INFO2222
Week 5 (of 6) on Usability
People

Overview

- Review of Mini-Assignment 4
- People … many aspects that matter for usability
- And how these interact with analysis, design and evaluation

Charles Perkins Centre
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lwel3754@uni.sydney.edu.au

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Mini-Assignment 4

Links to Assignment 1

Links to core topic – evaluation

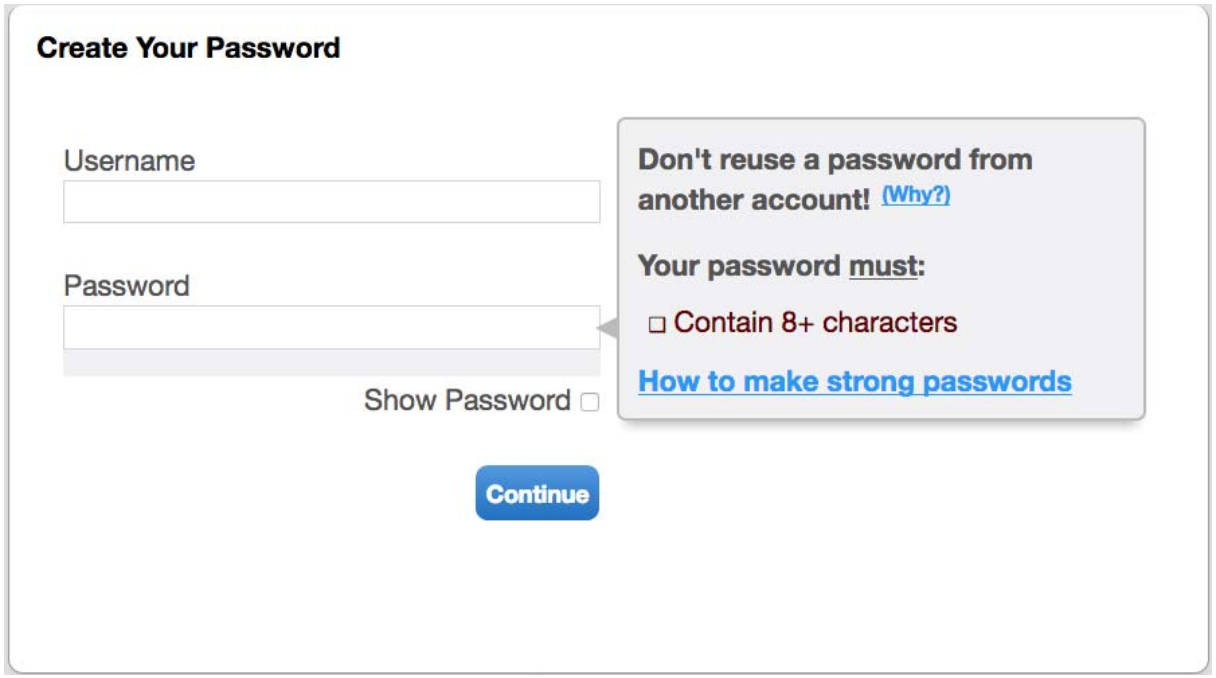
Thinking about “black box” testing

The initial screen

What are the user choices?

Perhaps you started by clicking the Why?

Or the other link?

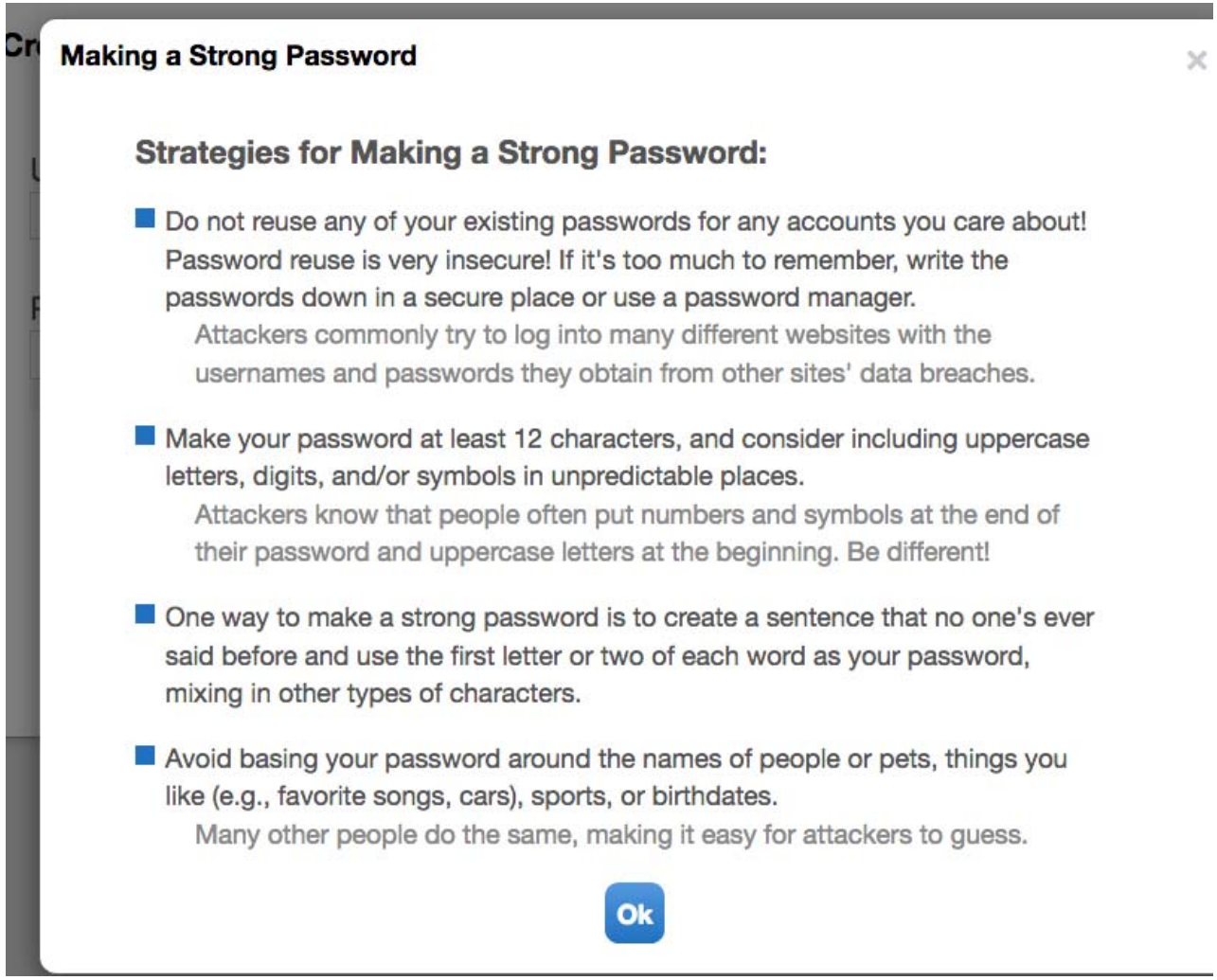


Click on the why?

This is what you see.

Would you read all of this carefully?

How did your experience of using this interface help you think about your interface for Assignment 1.

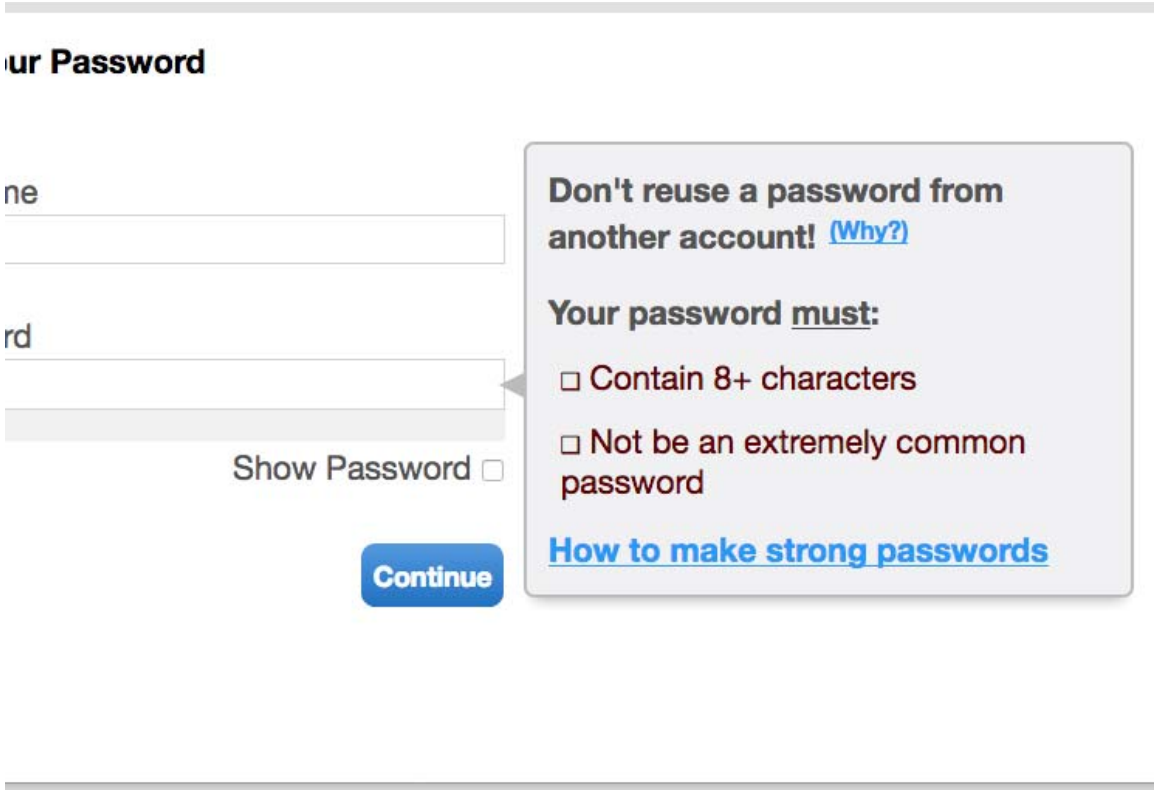


Screen as it appears after typing “secret” as the password

How does this relate to the previous information?

Can you get a sense of all the things you could learn from this interface?

i.e. How can a user build a mental model of things this site teaches



Quiz on mini-assignment 4

Core learning objectives for Week 5 - people

- Why is it important to study user **behaviour** as well as **asking people about their knowledge, needs and preferences**?
- Ways to **ask** people (complementing Think-aloud observations)
- What is **cognitive bias**?
- What are **implications of selected cognitive biases** for analysis, design, evaluation?
- What does **intuitive** mean, in terms of mental models and interfaces?
- What is **usability for all**?

People:
Psychology
Physiology
Context

Week 5

Analysis – to determine ***user needs***
Week 2 (Phishing)

Design – to meet user needs
Week 4 (Passwords, Phishing)

Implementation

Evaluation – against user needs
Week 3 (Passwords, Encryption)

Privacy
Integrated
Case study
Week 6

Understanding more about people

- Attributes of **most people**
  - Physical
  - Mental
- Attributes where **individuals differ**
  - Physical
  - Mental
- Attributes where even **one person differs at different times**
  - Context – people present and in mind, current task and demands
  - Age: key categories are young (with huge variation up to mid teens), adult, elderly (with considerable variation from 65+)

Physical attributes

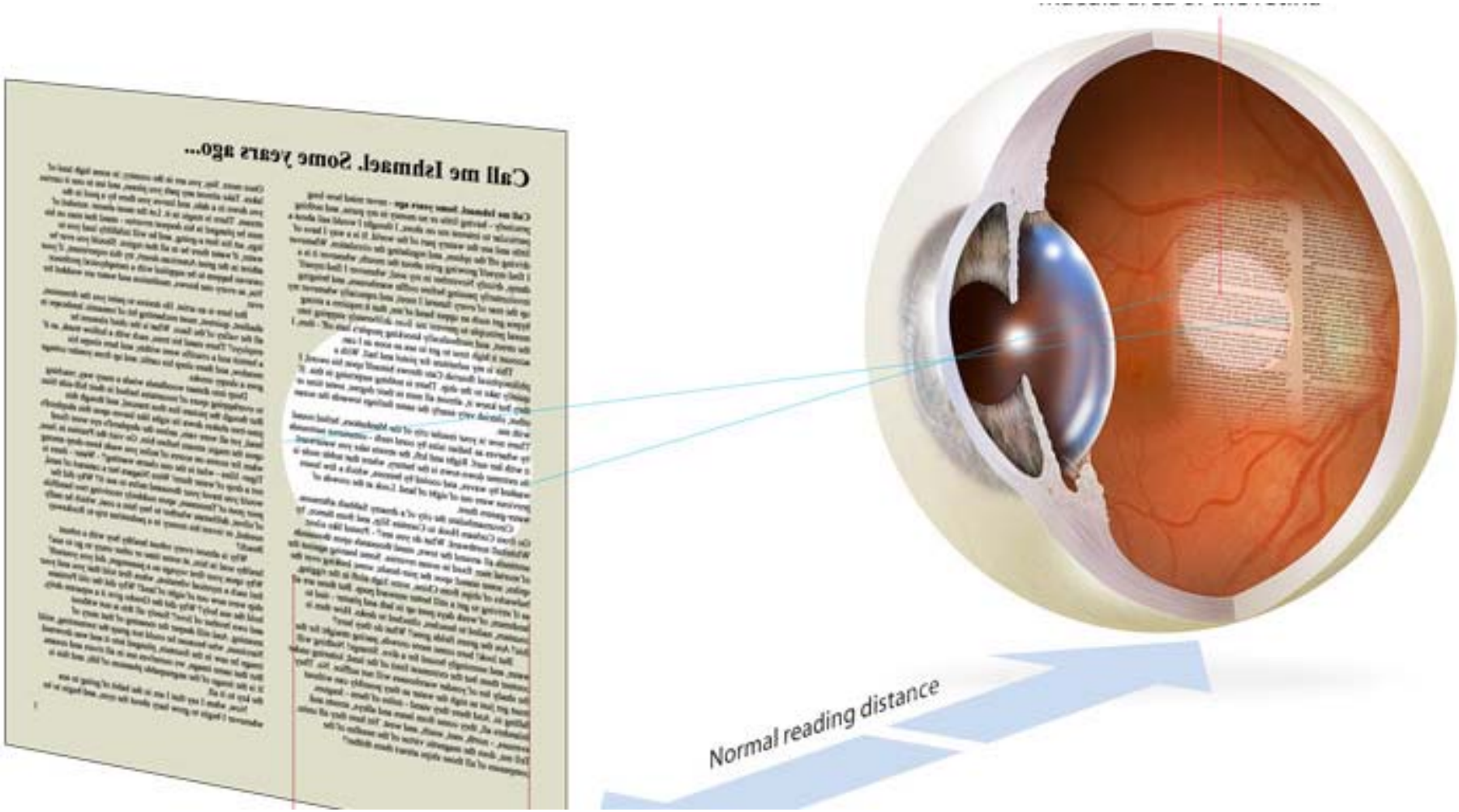
Ergonomics

Physical attributes

To interact with an interface the user must be able to:

- Perceive relevant parts of the interface
  - See – the dominant sense involved for most interfaces and most people
  - Hear – widely used for alerts/notifications … increasingly for ”Natural User Interfaces” (NUIs) such as car interfaces, Google Home, Alexa…..
  - Feel – widely used for alerts/notifications
  - Smell
  - Touch – for interfaces that can change the feel of the interface
- Do actions as needed
  - Type
  - Touch
  - Speak

Human factors associated with visual perception



The macula ~15% of the retina does detailed – high visual activity – tasks. At typical screen distance this limits the width of lines for comfortable reading. Very long lines (like these ones) are harder to read.

Visual physiology affects how easy it is to read different line lengths

Colour

Colour is very valuable in interfaces

There are many ways to use it well

Some of these rely on understanding visual perception of colour

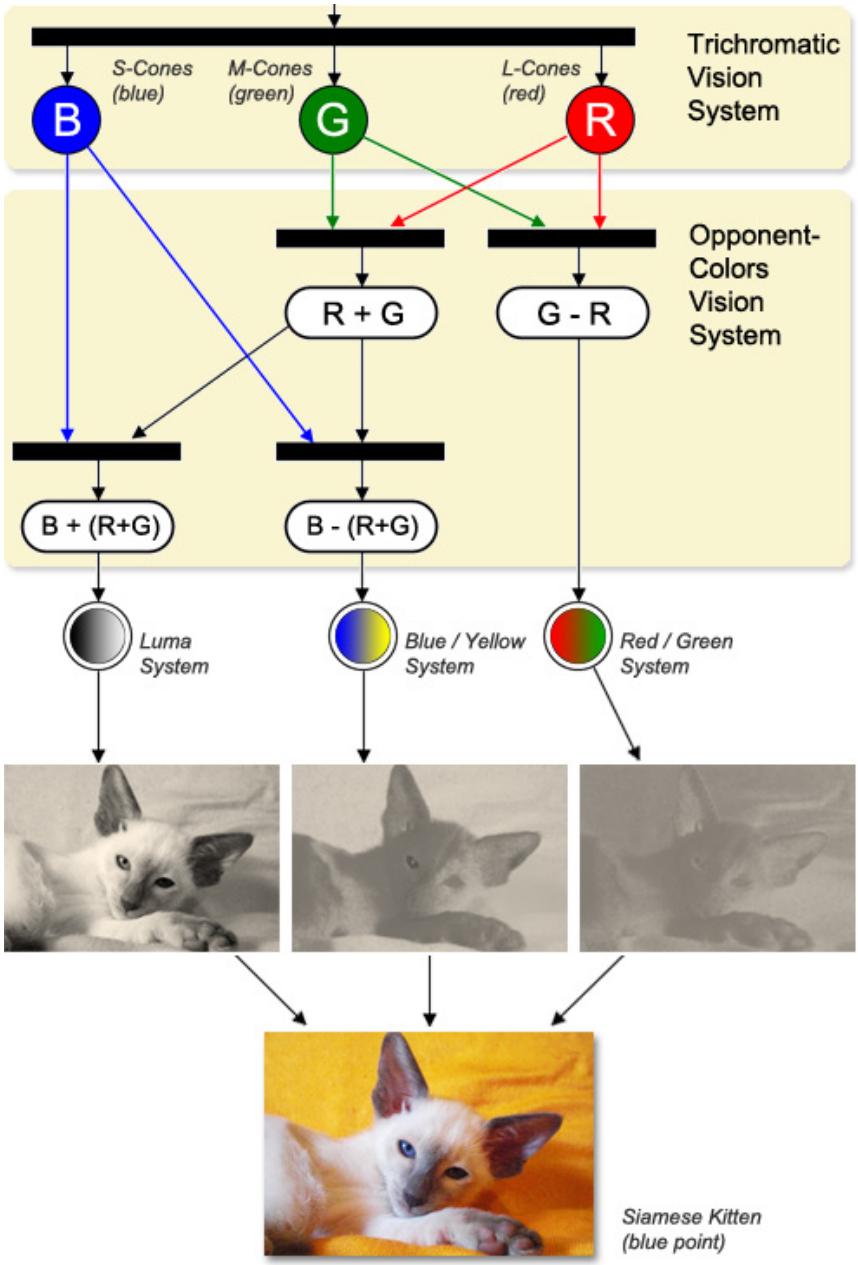
Colour vision

Most people

Colour vision

Relies on cone cells

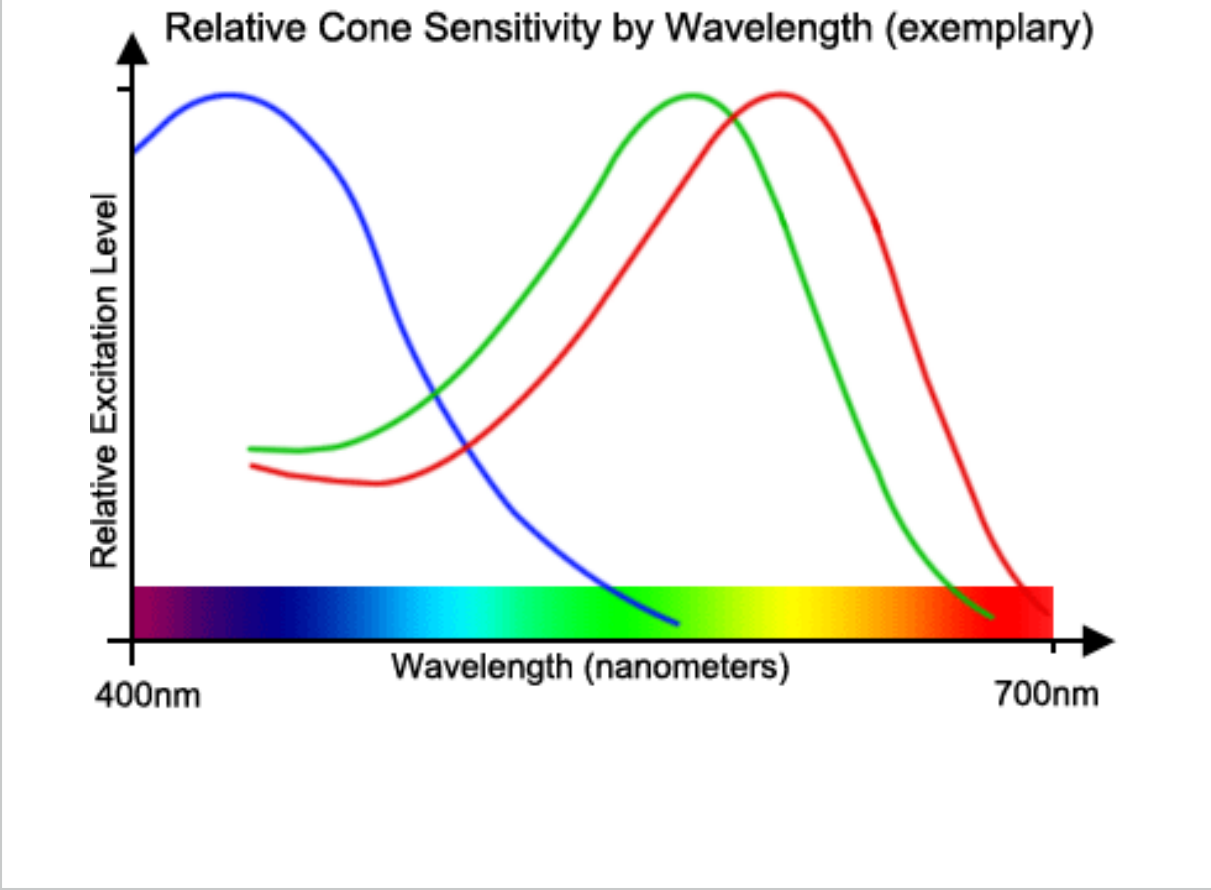
Three types – one for each of blue, green and red



Colour sensitivity is greater for the red and green than for blue

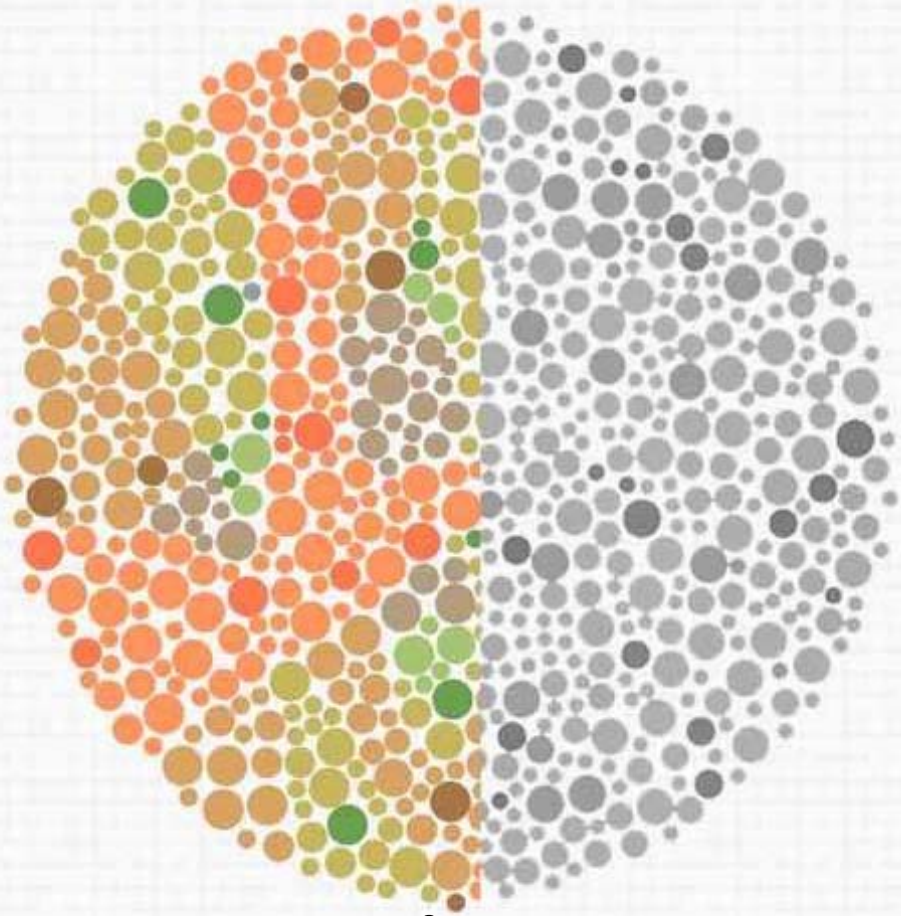
Aging ….

- Can’t distinguish violet, blues and greens
- prefer warm colours.
- Color brightness and purity perception diminishes.



Colour blindness

1 In 12 Men Are Color Blind: Take The Test



Also affects .5% of women – 1 in 200

Touch for interaction

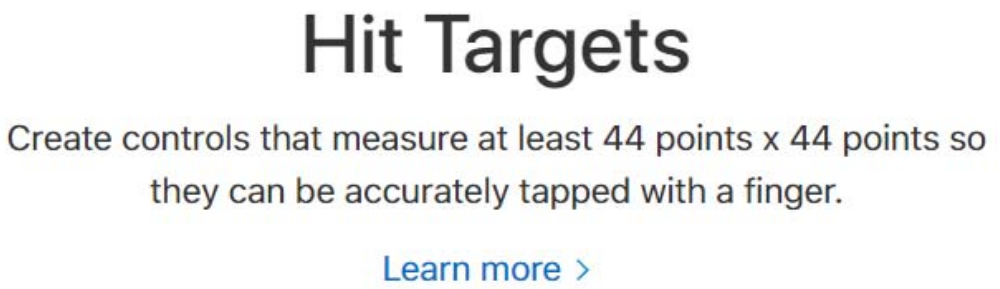
Human attribute – size of fingers

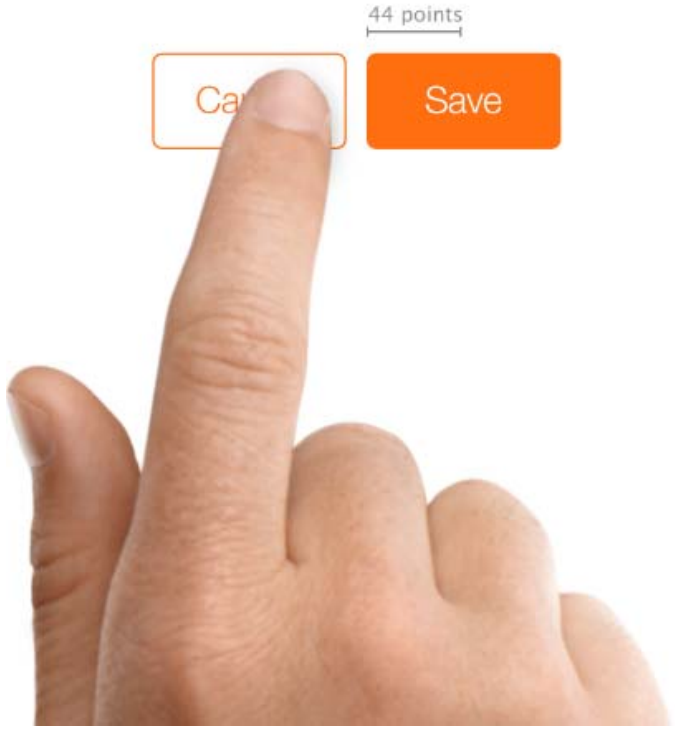
Finger size matters for touch interaction

Interface elements must be easy to select, without accidentally selecting a difference button as on the right

There are recommendations for size of buttons – user testing is critical too

Average index finger of adult is 1.6 - 2 cm wide. People also use thumbs….





Physical attributes summary

To interact with an interface the user must be able to:

- **Perceive** relevant parts of the interface
  - **See** – the dominant sense involved for most interfaces and most people
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- **Do actions as needed**
  - Type
  - **Touch**
  - Speak

We have “touched on” just the purple elements to illustrate ergonomic aspects that are important for usability

Mental attributes

What are implications of selected cognitive biases for analysis, design, evaluation?

Cognitive biases

What are they?
Why are they important for HCI?
And for creating usable systems?

Cognitive biases

These are systematic ways in which human reasoning may not be “rational”.

Systematic means - replicable in research studies

They come from psychology and behavioural economics

We each have different mental models - and constructed social reality.

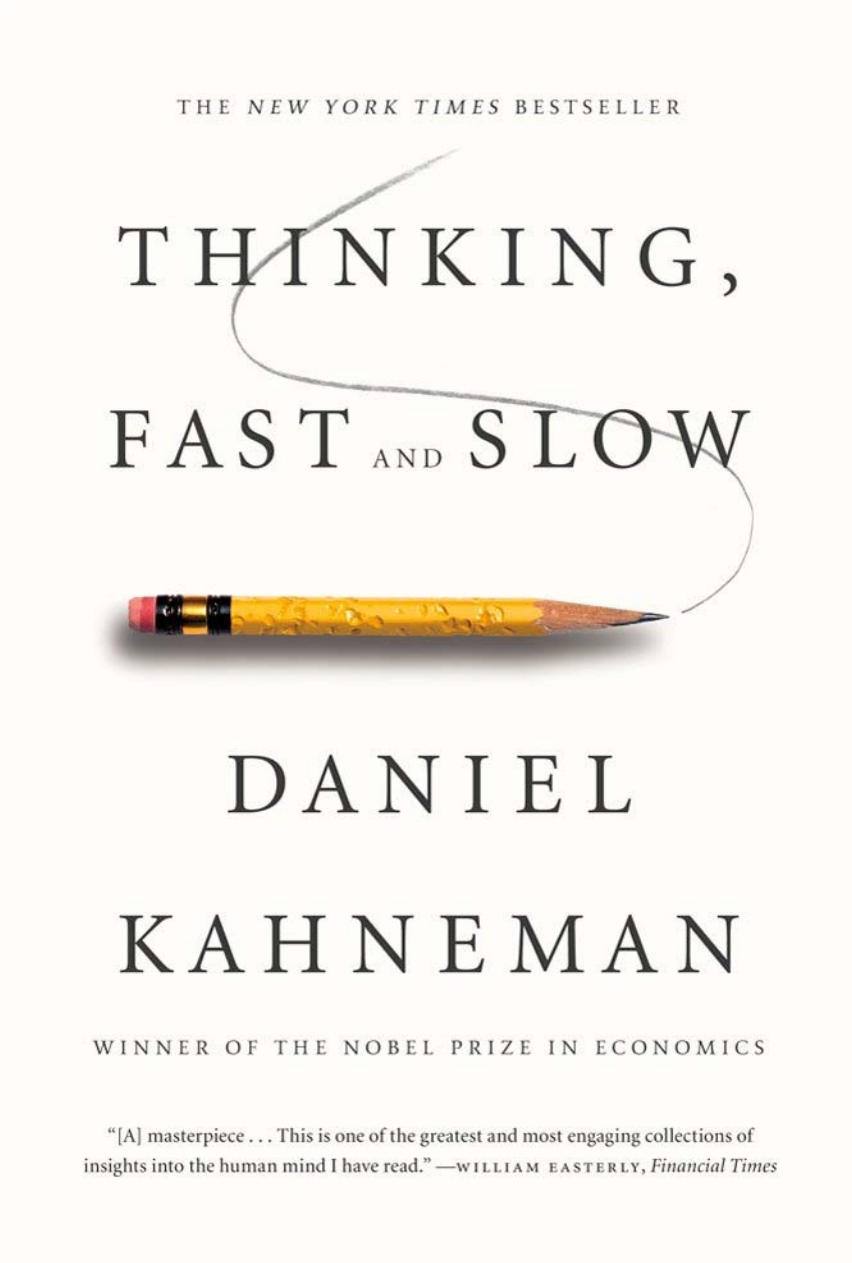
Notably, Kahneman's work that won a Nobel Prize in Economics.

This book is highly readable and describes some cognitive biases.

His key work was with Amos Tversky. eg

Tversky, Amos, and Daniel Kahneman. "Judgment under uncertainty: Heuristics and biases." *science* 185, no. 4157 (1974): 1124-1131.

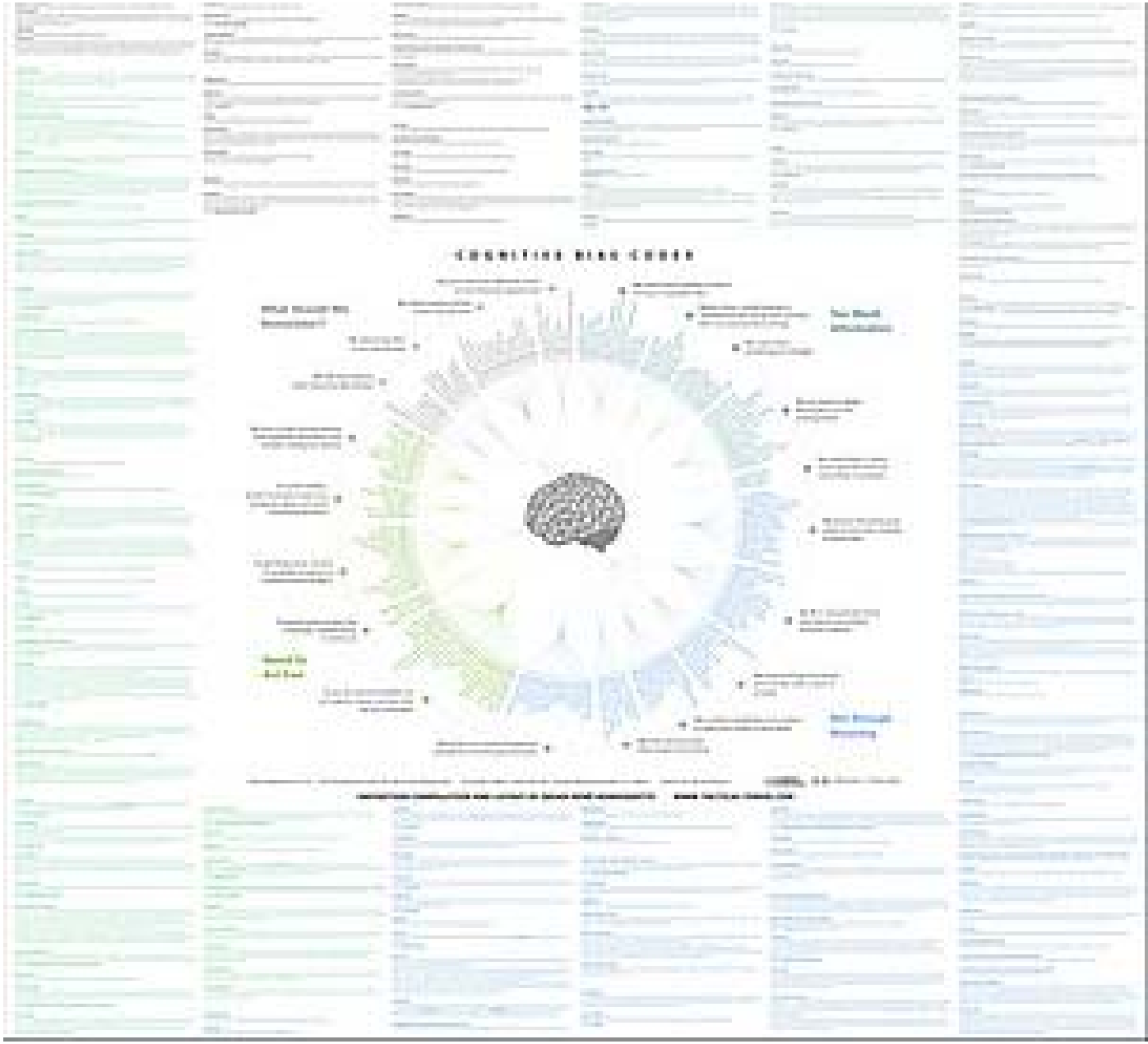
Tversky, Amos, and Daniel Kahneman. "The framing of decisions and the psychology of choice." *Science* 211, no. 4481 (1981): 453-458.



Researchers have identified many cognitive biases

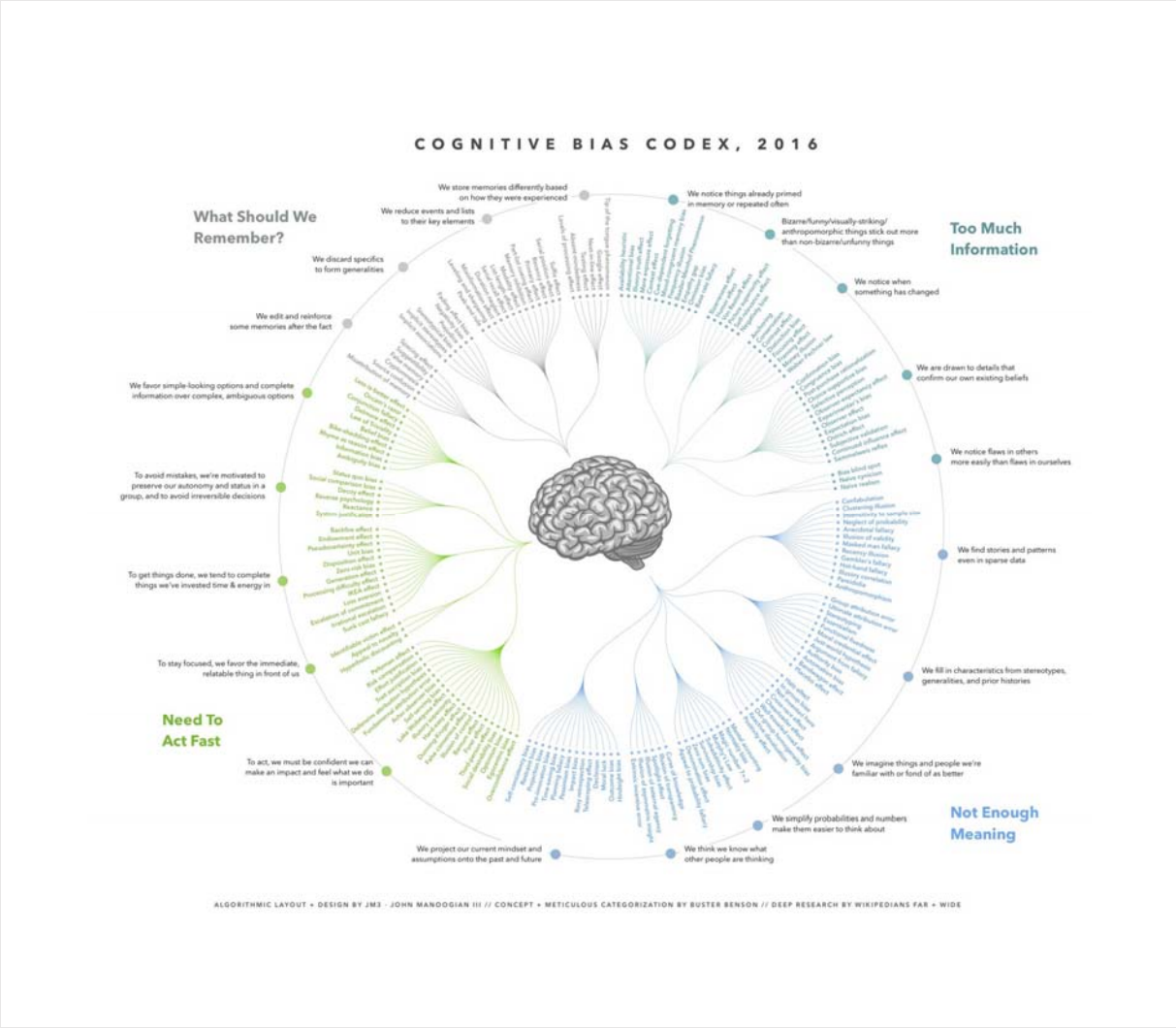
The Wikipedia page lists 175 of them…..

Wikipedia's codex of cognitive biases



We can group them down to 4 main categories

https://betterhumans.coach.me/cognitive-bias-cheat-sheet-55a472476b18



Some examples…

Google effect

Google effect – or digital amnesia

We tend to forget things that we could readily look up, rather than remember.

We essentially delegate some of our memory to digital systems we can search.

Sparrow, Betsy, Jenny Liu, and Daniel M. Wegner.
"Google effects on memory: Cognitive consequences of having information at our fingertips."
Science (2011): 1207745.

Over-confidence

Over-confidence effect

Broadly we tend to be over confident about:

- our performance
- our performance relative to others – most people believe they are above average ☺
- the accuracy of our beliefs

However, there is individual variation - a minority of people are under-confident. Confidence tends to be stable – a person who is over-confident in one context will tend to also be over-confident in other contexts.

Being too over-confident or too under-confident are both problematic.

Pallier, Gerry, Rebecca Wilkinson, Vanessa Danthiir, **Sabina Kleitman - @USYD– collaborates in research on phishing vulnerability -**, Goran Knezevic, Lazar Stankov, and Richard D. Roberts.

"The role of individual differences in the accuracy of confidence judgments."

The Journal of general psychology 129, no. 3 (2002): 257-299.

How is over-confidence bias important for usability?

Interface designers/programmers are confident that their interface is fine

They may be reluctant to believe that people cannot use it.

The good news!

A well run think-aloud can really help **most** designers/programmers

Stereotyping

“a set idea that people have about what someone or something is like, especially an idea that is wrong”

Examples:

I think I fit the popular stereotype of a mad scientist.

Adverts are full of stereotypes.

Her plots are predictable and her characters little more than stereotypes.

https://dictionary.cambridge.org/dictionary/english/stereotype

Stereotypes can be incorrect

They are generalisations ... Typically based on limited evidence

Many jokes are based on stereotypes e.g.

You Might Be an Engineer If ...

- You've actually used every single function on your graphing calculator.
- It is sunny and 70 degrees outdoors, and you are working on a computer.
- You have a pet named after a scientist.
- You are completely addicted to caffeine.

Selected from http://hutnyak.com/Jokes.htm

We all know of many much nastier ones

Stereotyping … benefits

- A way to simplify a complex world
- A way to reason from incomplete information
  - eg you see a person typing sophisticated Unix commands … so you use this small amount of evidence to infer that they are technically sophisticated
- A way to make fast decisions about people you can trust, will like…..

How are stereotypes important for usability?

Interface designers/programmers may make many assumptions about the users of their system

e.g. designers tend to assume users' knowledge is similar to their own
e.g. in Asst 1 you may assume Uni of Syd students have high technical knowledge

How does the usability engineer avoid stereotyping errors?

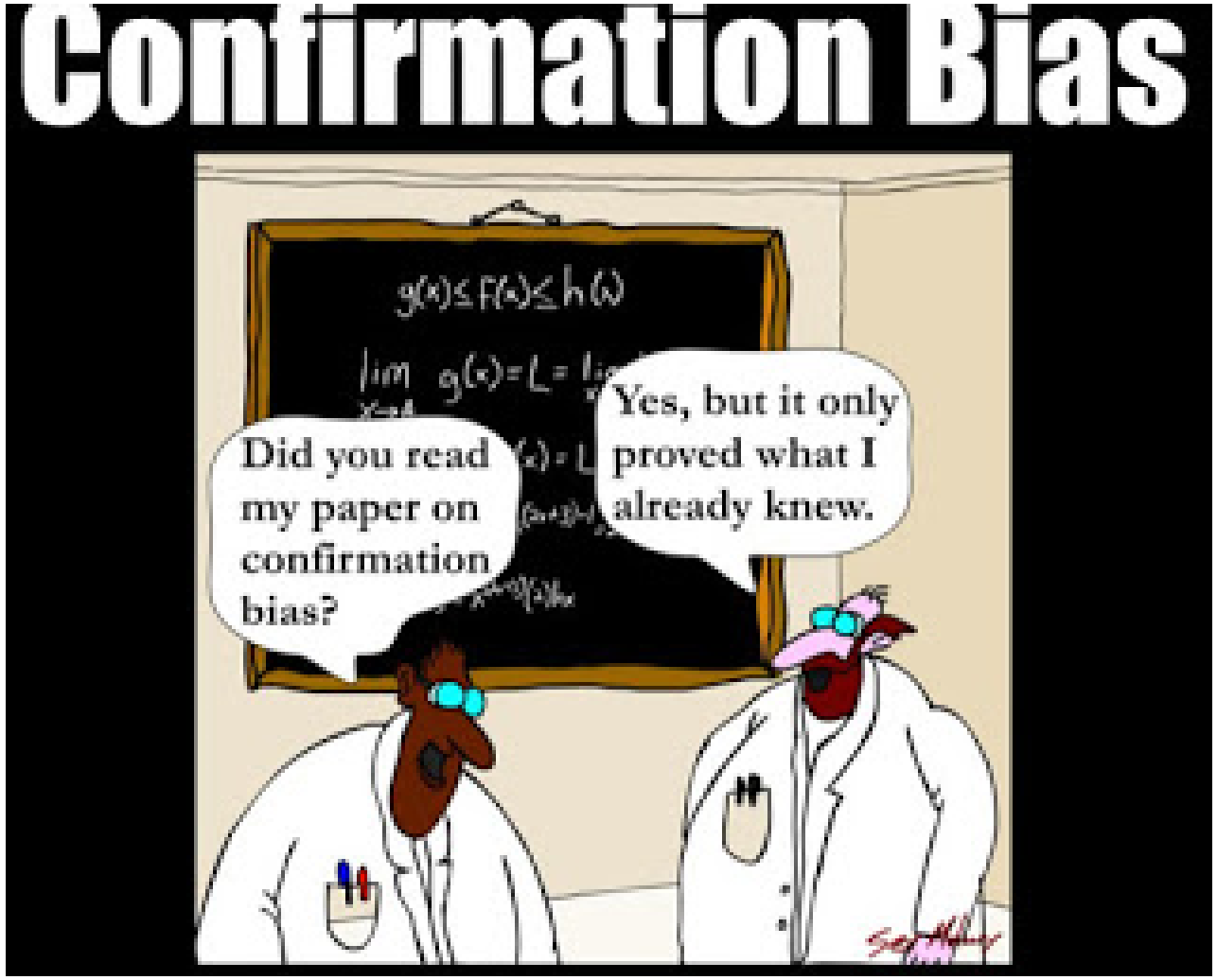
Do user research to learn more about users.

Evaluate with think-aloud to learn more about

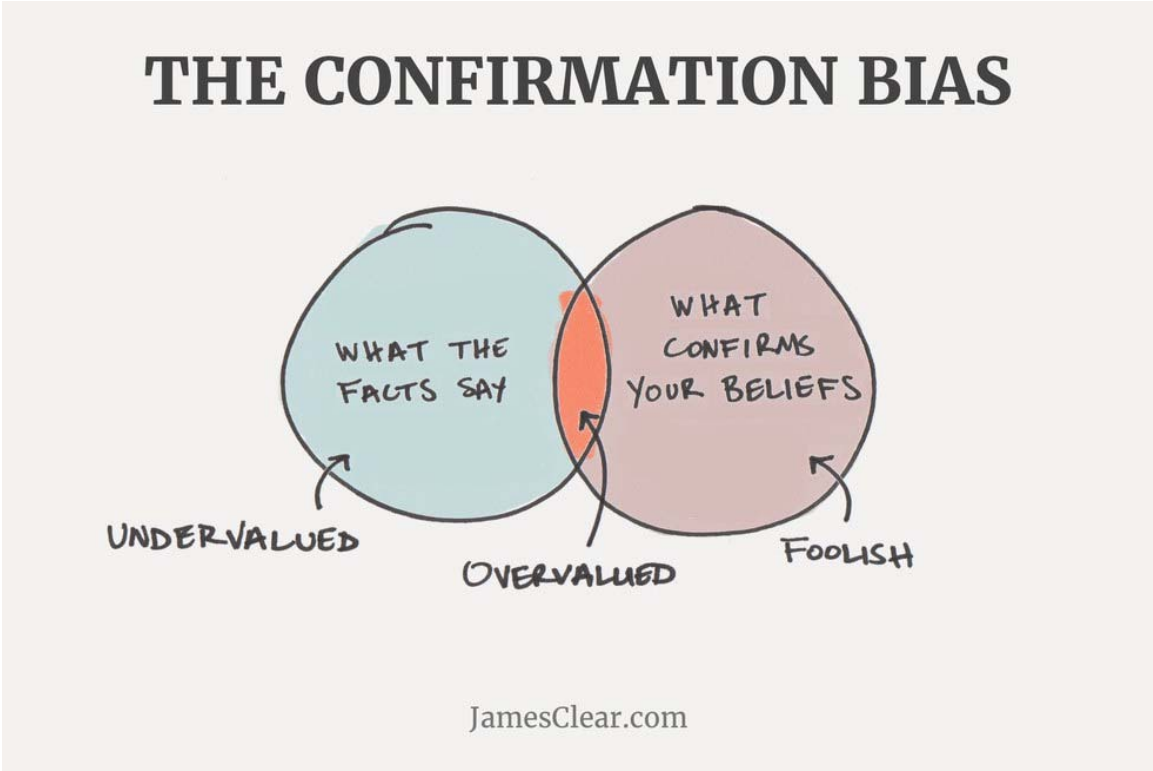
Confirmation bias

People tend to look for, see and remember in a way that maintains consistency with their current beliefs

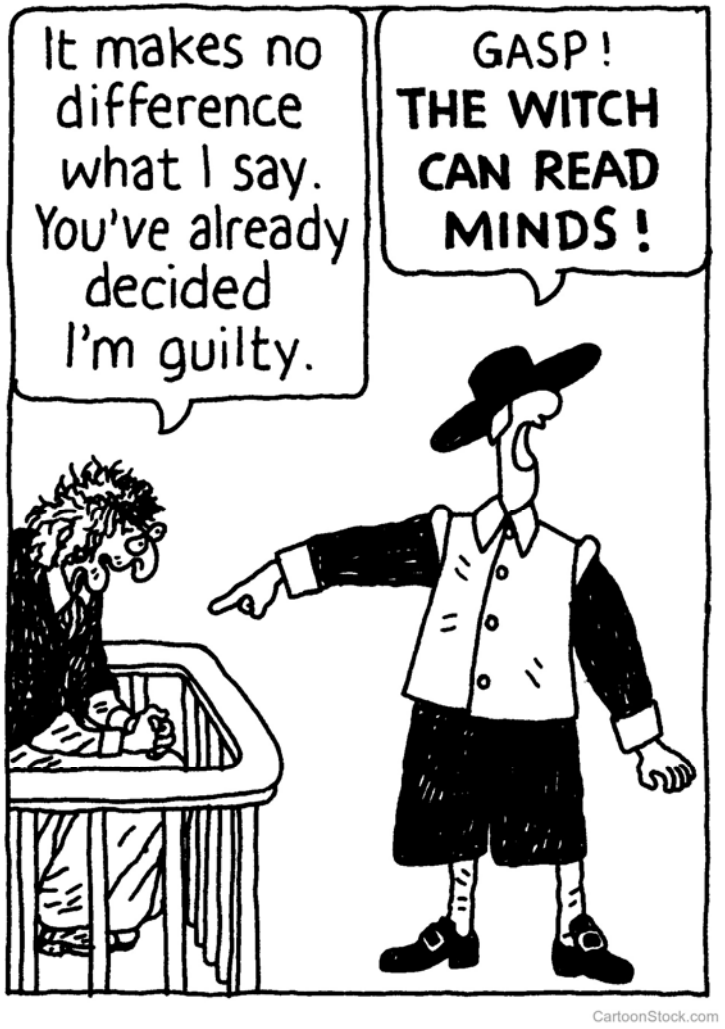
http://professionaljudgmentmatters.blogspot.com.au/2016/02/five-ways-to-overcome-confirmation-bias.html



https://www.theodysseyonline.com/5-ways-you-lie-to-yourself



https://www.persuasivelitigator.com/2017/08/fight-confirmation-bias.html



People may prefer to see information that confirms their mental model

Encouraging people to careful consider evidence that contradicts their beliefs ***may*** help them change their beliefs.

For ***simple factual*** mental model errors this can work well.

https://www.linkedin.com/pulse/brain-business-how-free-your-organization-from-bias-vinski-phd/

Confirmatory bias is complex when people have strong beliefs linked to their **identity and worldview** (eg religion, political views…)

…. when people have strong views (eg about capital punishment, gun laws, vaccination …. Security behaviours)

Evidence ***supporting*** their views strengthens their belief (as one would expect for rationale thought)

Contradictory evidence may also *strengthen* their beliefs!!!! (not consistent with rationale thought)

This could be relevant for the first part of Assignment 1 – depending on the Persona's concern about phishing and associated risks and how their best friends and family influence group feels about attitudes to risk

The first part of your Asst 1 – about the risks of phishing - is key to informing people about the need to be concerned about it

This may well help people change their attitude to the importance of learning about phishing.

But people who really believe it is not really important may maintain that view.

This is complex – but if a belief is linked to social identity – as in people with strong religious/political…. affiliations, it is

Social desirability bias

People tend to answer questions in a way that ensures the questioner will take a positive view of them

How social desirability bias important for usability?

This makes it hard to do analysis based on either asking people questions or observing them when they know they are being observed

e.g. in a Think-Aloud, the participant may well read all the instructions carefully – when they would not do that in real world contexts

How does the usability engineer account for this?

Field trials of authentic system use may help - if people are not unaware of being “observed” - this has ethical concerns for this?

More examples and how to deal with this

- eg would a person be willing to admit they had fallen for phishing?
- Designing questionnaires about this are hard
- Use available resources…. As in earlier lectures

- Hard to overcome – need to be aware at least and be very cautious in interpreting any data that may be affected by this bias

Why do we (people) need cognitive biases?

Yes – they are effective!

They are aspects of our reasoning that work a lot of the time.

But they also cause problems some of the time.

Problems people face in making rational decisions

- **Overload – there is a lot happening in the world around us**: The world has too much information for our brains to take it all in
- **The world is confusing, noisy**: We need to make sense of the information we do take in.
- **We** often **need to act** quickly. So we may not be able to think carefully through a complex decision such as one involving probabilities and complex evidence.
- **We cannot remember everything** – even from what we do take in - and our memories change over time, both adding and forgetting details.

How do cognitive biases help over come those problems?

How people deal with these problems

- **Overload: Humans don't perceive (see, hear, feel, smell,….) everything –** we only actually see some things – so may miss information that would be useful if we did see it
- **Meaning: Humans search for meaning – potentially confabulating to ensure consistency and confirm assumptions.** (Confabulate means fabricate imaginary experiences as compensation for loss of memory)
- **Speed: Sometimes "quick thinking" can be flawed.** Thinking fast … thinking slow.
- **Memory: Our memory and mental models can reinforce errors.** Some of the stuff we remember for later just makes all of the above systems more biased, and more damaging to our thought processes.

How does this map to usability and HCI?

Recasting this for HCI

- **Overload: Humans don't see everything.** We only actually see some things on an interface and our **mental models** play a role in what we see
- **Meaning: Humans search for meaning.** We try to make sense of interfaces, **interpreting interfaces** based on our mental models and what we see.
- **Speed: Sometimes "quick thinking" can be flawed.** We may act as soon as we perceive (usually meaning we see) something relevant, based on our mental, what we saw, how we interpreted it.
- **Memory: Our memory and mental models can reinforce errors.** Some of the stuff we remember for later just makes all of the above systems more biased, and more damaging to our thought processes.

What does intuitive mean, in terms of mental models and interfaces?

“perceiving directly by intuition without rational thought, as a person or the mind.

easy to understand or operate without explicit instruction: an intuitive design;”

http://www.dictionary.com/browse/intuitively

Intuitive….

Does not need conscious thought.

So it is effortless for the user to interact based on their current knowledge

All interaction with technology has to be learnt for the first use

Very familiar interactions become intuitive

Intuitive is different from…

Natural User Interfaces (NUI)

Represents a recent stage in interfaces

- CLI - Early interfaces were based on command line interaction – requiring the user to learn the command language and how to interpret the error messages ;-)
- GUI – graphical interfaces, also called WIMP (Windows, Icons, Menus, Pointer)
- NUI – involve **touch** interaction (already widely deployed), **gesture** interaction (based on touch eg pinch to make a window smaller on a touch screen), **mid-air gestures** as recognized by the Kinect, **speech** interaction (eg Siri, Google Now, Amazon Echo), **Brain-computer** interfaces

Recall from Week 1

Usability means easy and pleasant to use:

- **Learnability**: On ***first use, how easy*** is it for users to successfully do core tasks.
- **Memorability**: How easy to do this when ***returning after a break***.
- **Efficiency**: Once users have moved beyond the learning stage - how ***quickly*** they can do tasks.
- **Errors**: ***How many*** errors do users make, how easily they ***recover*** and if not, the error ***severity***.
- **Satisfaction**: How ***pleasant*** is it to use the design?

Intuitive interfaces usually mean…

- very easy to learn
- very easy to remember how to use after a break
- very ease to avoid making errors and very easy to recover from errors if they are made
- (likely reasonably efficient)

- and people are likely to consider the pleasant to use

So, intuitive means very usable for the person

NOTE: an intuitive interface

is only intuitive if the user has the previous knowledge relevant to being able to use it without feeling they need to think about it

- Touch screens for simple actions are exemplars … but only for people who have seen the “buttons” before and recognize them as buttons

- Speech interfaces are exemplars … once you know how you need to say “OK Google” and you become aware of what commands it can understand (eg “put apples on my shopping list”)

Quiz on lecture

Cognitive aspects that differ between individuals

Recall from Week 1

The most challenging usability problem is….

It is hard for designers to think like the users

- May need to understand the domain
- And the context of use
- And what the user knows
- And what they have experienced
- And how they will interpret the interface elements, what they will "see"

How can you learn about users?

This is important for both analysis and evaluation stages.

People:
Psychology
Physiology
Context

Week 5

Analysis – to determine ***user needs***
Week 2 (Phishing)

Design – to meet user needs
Week 4 (Passwords, Phishing)

Implementation

Evaluation – against user needs
Week 3 (Passwords, Encryption)

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Integrated
Case study
Week 6

Recall from Week 2

Three key methods for learning about user needs and preferences

Study peoples' **behavior**

Study what people **say**

Study **trustworthy previous work** reporting the above

2. Study what people say

- Ask people in context
  - what they do
  - why they do it
  - what they like/dislike about the current situation
  - **questionnaires**, interviews, in-context notification with question to answer
- Ask people out of context
  - After lab studies
  - Interviews, focus groups, questionnaires for small groups
  - Crowd-source studies (eg Amazon Mechanical Turk)
- Hybrid
  - study what people say to others eg on social media

Ways to ask people (complementing Think-aloud observations)

Many methods:

Individual: interviews, questionnaires (qualitative/quantitative, open/closed, standard/custom)

Groups: focus groups

Qualitative versus Quantitative

Quantitative : expressed as a number

eg how many users completed Task 1 without assistance, the average time users took to complete Task 1.

Qualitative : cannot be expressed as a number.

eg. gender, what the user most liked about the interface, what aspects of the interface were difficult to use, why the user thought an interface element had a different meaning from that intended by the designer

Note: after analyzing qualitative data, it is often possible to create quantitative summaries eg what percentage of users found a particular aspect of the interface difficult to use.

Assignment 1

Provides considerable qualitative data.

Importantly, you will use open ended questions for the pre- and post-test. This is THE most important measure of the success of your interface.

We now consider a broader class of qualitative questionnaire (if done on paper or at an interface) or interview (when a person asks the questions and records the responses).

Qualitative Questionnaires/Interviews

You ask people “open” questions and they give free responses

You then need to analyse the responses to make sense of them

Light-weight analyses can give useful insights

Qualitative Questionnaires/Interviews

Rigorous analysis of qualitative answers has two key stages:

Analysis: multiple people read the answer to draw conclusions

Each person in your group should analyse all pre- and post-tests carefully documenting which learning objectives users

- demonstrated knowing in the post-test
- demonstrated knowing in the pre-test
- Appear to have learnt from using your system

Inter-rater comparisons: you compare the individual results

Assess the conclusions that are consistent across all the analyses

You could also note aspects where team members disagreed on what had been learnt

(Beyond scope of this subject are several methods such as grounded analysis, thematic analysis… and then validation where multiple people analyse the data and then compare the inter-rater reliability)

Qualitative questionnaires/interviews and their applicability

A method where the design of the user study must take account of what people can reliably remember (and what they cannot)

Examples of things NOT to ask in an interview

- Should the *Buy* button be red or orange?
- Is it better to use a drop-down menu or a set of radio buttons for a certain set of choices?
- Where should the Foo product line reside in the IA?
- Is it better to have 3 levels of navigation, or should we stick to 2 levels even if it means longer menus?
- How should you write the *Help* information to best teach people how to correctly use the system?

What interviews can tell you

- Explore users' general attitudes
- Find out how people think about a problem
- Critical incident method: as users to recall a specific instance when they had a problem (or an interface worked very well) and then ask them to tell you more
  - This is more reliable and useful than asking about how people usually use an interface as this is less likely to be reliably remembered

Why is it important to study user behaviour as well as asking people about their knowledge, needs and preferences?

One part of the answer to this question relates to the earlier part of the lecture on cognitive bias

Another part of the answer relates to the limits of human memory

Aspects we need to learn about people ….

- **Physical**
- **Cognitive**
- Social
- Cultural
- Organisational
- Ethical frameworks, legal systems

Rather a lot for one lecture ☺

Stakeholder analysis for phishing (and the bigger picture context of Assignment 1)

- Attackers
- Individuals who receive mail
  - Students
  - Academic staff
  - Professional staff
  - People with control over large amounts of money
  - People in control of high worth data eg marks,
- Organisational context: culture, systems, shared understanding
- Regulatory framework,

What is usability for all?

Usability for all

- Focus on needs of people with special needs
- Such as people with colour blindness
- But it needs to include all variations in people
  - Physical eg blindness, motor difficulties making keyboards hard to use
  - Cognitive eg people with cognitive loss
  - Social and cultural eg people from minority groups which have different worldview, knowledge, needs, preferences

- There are methods for considering each of these in the analysis, design, implementation and evaluation of interfaces (beyond the scope of INFO2222)

Core learning objectives for Week 5 - people

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