

## Human Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

# Human Factors

Chaklam Silpasuwanchai

Asian Institute of Technology

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February 12, 2020

# Overview

## Human Factors

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### Know your users

Perception

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Learning

Reasoning

#### 1 Know your users

- Perception
- Memory
- Cognition
  - Attention
  - Learning
  - Reasoning

# Reminders

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- HW8-10 due Friday. Submit your CHI/UIST reading workshop on Friday as well.
  - Only the **group leader** submit; A **hard copy** during class
- **Miss Universe:** over-complications - crown, stairs, colors; order, proximity, bold-face are enough
- **Gear:** R is basically in the wrong place. But actually, even the gear mapping - PRNDL - has poor mapping, right?
- **Watch:** Technique is to read each paper, see whether they have any **limitations**, and see whether you can improve.
  - **Novelty:** What is new? “New” is based on past work.
  - **Technicality:** What is so hard about this?
  - **Depth:** Speed vs. accuracy? How to transition to expert users? How to do undo? Copy/paste? Select? Delete? Add space? Format text?
- Don't focus on scores, focus on training. Embrace criticism. And enjoy.

# Sources

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Reasoning

- 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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Perception

Memory

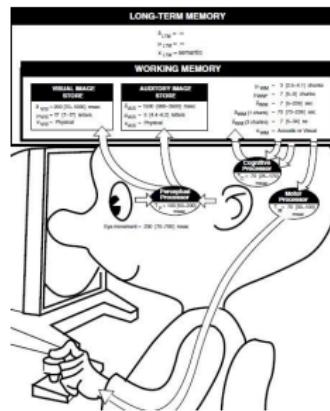
Cognition

Attention

Learning

Reasoning

- Humans are complicated. By comparison, computers are simple. Variability is the biggest challenge of HCI
- Obviously, understanding humans increase our success of design
- Here, we discuss human perception, memory and cognition



# Perception

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Reasoning

- **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
- In psychophysics experiment, human is presented with physical stimulus and is then asked how they felt/perceive
- A common experimental goal is to measure *just noticeable difference* (JND) - does the two stimuli differ? By manipulating the small difference between two stimuli, we can better understand human perception

# Facts about Perception

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Attention

Learning

Reasoning

- ➊ Our perception is biased by
  - our goals
  - our belief
  - our experience
  - the context
- ➋ Our vision is optimized to see structure
- ➌ Our color vision is limited
- ➍ Our peripheral vision is poor
- ➎ Visual search is linear unless target "pops"
- ➏ Reading is unnatural

# Our perception is biased...

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Reasoning



# Our perception is biased...

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Cognition

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Learning

Reasoning

## Page 3

Back

Next

## Page 4

Next

Back

# 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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Memory

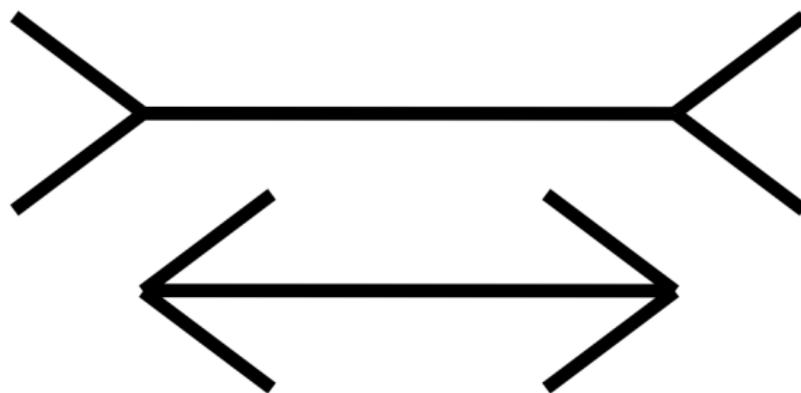
Cognition

Attention

Learning

Reasoning

## Muller-Lyer illusion



# Our perception is biased...

## Human Factors

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## Muller-Lyer illusion



# Our perception is biased...

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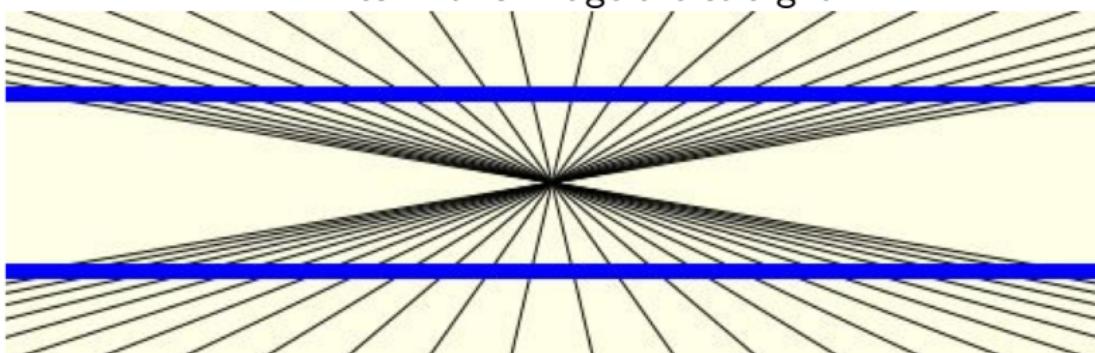
Cognition

Attention

Learning

Reasoning

All lines in this image are straight!



# Our perception is biased...

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Memory

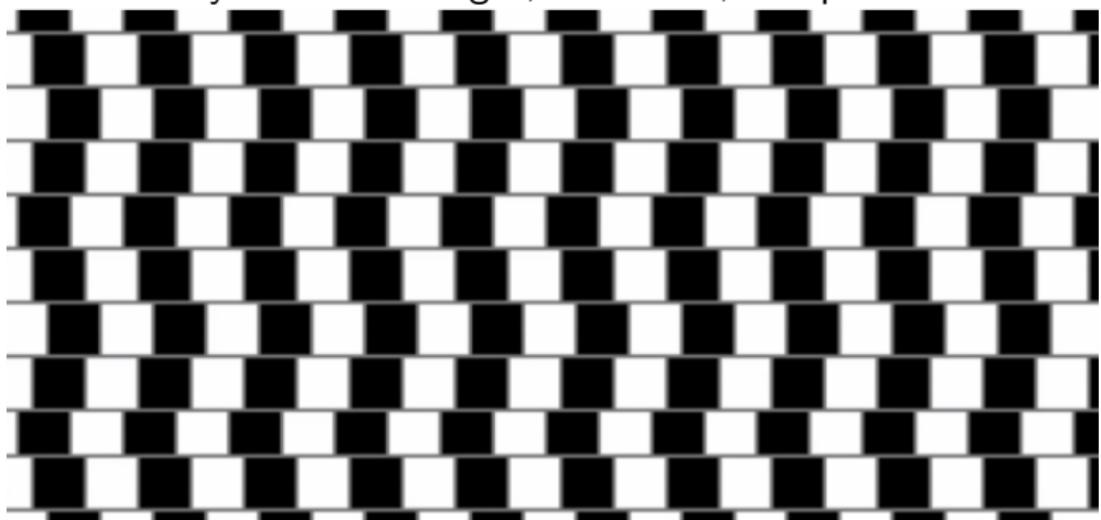
Cognition

Attention

Learning

Reasoning

Gray lines are straight, horizontal, and parallel!



# Our perception is biased by goals

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Perception

Memory

Cognition

Attention

Learning

Reasoning

- Adult's perception and attention focuses almost totally on our goals
- Tend not to notice things unrelated to goals

# Our perception is biased by goals

## Human Factors

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## Know your users

Perception

Memory

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The image shows the homepage of the University of Canterbury. At the top, there is a navigation bar with links to Study, Courses, Departments, Students, Research, Teaching, and Contact. A search bar is also present. The main content area features several large, colorful boxes. One box on the left contains the university's logo and the word "Courses". Another box below it is labeled "Liaison" and "More Engineering". To the right, there are boxes for "International", "Scholarships", and "Postgraduate". Each box includes a video thumbnail and some descriptive text. A red banner on the right side reads "Nau mai, haere mai ki te Whare Wānanga o Waitaha".

This block shows a sidebar titled "Information for" with a "Quick Links" tab. It lists several categories with arrows indicating they lead to more information: Prospective Students, International Students, Postgraduate Students, Current Students, Visitors and Community, Business and Industry, Alumni and Friends, and Prospective Staff.



Expert to talk about captive elephants  
6 May 2013 | Erin Ivory, one of the world's leading



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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## Know your users

Perception

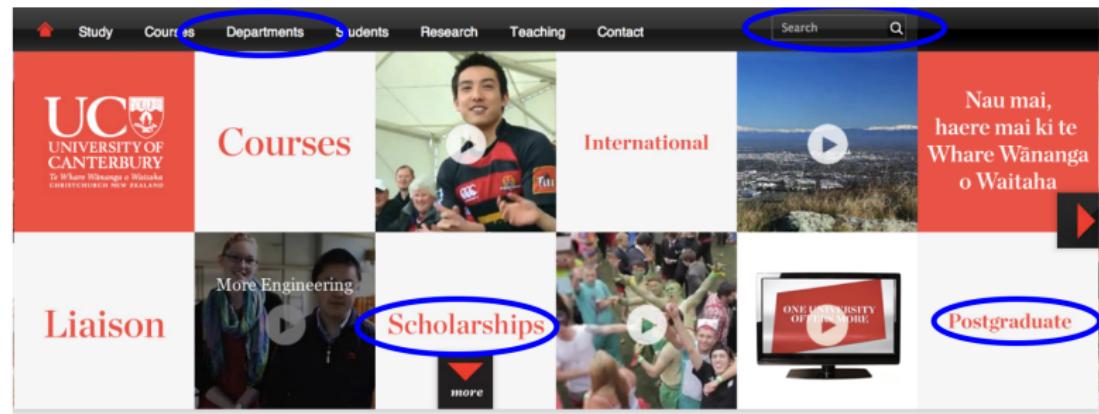
Memory

Cognition

Attention

Learning

Reasoning



The 'WHAT'S HAPPENING' section of the website features two news items. The first item, 'NEWS', shows a photo of a person riding a large elephant and includes the text 'Expert to talk about captive elephants' and '6 May 2013 | Erin Ivory, one of the world's leading...'. The second item, 'Events', shows a photo of a sign that says 'NEW CAREER AHEAD!' and includes the text 'What can I do with a degree from UC?' and 'Introducing the UC Careers Kit'.

Information for

Prospective Students

International Students

**Postgraduate Students**

Current Students

Visitors and Community

Business and Industry

Alumni and Friends

Prospective Staff

Quick Links

NEWS

Expert to talk about captive elephants

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

WHAT'S HAPPENING

Events

What can I do with a degree from UC?

Introducing the UC Careers Kit

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

# Design implications

## Human Factors

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### Know your users

Perception

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Learning

Reasoning

- Avoid ambiguity; test whether different users perceive the same; rely on conventions or standards
- Be consistent
- Understand user goals

# 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

# Gestalt

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Know your  
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Perception

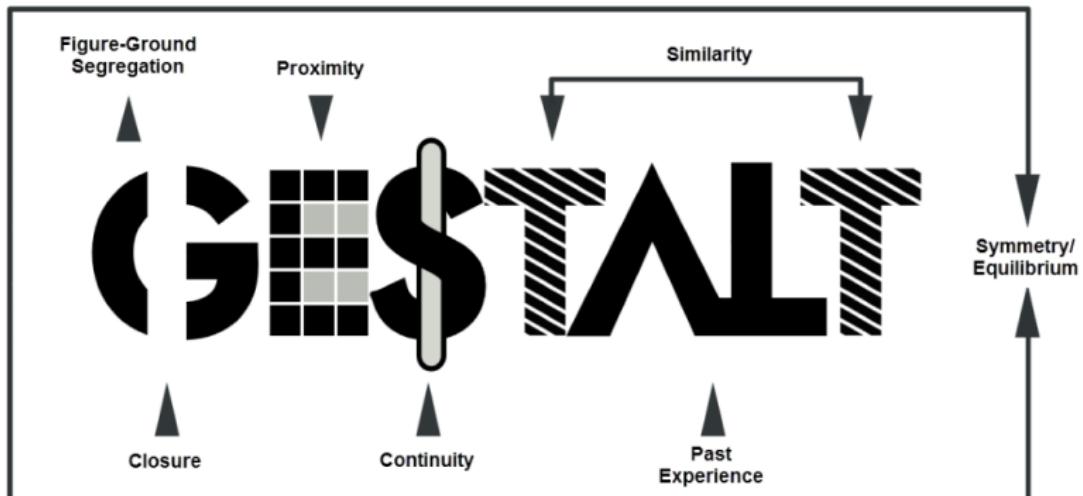
Memory

Cognition

Attention

Learning

Reasoning



# Proximity

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Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

Items that are closer appear grouped



# Proximity

Human  
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Know your  
users

Perception

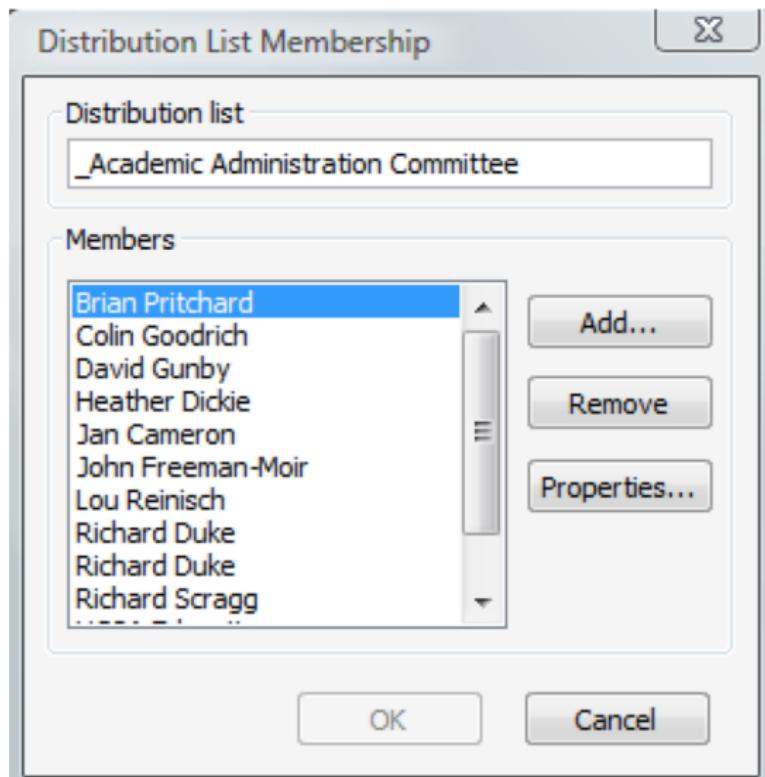
Memory

Cognition

Attention

Learning

Reasoning



# Proximity

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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

Human  
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Perception

Memory

Cognition

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Learning

Reasoning

Limited time

**iPhone XR from \$449. iPhone XS from \$699.\***

Trade in your current iPhone and upgrade to a new one.

[Buy now >](#)

**iPhone X®**

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

Fastest performance. Studio-quality photos.

[Learn more >](#) [Buy >](#)



# Closure

Human  
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Know your  
users

Perception

Memory

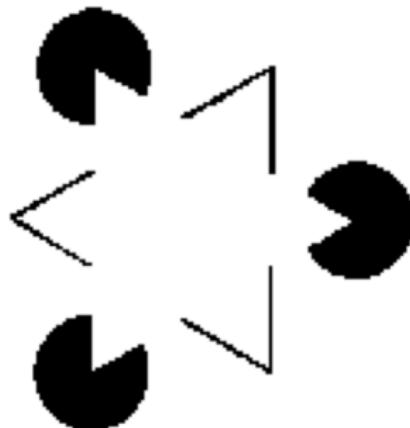
Cognition

Attention

Learning

Reasoning

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



# Closure

Human  
Factors

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Know your  
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Cognition

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Learning

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



# Simplicity

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users

Perception

Memory

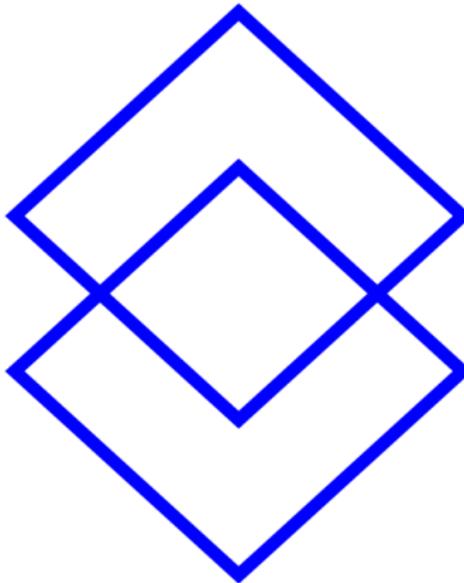
Cognition

Attention

Learning

Reasoning

We tend to see simple figures rather than complex ones



# Figure/Ground

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Know your  
users

Perception

Memory

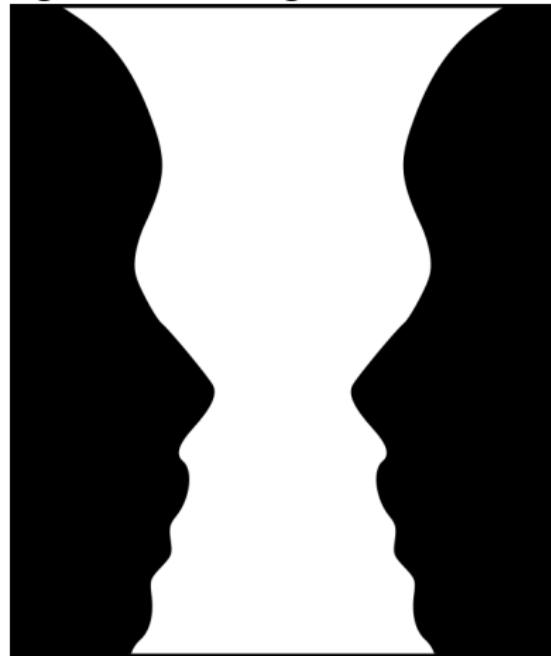
Cognition

Attention

Learning

Reasoning

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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Memory

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Attention

Learning

Reasoning

## ■ 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

## Human Factors

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## Know your users

Perception  
Memory  
Cognition  
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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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Perception

Memory

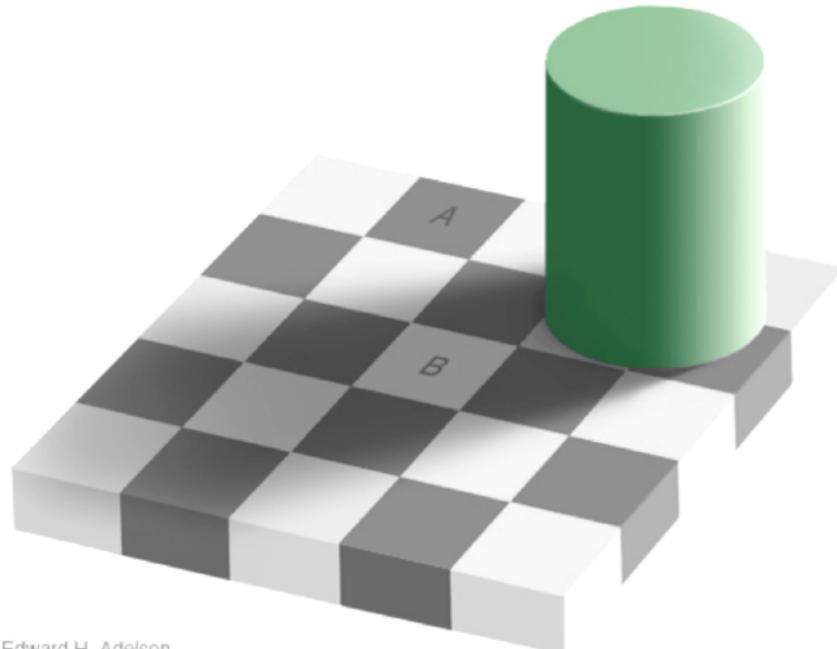
Cognition

Attention

Learning

Reasoning

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



Edward H. Adelson

# Our color vision is limited...

Human  
Factors

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Know your  
users

Perception

Memory

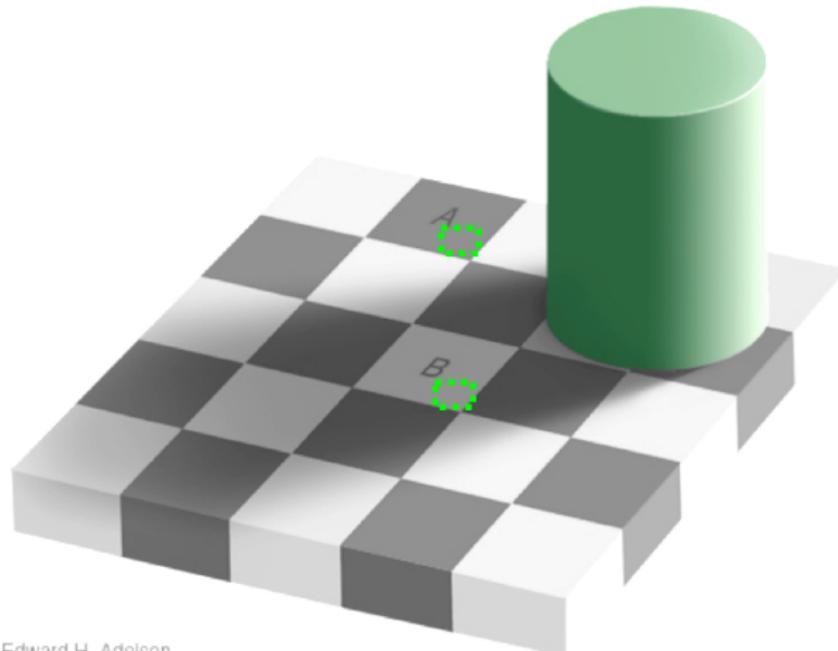
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Edward H. Adelson

# Our color vision is limited...

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Memory

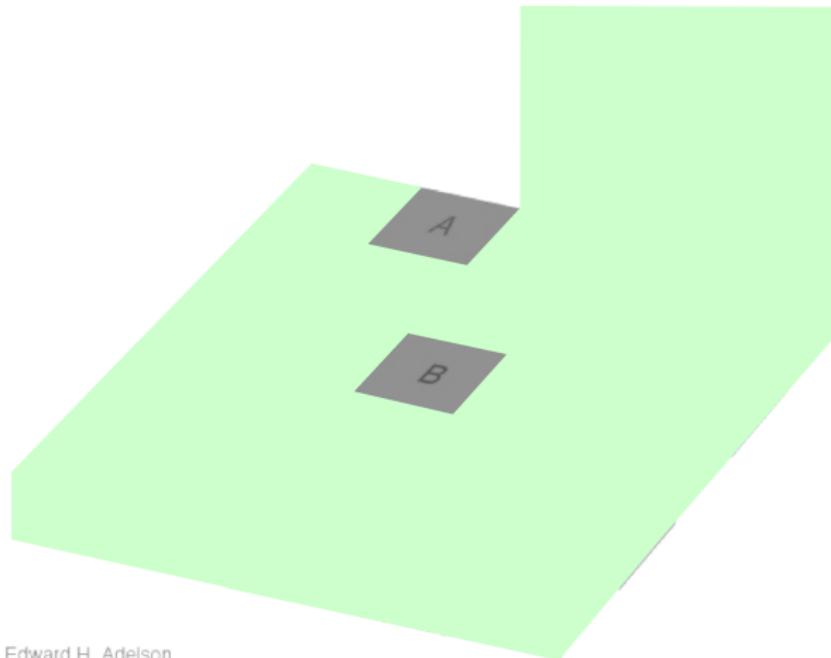
Cognition

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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...

## Human Factors

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Know your users

Perception

Memory

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



# Our color vision is limited...

## Human Factors

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



# Our color vision is limited...

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



# Our color vision is limited...

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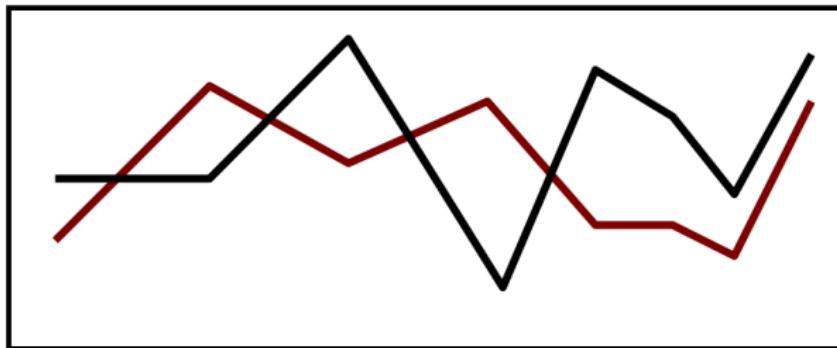
Learning

Reasoning

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



# Our color vision is limited...

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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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Know your  
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Perception

Memory

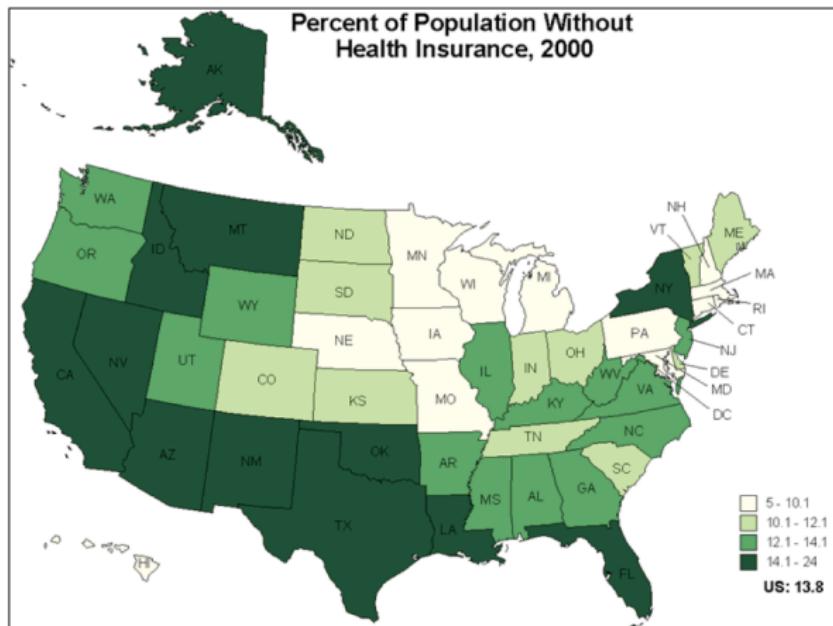
Cognition

Attention

Learning

Reasoning

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



# Our color vision is limited...

## Human Factors

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Know your users

Perception

Memory

Cognition

Attention

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Reasoning

Use distinctive colors when possible.

*Most distinctive colors:* 

*Other distinctive colors:* 

# Our peripheral vision is poor...

## Human Factors

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Perception

Memory

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Learning

Reasoning

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...

## Human Factors

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### Know your users

Perception

Memory

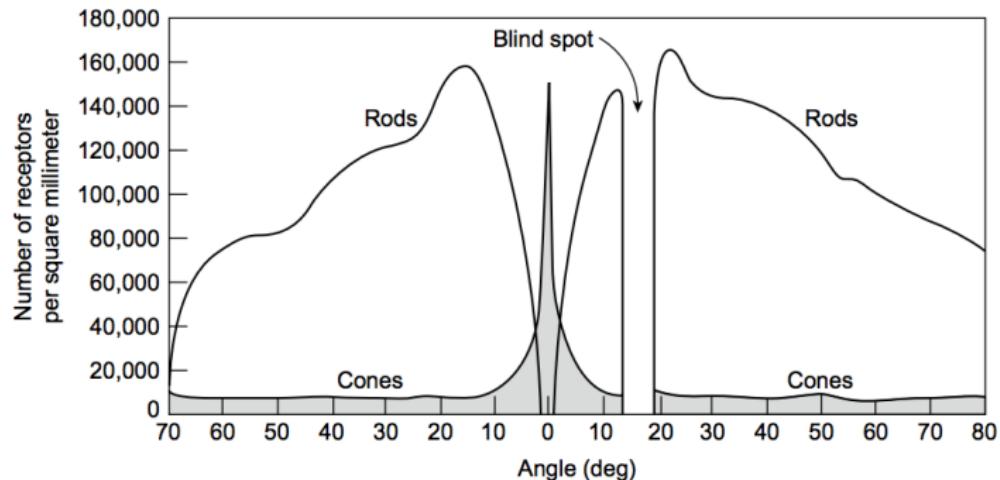
Cognition

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Pixels are much denser in the center...



# Our peripheral vision is poor...

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Know your  
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Perception

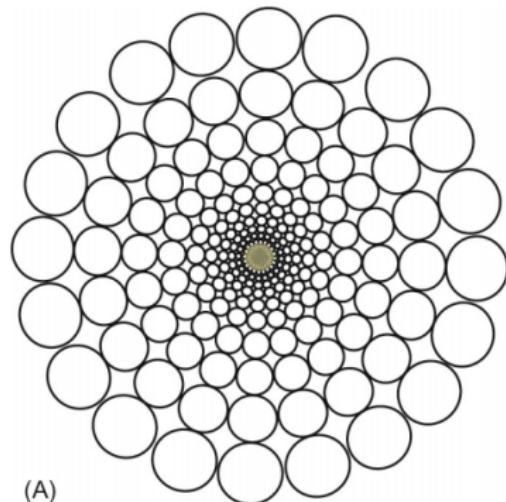
Memory

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(A)



(B)

# Our peripheral vision is poor...

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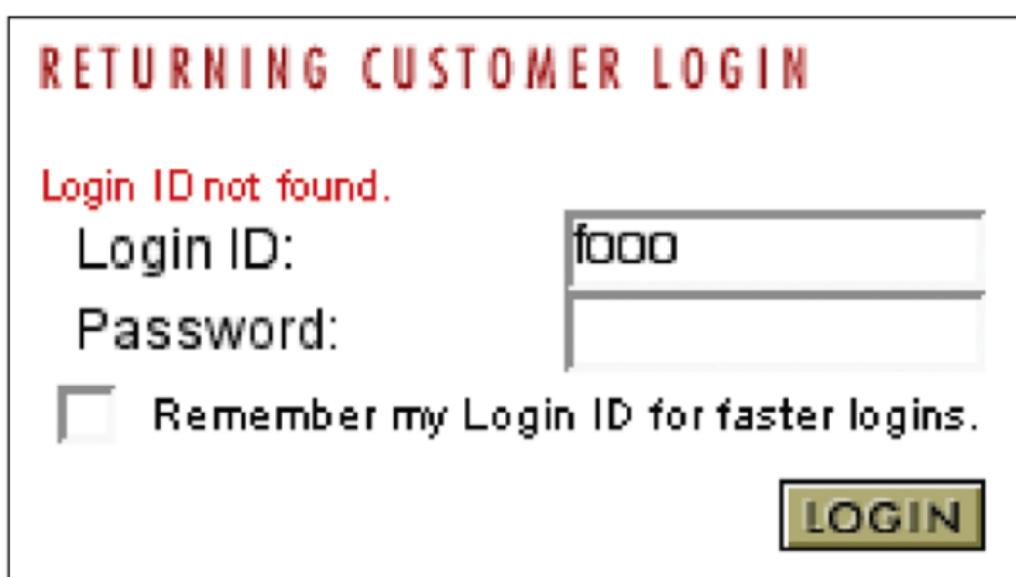
Cognition

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Bad design...



# Our peripheral vision is poor...

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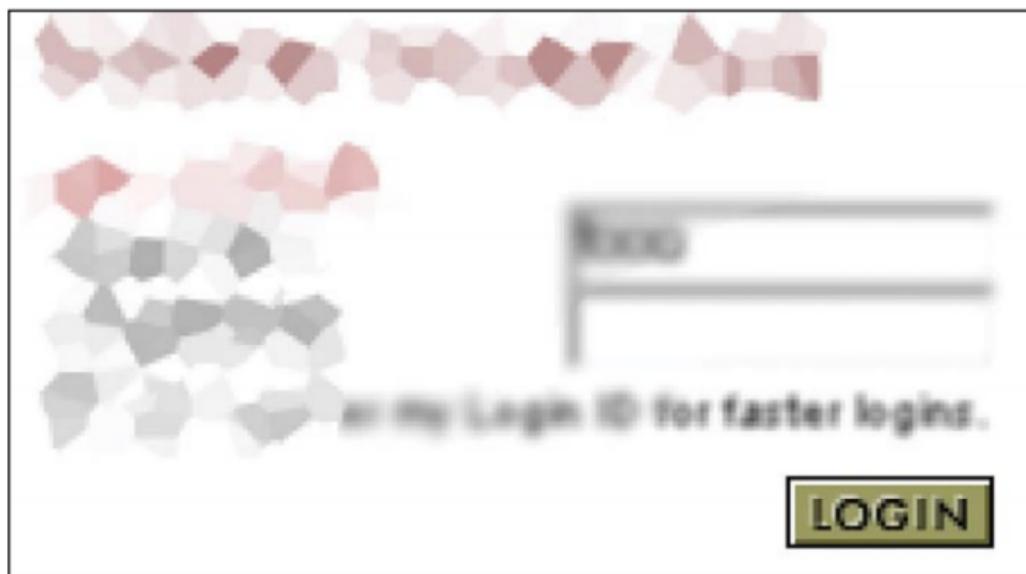
Cognition

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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 the navigation is a search bar with options to search "entire site" or "informaworld". There are also links for "Browse Publications A-Z", "Browse Subjects A-Z", and "Advanced Search". The main content area is titled "My Account" and includes tabs for "My Account", "Register", "Subscriptions", "Purchases", "Shopping Cart", "Alerts", "Marked Lists", and "Saved Searches". The "Register" tab is currently selected. Below the tabs, there are sections for "Personal Registration" and "Institutional Registration". The "Personal Registration" section explains that creating a personal account allows users to manage lists, set up email alerts, and purchase personal subscriptions. It also notes that accounts already exist for offline purchases and provides contact information. The "Institutional Registration" section is for purchasing subscriptions for an organization. Below these sections, there is a "Sign in" form with fields for "Username:" and "Password:", both of which are currently redacted. There is also a checkbox for "case sensitive" and a "Sign In" button. To the right of the sign-in form, a red warning icon with a triangle contains the text "Username/password combination was not recognised." At the bottom of the page, there are links for "[ forgotten password? ]" and "[ Athens users click here to sign in ]".

# 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.](#)

# Our peripheral vision is poor...

## Human Factors

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### Know your users

#### Perception

##### Memory

##### Cognition

##### Attention

##### Learning

##### Reasoning

- 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"

## ■ 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"

## 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.

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

## Human Factors

Perception

The image shows a Mac OS X desktop with a dark background. A grid of application icons is displayed, each with its name labeled below it. The icons are arranged in approximately five rows and seven columns. The applications shown include: Adobe Media Player, Adobe Photoshop CS5, Adobe Bridge, Adobe Reader 9, App Store, Automator, Calculator, Calendar, Chess, Contacts, Dashboard, Dictionary, Dropbox, DVD Player, FaceTime, Fetch, Firefox, Flip4Mac, Font Book, Game Center, GarageBand, GoBoingo!, GoToMeeting v5.4, iDVD, and Image Capture. The icons are color-coded and represent their respective functions, such as the orange play button for Media Player and the blue camera for Image Capture.

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

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

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 > Select styles Prices as marked. > 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: QUANTUM OF SOLACE

= \$30 Off Instantly

The screenshot shows the Amazon homepage with several promotional sections. At the top, there's a banner for 'Year-End Deals' with a 'Mayday' button. Below it, a large section highlights the Kindle Fire HDX. Further down, there are sections for 'New Year's Eve Deals', 'Up to 70% OFF CLOTHING', and 'LifeProof Cases for iPhone 4 & 5'. A 'Year-End Deals' section also features a 'Mayday' button. At the bottom, there are promotional offers for Prime members and movie deals.

# HCI and vision

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

- Two important actions of eye: **fixation** and **saccades**
- During fixation, eyes are stationary, typically last at least 200ms
- Changing fixation requires a saccade - a rapid repositioning of the eyes
- Saccades are quick, taking only 30 - 120ms

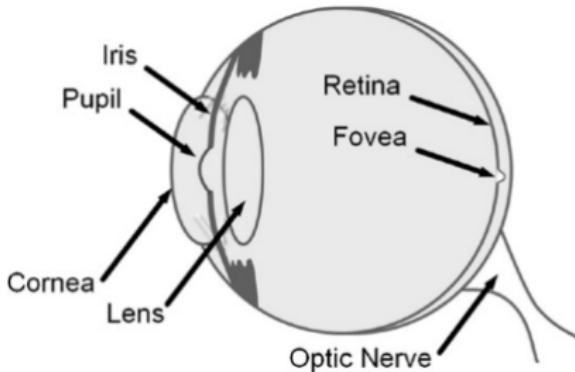


Figure: Source: Fig 2.3 (Mackenzie)

# HCI and vision

## Human Factors

Chaklam Sil-pasuwanchai

## Know your users

### Perception

### Memory

### Cognition

### Attention

### Learning

### Reasoning

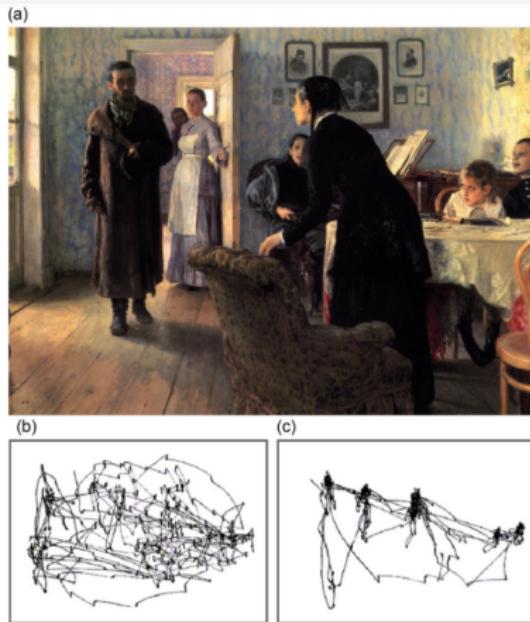


FIGURE 2.6

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

## Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

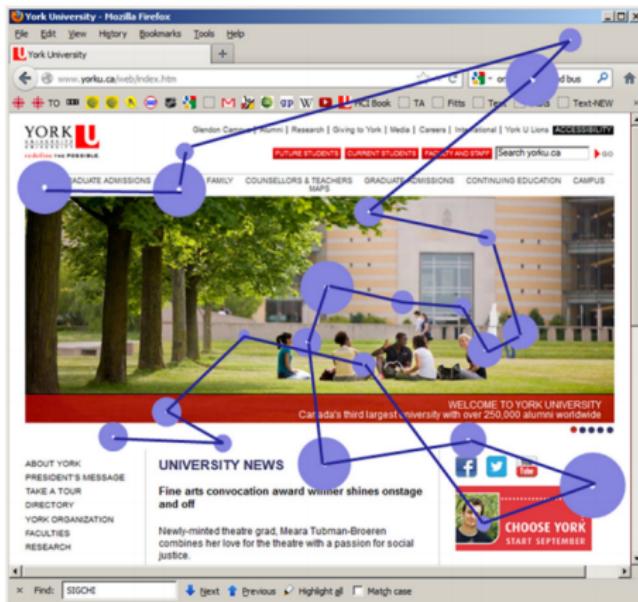


FIGURE 2.7

Scanpath for a user locating content on a web page.

Figure: Source: Fg 2.7 (Mackenzie)

# HCI and vision

## Human Factors

Chaklam Sil-pasuwanchai

## Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

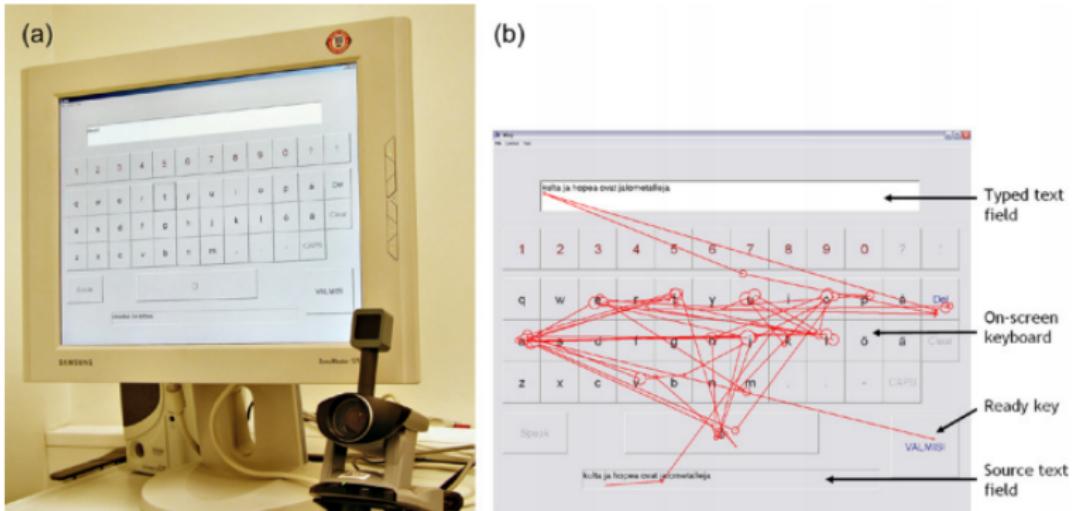


Figure: Source: Fg 2.13 (Mackenzie)

# Activities

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

## Classwork

Download latest PEBL from

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

Perform the Muller-Lyer experiment along with 3 of your friends (total - 4 data points)

What is the error rate? What is the average reaction time?

Report your findings.

# Reminders

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

- HW11-13 due Friday - be **creative** in your analysis. For example, aside from accuracy and speed, does users who press faster tend to make more errors? Does people get better after practice? If yes, in which trial does they get better? How does the differences in length affect error rates? What is the probability distribution of accuracy and speed - is it normal?
- This Friday - **proposal warm-up** - 20 mins (no grading)
- Feb 21 submitting your **first draft** using SIGCHI template format. Suggestions: try to find a (rigorous) model paper. Most of the time, you will be "copying" 70% but implement 30% of something new.
- **Shower:** labels vs. buttons; blind people; avoid using English when possible; analog switch with default position? separate vs. integrated interface for shower and faucet? Constraints for knobs and meters. Color shades are better than absolute temperatures. Knobs should provide pointer to indicate distance from initial point
- **Seats:** Symbols are sufficient and thus English can be entirely removed (chant: simplest but not simpler - keep on removing until nothing can be removed); put symbols and content in the same box (follows the Gestalt proximity principle)

# Brain Time

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

- Free time slots are allocated for your team to access the EEG device
- For the meantime, you will be working at my room CS101
- These are the following free slots:
  - Monday 9:00 - 11:00
  - Monday 13:00 - 15:00
  - Tuesday 9:00 - 11:00
  - Tuesday 13:00 - 15:00
  - Thursday 9:00 - 11:00
  - Thursday 13:00 - 15:00
- Send an invitation to my calendar (first come first serve!)

# Our memory is imperfect

## Human Factors

Chaklam Sil-pasuwanchai

Know your users

Perception

Memory

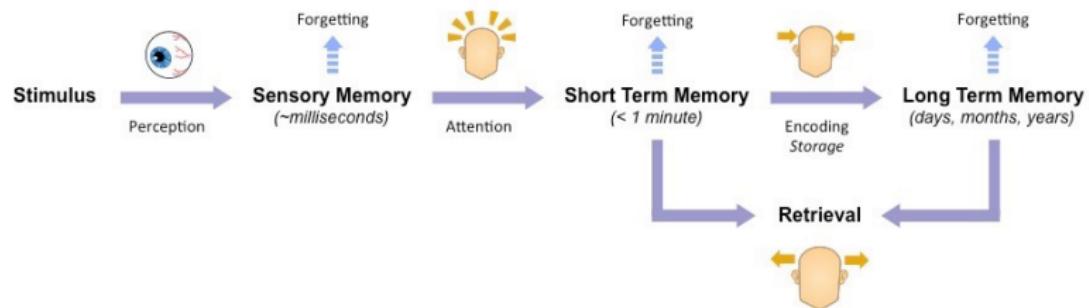
Cognition

Attention

Learning

Reasoning

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



# Our memory is imperfect

## Human Factors

Chaklam Sil-pasuwanchai

Know your users

Perception

Memory

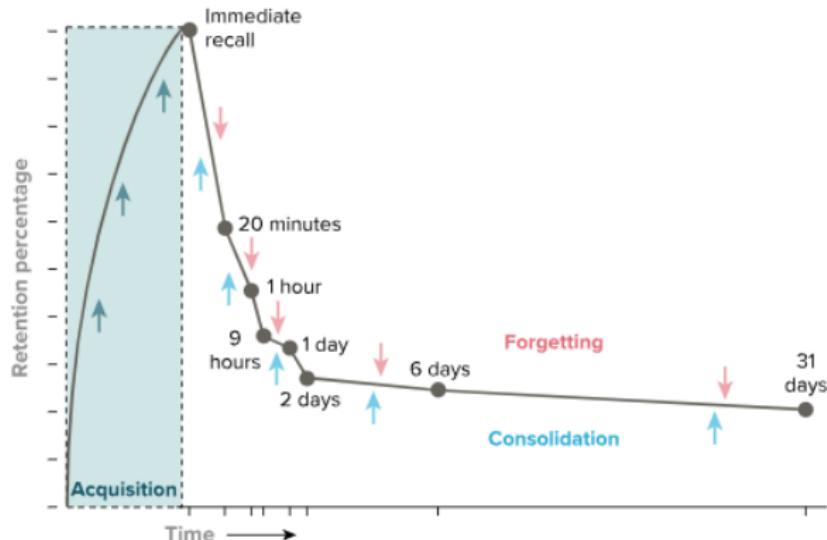
Cognition

Attention

Learning

Reasoning

## Memory strength over time



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

KNOWABLE MAGAZINE

# Short-term memory

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

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

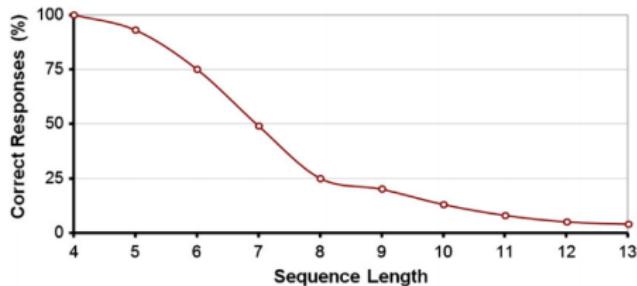


Figure: Source: Figure 2.18 (Mackenzie): Digital lengths and memory

# Chunking

## Human Factors

Chaklam Sil-pasuwanchai

### Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

## 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

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

- 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
- Key guidelines:
  - Design based on past experiences of users
  - Use recognition when possible (but do not forget ways for novice to transition to experts)
  - Put the knowledge in of the world (Norman, 1988), e.g., bookmarks, history of commands, tagging, time stamping, reminders, marked emails, pwd etc.

# Provide external memory aids

## Human Factors

Chaklam Sil-pasuwanchai

Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

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

19

# Provide external memory aids

## Human Factors

Chaklam Sil-pasuwanchai

### Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

Mailboxes

- Inbox 7
- Flagged
  - Red 185
  - Yellow 7
- Drafts 92
- Sent 692
- Junk 692
- Trash
- All Mail 408

Smart Mailboxes

- On My Mac
  - Recovered Me...
- Google
  - Important 13
  - Boomerang-O...
  - CHI-list 2
  - CSCW
  - Interaction De...

- Sort by Unread ↴
- Slideshare 11:25  
More content like "[ID] Week 02. Un... SlideShare is now on Android. Get the app We found something with that mi...
  - Kyoko Hatakenaka 11:10  
[renlab 02543] Fwd: (kut 06647) (... Dear all, University will do power outage work from 8:30 to 16:30 on A...
  - Patiphan Pholmat 11:03  
Accepted: Open House Meeting  
Attachment: Mail Attachment.ics
  - CHI-JOBS automatic digest... 11:02  
CHI-JOBS Digest - 3 Aug 2017 to 7... There are 2 messages totaling 83 lines in this issue. Topics of the day: 1...
  - CHI-ANNOUNCEMENTS auto... 11:01  
CHI-ANNOUNCEMENTS Digest - 6... There are 11 messages totaling 1538 lines in this issue. Topics of the day: 1...
  - Apiporn Simapornchai 11:00  
Accepted: Open House Meeting  
Attachment: Mail Attachment.ics
  - Quora Digest 07:34  
What laptop do I buy for deep learni...

## 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

Know your  
users

Perception  
Memory  
Cognition  
Attention  
Learning  
Reasoning

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

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

- We evolved to recognize things much faster
- We assessed situations very quickly
- We recognize faces fast
- We recognize complex patterns
- Command Line vs. Menus
- Key guidelines: See and Choose are much preferable than Remember and Type

Recognition



*Hello, my friend!*

Recall



*What is his name?*

# Context is important

- When we memorize something, the context is automatically encoded
- Sometimes it can be difficult for people to recall information that was encoded in a different context
- *You are on a train and someone comes up to you and says hello. You don't recognize him for a few moments but then realize it is one of your neighbors. You are only used to seeing your neighbor in the hallway of your apartment block and seeing him out of context makes him difficult to recognize initially"*

# Activities

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

## Classwork

Download latest PEBL from

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

Perform Corsi experiment along with 3 of your friends (total - 4 data points)

Report your findings.

# Reading is unnatural

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

- We're pre-wired for **language** - we learn language naturally since we are born
- We are pre-wired for **pictures**
- We are NOT pre-wired for **reading** - reading requires practice!
  - Patterned background or poor contrast make things worst
  - Long sentences...
  - Difficult typefaces
- Key guidelines: Use hierarchy (e.g., headings, subheadings), use keywords, no longer than 5 words, etc. (does not apply to academic as academia are quite good in reading!)

*TEXT IN ALL CAPS, ESPECIALLY IN A FANCY FONT*

# Length helps reading

## Human Factors

Chaklam Sil-pasuwanchai

### Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

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

Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning



# Attention

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

- Our attention is limited
- Goldfish has an attention span of 8s, guess how much is of humans?
- Humans have extremely low attention span
- Do you remember what I discuss in the previous slide?  
What did you eat yesterday morning?
- **Design guidelines:** Prioritize your information targeted to users in that limited amount of time. Avoid cluttering with too much information.



# Consider "viewport" - bad example

## Human Factors

Chaklam Sil-pasuwanchai

### Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

The screenshot shows a news article from Engadget. The header features the word "engadget" in a stylized font. The navigation bar includes links for Gear, Gaming, Entertainment, Tomorrow, The Buyer's Guide, Video, Reviews, and US Edition. A search icon is also present. The main content area has a sidebar titled "Featured" with two news items: one about Switch Online code hints and another about Epic's updated game store refund policy. The main article, titled "Unity, Improbable and Epic Games are squabbling in public", is displayed with a large image of a female character in a futuristic outfit. The author is listed as N. Summers, with a timestamp of 01.10.19. The footer contains standard website navigation icons.

# Consider "viewport" - good example

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

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 blue navigation bar with links for "Home", "Products", "Health Needs", "Ingredients", "Our Difference", "Shop", "My Account", and icons for search and cart. A red banner below the navigation bar says "Save when you subscribe today! Get 15% off your monthly subscription." The main content area features a photograph of a person walking away from the camera on a path through a forest. Overlaid on the photo is the 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, there's another red banner with the text "Special Offer free shipping\*. Save 15% when you subscribe." Below this, there are three product cards: "Every Woman™'s One Daily Multivitamin" (Vitamins, TOP PICK), "Zyflamend™ Whole Body" (Inflammation, TOP PICK), and "Bone Strength Take Care™ Slim Tablets" (Bone Strength, TOP PICK). Each card includes a "BUY NOW" button and a price (\$19.46, \$21.80, \$16.34 respectively).

# Consider "hierarchy" - bad example

## Human Factors

Chaklam Sil-pasuwanchai

## Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

The screenshot shows the homepage of the 'adidas' blog, specifically for the 'GAMEPLAN A' series. The header features the 'adidas' logo and navigation links for 'BLOG', 'ON-THE-JOB RECORDS', 'CAREER TALK', 'BUSINESS OPERATIONS', 'SUSTAINABILITY ASPECTS', 'HEADQUARTER NEWS', 'STRATEGY UPDATES', and 'MORE'. Below the header, there are four blog post cards. The first card, by Alison Smith on May 4, 2016, is titled 'On-the-Job Records: How being a Mom helps me stay fit'. The second card, by Sophie Schürer on April 28, 2016, is titled 'Career Talk: Get out of bed! Challenge yourself to be the early bird.'. The third card, by Joanne McDonald on April 27, 2016, is titled 'On-the-Job Records: Turn on the lights – harnessing positive energy in London'. The fourth card is a large image of a man running with the text 'WE ARE MOVING. MOVE WITH US.' and 'GAMEPLAN A by adidas'. The footer contains a copyright notice and navigation icons.

# Consider "hierarchy"

## Human Factors

Chaklam Sil-pasuwanchai

### Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

The diagram illustrates the concept of "hierarchy" in communication design by comparing two versions of a birthday invitation card.

**Left Version (X):**

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

**Right Version (checkmark):**

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

## Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

The screenshot shows the ESPN Football homepage. At the top, there's a navigation bar with links for Football, NBA, NFL, Cricket, Rugby, Golf, and Fantasy. Below the navigation is a match summary table for TOP FOOTBALL, specifically La Liga, showing results for ATM vs LEV, BIL vs SEV, BAR vs EIB, BET vs MAD, COPPA ITALIA vs TOR vs FO, INT vs NAP vs HAS, and a summary for Full Scoreboard. The main content area features a large image of Ole Gunnar Solskjær pointing and clapping. Below the image is a headline: "Solskjær's tactical acumen overcomes Pochettino". A sub-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 the main article is a sidebar titled "Top Headlines" with several news items. At the bottom right is a "Fantasy FOOTBALL" logo.

# Use grid

## Human Factors

Chaklam Sil-pasuwanchai

### Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning



# Just enough for decisions - bad example

## Human Factors

Chaklam Sil-pasuwanchai

## Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

The screenshot shows the Engadget website interface. At the top, there is a navigation bar with the Engadget logo, a 'Sections' dropdown, and social media links for Facebook, Twitter, and Email, along with a 'Login' button. Below the navigation bar, there is a search bar with the placeholder 'FIND A PRODUCT' and a magnifying glass icon. On the left side of the main content area, there is a 'SORT BY' dropdown set to 'Most Recent'. The main content area displays four product reviews in a grid:

Product	Score	Price
Nintendo Entertainment System Controllers	76	\$59
Sony PlayStation Classic	67	\$99.99
Fossil Sport	75	\$255
Microsoft Surface Headphones	79	\$349.99

Each product listing includes a small image of the item, its name, its score (displayed in a green box), and its price.

# Just enough for decisions - good example

## Human Factors

Chaklam Sil-pasuwanchai

## Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

The screenshot shows a user interface for a shopping website. On the left, there are four filter panels: 'Gender' (Men, Women, Kids), 'Product Category' (Apparel, Shoes, Accessories), 'Size' (XS, S, M, L, XL, 2XL, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5), and 'Color' (a grid of color swatches). In the center, a banner reads 'EXTRA 40% OFF SALE' with the text 'End of season sale extended. Get an extra 40% off already marked down items. Use code NEWYOU. Ends 1/14/19.' Below the banner are four product cards:

- Reebok CrossFit Nano 8 Flex...** Men Training. \$99.97 - \$130. ★★★★ 1,121. Options: > 16 colors.
- Reebok CrossFit Nano 8 Flex...** Women Training. \$99.97 - \$130. ★★★★ 759. Options: > 15 colors. Personalise.
- Speed TR Flexweave®** Women Running. \$69.97 - \$100. ★★★★ 27. Options: > 3 colors.
- Reebok Yourflex Train 10** Men Training. \$39.97 - \$60. ★★★★ 282. Options: > 5 colors.

Each product card includes a 'Personalise' button and a 'Shade Sneaker' badge. The bottom right corner of the page features a navigation bar with icons for back, forward, search, and other site functions.

# One click theory

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

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 "Limited time" badge is positioned above the text. Below the main headline, smaller text reads "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 background of the banner is white. Below the banner, the iconic Apple logo is centered. The main headline "Wrap up your gift list." is displayed in a large, bold, black font. Below this headline is a link "Shop last-minute favorites >". The bottom of the page features three decorative illustrations of Apple products: a row of colorful Apple Watch models on the left, a group of AirPods in the center, and a stack of various iPhone models on the right.

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

## Human Factors

Chaklam Sil-pasuwanchai

## Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

- We barely pay attention to computers....but our goals
- Software should not make us "think" (Don't make me think by Krug)
- We keep track of changes that are related to the goals.....
- We barely notice changes that are outside of our goals...
- Check out the "Door Study" on Youtube



# Loose ends

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

- 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
- **Design guidelines:** we should remind people of these "loose ends"; return to default mode (e.g., sleep, reset) after inactivity



# End with action

## Human Factors

Chaklam Sil-pasuwanchai

### Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

The image displays two screenshots of websites demonstrating design patterns for user engagement:

**DigitalOcean Website Screenshot:** This screenshot shows a landing page for DigitalOcean's Droplets service. At the top, there's a navigation bar with links for Products, Customers, Community, Pricing, Docs, Support, and Log in, along with a "Sign up" button. Below the navigation is a section titled "Do more with Droplets" with a sub-copy: "Discover your infrastructure's potential with the help of over a thousand easy-to-follow development and systems operation tutorials." Three cards are listed under "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 blue "Check out more tutorials" button is located below these cards. A large blue banner at the bottom contains the text "Ready to get started?" and a white "Create your account" button. At the very bottom, there's a footer with links for Developers, Products, Company, and Support, along with a copyright notice: "© 2018 DigitalOcean, LLC. All rights reserved."

**NiWCH Chapter Website Screenshot:** This screenshot shows a landing page for NiWCH Chapter. The header includes the NiWCH logo and a search bar. The main headline reads "The New Chapter tradition." Below it is a sub-copy: "NiWCH Chapter™ was founded over 20 years ago to bring natural well-being to families. We believe in the healing power of nature, and that's why we're committed to providing the healthiest and quality ingredients to make our ingredients." A purple "EXPLORE OUR STORY" button is visible. A "Stay in touch" section features a newsletter sign-up form with fields for "Email Address" and "SIGN UP", and a note: "Don't miss our special well-being and diet tips!" Below this is a social media sharing bar.

# Hearing capabilities

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

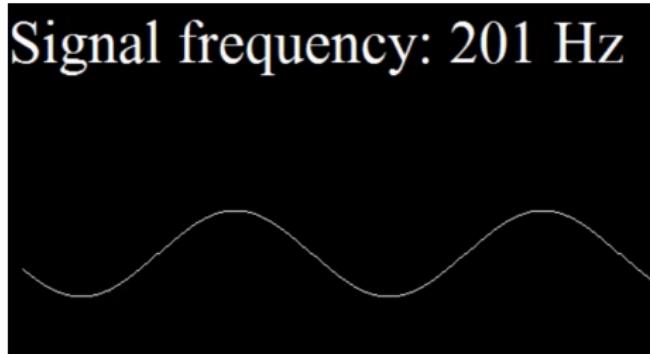
Cognition

Attention

Learning

Reasoning

- 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?)



# Multitasking

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

- Humans cannot really multi-task, we can only quickly switch between multiple tasks in ms
- In a famous invisible gorilla experiment, majority of the subjects did not notice the gorilla
- This implies that when one is focused, he/she may easily miss other details



# Colors

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

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



# Colors

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

Yellow - youthfulness, creativity



# Colors

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

Green - nature, friendly



# Colors

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

Blue - trustworthiness, security, stability



# Colors

## Human Factors

Chaklam Sil-pasuwanchai

## Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

## Purple - luxury



# Colors

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

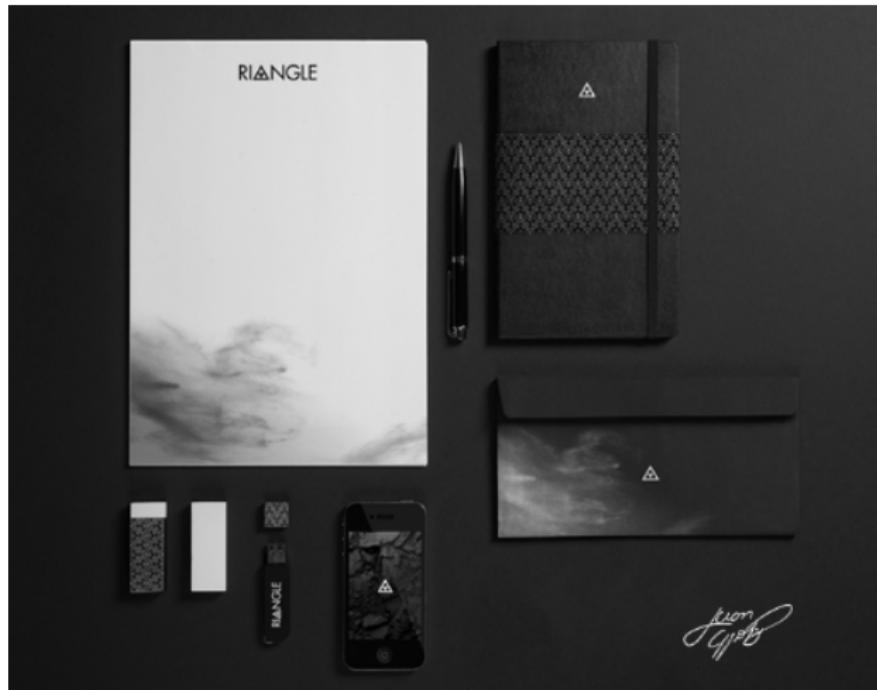
Cognition

Attention

Learning

Reasoning

## Black - neutral



## Colors

## Human Factors

## Attention



The image is a collage of five distinct scenes arranged in a grid-like pattern. At the top center is a clear glass Christmas ornament hanging by a string. Below it is a potted plant with green, rounded leaves in a textured brown pot, resting on a wooden chair. To the right is a large, crumpled sheet of white paper. In the bottom left corner, a white garment with a fringe hem hangs from a simple metal hanger. In the bottom right corner, a person wearing a blue shirt and jeans sits on a stool, facing away from the camera. Next to them is a kitchen scale holding a bowl filled with three green apples.

# Color guidelines

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

## 60-30-10 rule

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



# Color guidelines

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

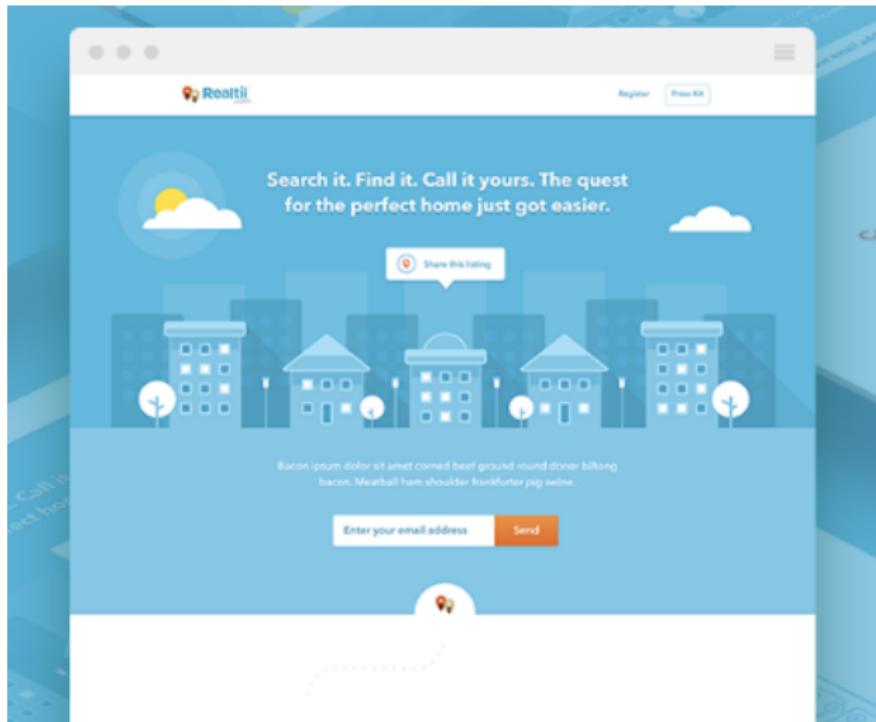
Cognition

Attention

Learning

Reasoning

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



# Learning

## Human Factors

Chaklam Sil-pasuwanchai

### Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

- We learn faster when things
  - Familiar
  - Consistent
  - Risk is low

# Geek-speak hurts learning

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning



# Geek-speak hurts learning

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

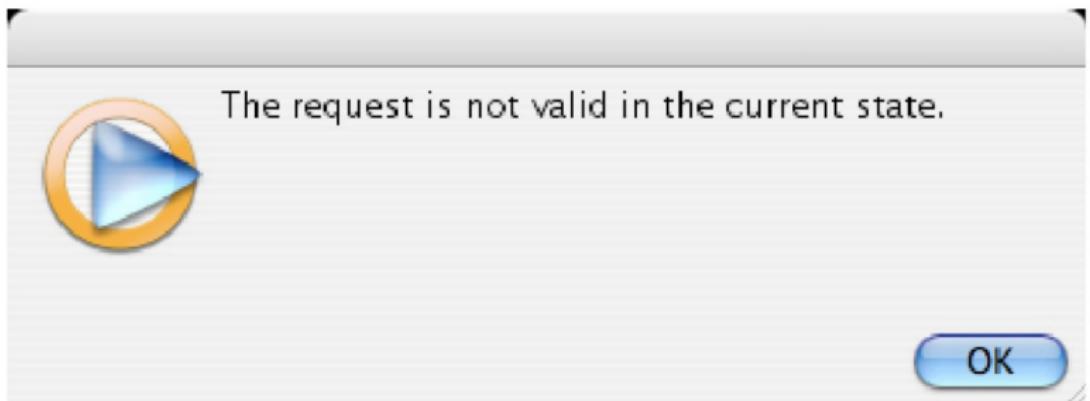
Memory

Cognition

Attention

Learning

Reasoning



# Geek-speak hurts learning

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning



Please Select Database:

- Iraq
- Afghanistan

# Familiar term helps learning

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning



**What happened?**  
The departure date for the return flight is prior to the outbound flight.

**What you need to do:**  
Go back to the previous page and modify yo

# Convention helps learning

## Human Factors

Chaklam Sil-pasuwanchai

### Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

Always preach...follows convention!

The screenshot shows a website's footer section with the following layout:

- Products**: Vitamins, Herbals, Fish Oil, Booster Powders, Mushrooms, Probiotics, Calcium.
- About**: Our Science, Our Tradition, Ingredients, New Chapter Rewards, Contact Us, Careers, FAQ.
- Legal**: Terms & Conditions, Retailer Policy, Privacy Policy, Our Guarantee, Accessibility Notice.
- Resources**: My Account, ILLIG: Unlocking Wellness, Newsletter, Recipes, Digital Resources.

Social media icons for Facebook, Instagram, Twitter, Pinterest, and YouTube are located above the footer.

A callout box contains the text: "\* 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."

Below the footer, there is a note: "\* Limited time introductory offer."

Logos for **ACADEMY OF NUTRITION AND DIETITIANS**, **CERTIFIED**, **B CORPORATE**, and **© Copyright 2018 NBC** are present.

# Convention helps learning

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

The screenshot shows the homepage of the New Chapter website. At the top, there is a purple header bar with the text "Always preach...follows convention!" in white. Below this, a sub-header says "Use our store locator to find products at a shop near you." The main navigation menu includes links for Home, Products, Health Needs, Ingredients, Our Difference, Shop, My Account, a search icon, a location pin icon, and a shopping bag icon. A red banner below the menu encourages users to "Save when you subscribe today! Get 15% off your monthly subscription." The main content area features a large headline "Bring wellness home." followed by the text "Our products are made with your well-being in mind." Below this, a paragraph explains the company's commitment to quality: "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

Chaklam Sil-pasuwanchai

## Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

### Convention is about "stealing" but make it better

The screenshot shows a search results page for men's apparel on the Nike website. At the top, there are filters for 'Weather' (Cold Weather, Mild Weather, Warm Weather, Water-resistant, Rainy Weather), 'Brand' (Nike, Converse, Hurley, + More), 'Collections' (Aerobill, Aerostill, Dri-FIT, + More), 'Fit' (Slim, Tight, Loose, Standard), and 'Color' (a grid of color swatches). Below these filters, there are four rows of product cards, each featuring a thumbnail image, the product name, and the price. The products include men's running shorts, men's training pants, men's zip-up jackets, men's hoodies, men's club fleece hoodies, men's tech fleece pants, men's joggers, men's cargo pants, and men's tech fleece icon joggers.

Product Category	Product Name	Color Options	Price
Men's Running Apparel	Nike Men's 2-in-1 Running Shorts	2 Colors	\$19.99
Men's Training Apparel	Nike Therma Sphere Men's Training Pants	2 Colors	\$19.99
Men's Outerwear	Nike Sportswear Men's Zip Hoodie	4 Colors	\$39.99
Men's Outerwear	Nike Sportswear Windrunner Men's Hooded Jacket	3 Colors	\$19.99
Men's Outerwear	Nike Sportswear Windrunner Men's Hooded Jacket	4 Colors	\$19.99
Men's Club Fleece	Nike Sportswear Club Fleece Men's Hoodie	7 Colors	\$45
Men's Tech Fleece	Nike Sportswear Men's Tech Fleece Men's Joggers	4 Colors	\$19.99
Men's Tech Fleece	Nike Sportswear Tech Pack Men's Power Cargo Pants	4 Colors	\$48.99-\$59.99
Men's Tech Fleece	Nike Sportswear Tech Fleece Icon Men's Sherpa Joggers	3 Colors	\$120

# System 1 and System 2

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception  
Memory  
Cognition  
Attention  
Learning  
Reasoning

- 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

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

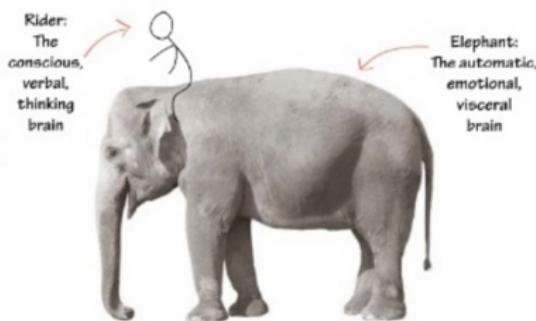
Attention

Learning

Reasoning

## 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

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

- 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

Chaklam Sil-pasuwanchai

Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

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

Chaklam Sil-pasuwanchai

### Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

## Kahneman and Tversky: Fourfold Pattern

- 0% → 5% to win \$1M
- 5% → 10% to win \$1M
- 60% → 65% to win \$1M
- 95% → 100% to win \$1M

# Human decisions are rarely rational

## Human Factors

Chaklam Sil-  
pasuwanchai

### Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

### Implications for design:

- Decision-support: helping System 2 override System 1
- Data visualization: harness System 1(perception) to support System 2
- Persuasion: seducing System 1 and bypass System 2

# Human decisions are rarely rational

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning



# Human decisions are rarely rational

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning



# Activities

Human  
Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

## Classwork

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

# Readings For Next Week

## Human Factors

Chaklam Sil-pasuwanchai

### Know your users

Perception

Memory

Cognition

Attention

Learning

Reasoning

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

## Human Factors

Chaklam Sil-  
pasuwanchai

Know your  
users

Perception

Memory

Cognition

Attention

Learning

Reasoning

# The End