Interaction Design

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Checklist

- Below are the lectures I've converted to notes and the lectures I'm going to convert to notes:

Lecture name	**Done?**
HCI Theory I	Yes
Data Gathering I	Yes
Data Gathering II + Data Analysis	Yes
Usability, UX and Accessibility	Yes

Interfaces: Past, Present & Future	Yes
Qualitative Methods I & II	Yes
Qualitative Analysis I & II	Yes
Privacy, Consent & Personal Data	Not on the exam
Designing for the Web I & II	Yes
Metaphors, Models & Assumptions	Yes
HCI Theory II	Yes
HCI Theory III & Prototyping I	Yes
Prototyping II	Yes
Accessibility I: Overview	Yes
Accessibility II: Designing for everyone	Yes
Cognition	Yes
Evaluation I: Intro, Stats & Heuristics	Yes
Evaluation II: User Testing	Yes
Values & Value Sensitive Design	Yes
Research & Design Ethics	Yes
Participatory Design	Yes
Persuasive design and behaviour	Yes

Book

- The core text of this module is:
    - Jenny Preece's Interaction Design: Beyond Human-Computer Interaction

HCI Theory

With vs. Through

- We can interact with technology and through technology
    - Interaction **with** technology means that we interact directly with the technology by doing some physical action.
    - Examples:
        - pressing a key on the keyboard,
        - pressing a physical button on a device

    - Interaction **through** technology means that we use the technology as a tool to communicate with some other person/service.
    - Examples:
        - writing a message on WhatsApp
        - poking someone on Facebook

Foci of interactive development

- You can scope your interface focus on different areas of the system:

Foci name	**Description**	**Things you'd develop where this foci is most prevalent**	**Things you'd look out for**
1. Hardware	The underlying hardware of the system.	Motherboard, faster processor	Is it safe? Could it be more efficient? Is memory handled correctly?
2. Programming task	The actual software of the system.	IDE, compiler	Is it optimal? Is it abstracted well? How many platforms does this work on?
3. Terminal	What is used by the user to interact with the system.	Keyboard, mouse, touch screen (almost any kind of peripheral)	Is it comfortable to use? Is it awkward to use? Does it do the job well?

4. Interaction dialogue	How the user interacts with the system.	Office software, video games, washing machines, ATMs, pretty much anything that is used by one person at a time.	Is it easy for the user to use? Does the user instinctively know what to do? Do they get stuck on what to do?
5. Work setting	How a group of users interact with the system.	Cloud storage service (like dropbox), Intranet software	Does the synergy work alright? How well does it work with different network types?

Types of theories

- When we think about designing a system's interface, there are three theories that we can follow:

Type of theory	**Description**
Classical	- Using psychology and predictive methods to determine how people will interact with our system
Modern	- Uses analytic tools to measure behaviour patterns, then uses that to design system interfaces - Focuses more on how the user uses the system and not what's going on inside their heads
Contemporary	- Like modern, but it takes it a step further and counts things in like culture and use in everyday life.

Affordances

- Affordances are uses / services that are offered by the system to the user.
- Examples:
    - The ability to send email is an affordance by Gmail to the user.
    - File management is an affordance by an operating system to the user.

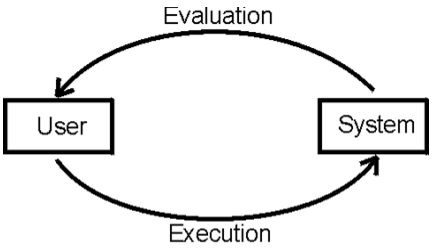
- There are different types of affordances:

Type of affordance	**Description**	**Example**
Instrumental	A way in which a person can use the tool to change the	Look at handling and effecter

	world in some way. This can be split up into “Handling” and “Effecter”.	
Handling	A way for the user to interact with the tool itself.	Using a scroll bar on an application only affects the tool itself, there’s no further purpose for it.
Effecter	A way in which a tool can bring about a change in another object.	Calling someone from your phone changes the state of their phone from idle to ringing.
Aggregation	Two systems can combine to create a new affordance.	A mobile phone with bluetooth hooking up with a headset to create a personal music player.
Learning	Provides information for the user to read and learn how to use the system.	A USB icon above a USB port, so the user knows that it’s supposed to be a USB port.
Maintenance	Allows the user to maintain the system.	A settings window, or the ability to change the battery of a mobile phone.

Norman Model of Interaction

- This model models interaction like a cycle:



- There are seven steps that loop in the Norman Model of Interaction:
- Execution includes:
    1. Establishing the goal
    2. Forming the intention
    3. Specifying the action sequence
    4. Executing the action

- Evaluation includes:
    5. Perceiving the system state
    6. Interpreting the system state
    7. Evaluating the system state

- Example:

Step	Example
Establishing the goal (What we want to do)	"I want to know how many files are in this folder"
Forming the intention (Why we want to do it)	"I'm going to do this by using a bash command"
Specifying the action sequence (How we're going to do it)	"I'm going to type in `find . -type f | wc -l`"
Executing the action (Doing it)	*types in `find . -type f | wc -l` and presses Enter*
Perceiving the system state (What is the result of the action)	"The command returned the number 4"
Interpreting the system state (What does the result mean)	"That means there are 4 files in this folder"
Evaluating the system state (Did the result meet the goal)	"I now know how many files are in this folder" Loop back to the first step if the user isn't satisfied

Situated actions

- Situated actions is the notion that people do things based on context.
- For example, you might have two devices that look exactly the same, but one's purpose is completely different to another's purpose.
- If you asked someone to use the first device, then use the second device, they will most likely attempt to use the device differently, because they know the devices fulfil two different purposes.

- Another example would be using the same device in two completely different scenarios. If someone is drinking and gets drunk, are they going to care about a notification from their quit smoking app compared to someone relaxing at home?

Ortony's model of emotional design

- There are three parts to this model:

Part	Description	Example
Visceral	This refers to parts of the brain that respond to things in the physical world, usually emotionally. In terms of interaction, this would refer to products that feel / sound / look good.	Any design that makes you feel good, like Material Design, Apple's design, etc. https://material.io/ https://developer.apple.com/design/human-interface-guidelines/macos/overview/themes/

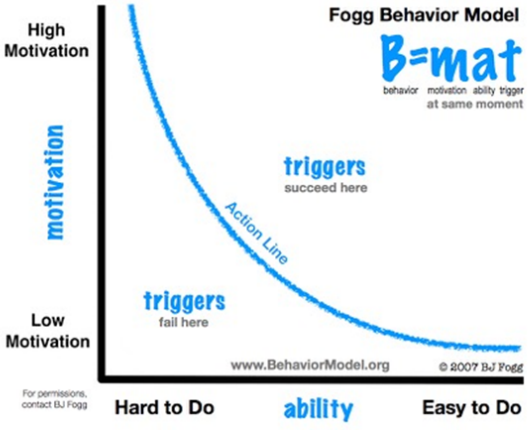
Behavioural	This refers to parts of the brain that performs tasks. In terms of interaction, this would refer to components that you can use and are intuitive (e.g. buttons, check boxes, switches etc.)	Bootstrap https://getbootstrap.com/ For a better example, try some of these themes: https://themes.getbootstrap.com/
Reflective	This refers to parts of the brain that contemplate things and reflect upon things. This is more high-level than the others in terms of interaction. This refers to interaction choices that make the user reflect upon what they're doing.	This light displayed on the cloud from a coal plant:  When people see the light getting bigger, they know they're using more energy and harming the environment more. They reflect upon this, and might decide to use less energy.

Distributed cognition

- Distributed cognition says that what a person does doesn't just start and end with what they remember; they use other resources too, like artefacts and their environment, which are all encapsulated into one "cognition".

Fogg's behaviour model

- The Fogg Behavior Model shows that three elements must converge at the same moment for a behaviour to occur: **Motivation**, **Ability**, and **Trigger**. When a behaviour does not occur, at least one of those three elements is missing.



- For example, if someone is really motivated and it's easy to do, the behaviour will occur (they'll definitely do it).
- If someone isn't motivated and it's really hard to do, the behaviour will not occur (they won't do it).(basically the Interaction Design module)

- An example of an application of this model is a smoking app:

- This smoking app performs “gamification” to increase motivation to stop smoking and continue using the app.
- With this model, the higher the motivation, the higher the likelihood of the behaviour occurring.

Data Gathering

- When gathering data, you should first **evaluate what the problem actually is** and **what the outcome needs to do**.
- You must collect data that is sufficient, accurate and relevant.
- Remember, we want to solve a problem. We don’t want to create more problems.

- Identify what works and what doesn’t work.
- Is your current design good enough yet?

- When collecting data, you can use a variety of methods:
  - Interviews
  - Questionnaires
  - Observations
  - Cultural probes
  - Literature reviews → Leverage existing data

Research questions vs ‘Instrument’ questions

- **Research** questions are questions like “What do people understand about their home energy use?” or “What factors reduce productivity in the work place?”
- **Instrument** questions are questions like “What are some things you know about “energy use””?

- Research questions are the questions we want to answer (questions we need answers to).

- Instrument questions are the questions that we ask other people, usually our target audience.
- Basically, we need to break up a research question into instrument questions.

- With the answers to the instrument questions, we can (hopefully) answer the research questions.
- We should not ask research questions in questionnaires!

Key steps in data gathering

- Setting goals
  - What questions do we need to answer?
  - How will we analyse the data that's collected?
- Identify participants
  - Determine population (how many people)
  - Determine sampling (what type of people)
- Engage participants
  - Professionally, clearly, ethically

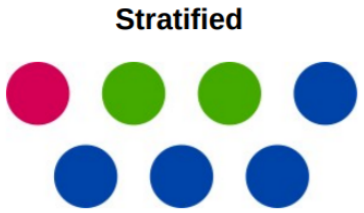
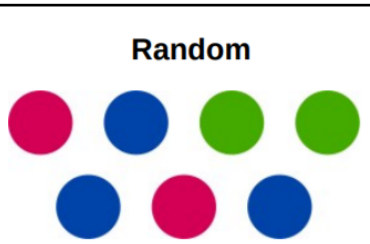
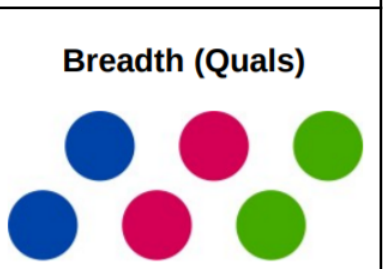
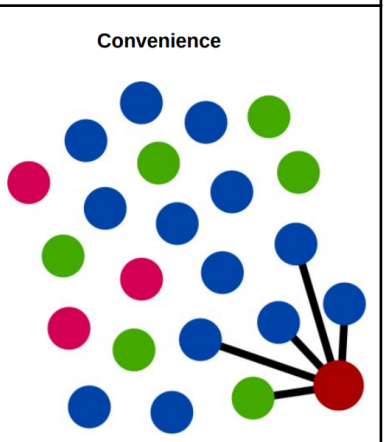
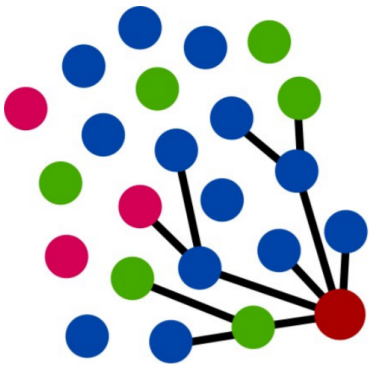
Breadth vs Representativeness

- In qualitative research, we want answers that are more specific, hence we sample for **breadth** of experience.
- In quantitative research, we want to find results that represent the best interests of our whole audience (or the majority of them), so we aim for a sample that is **representative** of the population of interest.

- Here, we have our whole population of interest:

- We can't interview them all. We need to take a sample. There are different kinds of samples:

Type of sample	Description	Illustration

Stratified	You use the ratio of the different kinds of people to scale down your sample. For example, most of the population are blue, so most of our sample are blue.	
Random	Randomly pick people.	
Breadth (Qualitative)	Keep an equal number of different kinds of people. In other words, the equivalence classes of your sample are all the same size.	
Convenience	You just interview the people who are most convenient to talk to.	
Snowball	You start off with a normal sample, like convenient, and then you use their connections to reach more people in the population, e.g. “be sure to tell your friends and family about us”	

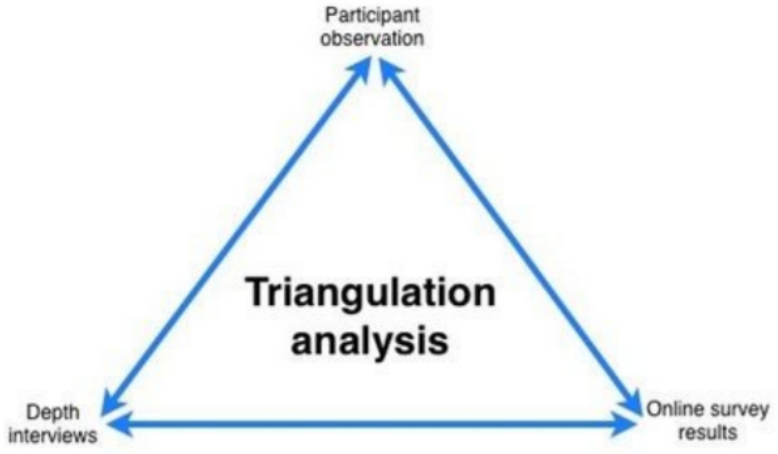
- Remember, big samples don't necessarily mean a good sample, because you may sample the wrong people.
- For example, if you wanted to research how older generations use technology, you wouldn't post an interview on Twitter because you'd get the wrong sample.

Pilot studies

- A pilot study is a small study that you do before the main study.
- You do this to make sure that your study will work on a bigger one.

Triangulation

- Triangulation refers to combining data from different data gathering methods.
- You're going to get data that differs slightly. You can't assume all of them are 100% true. You're going to have to get the "mid-way point" of all the data.



- A good analogy of triangulation is coming up with a line of best fit. You're combining a bunch of different data points to get one approximate (yet accurate) model.

Interviews

- There are four types of interview:

Type of interview	**Description**
Unstructured	No script. It's good for data (is rich), and is steered by both parties. It's more like a conversation. This kind of interview can't be repeated, though.
Structured	Stick to the script. It can be repeated, but it might miss good details (lacking in richness)
Semi-structured	Use the script, but we can wander off on tangents that seem interesting or useful. The halfway point between unstructured and structured.
Focus group	A group interview.

- There are also two kinds of questions:

Type of question	Description
Closed	Has a discrete set of possible responses, for instance yes/no, a number or a choice from a list. Used for quantitative data. “Do you use an umbrella or a raincoat?” “How many hours of TV do you watch a day?” “Do you use this product every day?” “Is Sword Art Online the best anime?”
Open	No predetermined answers. Usually answered in a sentence or paragraph. Used for qualitative data. “How do you feel about climate change?” “What do you think about JoJo’s Bizarre Adventure?”

- Avoid:
    - Long questions
    - Jargon and complex language
    - Leading questions or assumptions
        - “Why do you like?”
    - Unconscious biases e.g. gender stereotypes
    - Instead of asking “Why …?”, ask “What are the reasons that …?” instead

- When running an interview, remember these few things:
    - **Intro**: Introduce yourself, explain goals and process, reinforce right to stop/leave, ask to record, get consent
    - **Warm up**: Make first questions easy, non-threatening
    - **Main body**: Present questions in a logical order
    - **Cool off**: A few easy questions to defuse tension at the end
    - **Closure**: Switch recorder off, signal end, thank interviewee, debrief
    - **Output**:
        - Notes; on the protocol itself, or plain paper
        - Audio recording
        - Other props/materials, like drawings, timelines, lego?

Questionnaires/Surveys

- Question order can be important – Priming, learning and consistency effects
- Different versions for different populations – Language, locale, expertise
- Provide clear instructions
- Avoid very long questions
- Decide whether phrases will be all positive, all negative or mixed.

- To get good responses from questionnaires, you should:
  - Make the purpose clear
  - Promise anonymity ← If you can!
  - Offer a short version for people in a hurry
  - Include a return envelope (Stamp / freepost) if mailed
  - Provide an incentive
  - 40% response is good; 20% is often acceptable
    - You might decide to weight responses during analysis if response is skewed

Technique	Good for	Kind of data[a]	Advantages	Disadvantages
Interviews	Exploring issues	Some quantitative but mostly qualitative	Interviewer can guide interviewee if necessary. Encourages contact between developers and users	Time-consuming. Artificial environment may intimidate interviewee
Focus groups	Collecting multiple viewpoints	Some quantitative but mostly qualitative	Highlights areas of consensus and conflict. Encourages contact between developers and users	Possibility of dominant characters
Questionnaires	Answering specific questions	Quantitative and qualitative	Can reach many people with low resource	The design is crucial. Response rate may be low. Responses may not be what you want
Direct observation in the field	Understanding context of user activity	Mostly qualitative	Observing actual work gives insights that other techniques can't give	Very time-consuming. Huge amounts of data
Direct observation in a controlled environment	Capturing the detail of what individuals do	Quantitative and qualitative	Can focus on the details of a task without interruption	Results may have limited use in the normal environment because the conditions were artificial
Indirect observation	Observing users without disturbing their activity; data captured automatically	Quantitative (logging) and qualitative (diary)	User doesn't get distracted by the data gathering; automatic recording means that it can extend over long periods of time	A large amount of quantitative data needs tool support to analyze (logging); participants' memories may exaggerate (diary)

Observation

- Observing is where you observe a working system in use
- Covered more deeply when we talk about Evaluation
- Quantitative or Qualitative
- In the field or in a controlled setting
- **Direct**: Directly observe what's happening
- **Indirect**: Use instrumentation (e.g. web analytics, click tracking, screen recorder)

Hybrid methods

- There are a bunch of unique methods that can be used in interviews:

Hybrid method	Description
Think-aloud	Ask someone to explain what they're doing while they're trying to use a system.
Wizard-of-Oz	Get someone to use a prototype system that they think is autonomous, but is actually controlled by someone else.
Speculative design	Propose possible design options to people to prompt discussion.

Experiments

- An experiment, like in science, is used to test a hypothesis.
- You can do experiments in a controlled environment (like a lab)
- Or you can do it in the "wild" (like Google Analytics)

Data Analysis

- Once you get your data, how do you analyse it?

Quantitative - Measures

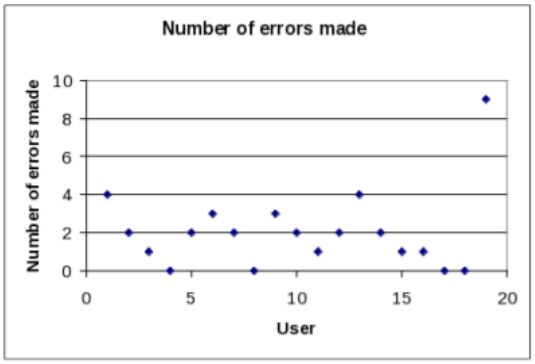
- There are 5 measures with quantitative data:

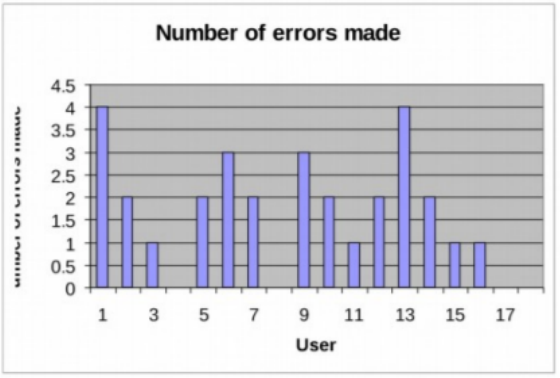
Measure	Description
Mean	The true average of all of the data points
Median	The middle data point when sorted
Mode	The most often data point
Range	The highest data point - the lowest data point
Standard deviation	The measure of spread from the mean, in other words, how spread all the data points are from each other

Quantitative - Alternative representations

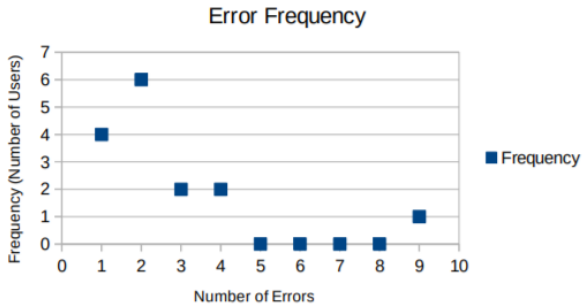
- There are lots of representations of data, like bar charts, histograms, line charts etc.
- Sometimes you can't really see a pattern until you use the right representation.

- For example, we could gather data to see how many errors are made in a software firm:





- No patterns here... how about we try a frequency graph?



- Now it's obvious that most programmers only make 4 errors at best. There's one guy who made 9 errors, but that's just one anomalous result; it doesn't represent the majority.

Qualitative - Coding

- Coding refers to labelling parts of the qualitative data, which abstracts the important parts.
- Example:

Qualitative data	**Coding key**
"It's hard to find the time to get to the gym; sometimes I mean to go after work, but I don't always make it." "My schedule is quite hectic, it's hard to fit exercise into my routine." "I try to get some exercise by walking the kids to school in the morning; unless it's raining! Then we take the car."	Time Place Other Commitments

Usability, UX and Accessibility

What's the difference?

- **Usability** is a quality attribute that assesses how the interface is:
    1. Efficient to use
    2. Effective
    3. Easy to use
    4. Easy to learn
    5. Easy to remember
- **"User experience"** (or UX) encompasses all aspects of the end-user's interaction with the company, its services, and its products.
- **Accessibility**: Usability of a product, service, environment or facility by people with the widest range of capabilities

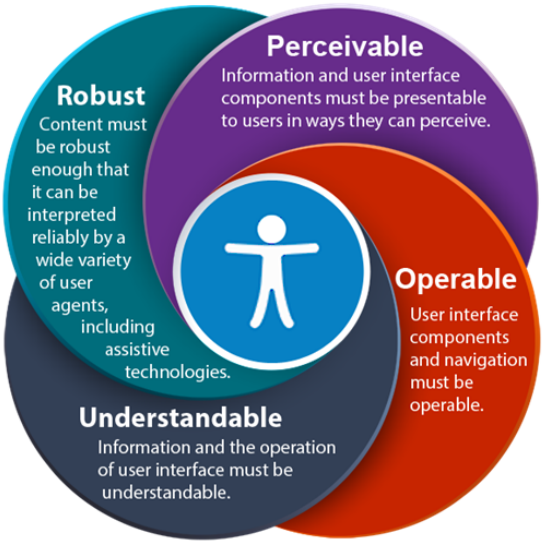
- Examples:

- **Usability**: easy to use ? e.g.
    - Learnability: first time use
    - Efficiency: speed, effort
    - Memorability: re-use
    - Errors: number, severity, recoverability
- **Accessibility**: Who can use it?
- **User Experience**: e.g.
    - Usability
    - Accessibility
    - Utility
    - Satisfaction (including feelings/emotions)

Enforcing usability, UX and accessibility

- Typically, an accessible website:
    - is **perceivable** and **interactable** with alternative devices
    - can be **navigated easily** and **effectively,** independently of the modalities used
    - is easily **understandable**

- The World Wide Web Consortium (W3C) produced Web Content Accessibility Guidelines (WCAG), divided into four principles:



Universal design

- Universal design includes:
- **Equitable**
  - Avoid segregating or stigmatizing users
- **Flexible**
  - accommodating preferences and abilities.
- **Simple and Intuitive Use**
  - easy to understand, regardless of experience, knowledge, language skills
- **Perceptible Information**
  - effective regardless of ambient conditions or sensory abilities.
- **Tolerance for Error**
  - minimizes hazards and adverse consequences of accidental or unintended actions
- **Low Physical Effort**
  - efficient and comfortable use with minimum of fatigue

Interfaces

- Different interfaces are useful for different tasks.
- When designing products, you should pick an interface that fits the function the best.
- Take into account:
  - Comfort
  - Hygiene
  - Ease of wear
  - Usability

Past

- 1980's interfaces:

    - **Command line**
    - Efficient and fast, but have to learn commands

    - **WIMP** (Windows, Icons, Menus, Pointing device)
    - Everybody is used to it
    - Not as flexible as command line

- 1990's interfaces:
    - **Web**
    - Available on any device
    - However requires a connection

    - **Speech** (voice)
    - Easy to do
    - But not always reliable

    - **Pen, gesture, touch**
    - Simple and intuitive
    - But can get tricky when doing complex tasks

Present

- 2000s interfaces:
    - **Mobile**
    - Available wherever you are

    - **Wearable**
    - Suited for certain functions, like watches or glasses

    - **Shareable** (smartboards, electronic tabletops)
    - Good for group work and devices where lots of people will be using it at a time

Future

- **Virtual, augmented & mixed reality**
- Good for visualising real objects

- **Robotics**
- Useful for automated activities

Qualitative Methods

Contextual inquiry

- Don’t design a product before you understand the user!
- Understand the user first, then design a product around them.

- *“You've got to start with the customer experience and work backwards to the technology. You can't start with the technology and then figure out how you're going to sell it”* - Steve Jobs

- Contextual inquiry involves establishing the context of your product:
    - Where is it? Work, home, supermarket, other
    - Activities, tasks, habits, etc undertaken in that space
    - Tools used in activities/tasks etc
    - How people interact/work together
    - Organisational structure
    - Cultural influences
    - Uncovers requirements for design
    - What are the problems people face in their task?
        - Are there problems with existing products people are using?
        - Are there problems with existing user experiences?
        - What are the causes of these problems?
    - Identify the assumptions people make
    - Observe people’s actions and practices
    - Who are your users?
    - What are their tasks?

- It’s not about testing the validity of your ideas; it’s about understanding your user base.

- There are several qualitative methods when performing contextual inquiry:
    - Interviews
    - Ethnography
    - Direct observation
    - Diary Studies
    - Cultural Probes + Technology Probes

Qualitative methods

Interviews

- **Introduction**: Intro to study, study aims, ethical consent gathered

- **Primer questions**: easy to answer but still useful information: “how often do you use your eco-feedback? What for?”

- **Pointy questions**: Questions that determine how the user has/hasn’t been affected
- “How has your eco-feedback changed your appliance use behaviour?”… “Describe how it has or hasn’t had a persuasive effect”

- **Insight questions**: Questions that determine what the user would do
- “If you could influence the design of the eco-feedback’s interface, name two key changes you would make to it such that it suit your needs better?”

- If your participant is explaining an idea >>> Give them a pen to sketch it!

Rapid Ethnography

- Ethnography is the study of culture.
- It’s the origins of anthropology.

- Rapid ethnography involves in-depth interviews and observations at key contextual times.

- Let’s just say you wanted to design an agricultural robot that detected weeds and exterminated them.
- Rapid ethnography could help you discover that your robots would only be suited to certain types of soil, because the wheels would get bogged in certain soils.

Diary Studies

- Your participants have a “diary” and log data in that diary.
- For example, a diary for location and purpose of smartphone usage.
- You have to rely on your participant to remember to log data.

Cultural Probes

- Consists of probe packs that are sent out to participants with activities for them to complete and return the probe packs to the researchers
- Can provide insights into people’s day to day lives, habits, attitudes, activities
- Useful in contextual inquiry, gathering design inspiration

Technology Probes

- Based on Cultural Probes
- **Definition**: Flexible, adaptable technologies used for understanding needs and desires of users; inspiring users and; encouraging researchers to think about new technologies (Hutchinson et al. 2003)
- They’re basically cultural probes, but they’re tecchy

Qualitative Analysis

Traditional experimental theory

- This is where you try to explain your findings through some existing theory.
- For example:
    - Q: “Does time-of-use electricity pricing change washing/drying behaviour at home?”
    - A: “Based on Rational Actor Theory and Theory of Planned Behaviour, people will switch their energy use to the most economic times of day”

- But this isn’t always the case. Not everything can be explained away through theory.
- This is why we have grounded theory.

Grounded Theory

- Grounded theory is coming up with your own theory of interaction out of your findings.
- It’s called grounded theory because you’re “working from the ground up”.

- The following approach to grounded theory is called **thematic analysis**, or **coding**.

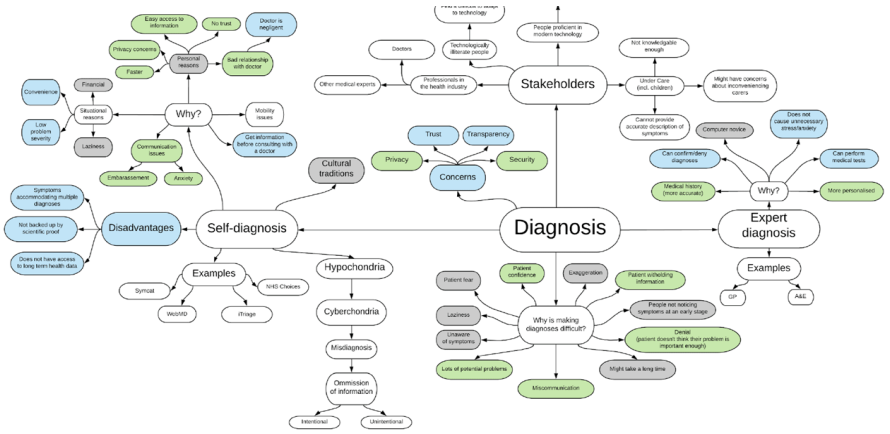
- However, before you do any thematic analysis, make sure you:
    - Summarise + tabulate demographic info
    - Summarise answers to any short answer questions
        - “How many times per day would you access your eco-feedback display?”
    - Come back to do thematic analysis later on with a clear head

Coding / Thematic Analysis

- There are two types of coding: open coding and axial coding.

- With open coding, you identify categories and colour code the qualitative data according to those categories, e.g.:
- “I try to go to sleep around 11:00 pm, but I usually have lots of work to do.”
- Red category - Time
- Blue category - Work

- With axial coding, you use your findings in open coding to draw out conclusions and link certain behaviours together.
- One of the ways this can be done is through an affinity diagram:



- Coding is an iterative process:
  - *First iteration*: Everyone independently codes the transcripts and identifies key themes in the text
  - *Second iteration*: Research team comes together and everyone compares themes
    - Common themes decided upon
    - Themes revised based on commonality among researchers' coding
  - *Third iteration*: Axial Coding - revise themes and finalise code book (a table / document outlining category findings and such)

Designing for the Web

Motivation

- When people look at your design, do they want to interact with it?
- Your goals for designing should be:
  - Simplicity (should be simple: KISS Keep It Simple, Stupid)
  - Feedback (see what people think)
  - Speed (things you can do on the site should be quick)
  - Ease of use (it should be easy to use)

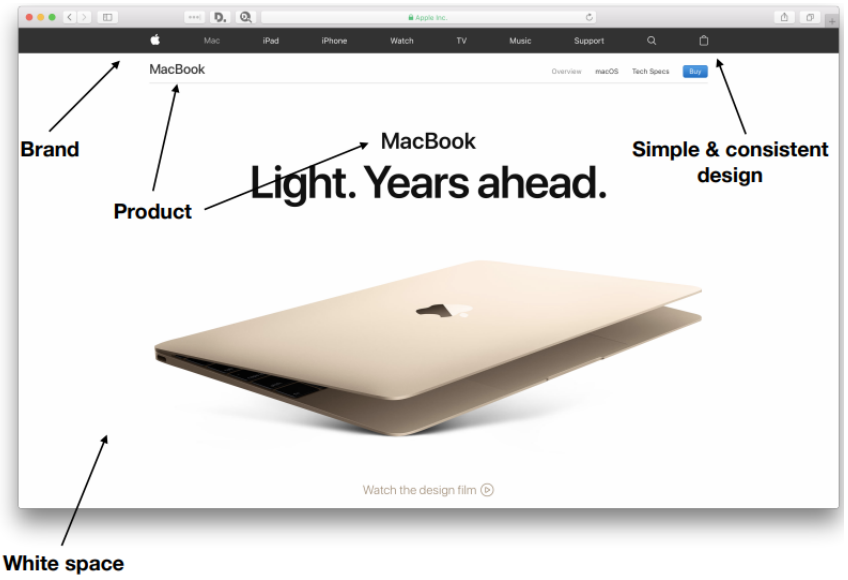
- Remember, you shouldn't have to think to use an interface; it should be intuitive!

Layout

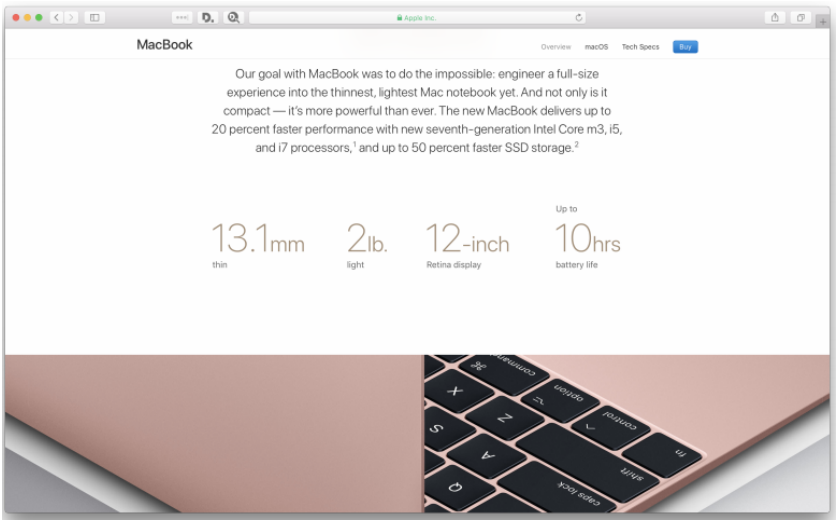
Above and below the fold

- This is a technique from newspapers.

- 'Above the fold' is everything the user sees upon entering the site for the first time.
- Here should be all of the important stuff that users should see first.

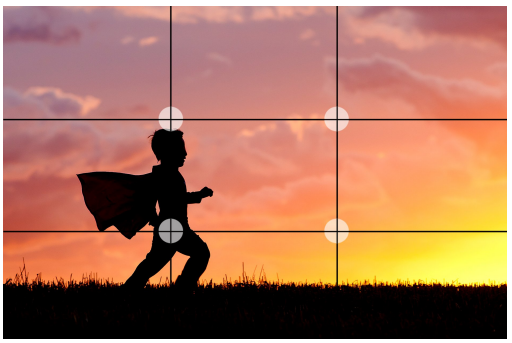


- ‘Below the fold’ is everything the user will see when they scroll down.
- Here, more specific details should be available.



Rule of thirds

- This technique comes from photography.
- This technique involves splitting up your screen into thirds, then placing the subject on one of the splitting intersections.
- For example, in this image of a boy, the boy is placed not in the centre, but on one of the line intersections.



- The same thing can be applied to web elements, for example:

Responsive design

- Responsive design refers to a design that can change shape according to what device it's on.
- It's one design that changes its shape; not lots of designs that the website picks from.

Break-point design

- Lots of designs suited to different devices that the website picks from, e.g. a desktop design, mobile design, tablet design etc.
- The designs do not change shape like responsive design does, the designs are specialised for different devices and are picked accordingly.

Semantic web

- You can add semantics to your website.
- With HTML5 and schema.org, lots of websites can semantically include objects in their site that are recognisable by other services, like Google.
- By adding semantics to websites, it makes it easier for machines to understand what they're about.
- IMDb is an example of a website that uses semantics.

Web page elements

- **Fonting** is important as it can direct attention, complement the layout and tell you what the text is about before you read it (e.g. bold text indicates a title).
- Use appropriate **words** according to what your site is about. There's no use using weird jargon where it's not necessary!
- **Colours** have strong meaning and can indicate common conventions, for example 'red' may mean to close something down.

Interaction

- What type of feedback does your website give? Video? Audio?
- What type of feedback should it give? Which is the most appropriate for your site?

- If you need to deliver content to the user after the page has been loaded, consider using AJAX (Asynchronous JavaScript and XML).

Metaphors, Models & Assumptions

- Sometimes, we make stupid assumptions, like assuming that people want to watch TV while driving.

- How do we stop making stupid assumptions? Make a conceptual model!

Conceptual models

- A Conceptual Model is an account of how a system works.

- Why do we do this?
- Orientate
    - Allow the design team to ask specific questions
- Open-Mind
    - Prevent a design team becoming too narrowly focused early on
- Common Ground
    - Agree a set of common terms within the team

- It allows us to rail ourselves onto the right thought track before we jump into anything.

- The components of a conceptual model are:
    - Metaphors and analogies
        - understand what a product is for and how to use it for an activity
    - Concepts that people are exposed to through the product
        - task–domain objects, their attributes, and operations (e.g. saving, revisiting, organizing)
    - Relationships and mappings between these concepts

- The first steps of creating a conceptual model would be:
    - What will the users be doing when carrying out their tasks?
    - How will the system support these?
    - What kind of interface metaphor, if any, will be appropriate?
    - What kinds of interaction modes and styles to use?

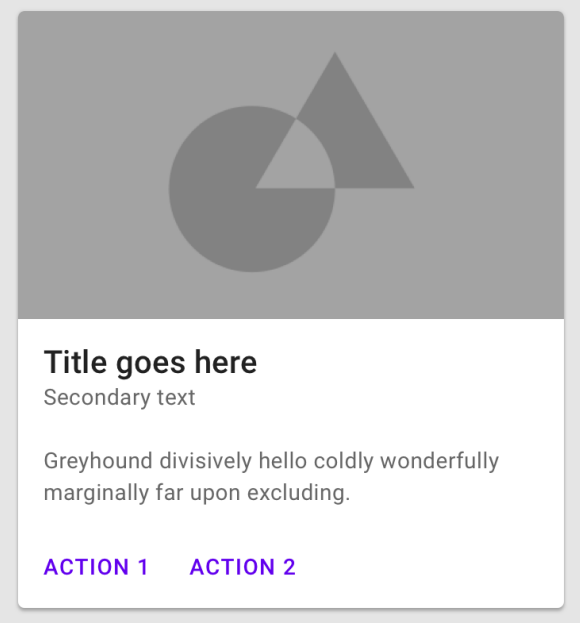
Interface metaphors

- An interface metaphor conceptualises the task in a way people can understand.
- For example, a shopping trolley icon alone conveys conventions such as adding items, going to a checkout, purchasing the items in your trolley etc.

- This makes learning the system easier and more accessible for other people, but it can break conventional and cultural rules.

Material metaphors

- A material metaphor does not conceptualise a ‘task’, but instead draws parallels between your interface and real life material objects.
- For example, the ‘card’ component in Material Design makes you think of a surface of paper:



Interaction types

- How do you interact with a system?

Instructing

- You can just tell it what to do using instructions. You know, with a terminal and stuff.
- It's quick and efficient, but some interfaces are harder than others!

Conversing

- Just talking to the system in English.
- It can make novice users feel at ease, but it can break down if it cannot parse the input sentence.

Direct manipulation

- Dragging, selecting, opening, closing, zooming virtual objects
- Novices can learn how to interact very quickly, but you can't apply this to everything

Interface type

- **Interaction type**: Conceptually, the way that concepts and commands are represented.
- **Interface type**: The concrete means of facilitating the interaction, e.g. speech, menus, buttons

Prototyping

What is a prototype?

- Anything that demonstrates how the final product is going to work / be used
- Examples:
    - a series of screen sketches
    - a storyboard, i.e. a cartoon-like series of scenes
    - a wireframe / mockup
    - a video simulating the use of a system
    - chopsticks and rubber bands
    - a piece of software with limited functionality written in the target language or in another language
- It should NOT be finished.

- Try not to make a design that will SOLVE ALL THE PROBLEMS
- A prototype should aim to address one specific aspect; one specific problem within the whole. Make it manageable:

    - Good: A technology persuading you to take the stairs not the elevator, that talks to your fitbit and smartwatch
    - Bad: An ‘all round health app’ used for tracking running, walking, dieting, tracking progress, calorie counting and making you healthy
- Prototypes should be evocative, imaginative, malleable, but practical

Why do we prototype?

- Evaluation and feedback are central to interaction design
- Stakeholders can see, hold, interact with a prototype more easily than a document or a drawing
- Team members can communicate effectively
- You can test out ideas for yourself
- It encourages reflection: very important aspect of design
- Prototypes answer questions, and support designers in choosing between alternatives
- It’s much easier to change a prototype than a final design

What to look out for in prototyping

- You need to prototype the interaction and experience, not just the interface.
- If it seems like they’re having trouble performing a basic function, maybe you should redesign your prototype.
- The interface could be just fine, but there may be other problems, e.g. the user might think the visual design is too basic etc.

Low vs high fidelity prototyping

Low fidelity

- Uses a medium which is unlike the final medium, e.g. paper, cardboard
- Is quick, cheap and easily changed
- Examples:
    - sketches of screens, task sequences, etc
    - ‘post-it’ notes
    - storyboards
    - ‘Wizard-of-Oz’

- Another example is a *storyboard*.
- Often used with scenarios, bringing more detail, and a chance to role play.
- It is a series of sketches showing how a user might progress through a task using the device.
- Used early in design.

- The 'Wizard-of-Oz' prototype involves a hidden person pretending to be a computer, changing the fake system for the user to interact with.

- The "**facilitator**" provides the tasks, instructs the participants and takes notes
- The "**wizard**" is a hidden human who operates the interface
- User feedback = think aloud, retrospective or heuristic evaluation

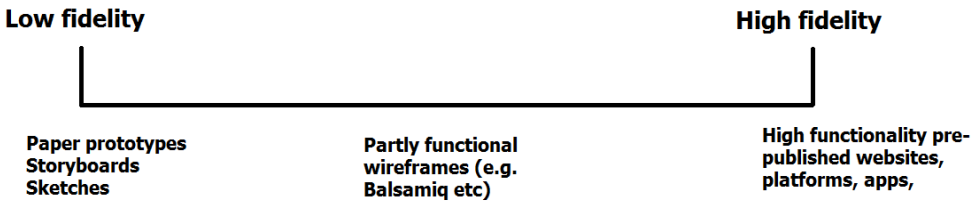
- Here's an example of a wireframe prototype made in Balsamiq:

- Advantages of low-fidelity:
  - Faster to iterate, also cheaper than fully functional prototypes
  - Creating multiple variations = easy
  - User-centred development
  - Feedback about a design straight away
- Disadvantages of low-fidelity:
  - Easy to get over-commit for tech in the design (i.e. technologies which are impossible to design)
  - Cannot simulate all system features

High fidelity

- Uses materials that you would expect to be in the final product
- Prototype looks more like the final system than a low-fidelity version
- High-fidelity prototypes can be developed by integrating existing hardware and software components
- Danger that users think they have a complete system and are less likely to give you useful input

Low vs High



Type	Advantages	Disadvantages
Low-fidelity prototype	Lower development cost Evaluates multiple design concepts Useful communication device Addresses screen layout issues Useful for identifying market requirements Proof of concept	Limited error checking Poor detailed specification to code to Facilitator-driven Limited utility after requirements established Limited usefulness for usability tests Navigational and flow limitations
High-fidelity prototype	Complete functionality Fully interactive User-driven Clearly defines navigational scheme Use for exploration and test Look and feel of final product Serves as a living specification Marketing and sales tool	More resource-intensive to develop Time-consuming to create Inefficient for proof-of-concept designs Not effective for requirements gathering

Table 11.3 Advantages and disadvantages of low- and high-fidelity prototypes

Personas

- Personas are characteristics that capture a certain group of people.
- They’re not hypothetical people, but they represent a group of real people.
- They have backgrounds, needs and frustrations that need to be solved.
- Take Ginnie, for example:

Accessibility

- Accessibility is all about who can use your products.
- This includes disabled people, people who can't see very well, people who can't read very well etc.
- There are lots of assistive technologies for this:
    - enlarging software
    - speech recognition
    - synthetic speech readback
    - refreshable braille display
    - scanner/OCR system
    - alternative keyboards
        - *ergonomic, one handed, large, small, switch scanning, on-screen*
    - alternative 'pointing' devices
        - *programmable or left handed mice, joysticks, trackballs, trackpads, eye & headpointing systems*

- Tips to make websites more accessible:
    - **Images & animations**: "alt" attribute to describe function
    - **Multimedia**: captions and descriptions of video.
    - **Hypertext links**: text that makes sense: avoid "click here."
    - **Page organisation**: headings, lists, CSS
    - **Graphs & charts**: Summarize
    - **Tables**: Make line-by-line reading sensible.

Terminology

- What's the difference?
- **Impairment**:
    - physical/sensory/cognitive
- **Disability**:
    - Effect of impairment on abilities
    - Person with a disability
- **Disabled**
    - By society ? (social model)
    - Disabled person

Why should I care

- You could become disabled! What will you do then? You'll have to implement assistive features to your products so that you can use them!

- It's also a morality thing; it's a good thing to do (or at least, it makes you look good).

- Economics? I don't know, it was on the slides. (Maybe larger customer base?)

- Legislation. That's right; it's illegal for you not to do it.
- Well, it's illegal for you to refuse...
- It's called the Disability Discrimination Act (DDA), and is now a part of the 2010 equality act.

Who else benefits

- This stuff also comes under aiding users using:
    - mobile devices
    - search engines

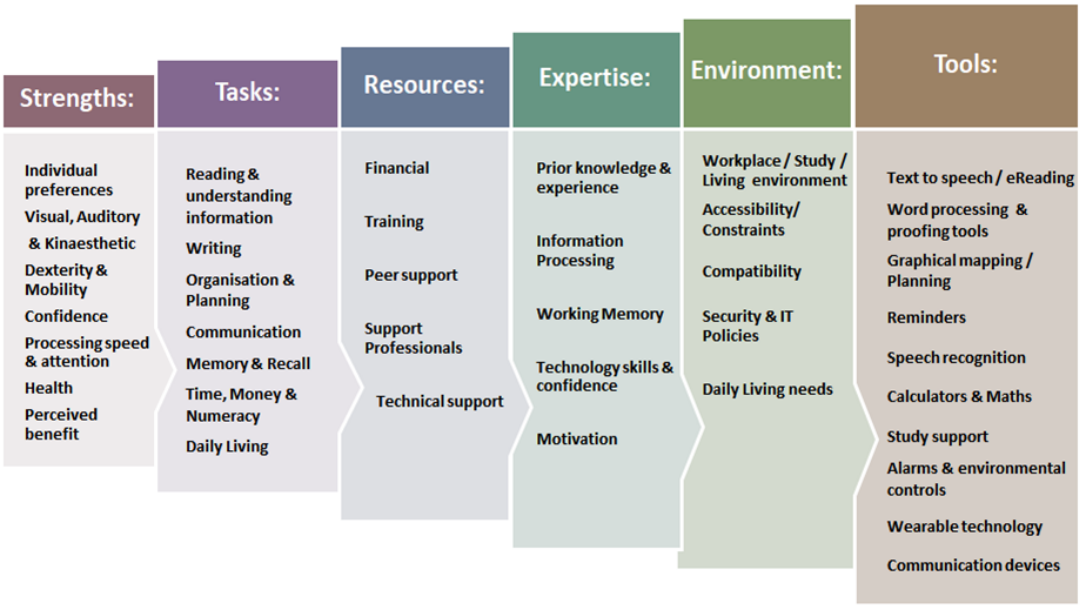
Ordinary people

- Sometimes it's not someone with a broken leg, but it's someone who's never used a computer before, or someone who has really slow internet.

- So if you design for 'extra-ordinary' people in ordinary situations, you can help ordinary people in 'extra-ordinary' situations.

STREET

- There's this thing you can use called STREET.
- Don't think disability; think STREET!
- Use this chart to pick the best design for your users!



- If you're struggling for ideas, check out what other people have done; have a look at that accessibility folder for your OS that you never go on! (e.g. Ease of Access Center, mouse pointer options, high contrast mode etc.)

Scenarios and personas

- **Scenarios** are stories describing a product achieving a specific goal.
- In this context, a **persona** is a character whom the story is about.

- These personas and scenarios can help with user centred design methodology, and help developers and designers notice things they wouldn't otherwise notice.

- Remember, they shouldn't be too personal or thought of as real people; that would scope the thought track and do more harm than good.

- To help you design for less-abled people, try following this: https://github.com/UKHomeOffice/posters/blob/master/accessibility/dos-donts/posters_en-UK/accessibility-posters-set.pdf

Cognition

- Cognition involves what the user is capable and not capable of doing.
- It also goes into detail about what goes on in the user's mind when using your product.

Cognition

Attention

- Attention means selecting things to concentrate on at a point in time from the mass of stimuli around us
- Nobody likes cluttered text. Keep things orderly and structured, so that attention is distributed in the correct order and is efficient in terms of information gain.

Perception

- How people process the information they're looking at.
- Weller (2004) found people took less time to locate items for information that was grouped, using whitespace and borders and stuff.

- Your designs should be as follows:
- **Icons** should enable users to readily distinguish their meaning
- **Bordering and spacing** are effective visual ways of grouping information
- **Sounds** should be audible and distinguishable
- **Speech output** should enable users to distinguish between the set of spoken words
- **Text** should be legible and distinguishable from the background
- **Tactile feedback** should allow users to recognize and distinguish different meanings

Memory

- Can users remember how to use your product?

- George Miller's (1956) theory of how much information people can remember states that people can remember around 5-9 things at a time, in other words, 7 ± 2.
- Therefore designers tend to:
    - Present only 7 options on a menu
    - Display only 7 icons on a tool bar
    - Have no more than 7 bullets in a list
    - Place only 7 items on a pull down menu
    - Place only 7 tabs on the top of a website page

- Don't overload users' memories with complicated procedures for carrying out tasks
- Design interfaces that promote recognition rather than recall
- Provide users with various ways of encoding information to help them remember
    - e.g. categories, colour, flagging, time stamping

Learning

- People find it harder to learn by reading; they prefer to learn by doing

- Design interfaces that encourage exploration

- Design interfaces that constrain and guide learners
- Dynamically linking concepts and representations can facilitate the learning of complex material

Communicative

- These are the main ways people get information from a screen.

- Speech-based menus and instructions should be short
- Heighten the pitch change of artificially generated speech voices (they are harder to understand than human voices)
- Provide opportunities for making text large on a screen

Problem-solving, planning, reasoning and decision-making product.

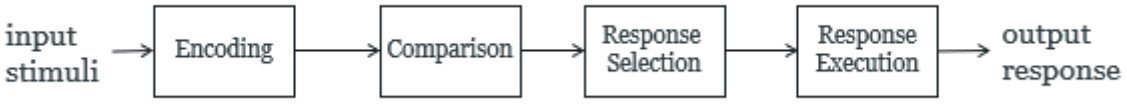
- All are reasoning tasks involving reflective cognition
    - e.g. thinking about what to do, what the options are, and the consequences
- Often involves conscious processes, discussion with others (or oneself), and the use of artefacts
    - e.g. maps, books, pen and paper
- May involve working through different scenarios and deciding which is the best option

Theoretical frameworks

- We create theoretical frameworks to get a better understanding of how users use our system, how they learn etc.
- There's plenty of different kinds of approaches to this:

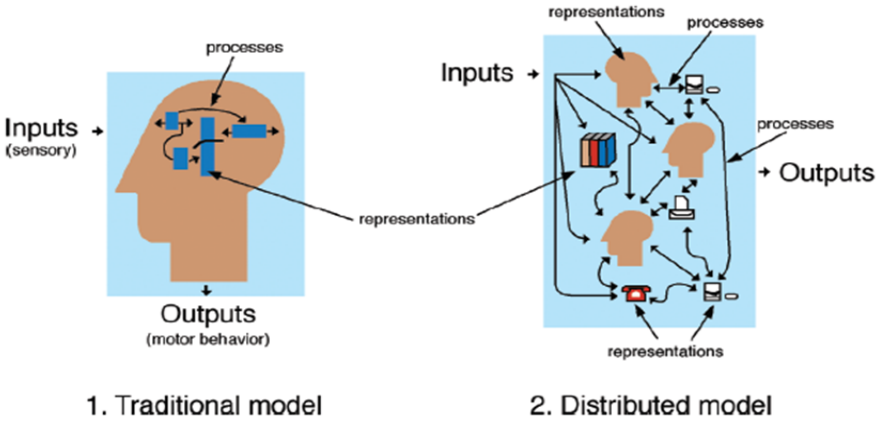
Information Processor Model

- Splits up human performance into 'stages'.
- You can use this to identify what processes are running through the user's mind when performing a task.
- You can also use this to calculate how long a user will take to react to something.



Distributed cognition

- You don't remember everything, do you?
- You look stuff up. Don't lie!
- This is what this theory is about.



1. Traditional model 2. Distributed model

- People get information from various sources, called ‘artefacts’.

External cognition

- Concerned with explaining how we interact with external representations (e.g. maps, notes, diagrams)
- What are the cognitive benefits and what processes involved
- How they extend our cognition
- What computer-based representations can we develop to help even more?

- Diaries, reminders, calendars, notes, shopping lists, to-do lists
  - written to remind us of what to do
- Post-its, piles, marked emails
  - where placed indicates priority of what to do
- External representations:
  - Remind us that we need to do something (e.g. to buy something for mother’s day)
  - Remind us of what to do (e.g. buy a card)
  - Remind us when to do something (e.g. send a card by a certain date)

Evaluation

- How do we know if what we made is good enough?
- I’ll tell you how: we evaluate it!

Inspections

- What better way to test a product than to ~~use it yourself~~ get experts to do it for you?

Heuristic evaluation

- Heuristic evaluation is a type of inspection.
- It’s where you test your product against a list of heuristics.
- There are two kinds:

- **Shneiderman's 8 Golden Rules:**

1. Strive for Consistency
2. Enable frequent users to use shortcuts
3. Offer informative feedback
4. Design dialog to yield closure
5. Offer simple error handling
6. Permit easy reversal of actions
7. Support internal locus of control
8. Reduce short-term memory load

- **Nielsen's Heuristics:**

1. Visibility of system status
2. Match between system and the real world
3. User control and freedom (undo)
4. Consistency and Standards (conventions)
5. Error prevention (eliminate error-prone conditions, get confirmation)
6. Recognition rather than recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help users recognize, diagnose and recover from errors
10. Help and documentation (easy to search, focussed on task, concrete)

- How do you use these?

1. Tell your experts what to do
2. Spend 1-2 hours using the product
3. Discuss findings, compare notes, prioritise issues and discuss solutions

- You would usually use heuristic evaluation when you're low on budget and have no time.

Predictive methods

- Or, you can use predictive methods. One of which is **Fitt's Law**.
- The average time taken to click something is proportional to the distance from the target, divided by the size: $\overline{T} \propto$ D/S
- Basically, it means **a button is easier to click if it's bigger and closer to the cursor**.

Experiments + Statistics 101

- You can also evaluate your product through experiments.
- Experiments allow you to predict the relationship between two or more variables.
- For example, you could test how likely people are willing to sign up if the register button is red.
- Remember, correlation does not imply causation!

- When designing experiments, there are three approaches:

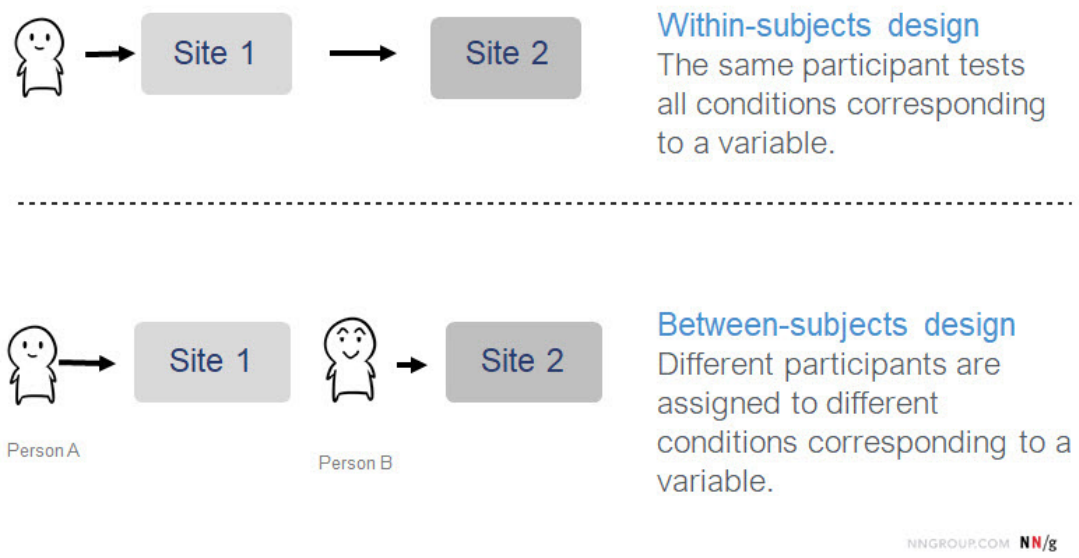
Between-subject design

- Different people test each condition, so that each person is only exposed to a single user interface.
- For example, if we wanted to compare two car-rental sites A and B, each participant could test a single car-rental site and book a car only on that site.

Within subjects design

- The same person tests all the conditions (i.e., all the user interfaces).
- For example, if we wanted to compare two car-rental sites A and B, Each participant could test both car-rental sites and book a car on each.

- Here's a really nice picture demonstrating the difference between between-subject and within-subject:



Pair-wise design

- Participants are matched up in pairs, usually based on expertise, gender etc.

- Citation for this topic

Types of evaluation

Controlled settings involving users

- This involves usability testing, experiments in laboratories and living labs.
- Basically, drag in some users and get them to use your product.

- Test conditions should be the same for each user.
- For example, give the user a list of things to do with your product, and log what they do / how they approach the task etc.

- Things to log could be:
    - Time to complete a task
    - Time to complete a task after a specified time away from the product
    - Number and type of errors per task
    - Number of errors per unit of time
    - Number of times online help and manuals accessed
    - Number of users making an error
    - Number of users successfully completing a task

- Methods of Logging could be:
    - Verbal Protocol: User speaks their thought processes aloud, and is encouraged to criticise the system.
        - Easy for the evaluator to read.
        - Provides unconsidered thoughts and criticisms.
    - Software Logging: Automated logging of user actions
        - Interaction Logging, Click-Tracking, Time-Stamped Key Presses
        - Easy for the evaluator
        - Data is accurate and quantitative

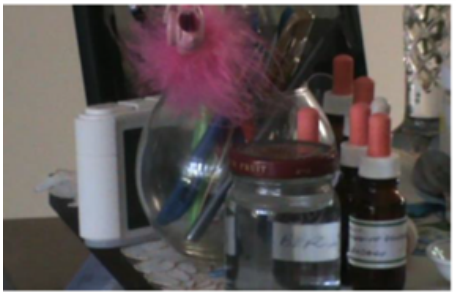
- Beware of the Hawthorne Effect!
- People act differently when they’re being watched.
- Therefore, field study may be more appropriate.

Natural settings involving users

- This involves field studies and in-the-wild studies to see how the product is used in the real world.
- Basically, get a user to use your product in the real world instead of a weird room with weird people looking at them weirdly and writing weird things down.
- You can notice things that you wouldn’t notice in controlled settings.

- For example, let’s say you designed this strange white thing.

- Would you have known that users would hide it behind stuff?

- You wouldn't know that unless you used natural settings for your evaluations.
- Also, don't walk up to them with a clipboard and a lab coat. Just throw on your shirt and jeans and talk to them informally; it'll feel more natural (unless they grew up in a lab).

Settings not involving users

- Cognitive Walkthrough is an example. It focuses on the ease of learning for the user.
    - Cognitive Walkthrough uses experts - not users. It's like Inspections.
    - Experts work through a series of tasks to understand the user process.
    - Experts also ask questions about the user and the design.
        - Will the user have sufficient evidence to make the correct action?
    - Pros of Cognitive Walkthrough: Quick usability testing, testing improvements of an existing product
    - Cons of Cognitive Walkthrough: Uses experts - they may be hard to find, or expensive.
- Also involves methods like unit testing and heuristic evaluation.

Values & Value Sensitive Design

- Values refers to everything that we care about.
- So what do we care about?
    - Family?
    - Friends?
    - Money?
    - The release of Kingdom Hearts 3 on 25th January 2019?
    - JoJo's Bizarre Adventure?
    - Sword Art Online? (jk nobody cares about that)

- Basically, everyone has values.
- Remember, values are not the same as needs.
- Needs are things that all animals require, like food, water, shelter, sex (except if you're a Computer Science student)
- Values are things we like but don't need to survive.

Types of values

- There are two types of values: **universal** and **cultural**.
- Universal values are values that everyone usually has, like Achievement, Tradition, Conformity etc.
- Cultural values are values localised within a culture, e.g. Spirituality and Democracy.

- There are values that are a lot more closely entwined to Computer Science, like Health and Intimacy vs Security and Privacy.

Why consider values

- For the same reason why people use DuckDuckGo instead of Google.
- If you don't consider values, you'll miss what people really want.(like Sonic Team)

- Values can also teach you about why people want to use your product.
- **Motivational** values are known to the user and are the reason why they do things, e.g. people cycle because it's good for their health.
- There are other values that may be less obvious, e.g. people cycle and discover that it offers a new social opportunity.

Research & Design Ethics

- Is what you're doing ethically right or wrong?

Milgram experiment: The Zapping Experiment

- Basically people were pretended to be zapped, and people got upset and scientists studied it.
- But they made people so upset that they established ethical bodies to stop people from doing this again.

ACM Code of Ethics and Professional Conduct

- Here is a code of ethics. Follow these or get in trouble!

1.1 Contribute to society and human well-being.
1.2 Avoid harm to others.
1.3 Be honest and trustworthy.
1.4 Be fair and take action not to discriminate.
1.5 Honor property rights including copyrights and patent.
1.6 Give proper credit for intellectual property.
1.7 Respect the privacy of others.
1.8 Honour confidentiality.

2.1 Strive for quality, effectiveness and dignity at work.
2.2 Acquire and maintain professional competence.
2.3 Respect existing laws pertaining to professional work.
2.4 Accept and provide appropriate professional review.
2.5 Evaluate computer systems and their impacts and risks.
2.6 Honor contracts, agreements, and responsibilities.
2.7 Improve public view of computing and its consequences.
2.8 Access computing and resources only when authorized

3.1 Articulate social responsibilities of colleagues and encourage full acceptance of those responsibilities.
3.2 Manage resources to design and build systems that enhance the quality of working life.
3.3 Support good use of computing & communication resources.
3.4 Ensure that users have their needs assessed during the design of requirements; and that the system is validated to meet these.
3.5 Support policies that protect the dignity of users and others
3.6 Create opportunities for members of the organization to learn the principles and limitations of computer systems.

Ethics in Interaction Design

Avoiding bias

- Order & Instructions
- Within-groups comparative studies: counterbalanced order
    - Possible? Not always or not easily
- Mood factors (e.g. weather & mood)
- Reward consistently before or after (give people chocolate to set them in a good mood)
- Experimenter attitude (even unconscious)
    - Experimenter blind to hypothesis
    - Written instructions

Recruiting participants

- You should recruit participants where your target audience is.
- It should be very general, so no cherry-picking!

- To motivate participants, give them chocolate or something.
- Make sure motivation is consistent and valid.

- How do you recruit participants?
    - Generic adverts
    - Generic + screening or group assignment
    - Snowball sampling: word of mouth based on criteria

Presenting findings

- Only make claims that your data can support!
- Use graphical representations, like graphs and stuff.

Ethics in FEPS (ERGO2)

- What's FEPS and ERGO2?
- FEPS stands for Faculty of Engineering and Physical Sciences
- ERGO2 is a submission system used to hand in questionnaires and stuff.

- First of all, the ethical body looks at the application form and checks if everything is alright.
- It identifies the participants and what the participants will go through.

- Then, they identify what group the participants are from and what the relation is between investigator and participant.
- After that, they find out how the participants will be approached and how you will obtain the information needed to approach them.
- Following that, they find out how the participants are selected.
- Afterwards, they find out when and how participants will be given Participant Information:
    - indicates how long participants have to decide whether to take part;
    - indicates how informed consent will be obtained;
    - indicates when and how participants are accepted into the study.
- Participant information and consent are then analysed.

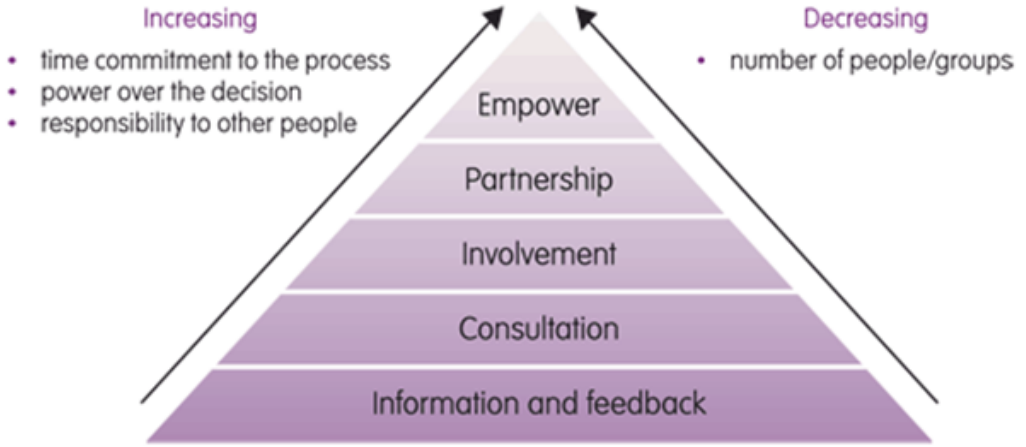
- What happens during the study is also considered. It's split up into three categories, defined by severity:
- **L - Low risk**
    - The one funding this study is a commercial organisation.
    - There's restrictions on the study, like publication restrictions
    - Participants are accessed through a proxy (e.g. students through a school, patients through a hospital etc.)
- **M - Moderate risk**
    - Not all data is anonymous
    - The participant is induced (persuaded)
    - The study is intrusive
    - There is some risk of harm
    - The true purpose of the study isn't told to all participants, so they are being deceived.
    - Participants may be minors or otherwise have diminished capacity to provide informed consent.
    - Sensitive data is collected / processed.
- **H - High risk**

- Invasive equipment, material(s), or process(es) are involved
- Some participants are unable to withdraw at any time and for any reason while retaining their inducement (if any)
- Animals are involved
- Human tissue is involved
- Biological samples are involved

Participatory Design

- Users are not developers / designers; they can't articulate exactly what they want.
- Users don't know what they want, but they're the best we have.
- Why not just include them in the design process?
- That's what participatory design is!

- Interviews, focus groups, prototyping (low fidelity and high fidelity prototypes)
- Gives people a genuine "say". Not just consultation, but active participation in the design process.



- The benefits of participatory design are:
  - You don't waste time implementing something the user didn't mean
  - You're more likely to create something the user will need more

Persuasive Design & Behaviour

- This topic is all about behaviour change theory and how people act.
- For example, stopping someone from smoking, enforcing better eating habits etc.
- In this topic, we're going to learn how to create an 'intervention method'.
- An 'intervention method' is a way of stopping / enforcing a behaviour / habit within someone.
- There are 5 steps of intervention development:

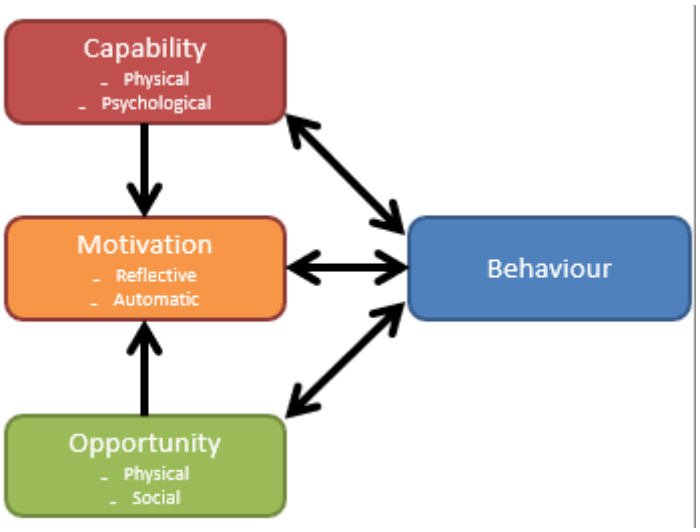
Step 1: Behaviour identification

- Identify your behaviour(s) and your target group.
- Be specific: Do you want to encourage a behaviour (better eating habits) or stop one (stop smoking)?
- Be targeted: The things that may influence one group may not influence another (in other words, have a target audience)

Step 2: Change identification

- Identify what needs to change for your behaviour to occur or stop.
- What do you actually need to change?

- There are behaviour change theories to help you locate this.
- One of which is the COM-B system:



- **Capability**: People must have the physical strength, knowledge, skills, stamina etc. to perform the behaviour
- **Motivation**: People must be more highly motivated to do the behaviour at the relevant time than not to do the behaviour, or to engage in a competing behaviour
- **Opportunity**: People must have a conducive physical and social environment: e.g. it must be physically accessible, affordable, socially acceptable and there must be sufficient time

- How do you identify what needs to change so you can make a COM-B model?
- Interviews or focus groups (qualitative):
    - Ask open questions about behaviour: “Tell me about when you last tried to give up smoking? What things make it easier/harder to stop smoking?”
- Self-report questionnaires (quantitative):
    - COM-B Self Evaluation Questionnaire (Michie et al. 2014b) – circle things that it would take for them to do the behaviour (e.g ‘have more time to do it’)

- Review the literature (systematic review, scoping review) on influences on behaviour

Step 3: Intervention content identification

- Identify intervention content.
- How are you going to change things?
- There are two ways to think of this:

Behaviour Change Techniques

- There are plenty of techniques:
    - Knowledge and skills (fulfils Capability)
    - Pros/cons, rewards and punishments (fulfils Motivation)
    - Physical & social environment (fulfils Opportunity)
    - Self-monitoring of behaviour and outcome (like an app that tells you how much weight you've lost)
    - Stories and quotes

Implementation intention

- This one is a bit more explicit.
- Basically, you list a 'goal' along with an 'implementation intention'.
- The 'goal' is what you want to achieve, and the 'implementation intention' is how you want to achieve it.

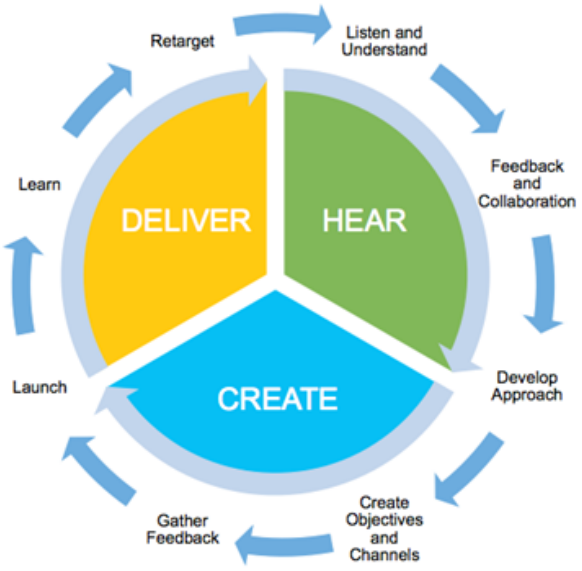
- Here's a stupid example:
- **Goal**: I want to stop smoking
- **Implementation intention**: If I feel like smoking, I'll remember how I won't be able to watch my kids graduate if I continue smoking and die of lung cancer.

Step 4: Understanding perspective

- Understand and accommodate the perspective of your target users (the Person-Based Approach to intervention development)
- You know what you want to do; now it's time to make it a bit more personal.

- Carry out iterative qualitative research with a wide range of people from the target user populations
- Identify 'guiding principles' that inform intervention development to meet needs.

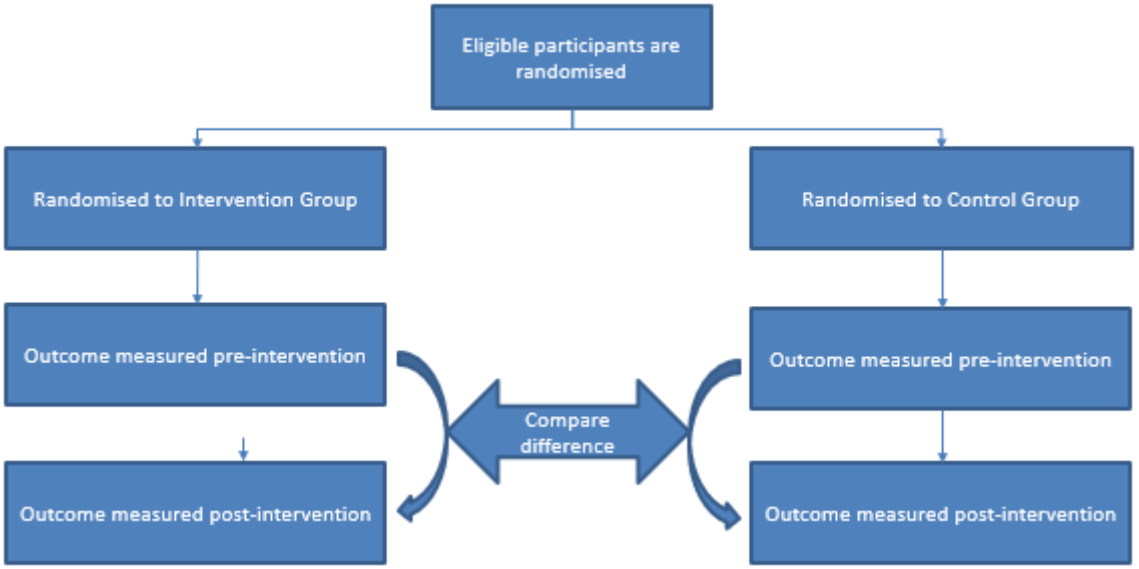
- Basically, talk to your target audience!
- Refine your methods to be more personal to your target audience.



- This helps the developer to:
  - Select theory and evidence-based techniques that are most acceptable, salient, feasible for target population
  - Avoid or modify intervention characteristics that are disliked, impractical, intrusive
  - Suggest the need for new intervention characteristics, hence not yet evidence-based

Step 5: Evaluation

- Evaluate it!
- How do you evaluate it?
- Randomised controlled trials, that's how!



- So what happens in a randomised controlled trial?

1. **Use a control group** (e.g. usual care, no intervention, another intervention) – to prove the changes are down to the intervention and not due to chance
2. **Treat both groups the same** – so you know any changes are down to the intervention, not any other differences
3. **Randomisation** – to ensure that participants have an equal chance of being allocated to either group
4. **Measure outcomes before and after the intervention** - to show changes are down to the intervention
5. **Blinding of participants and assessors of outcome** – to avoid their knowledge of allocation from biasing their results (e.g. by using a placebo)
    - However, this can be difficult in behaviour change interventions
    - Using a 'minimum credible intervention' (e.g. brief advice) can overcome this

- Through this, we measure health outcomes, behaviour outcomes etc.
- We can also measure how effective our intervention method is.

TL;DR 

- Welcome to the TL;DR section, where you get more information for less effort!
- Remember, this is all a summary to jog your memory.
- I suggest you scroll up and read the real notes at least once. Please don't rely solely on the TL;DR section for the exam (or do; it's up to you)!

HCI theory

- Interaction **with** technology => we interact directly with the technology by doing some physical action.
- Interaction **through** technology => we use the technology as a tool to communicate with some other person/service.

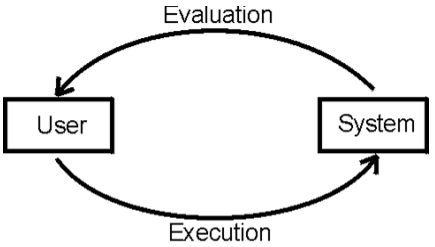
- Scope your interface on different areas of the system:
    - Hardware
    - Programming task
    - Terminal
    - Interaction dialogue
    - Work setting

- Three theories for designing an interface:
    - Classical (psychology and predictive methods)
    - Modern (using analytic tools)
    - Contemporary (like modern, but uses culture)

- Affordances are uses / services that are offered by the system.
- Types:
    - Instrumental

    - Handling
    - Effecter
    - Aggregation
    - Learning
    - Maintenance

- Norman Model of Interaction:
- Execution: doing actions, changing the state of the system, establishing the goal
- Evaluation: what the system state means to the user

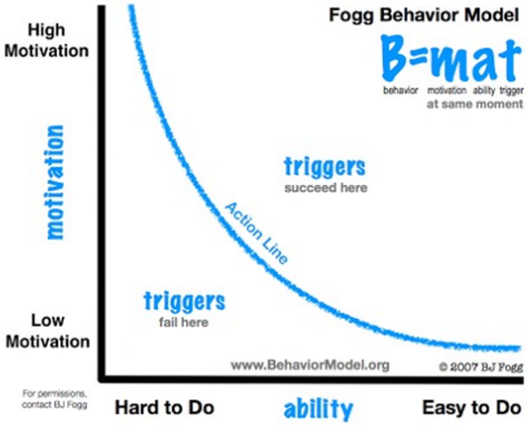


- Situated actions: people do things because of the context they're in.

- Ortony's model of emotional design:
- Visceral: feel / sound / look good
- Behavioural: intuitiveness, like buttons, check boxes, switches etc.
- Reflective: high-level things that people have to figure out a little, like a light in the sky that shows the amount of pollution emitted

- Distributed cognition means that people use other resources to do things; it's not just what they remember. Those things are "artefacts" and it all forms one big "cognition".

- Fogg's behaviour model:
- **Motivation**, **ability** and **trigger** are factors of whether behaviour occurs.



Data Gathering

- Gather data by:
    - Interviews

    - Questionnaires
    - Observations
    - Cultural probes
    - Literature reviews

- **Research** questions are questions like “What do people understand about their home energy use?”
- **Instrument** questions are questions like “What are some things you know about “energy use””?

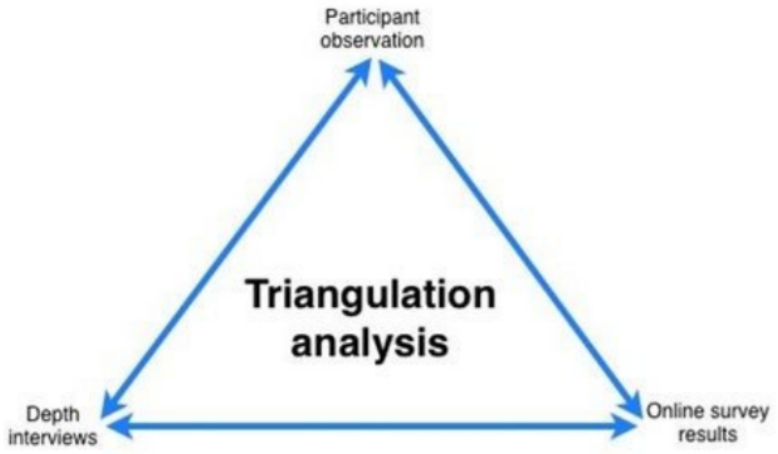
- Key steps in data gathering:
    - Setting goals
    - Identify participants
    - Engage participants

- Qualitative research => **breadth** of experience
- Quantitative research => **representative** of population of interest

- Types of samples:
    - Stratified
    - Random
    - Breadth
    - Convenience
    - Snowball

- Pilot study: small study that you do before main study.

- Triangulation: combining data from different data gathering methods.



- Types of interviews:
    - Unstructured - No script
    - Structured - Stick to the script
    - Semi-structured - Loosely stick to the script
    - Focus group - Group interview

- Types of questions:
  - Closed - discrete set of possible answers
  - Open - answer with a sentence

- Avoid:
  - long questions
  - jargon
  - leading questions
  - assumptions
  - basically, be professional and don't be stupid

- Usual structure of an interview:
  - Intro
  - Warm up
  - Main body
  - Cool off
  - Closure

- When doing questionnaires:
  - Make purpose clear
  - Promise anonymity if you can
  - Offer short version
  - Include return envelope (for offline questionnaires)
  - Provide incentive

- Observation: where you go to a place to observe a working system
- Two types:
  - Direct => directly observe what's going on
  - Indirect => web analytics, click tracking, screen recorder etc.

- Hybrid methods:
  - Think-aloud => Ask someone to explain what they're doing while they're using a system
  - Wizard-of-Oz => Someone uses a prototype system, but someone else is controlling it
  - Speculative design => Propose possible design options to people to prompt discussion

- Experiments: test a hypothesis by doing something

Data Analysis

- There are 5 measures of quantitative data:
  - Mean
  - Median

    - Mode
    - Range
    - Standard deviation

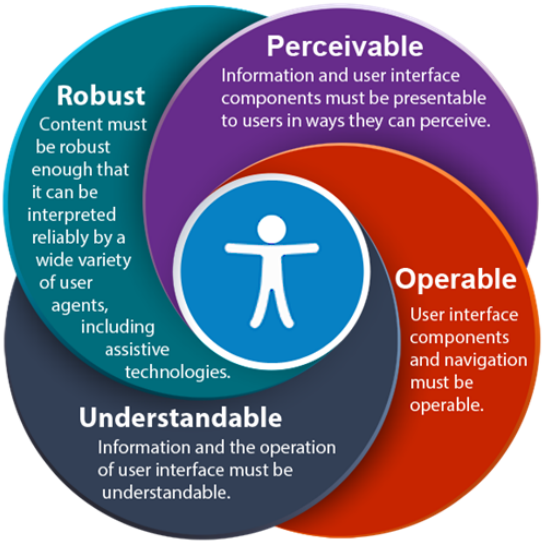
- Representations:
    - Line charts
    - Bar charts
    - Frequency graphs

- Coding: labelling parts of qualitative data

Usability, UX and Accessibility

- Usability: how easy the user interfaces are to use
- UX (User Experience): encompasses all interactions of the end user with the company, services and products.
- Accessibility: usability of a product or service by people with the widest range of capabilities

- Abide by these four principles:



- Universal design:
    - Equitable
    - Flexible
    - Simple and intuitive
    - Perceptible information
    - Tolerance for error
    - Low physical effort

Interfaces

- Take into account:
  - Comfort
  - Hygiene
  - Ease of wear
  - Usability

- 1980's:
  - Command line
  - WIMP

- 1990's:
  - Web
  - Speech
  - Pen, gesture, touch

- 2000's:
  - Mobile
  - Wearable
  - Shareable

- 2xxx's:
  - Virtual, augmented & mixed reality
  - Robotics

Qualitative Methods

- Contextual inquiry: establishing the context of your product

- How to perform contextual inquiry:
  - Interviews
  - Ethnography
  - Direct observation
  - Diary studies
  - Cultural probes + technology probes

Qualitative Analysis

- Traditional experimental theory: existing theory explains someone's behaviour

- Grounded theory: come up with your own theory for why someone does something

- Thematic analysis: an approach to grounded theory, also called coding

- Open coding: Identify categories and colour code
- Axial coding: Draw out conclusions and link behaviours together

- Iterative process of coding:
    1. Everyone independently codes the transcripts
    2. Everyone comes together and compares themes
    3. Do axial coding as a group

Designing for the Web

- KISS: Keep It Simple, Stupid

- Goals for designing:
    - Simplicity
    - Feedback
    - Speed
    - Ease of use

- Above and below the fold:
    - **Above**: What you first see
    - **Below**: What you see when you scroll down

- Rule of thirds: split your screen into thirds and position your elements along the lines / on the intersections

- Responsive design: design changes shape
- Break-point design: design is picked according to device

- Add semantics to your site so services like Google know what your pages are about

- Web page elements to pick carefully and meaningfully:
    - Fonts
    - Words
    - Colours

- What type of feedback is most appropriate for your website?
    - Video?
    - Audio?
    - Plain text?

- Use AJAX to deliver content asynchronously.

Metaphors, Models & Assumptions

- Conceptual model: an account of how a system works

- Why make one:
    - Orientate
    - Open-mind
    - Common ground

- Components of a conceptual model:
    - Metaphors and analogies
    - Concepts that people are exposed to
    - Relationships and mappings between concepts

- Interface metaphors: conceptualises a task so people can understand
- Material metaphors: draws parallels between interface and IRL objects

- Interaction type: how do you interact with the system?
- Interface type: concrete means of facilitating the interaction

Prototyping

- Prototype: unfinished product that shows how the final product will work

- We do this for feedback and evaluation

- Low fidelity: quick, cheap and easily changed; lower level
- High fidelity: looks more like final system; higher level

- Persona: characteristics of a certain group of people

Accessibility

- Accessibility: who can use your products?

- Assistive technologies:
    - enlarging software
    - speech recognition
    - synthetic speech readback
    - refreshable braille display
    - scanner / OCR system
    - alternative keyboards
    - alternative ‘pointing’ devices

- Making websites more accessible:
    - Images & animations
    - Multimedia
    - Hypertext links
    - Page organisation
    - Graphs & charts

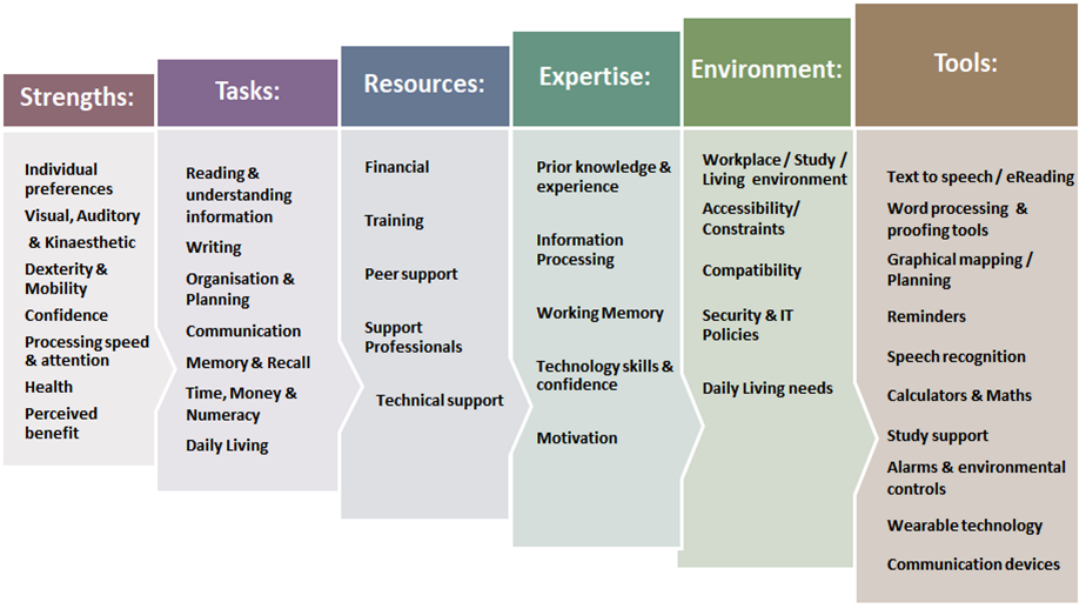
    - Tables

- Impairment: physical / sensory / cognitive
- Disability: effect of impairment on abilities
- Disabled: social model

- Disability Discrimination Act (DDA) says it's illegal for you to refuse to offer features to your system for disabled people.

- Also think of people who have never used a computer before, or someone with slow internet.

- STREET: a chart for picking the best design for users



- Also can use scenarios and personas to help

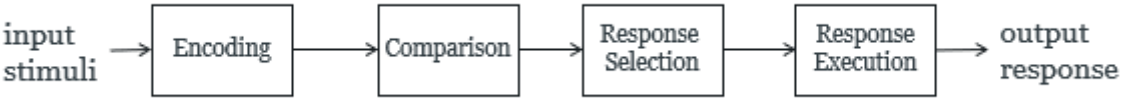
Cognition

- Cognition: involves what the user is capable of doing

- **Attention**: keep things orderly and structured
- **Perception**: make elements intuitive and use whitespace
- **Memory**: don't put too many items on a menu (put around 7, give or take 2)
- **Learning**: design interfaces that encourage exploration
- **Reading, speaking and listening**: keep instructions short

- Theoretical framework: theories about how users understand systems

- Information processor model:



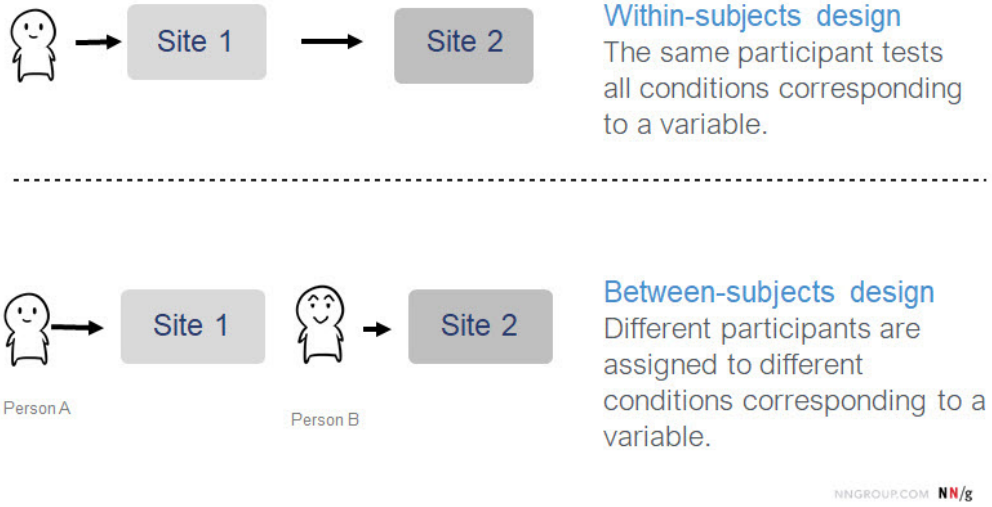
- Distributed cognition: people get information from sources, called ‘artefacts’

- External cognition: how do we interact with things like maps, notes, diagrams etc.?

Evaluation

- Inspections: experts test your product

- Experimental design:
  - Between-subject design — *different people doing different things*
  - Within-subject design — *same people doing the same things*
  - Pair-wise design — *matching people up based on attributes*



- Heuristic evaluation: a type of inspection where your product is tested against a list of heuristics

- **Shneiderman’s 8 Golden Rules:**

1. Strive for Consistency
2. Enable frequent users to use shortcuts
3. Offer informative feedback
4. Design dialog to yield closure
5. Offer simple error handling
6. Permit easy reversal of actions
7. Support internal locus of control
8. Reduce short-term memory load

- **Nielsen's Heuristics:**

1. Visibility of system status
2. Match between system and the real world
3. User control and freedom (undo)
4. Consistency and Standards (conventions)
5. Error prevention (eliminate error-prone conditions, get confirmation)
6. Recognition rather than recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help users recognize, diagnose and recover from errors
10. Help and documentation (easy to search, focused on task, concrete)

- Fitt's Law: a type of predictive method that states that the average time taken to click something is proportional to the distance from the target, divided by the size
    - *The longer the distance to the target, the longer it'll take to click it*
    - *The bigger the size of the target, the shorter it'll take to click it*

- Types of evaluation:
    - Controlled settings involving users
    - Natural settings involving users
    - Settings not involving users

Values & Value Sensitive Design

- Value: things we like that are important to us, but don't need to survive

- Types of values:
    - **Universal**: everyone has them
    - **Cultural**: localised within your culture

- Motivational values: values known to the user and are the reason why they do things
- Other values: values users might not know until they do things

Research & Design Ethics

- Milgram experiment: he made people zap other people but they weren't really zapped

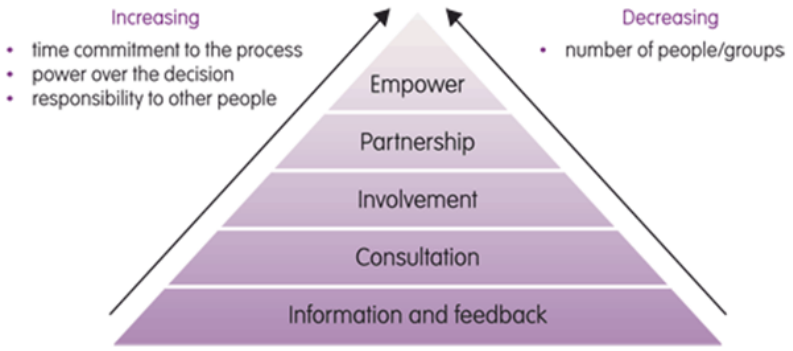
- ACM Code of Ethics and Professional Conduct: a list of ethics that one should follow

- How to apply ethics in Interaction Design:
    - Avoid bias
    - Recruit participants in your target audience and no cherry picking
    - Only make claims that your data can support

- **ERGO2 low risk**:
    - Restrictions on study
    - Participants are accessed through proxy
    - Funding from commercial organisation
- **ERGO2 moderate risk**:
    - Participant is induced
    - Sensitive data is collected / processed and not all of it is anonymous
    - Generally quite shady
- **ERGO2 high risk**:
    - Invasive equipment
    - Participants are unable to withdraw
    - Animal / human tissue is involved
    - Very weird and suspicious

Participatory Design

- Engage users in the design process



Persuasive Design & Behaviour

- Intervention development: stopping / enforcing a behaviour / habit

- Steps to intervention development:
    1. Behaviour identification
    2. Change identification
    3. Intervention content identification
    4. Understanding perspective
    5. Evaluation