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Memory

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Cognition

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Design implications

History of commands helps...

```
STIU-M-00101:~ csilpasuwanchai$ history
 1 ipconfig
 2 ifconfig
 3 ping 10.10.101.62
 4 ping Server returned error: "334
 5 Server returned error: "334
 6 ping smtp.office365.com
 7 java -version
 8 cd /System/Library/Java/
 9 ls
10 ls
11 cd ..
12 ls
13 cd ..
14 ls
15 cd /Library/
16 ls
```

Recognition much faster than recall

Human Factors

Chaklam Sil-pasuwanchai

Perception

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Design implications

Cognition

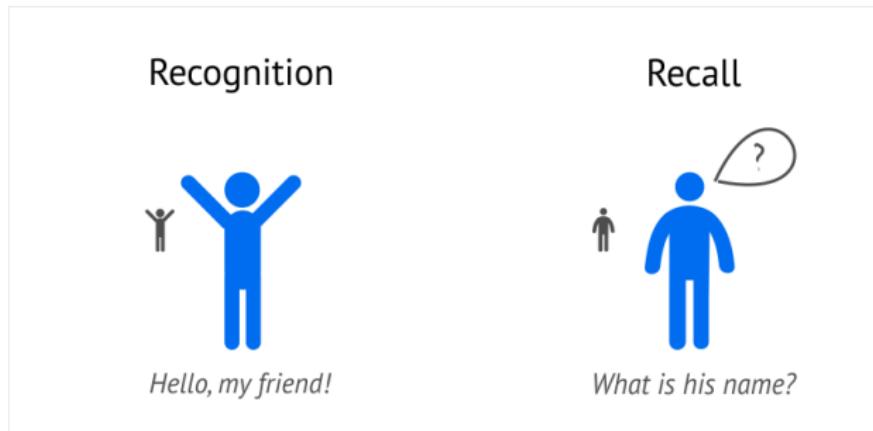
Attention

Learning

Reasoning

Design implications

- Use menus and metaphors
- Use auto-completion if recall is really needed



Design Implications

Human
Factors

Chaklam Sil-
pasuwanchai

Perception

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Design implications

Cognition

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Reasoning

Design implications

- Use **convention** and **consistency**
- Use **recognition** instead of recall when possible (but do not forget ways for novice to transition to experts)
- Use **chunking** when possible; 3-5 rule
- Put the knowledge in of the world (Norman, 1988), e.g., bookmarks, history of commands, tagging, time stamping, reminders, marked emails, pwd etc.

Attention

Human
Factors

Chaklam Sil-
pasuwanchai

Perception

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Design implications

Cognition

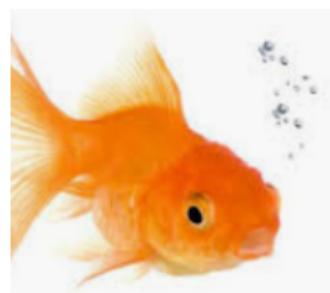
Attention

Learning

Reasoning

Design implications

- Our attention is limited
- Goldfish has an attention span of 8s, guess how much is of humans?
- Do you remember what I discuss in the previous slide?
What did you eat yesterday morning?



Our attention is on the goal, not the tools/person

Human Factors

Chaklam Sil-pasuwanchai

Perception

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- <https://www.youtube.com/watch?v=FWSxSQsspiQ>



Consider "viewport" - bad example

Human Factors

Chaklam Sil-pasuwanchai

Perception

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Design implications

The screenshot shows the Engadget website homepage. At the top, there's a navigation bar with links for Gear, Gaming, Entertainment, Tomorrow, The Buyer's Guide, Video, Reviews, and US Edition. On the right side of the header is a 'Login' button and a magnifying glass icon for search. Below the header, there's a sidebar with a 'Featured' section containing a thumbnail of a Nintendo Switch console and some text. The main content area features a large, vibrant image of a female character with white hair and armor from the game Final Fantasy VII Remake. To the left of this main image is a news article thumbnail with the headline 'Switch Online code hints at potential SNES game additions' and a timestamp '(3h ago)'. To the right of the main image is another news article thumbnail with the headline 'Epic's updated game store refund policy matches Steam' and a timestamp '(17h ago)'. At the bottom right of the page, there's a 'Business' section with an article about Unity and Epic Games, followed by a small bio for the author and a timestamp '(01.10.19 11:17)'.

Consider "viewport" - good example

Human Factors

Chaklam Sil-pasuwanchai

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Design implications

The screenshot shows the homepage of the New Chapter website. At the top, there's a purple header bar with the text "Use our store locator to find products at a shop near you." Below it is a navigation bar with links for "Home", "Products", "Health Needs", "Ingredients", "Our Difference", "Shop", "My Account", and icons for search and shopping cart. A red banner below the navigation bar says "Save when you subscribe today! Get 15% off your monthly subscription." The main visual is a photograph of a person walking away from the camera on a path through a forest. Overlaid on the image is text: "INTRODUCING New Chapter® Rewards" and "The next step in your self-care journey...". There's a purple "Learn More" button. At the bottom of the page, another red banner offers "Special Offer free shipping*. Save 15% when you subscribe." Below this are three product cards: "TOP PICK Vitamins Every Woman™'s One Daily Multivitamin" (BUY NOW \$19.46), "TOP PICK Inflammation Zyflamend™ Whole Body" (BUY NOW \$21.80), and "TOP PICK Bone Strength Take Care™ Slim Tablets" (BUY NOW \$16.34).

Consider "hierarchy" - bad example

Human Factors

Chaklam Sil-pasuwanchai

Perception

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Reasoning

Design implications

adidas

BLOG ON-THE-JOB RECORDS CAREER TALK BUSINESS OPERATIONS SUSTAINABILITY ASPECTS HEADQUARTER NEWS STRATEGY UPDATES MORE ▾

SEARCH ARCHIVE

ALL POSTS MOST RECENT MOST POPULAR

The screenshot shows the Adidas blog homepage. At the top, there's a navigation bar with links for 'BLOG', 'ON-THE-JOB RECORDS', 'CAREER TALK', 'BUSINESS OPERATIONS', 'SUSTAINABILITY ASPECTS', 'HEADQUARTER NEWS', 'STRATEGY UPDATES', and a 'MORE ▾' dropdown. Below the navigation is a search bar and an 'ARCHIVE' button. The main content area has two sections: 'ALL POSTS' and 'MOST RECENT / MOST POPULAR'. Under 'ALL POSTS', there are three blog posts with small thumbnail images and titles: 'On-the-Job Records: How being a Mom helps me stay fit' by Alison Smith (May 6, 2016), 'Career Talk: Get out of bed! Challenge yourself to be the early bird.' by Sophie Schirer (April 28, 2016), and 'On-the-Job Records: Turn on the lights – harnessing positive energy in London' by Joanne McDonald (April 27, 2016). To the right of these posts is a large, dark advertisement for 'GAMEPLAN A by adidas' featuring a man in a dynamic pose. The text 'WE ARE MOVING. MOVE WITH US.' is overlaid on the ad. Below the ad, a caption reads: 'It's finally here: the new digital magazine we've been dying to share with you. Join the huddle to make work life better, more inspiring and fun.'

Consider "hierarchy"

Human Factors

Chaklam Sil-pasuwanchai

Perception

Biases

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Visual search

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Design implications

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Design implications

Cognition

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Reasoning

Design implications



Dear Jane, you are invited to
John's 21st Birthday Party
Come eat, drink and be
merry with John as he turns
the big two-one!
Saturday, May 19th
7.00PM – 12.00AM
12 Street Road, Suburb Town
RSVP by May 5th



Dear Jane, you are invited to
**John's 21st
Birthday Party**

Come eat, drink and be merry with
John as he turns the big two-one!

**Saturday, May 19th
7.00PM – 12.00AM**

12 Street Road,
Suburb Town

RSVP by May 5th

Consider "hierarchy" - good example

Human Factors

Chaklam Sil-pasuwanchai

Perception

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Design implications

The screenshot shows the ESPN Football homepage. At the top, there is a navigation bar with links for Football, NBA, NFL, Cricket, Rugby, Golf, and Fantasy. Below the navigation bar, there is a section titled "Customise ESPN" with "Sign Up" and "Log In" buttons. To the right of this is a large image of Ole Gunnar Solskjær pointing. Below the image is a headline: "Solskjær's tactical acumen overcomes Pochettino". The text below the headline states: "Man United had won games before under their caretaker manager, but their victory at Spurs showed why Ole Gunnar Solskjær's reputation is growing." To the right of this article is a sidebar titled "Top Headlines" with several news items. At the bottom right is a "FANTASY FOOTBALL" logo.

Team	Opponent	Score
ATM	LEV	1 - 0
BIL	SEV	2 - 0
BAR	EIB	3 - 0
BET	MAD	1 - 2
Coppa Italia	TOR	0 - 2
INT	FIO	2 - 0
NAP	NAS	6 - 2

Full Scoreboard >

Fantasy powered by

Topics:

- Premier League
- Champions League
- La Liga
- Liga MX
- Football Asia
- Fantasy Football
- Transfers
- Teams
- Tables
- Leagues & Cups

Top Headlines:

- Solskjær surpasses Busby, sets United record
- Poch: Spurs' Kane injury would be 'massive' blow
- Pogba lauds 'freedom' to play under Solskjær
- Chelsea's Hudson-Odoi nearing top level - Sarri
- Guardiola: City battling Barca, Real for signings
- Messi becomes first to score 400 La Liga goals
- Solan: Not 'personal' for starting Real youngsters
- Inter gets Coppa Italia win at empty San Siro
- Transfer talk: Emery wants Ozil out of Arsenal

Use grid

Human Factors

Chaklam Sil-pasuwanchai

Perception

Biases

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Limitations

Visual search

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Design implications

Memory

Design implications

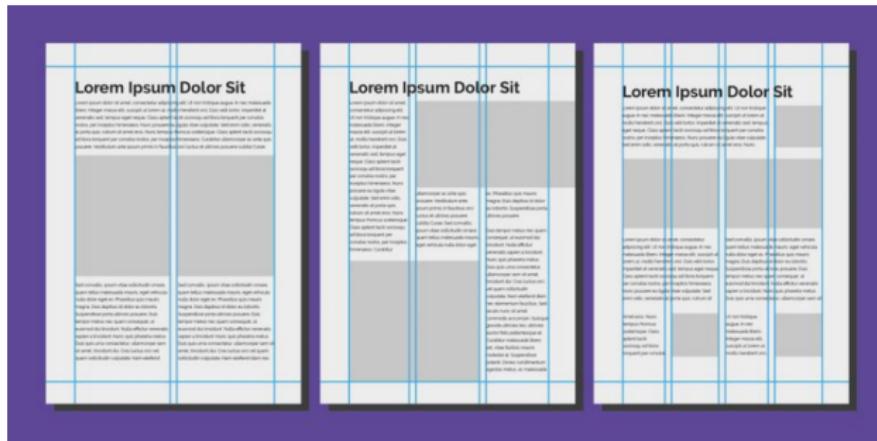
Cognition

Attention

Learning

Reasoning

Design implications



Just enough for decisions - bad example

Human Factors

Chaklam Sil-pasuwanchai

Perception

Biases

Structure

Limitations

Visual search

Reading

Design implications

Memory

Design implications

Cognition

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Learning

Reasoning

Design implications

The screenshot shows a product feed on the Engadget website. The products are sorted by 'Most Recent'.

- Nintendo Entertainment System Controllers**: Price \$59. A green badge in the top right corner shows the number 76.
- Sony PlayStation Classic**: Price \$99.99. A green badge in the top right corner shows the number 67.
- Fossil Sport**: Price \$255. A green badge in the top right corner shows the number 75.
- Microsoft Surface Headphones**: Price \$349.99. A green badge in the top right corner shows the number 79.

Just enough for decisions - good example

Human Factors

Chaklam Sil-pasuwanchai

Perception

Biases

Structure

Limitations

Visual search

Reading

Design implications

Memory

Design implications

Cognition

Attention

Learning

Reasoning

Design implications

The screenshot shows a user interface for a shopping website. On the left, there are three vertical columns of filters: 'Gender' (Men, Women, Kids), 'Product Category' (Apparel, Shoes, Accessories), and 'Size' (XS, S, M, L, XL, 2XL, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5). Below these is a 'Color' section with a 'View More' link and a grid of color swatches. The main content area features a large promotional banner at the top with the text 'EXTRA 40% OFF SALE' and a message about an extended season sale. Below the banner are four product cards, each featuring a sneaker image, a color-coded 'View More' button, and a detailed product card below it.

Product	Color Options	Category	Price	Rating	Reviews
Reebok CrossFit Nano 8 Flex...	> 16 colors	Men Training	\$99.97 - \$130	★★★★★	1,121
Reebok CrossFit Nano 8 Flex...	> 15 colors	Women Training	\$99.97 - \$130	★★★★★	759
Speed TR Flexweave®	> 3 colors	Women Running	\$69.97 - \$100	★★★★★	37
Reebok Yourflex Train 10	> 5 colors	Men Training	\$39.97 - \$60	★★★★★	282

One click theory

Human
Factors

Chaklam Sil-
pasuwanchai

Perception

Biases

Structure

Limitations

Visual search

Reading

Design implications

Memory

Design implications

Cognition

Attention

Learning

Reasoning

Design implications

Fewer scrolls, fewer hovers, fewer mouse moving, faster decision makings

The screenshot shows the Apple website's homepage. At the top, there is a navigation bar with links for Mac, iPad, iPhone, Watch, TV, Music, Support, a search icon, and a shopping bag icon. Below the navigation bar, a large promotional banner features the text "Save 6% on holiday gifts at Apple." in bold black font. A smaller line of text below it says "Get 6% Daily Cash back when you pay with Apple Card from now until December 31.*". There are two blue links: "Learn more >" and "Apply now >". The central part of the page has a white background with the Apple logo at the top. Below the logo, the text "Wrap up your gift list." is displayed in a large, bold, black font. Underneath this text is a link "Shop last-minute favorites >". At the bottom of the page, there are three decorative illustrations: a row of colorful Apple Watch bands on the left, a cluster of white AirPods in the center, and a stack of colorful iPhone cases on the right.

Loose ends

Human
Factors

Chaklam Sil-
pasuwanchai

Perception

Biases

Structure

Limitations

Visual search

Reading

Design implications

Memory

Design implications

Cognition

Attention

Learning

Reasoning

Design implications

- When we finish our goal, we often forget the "loose ends" of tasks
 - Turning headlights of car off
 - Forgetting to take your ATM card after withdrawing money



End with action

Human Factors

Chaklam Sil-pasuwanchai

Perception

Biases

Structure

Limitations

Visual search

Reading

Design implications

Memory

Design implications

Cognition

Attention

Learning

Reasoning

Design implications

The image displays two website screenshots side-by-side, illustrating design principles for user engagement.

Left Website Screenshot: A landing page for DigitalOcean's Droplets service. The header includes the DigitalOcean logo, navigation links for Products, Customers, Community, Pricing, Docs, Support, and Log in, and a "Sign up" button. Below the header is a section titled "Do more with Droplets" with the subtext: "Discover your infrastructure's potential with the help of over a thousand easy-to-follow development and systems operation tutorials." Three cards are shown under the heading "TUTORIALS": "How To Automate the Scaling of Your Web Application on DigitalOcean Ubuntu Droplets", "How to use Block Storage on DigitalOcean", and "An Introduction to DigitalOcean Monitoring". A "Check out more tutorials" button is located at the bottom of this section. Below this is a large blue "Ready to get started?" button with a "Create your account" link underneath. At the very bottom of the page are footer links for Careers, Press, Products, Company, and Support, along with a copyright notice: "© 2018 DigitalOcean, LLC. All rights reserved."

Right Website Screenshot: A landing page for "The New Chapter". The header includes the "THE NEW CHAPTER" logo, navigation links for Home, Products, Health Needs, Ingredients, Our Difference, Shop, and Help, and a search bar. The main headline reads "The New Chapter tradition." Below it is a subtext: "New Chapter™ was founded over 20 years ago, believing natural and healthy ingredients were the key to a healthy life. We believe in the healing powers of nature, and that's why we've spent over 20 years finding the best, fresh and quality ingredients to make our ingredients." A "EXPLORE OUR STORY" button is present. Below this is a "Stay in touch" section with a "Sign up for our newsletter today for delicious tips and special offers" message, an "Email Address" input field, and a "SIGN UP" button. At the bottom of the page is a social media sharing bar.

Hearing capabilities

Human
Factors

Chaklam Sil-
pasuwanchai

Perception

Biases

Structure

Limitations

Visual search

Reading

Design implications

Memory

Design implications

Cognition

Attention

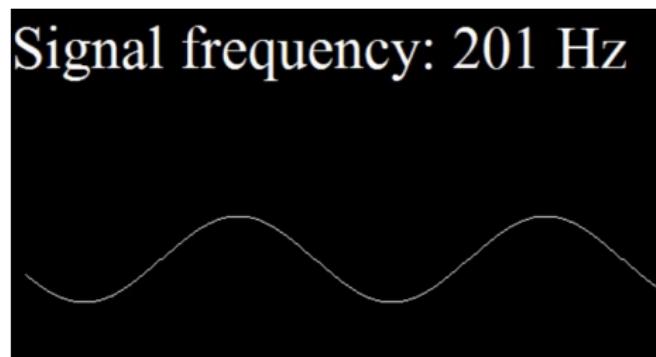
Learning

Reasoning

Design implications

- Human hearing begins with sounds of 0-10dB. Conversational speech is about 50-70 dB. Painful sound is about 120-140 dB
- Pitch is the frequency and human can perceive sounds in the range of 20Hz to 20,000Hz (mine was 200Hz! How about yours?)

<https://www.youtube.com/watch?v=qNf9nzvnd1k>



Multitasking

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- Humans cannot really multi-task, we can only quickly switch between multiple tasks in ms

<https://www.youtube.com/watch?v=vJG698U2Mvo>



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Color is subjective, but also follow some rule on human perception. For example, red implies power, confidence, strength



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Yellow - youthfulness, creativity



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Green - nature, friendly



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Blue - trustworthiness, security, stability



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Purple - luxury



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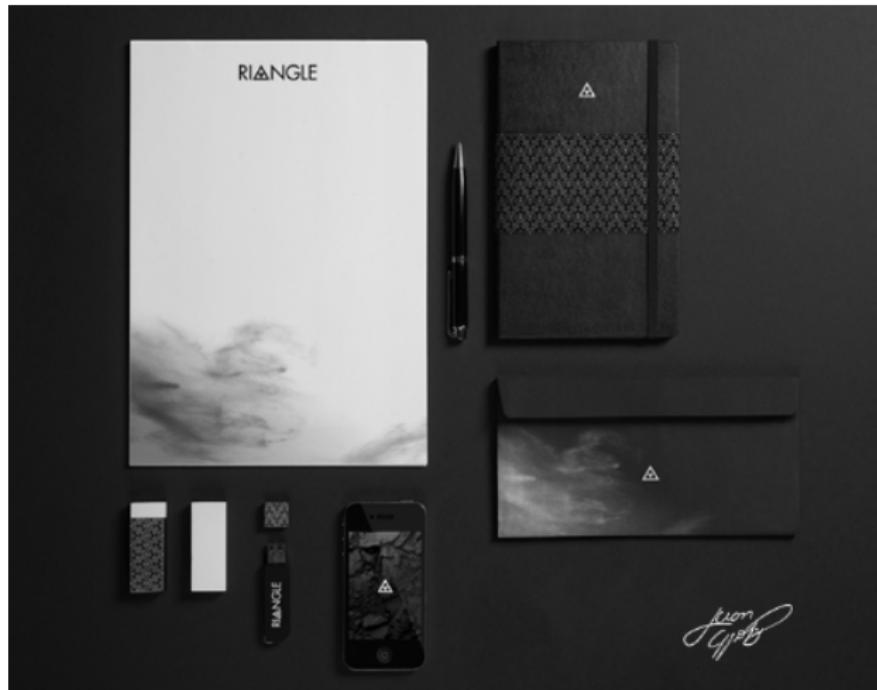
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Black - neutral

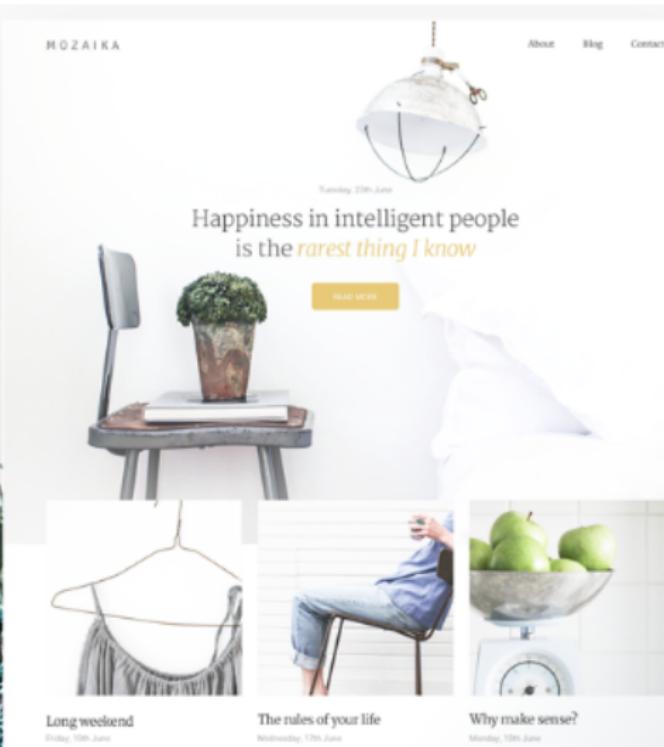


Colors

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Color guidelines

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60-30-10 rule

- 60 main color - suits and pants
- 30 accent color - shirt
- 10 another accent color - tie



Color guidelines

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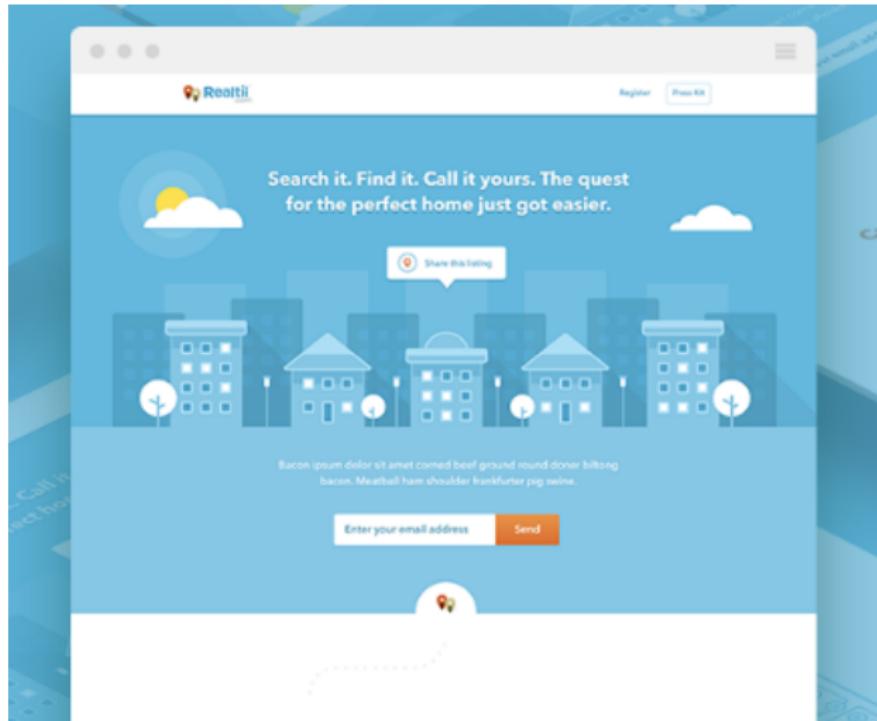
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Use tint and shades - HSB (HUE, Saturation, Brightness),
opacity



Learning

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- **Convention helps learning**
- **Feedback helps learning**
- **Risk is low**
- **Reward is high**

Convention helps learning

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Always preach...follows convention!

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* These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.

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Convention helps learning

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Always preach...follows convention!

Use our store locator to find products at a shop near you.



Bring wellness home.

Our products are made with your well-being in mind.

You'll feel good about choosing New Chapter® – our multivitamins are all Non-GMO Project Verified and we strive to create products made with certified organic vegetables and herbs. We use only the highest quality ingredients, just for you.

Convention helps learning

Human Factors

Learning

The screenshot shows a search results page for 'men's' on the Nike website. The top navigation bar includes links for 'Men', 'Women', 'Kids', and 'Customize'. On the left, there are filters for weather (Cold Weather, Mild Weather, Warm Weather, Water-resistant, Rainy Weather), brand (Nike, Converse, Hurley, + More), collections (Aeroflot, Aeropost, Dri-FIT, + More), fit (Slim, Tight, Loose, Standard), color, and size. The main content area displays a grid of men's apparel items, each with a small image, color, and price. Products shown include men's running shorts, zip-up jackets, hoodies, and various styles of pants like Tech Fleece, Windrunner, and Club Fleece.

Feedback helps learning

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Feedback informs us how to become better



Risk is low

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- **Cheap failures** - no ways to make errors; easy to recover



Rewards

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- If you decide to break the cycle and reinvent something new
 - make sure its **reward exceeds learning effort**
 - make sure it's **learnable** and able to master over time!
 - even better, **expert can still learn** something, i.e., novice vs. expert mode
- **Games** are fun, because everytime we play, **we get better, to no limits.** (Self Determination Theory, 1985)



System 1 and System 2

Human
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- Our brain has two systems: system 1 and system 2
- **System 1** is the *irrational* brain - fast, automatic, unconscious, yet govern most of our behavior
- **System 2** is the *rational* brain - slow, precise, conscious, "believes" it governs our behaviors

System 1 and 2

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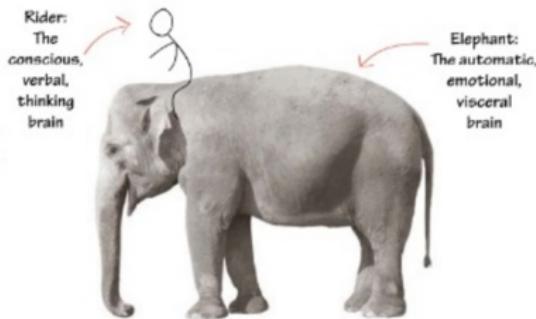
Learning

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One brain, two minds

- Elephant = impulsive mind
- Rider = Rational mind
- Path = the environment



Willpower is the strength of the rider

System 1 and System 2

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- A baseball and a bat together cost 110. The bat costs 100 more than the ball. How much does the ball cost?
- System 1 instant answer: 10 (wrong)
- System 2 may reject that answer. Or not.
- System 2 can calculate correct answer; System 1 cannot.

Human decisions are rarely rational

Human Factors

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System 1 usually controls decisions but is very biased.

- **Losses mean more than gains**
- **Recent history and strong memories "feel" more**
- **Experience and intuition** means more than mountains of statistics and data
- People **avoid risks** for potential gains, but **take risks** for potential losses
- Influence by **word** (75% survival rate vs. 25% mortality rate)

Human decisions are rarely rational

Human Factors

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Kahneman and Tversky: Fourfold Pattern

	Gains	Losses
High Probability Certainty effect	95% chance to win \$10k Fear of loss Risk Averse	95% chance to lose \$10k Hope to avoid loss Risk Seeking
	5% chance to win \$10k Hope to gain Risk Seeking	5% chance to lose \$10k Fear of loss Risk Averse
Low Probability Possibility effect	5% chance to win \$10k Hope to gain Risk Seeking	5% chance to lose \$10k Fear of loss Risk Averse

- TL - eye surgery with 95% success but afraid of eye loss
- TR - desperate investment with 95% failure but still do it
- BL - only 5% chance to win **lottery** but still do it
- BR - only 5% chance to lose, but get **insurance**

Human decisions are rarely rational

Human Factors

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Human decisions are rarely rational

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Design Implications

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- **Prioritize** your information
- Remind **loose ends** - e.g., return to default mode, disconnect after inactivity, end with action, etc.
- **Convention** and **feedback** helps learning
- If it is something **new**, make sure learning is fun with **low risk** and **high rewards**
- Don't assume people **will think or read or learn**. We are irrational! Test regularly and quantitatively. Don't take **average** performance but take note of the **special** cases.

Activities

Human
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Classwork

Download ReactionTimeExperiment.jar from
<http://www.yorku.ca/mack/ExperimentSoftware/>. Then perform experiment for all five matchings (each with 10 trials).

- How reaction rates differ on different matching?
- How are the reaction times when there is a match and when there is no match? (Not including simple search because there is no notion of match and no match in it).

Readings For Next Week

Human Factors

Chaklam Sil-pasuwanchai

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- Mackenzie, Chapter 4-5, **Scientific Foundations, Designing HCI Experiments**, Human Computer Interaction: An Empirical Research Perspective, 1st ed. (2013)

Human Factors

Chaklam Sil-
pasuwanchai

Perception

- Biases
- Structure
- Limitations
- Visual search
- Reading
- Design implications

Memory

- Design implications

Cognition

- Attention
- Learning
- Reasoning
- Design implications

The End