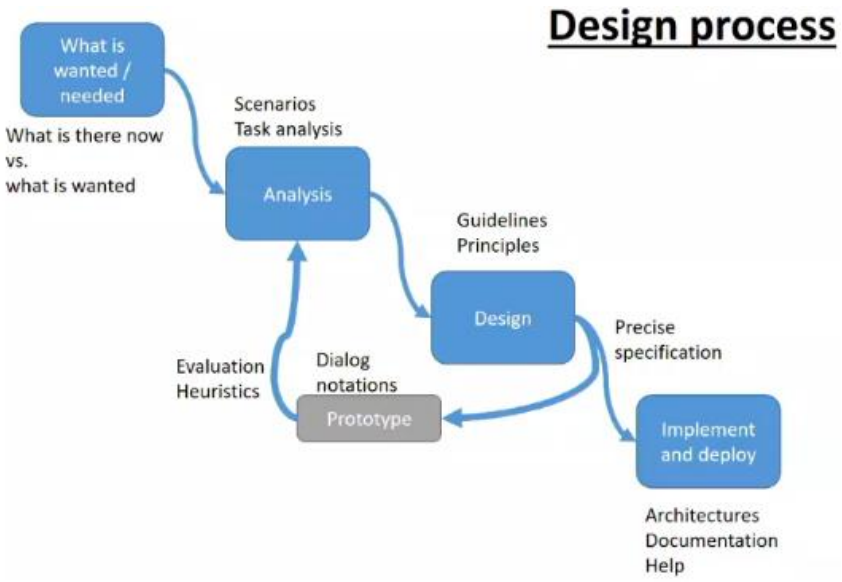
HCI – Summary



TPS – Think Pair Share

Introduction

Design Process

1. The one we discuss
    1. Planning, Scoping, and Definition
    2. Exploration, Synthesis, and Design Implications
    3. Concept Generation
    4. Evaluation, Refinement, and Production
    5. Launch & Monitor
2. There's also the double diamond

Static Analysis

3. Breaks an app into a control flow diagram
4. Human compute interaction challenge: How to convey privacy (data usage) to the user
    - Flow diagrams is a possibility
    - Most people don't understand permissions

Defining Problems

- Central to "What is wanted / needed"
- Human Computer Interaction is not about the UI it's about the interaction of the user with technology

Problems

- Undesirable situations
- User Groups
    - Only bad for some people; So who has the problem?
- Consequences
    - What bad things could happen if this problem keeps happening?
    - How bad are they?
- Causes
    - What is causing the problem? – There could be many

- Example: **Many people are missing the busses**
    - The problem is directly related to the cause of it to exist
    - Is it the bus schedule which should be updated?
    - Is it that the alarm in the morning doesn't ring?
- Ask the users what is the problem -> fastest way to find the problem
- Techniques to learn the problem
    - Interviews with users
    - Interviews with experts
    - Contextual Inquiries
    - Surveys
    - Focus Groups
    - Reading Background Literature
    - Diary Studies
    - AEIOU
    - Artifact Analysis

Interviews

- Used for what is wanted / needed as well as Analysis (how is the user using the system right now?)

Unstructured

- Rich data; no possibility to replicate; Horribly Structured
- When to use it
    - Best when little understanding of the topic being discussed
    - Useful when talking with a client about the project
- Pros
    - Highly flexible, participant does most of the talking
- Cons
    - No planning means high likelihood of missing out on data
    - Challenging to identify what exactly to follow up on in real time
    - Data is challenging to analyze
- Example:
    - Buses for sight impaired people

Semi-structured

- Somewhat comparable; Possible to replicate
- When to use it
    - When we can predict key areas
    - Possibly as the result from an earlier (unstructured) interview
- Pros
    - Loose script to keep track of the key topics
    - Possible to somewhat replicate between interviews
    - Data is structured by topic
- Cons
    - Interview is more topic-constrained than unconstrained, may miss key ideas because they are not in the script
    - Follow-up possible, but more time limited
- Example:

    - Why don’t people update their software

Structured

- More data over all; less new data; perfectly structured
- Almost like a survey
- When to use it
    - When we know our topic and we can predict common options
    - When we want structured data
    - Not trying to find what problems there are but how common they are
    - Can be executed by anyone
- Pros
    - Strong Script. Very clear questions
    - Easy to replicate between participants and interviewees
    - Resulting data is very structured and easy to analyze
- Cons
    - Inflexible
    - Difficult to identify if we have the correct questions/answers
- Example: Phishing Links

Conducting an interview

Overview

- Explain what the research is about
- What the purpose of the interview is
- That this is not an evaluation of the participant, you are here to learn from them
- While it’s not possible to get unbiased results from people, if they know what the interview is for, they don’t try to manipulate the answers they give just to get the outcome they would like to get.

Notification and consent

- **Also a written form of this**
- Make sure to tell the interviewees who will see the data collected (e.g. boss)
- Clearly state what kinds of data you will be collecting
- Show them any recording equipment
- Explain how that information will be used and if it might appear publicly
- Obtain clear consent from the participant – written or formal

Proceedings

- Simple questions
    - particularly at the start in order to ease them into the interview
- Main Interview
    - Focus of interviews is on the interviewees
    - Avoid leading questions
- Thank the participant
    - Ask further questions
- Questions
    - Depends on goals
    - Clear & unambiguous
    - Do **not** ask people to design for you

Types of Studies

Diary Studies

- Ask people to record events as they happen
    - Diary
    - App which reminds them of that
- When to use
    - Rare events
    - Easily Forgotten
    - Actual frequency important (e.g. how often do your users do things)
- Why **not** to use this
    - Study changes behavior

Contextual Inquiries

- Similar to interview but done in the "context" (where the problem actually arises)
- Starting point of **contextual design**
    - Has many more points than our design process
- Leads to better interaction with the participants (working together)
- Pros
    - Rich data – structured / unstructured (video, text, recordings)
    - Get to see the space where people usually interact with your tech
    - Opportunity to identify obvious things that users don't
        - Automatic for most users; part of their every-day life
    - Follow-up questions can be immediate and intuitively given by the context the interview is taking place in
- Cons
    - More involved
    - Less structured data
        - Difficult to compare participants as they have different contexts
    - May require special permission to visit and record
    - Limited number of users
    - **We assume we know from the context**
        - Example: Do we know why people have Laptop & Tablet & Smartphone … etc.
- Principle: People are experts at what they do – but are unable to articulate their own work practice
- Examples: Backing-up data in the Library; Order system, participant calling stock people; Backpack content of students **TPS**
- When to use
    - When we think the environment is impacting on how users interact with our tech

Storyboards

- Series of sketches (**have to be low-fidelity**) showing how a user might interact with tech or progress through task. Used to express your ideas to others, go through your ideas, get fast feedback. Allow to share concepts (problem, idea, anti-design).
- Draw something up and ask someone if they can see themselves in that scenario
- Includes actors and a fictive story behind it. Different to paper prototyping
- Very fast development

- Don’t only express the problem: use anti-scenarios (what would be without the tech; misuse of tech), create new scenarios from insights found in storyboard.
- Poorly drawn storyboards are actually better to get feedback
    - participants clearly see that they don’t have a final product in front of them
    - Get high level feedback
    - If it would be neater – we get **different** feedback (shapes, colors, etc)
- Useful in early design stages
    - In focus groups, with customers, with potential users, with client / boss
- Actually helps to think through the design:
    - Forces designer to step through the app (and find flaws based on participants feedback)
- Often used with scenarios
    - Can actually also be a drawing which includes the UI as a component of the scenario
- Pros
    - Can be on paper (DIY)
    - Makes you think through the process of how something will be used and identify features
- Cons
    - Rough sketches, not everything can go in (somewhat also the positive part of the whole thing)
    - Limited in scope, impractical to use on a whole project
- Process
    - Identify app requirements (what should the user be able to do with it)
    - Create a rough outline

Design Fictions

- Work well with storyboards
- Make a story around the storyboard / scenario
- Similar benefits as storyboard but focuses more on the actual users and are text based
- Use when
    - Design is not yet clear, and we just have an idea of what a user could need / use

Card Sorting

- Take several ideas, concepts, or things to put them on (physical) cards. Ask users to sort the cards and understanding how they group concepts.
- Helps to understand how people put things into groups naturally
- Usually with follow-up interview
- Pros
    - Easy to explain to participants
    - Outcome shows how participants think about concepts
- Cons
    - Limited in scale
    - We need to know what we want to be grouped
    - Limited to things that make sense when grouped / laid out spatially
- When to use it
    -
- Example:
    - ITO Handbook; How could we sort information in order for users to easily find what they need

        - Users **find sorting and give outcome labels**
    - Find the different definitions of a term
        - Users give **association and outcome labels are given**

Artifact analysis

- Looking at the “things” people leave around in the world in order to understand a problem
- When to use
    - Physical Spaces
    - Tasks involving artifacts
        - i.e. specific software
    - Interactions generate artifacts
        - E.g. emails, posts, etc.
- Why **not** to use artifact analysis
    - There are no meaningful artifacts
    - It’s faster to learn the information another way (this method can take some time)

Design Patterns

- Don’t re-invent the wheel, use design patterns which are already heavily used and re-use them
- Structured like a receipt.
- UI Pattern Card deck
- Pros
    - Learn from others’ mistakes
    - Good when not sure on how to design certain components of the UI
    - Saves time
- Cons
    - Only common things have patterns
    - Patterns are not one-size-fits-all

Think Aloud

- Let the user clearly speak aloud their thought and action process when interacting with the design
- Rule of fist: With 5 participants we can fins approximately 80% of the design issues
- Can be very versatile, long / short, detailed or minimal, planned or ad-hoc
- Pros
    - Get a sense of what the user is trying to use
    - Very detailed information
- Cons
    - Small sample size (lots of data, especially if recording and then transcribing)
        - This is a big problem for **generalizability / external validity**
    - Talking aloud changes users’ perception of the design and their actions
        - Think of implementing timing for tasks such that users don’t spend too much time on specific sub tasks
- Typically scripted
- Everything you say to the participants will change their behavior
- Typical Session
    - Tell participants what the session will involve like
        - How long the session will approx. last
        - What kind of data will be recorded (**informed consent**)

        - Train them in think aloud (do a test session) **this is important**
            - All users should be prepared to do the same things (for comparability)
        - Ask them to accomplish several tasks previously written down, reading aloud each task before starting it
        - End by thanking them and offering to answer any questions they may have
- Have to record
    - Tasks and subtasks the user engages in
    - Any critical issues they have
    - Any unexpected behaviors they engage in
- **Analysis**
    - Task analysis
    - Critical Incident Analysis
        - Discovered issues which triggered strong feelings or frustration in the participant. For negative ones keep track why they occurred. They could also be positive! Keep those design aspects.
- Easy but
    - Wording is important (changes behavior of the participants)
        - Read from script / memorize script
        - Sometimes even actors are hired
    - **Don't talk to the participants during the tasks**
    - Only things you can say
        - "please keep talking"
        - Provide a hint if the participant is clearly frustrated
            - If they spend more than **3 minutes** on a sub-task
    - Never call the protocol "think aloud" in front of the participant but **talk aloud** or **speak aloud**
    - Stop protocol if participant becomes distressed

Paper Prototyping

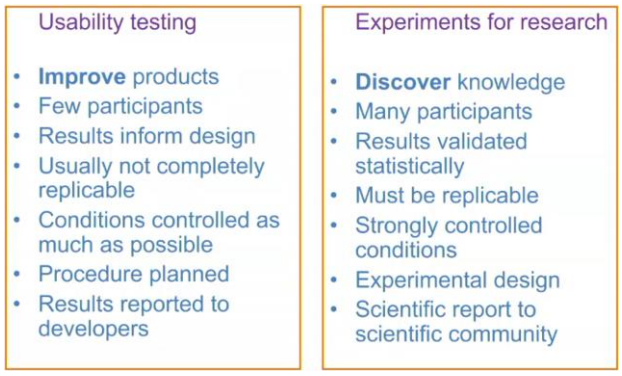
- Very fast in development (change a screen card with a pen and ask the user what they think about the alternative design)
- Different to storyboards as here the actual UI is being designed
- Similar idea to storyboarding
- Informal method: draw something up and ask someone how they would interact
- When to use
    - Whenever designing or modifying any UI element
    - Nearly always

Human Computer

- Formalized method of doing paper prototype testing
- Needs at least two people (researcher [facilitator], computer, participant)
- When to use
    - When we need more formal or in-depth feedback than just showing someone a design

Usability Testing vs. Research

- Usability Testing vs. Research



need to control environment & conditions to draw findings in an accurate way.

- Same methods but different application (one is "sloppier" than the other)

Lab Studies

- Used for **usability testing**
- Basic Idea: Have a participant come to a physical place & interact with the interface there
- Lab mimics situation we want to test
- Pros
  - Full control over environment
  - Detailed data
  - Ability to do follow-up questions
- Cons
  - Small sample size
  - Being in lab changes user behavior
    - Maybe they say something different from what you observe
    - Could be completely different than in their normal environment
  - Small sample size

Case Studies

- What we are measuring
  - Dependent / Independent Variables
  - In order to control more (particularly confounding variables) we need make the setup more artificial
  - But the more artificial something is, the less it can **generalize** (bad for **external validity**)
- Example: Case Study 2 – New SnapChat Beta
  - Dependent variables
    - Frequency the app was used, enjoyed it (compared to older version), themes (from thematic analysis)
    - No dependent variable on ease of use
  - Independent variables
    - Age, gender, occupation, past experiences
  - Limitations
    - Self-selection in a snapchat forum (very specific type of user), memory, participant size
    - There isn't an actual research question
      - Actual idea is to test for usage simplicity
      - But then evaluation is on user enjoyment

Empirical Evaluation

- Used in Lab studies
- Compare design A to design B (which one is better)
- Pros
    - Good way to compare two design
    - Easy to combine with other methods like Think Aloud, Survey, or even Interviews
- Cons
    - Need at least two designs
    - Care is needed to make sure the setups are comparable

Focus Group

- Also used in Lab studies
- Not the strongest method to evaluate a prototype but **can do**
- A group of participants have a discussion on a topic directed by a researcher
- Pros
    - Get (just) group **opinions** about issues
        - 3 to 12 people
    - Efficient way to test early ideas / design
    - Good way to identify issues or areas of conflict
    - Multi-constituent discussion
- Cons
    - Can be taken over by assertive individuals
        - Need to balance discussion
    - Focus on people's opinions not actual behaviors
    - Limited sample size
- Manage Group
    - Invite Target Users
    - Prepare list of questions
    - Your opinions don't matter
- When to use
    - Beginning of the design
        - Design requirements
    - Product idea testing
        - Test the concept for a product
        - Test reactions to a mock-up physical or digital
    - Finished product opinion
- Plan for Discussion
    - Brief participants
    - Let them introduce them to each other
    - Easy Question
    - Target Questions
    - Easy Question & thank participants
- Plan for Evaluation
    - Brief participants
    - Let them introduce them to each other and exchange their most recent experiences with the problem the design tries to solve
    - Hand out paper copies of the interface and associated questions, similar to the survey questions

        - Let them individually assess the design
        - Ask participants to discuss the answers one interface at a time
        - Finish with an easy question and thank the participants
- Question Categories
    - Background
    - Technical
    - Graphical design
    - Structure Navigation
    - Suitability
    - Best/worst characteristics

Mixed-Methods Studies

- Most lab studies are mixed
- Most common is to do an experiment with post-interview
- Pros
    - More data
    - One method will likely catch what another missed
- Cons
    - More methods take longer to plan and longer to run
    - Data from different sources sometimes contradict each other
- Take notes with timing
- How a setup could look like
    -

Study	Aims	Methods	Participants
Study 1 (3 x 60 minutes sessions)	To identify what kinds of reward children liked. 2. To collect, discuss and prioritize ideas for rewards. 3. To explore the design space and refine the reward requirements.	Testing existing apps Brainstorming Prototyping	3 children with ASD
Study 2 (1 x 60 minutes session)	1. To discover what types of reward children with ASD and/or ID prefer. 2. To explore how rewards could be developed and presented in a technology-based intervention.	Questionnaire Card sorting Prototyping	12 children (4 with ASD & ID, 4 with ASD, and 4 with ID)

Pre/Post Questionnaire

1. Participant fills out a questionnaire immediately after they complete informed consent.
2. They engage with the content of the study (do stuff)
3. Participant fills out a very similar or identical questionnaire
4. The researcher compares the answers in the pre and post questionnaires to determine if the content of the study had an impact on the participant

- Pros
    - Easy way to determine if study had an impact on the participant
    - Very useful in education or attitude changing
    - Easy to compare (pre and post score)
- Cons
    - Learning effect

        - Can be pre-determined by giving questionnaire, let the participant do a random task and then give them the questionnaire again – if change was observed, then yes
    - Often need to compare to prove that the results are note just a learning effect

Design Workshop

- Small group of participants collaborate on initial design work
- Pros
    - Create innovative solutions that better meet customer needs
    - Promote culture of innovation
    - Reduce risks in projects using a collaborative & iterative approach
- Cons
    - Take a lot of work to design and run good workshops
    - Participants' skills may vary widely
    - Outcomes may be difficult to interpret
    - Need people from outside to really find how to create the design / how to change it

Triangulation

- Convergence of multiple methods on the same research question, to combine evidence from several different angles
- Ensures accuracy of the information
- Different Forms
    - Data
        - Data gathered across a variety of time, contexts, people
    - Methodological
        - Multiple methods (questionnaire, interviews, observations)
    - Investigator
        - Multiple researchers to collect and interpret data
    - Theoretical
        - Multiple theoretical positions in interpreting data

Questionnaire

- Difficult to build a questionnaire
- Participants answer a set of pre-defined questions.
- Similar to a structured interview but on paper or on a computer
- Pros
    - A lot of data from a lot of participants
    - can determine how prevalent an issue or concern is
    - close-ended questions are easy to analyze
- Cons
    - Have to know questions
    - Careful planning is needed
    - Open ended questions take a lot of time to analyze
- Can be used for
    - Requirements gathering [Current software update process]
        - Understand the target population
    - Testing a theory []
    - Testing a prototype design (Interface Testing) []
        - How do people interpret my interface?

    - Testing the final design
- Knowledge that we can gather
    - Attitudes
    - Behaviors
    - Conceptualizations
    - Expectations
    - Capabilities
- Common survey elements
    - Single / Multiple Choice
    - Matching
    - Scale
    - Open ended response (**see cons**) vs Close-ended
- Process
    - Don't reinvent the wheel
        - Response Anchors are already researched and available
        - Used particularly for *Likert Scale* questions & *Scale* questions
    - Pre-test Questionnaire
    - Think about mode (paper, phone, pc, etc.) of questionnaire
    - Keep it short
    - Question Order matters
        - Easier questions at the beginning
        - Don't ask questions to prime the participants
    - Filtering and Branching
        - If the participant doesn't know something, then avoid asking more questions on it – branch
    - Can also do retrospective open-ended questions
    - And follow-up questions after a while
- Ideal Question & Some Rules
    - Measures underlying concept it is intended to tap
    - Doesn't measure other concepts
    - Means the same thing to all respondents
    - Avoid technical terms & jargon
    - Avoid vague or imprecise terms
- Additional notes on questions
    - We can combine questions e.g. to add emotional scaling to another question
    - Questions can be intended to be combine

Human Perception

Affordance

- Properties of an object that allows people to know how to use it
- To afford = give a clue; Something affords ("is for") …
- It should be obvious how to interact with an object

Metaphors

- Are better to evolve the users' initial mental modal
    - Transfer the modal from one thing to another

- Use something that is generally accepted or recognized by people (e.g. play/pause button matching the one on a tape player)
- Metaphors can convey affordances (e.g. affordance of pressing a button)

Perception Bias

- Influence from our personal Past / Presence / Future
- Perceptual priming: once you're told what to see, your perception is altered
- Familiar perceptual patterns or frame: Repeated exposure builds a patter of what we expect to see (e.g. location of next button)
- Habituation: repeated exposure to the same perceptions dulls our perceptual system's sensitivity to it
- Attentional blink: when attention mechanism is fully occupied and not able to recognize newly exposed information
- Perception Bias by Context
- Perception Bias by Goals
    - **Guided** (so we sample the information we need from the outside world)
    - **Filtered** (things unrelated to our goals are filtered *preconsciously*)
    - *Mechanism:*
        - Influencing where to look
        - Sensiting out perceptual system to certain features
- **Design Implications**
    - Avoid Ambiguity
    - Be consistent
    - Understand the goals

Visual Perception

- Functions: Guide fovea (tell us that something is there even if not in focus), Detect Motion, See better in the dark
- Example: Error messages too far away, Same color as font, badly positioned (far away from botton)

Making Messages Visible

- Put it where the users are looking
- Mark the error
- Use Error Symbols
- Reserve Red for error
- Heavy artillery
    - Pop-up message in error dialog box
    - Use sound
    - Wiggle or blink briefly

Visual Search

- Is linear
- Use visual hierarchy (especially for text)
    - Related content is close to each other
        - Logically related = Visually related
    - Important content is prominent
    - Things which are part of other things are nested
        - E.g. Shopping Cart

- Use color to indicate status
- Peripheral 'pop' – illustrations instead of text
- Actually pattern matching -> good at scanning
- Usability of a webpage is actually based also on
    - How fast can we retrieve information
    - Quickly identify if the content is what we are looking for
    - Search is facilitated by bold / colored text

Text

- Common issues
    - Uncommon vocabulary
        - Avoid domain jargon
    - Tiny / difficult fonts
        - E.g. All capitals, tiny font, weird font, noisy background
    - Information buried in repetition
        - If text starts & ends with the same text but changes in between
    - Centered Text
    - Too much text

Gestalt Principles

All the below happen mostly together

- **Proximity**
    - Relative distance of objects changes how we see them (e.g. sub-groups)
- **Similarity**
    - Objects looking similar appear grouped
- **Continuity**
    - Resolve ambiguity by adding missing data such that we perceive whole objects
        - Brain fills gaps to create whole structures
    - Biased towards perceiving continuous forms rather than disconnected pieces
- **Closure**
    - Automatically try close open figured
    - Partially visible objects are perceived as a whole
- **Symmetry**
    - We try to reduce structural complexity. Brain picks simplest interpretation of form
- **Figure / Ground**
    - Brains try to separate images into fore- and background
    - Is used to **bring more information over other content (e.g. map in background)**
- **Common Fate**
    - Focus is on grouping objects by similarity of motion (just like proximity & similarity)

Heuristics

Heuristic Evaluation

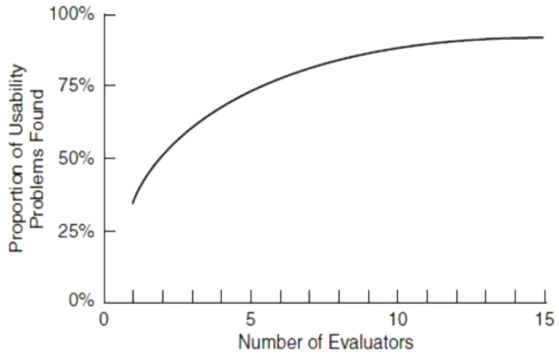
- First thing to do when we should fix/improve a design
- Have one or more experts evaluate an interface based on a common set of criteria
- Heuristic Evaluation is very easy to do
- Pros
    - Can be done by even a single person

    - Not ethics, recording or other human-related problems
    - Minimal expense to find a large number of potentially expensive problems
- Cons
    - Experts are not the same as end users (will miss things)
    - Heuristics are the most common types of problems, but they don't represent all problems (doesn't work well in for systems not meant for the common user)

Informal Method

- Just the researcher
- Figure out which heuristic broke and why – recommend how to fix
- As an outcome:
    - design study to test if the problems identified are actually problems
    - Write a report for the client explaining problems found

Formal Evaluation

- Procedure
    - Get a bunch of experts
    - Brief every expert in the session
    - Each expert works separately
    - Take one pass to get a feel for the product
    - Take a second step to focus on specific features
    - Debrief session in which all experts work together to prioritize problems
    - Same outcomes as informal methods
- Cons
    - Can be difficult & expensive
    - Many trivial problems are often identified
    - Experts have biases therefore never all problems will be found as the experts are not normal users anymore and they might also maybe don't know how the actual targeted user group will interact with the design
- How many experts
    - 

Usability Aspect Reports (UAR)

- Similar to a bug report but for usability issues
- Can be good or bad features
- Should link to a heuristic

Neilson's 10 Heuristics

1. **Visibility of system status**

- Always keep user informed about what is going on
- Why
    - People learn from seeing feedback from their actions
    - Knowledge of system state is necessary for some actions

2. **Match between system and the real world**
    - Use concepts, language, and real-world conventions familiar to the user (metaphors)
    - Why
        - Users already know the components from the outside world
        - People become confused otherwise
3. **User control and freedom**
    - Allow user to have control of the interaction
    - Exit from any sequence of actions and not being forced into a series of actions
    - Why
        - Users make errors sometimes
        - Need the ability to go back and correct errors
4. **Consistency and standards**
    - Information that is the same should always appear the same
    - Developers need to know conventions being used in the software
    - Why
        - Similar to real world heuristic, can leverage what people already know
        - They will except that something they learned earlier will continue to be true
5. **Error prevention**
    - Prevent users to make errors – do it WHERE errors occur
    - Hardest heuristic to do upfront and easiest to fix later
    - Why
        - Users are not machines
        - Computers are really good at using all the information available and remembering the last few things
6. **Recognition rather than recall**
    - Show all options available to the user rather than expecting them to remember all
    - A system which is not used the continuously has to leverage recognition
    - Expert systems have to leverage recall
    - Why
        - People are less good at remembering (recall) than they are at recognizing (recognition)
7. **Flexibility and deficiency of use**
    - Experts should have a way to use the interface faster or more efficiently
    - Design should have accelerators (e.g. keyboard access)
    - Why
        - Using the mouse is much slower
8. **Aesthetics and minimalist design**
    - Get rid of clutter
    - Easier to see things when there are not piles of other things in the way; The more data there is, the harder it is for users to process is
9. **Help users recognize, diagnose, and recover from errors**
    - Error messages should be clear written in plain English and constructive advice should be given
    - Why

        - Errors should only be given to users when the system can't handle the situation anymore

10. **Help and documentation**

Cognitive Walkthrough

- A formalization of the "step through" process discussed in Heuristic Evaluation
- A method that evaluates whether the order of cues and prompts in a system supports the way people process tasks and anticipate the "next steps" of a system.
- **Informal:** Can be done alone and when evaluating a system for the first time
- **Formal:** Someone external has to look at it
- Pros
    - Step through the design, one element at a time
    - Very effective
- Cons
    - Extremely slow
        - Hence take big and most problematic tasks
    - Takes a lot of planning
    - Costly
- When to use:
    - Initial evaluation
    - Low Budget
    - First-use situations
    - **Formal:** Access to HCI experts
- When **not** to use:
    - Formal evaluation of **own** system with you as an evaluator
        - Too biased
    - Systems a user will use frequently
- Stages
    - Briefing to tell experts what to do
    - Evaluation period (1-2 hours) where
        - Each expert works separately
        - Takes one pass to get a feel for the product
        - Takes a second pass to focus on specific features
    - Debrief session where experts work together to prioritize problems
- Core Questions
    - For each **component** and **state**
        1. Will users want to produce whatever effect the action has?
        2. Will users see the control (button, menu, label, etc.) for the action?
        3. Once users find the control, will they recognize that it will produce the effect they want?
        4. After the action is taken, will users understand the feedback they get, so they can confidently continue on to the next action?
- How can we accurately judge what the user does or does not know?
    - Have to have a specific user in mind -> **Personas**
- **Cognitive Walkthrough with Personas:** combine to better define if something is or is not usable
- **Cognitive Walkthrough with Heuristics**

Personas

- Short biography about a fictious user that describes a reasonably large segment of the intended user population
- Helpful as a way to gather together data from interviews and present it clearly to others
- Useful to explain who the user is to other people
- Normally have a sequence of personas
- Use these in the cognitive walkthrough
- Classical Build-Up
    - Background
    - Work Environment and Information Management
    - Duties

Design Studies - Testing Application with the Users

Study Design

- How to design an actual design study
- **Most important thing:** Think about what variables you are interested in and what graph / plot / table you want *before* you conduct the study

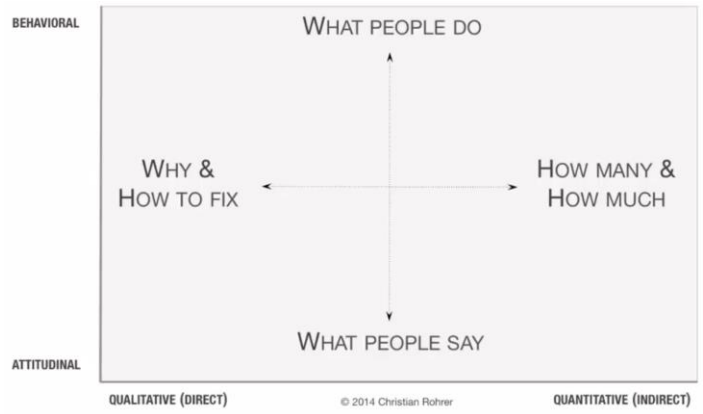
Steps

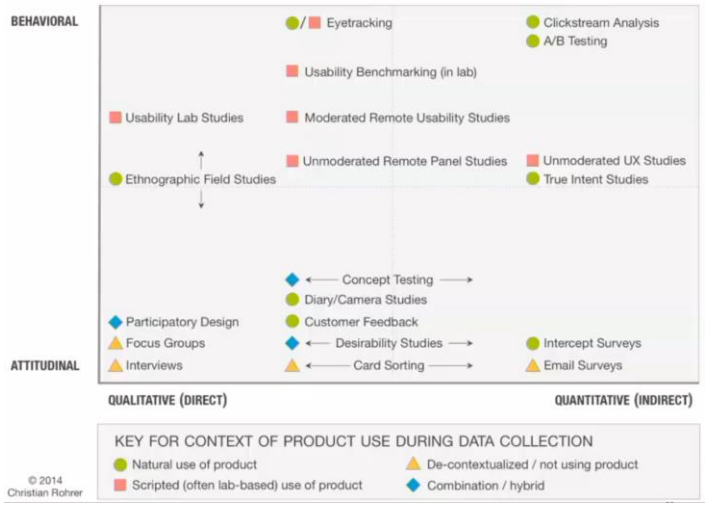
1. Define what "usable" means

- Define usability goal (easy to understand & specific)
    - Like specifying a task
    - Define what users should be able to do and what kind of attitude they should have by doing so
    - Easy to understand & specific – low **cognitive load**
    - Example:
        - Find a stool on a shopping page and purchase it
        - Be willing to give 5-star review after first time interaction
    - Usable could mean
        - Timing on task
        - Accomplish task without major errors
        - Users can learn to use the interface the first time
        - Etc

2. Identify your variables

- What kind of data are we looking for
    - Attitudinal
    - Behavioral
    - Qualitative – unstructured
    - Quantitative – structured
        - E.g. Understand how many people struggled with a certain aspect of the design

- 

- 

3. What are we going to measure

- **Dependent variables**
  - Outcome variables
  - Measure usability goal
  - E.g. Number of clicks, Time spent on task, etc.
- **Independent variables**
  - Anything we are directly manipulating
  - A pre-existing feature of the participant
  - Study group, order of tasks, demographics of participant, etc.
- **Confounding Variable**
  - Outside influence that changes effect of a dependent and independent variable
  - Additional variable not accounted for
  - Example: Storks Delivery Babies
  - **Correlation is not Causation**

4. Setup the study

- Between Subjects
  - Only one interface to each person
  - Lots of variability
- Within Subjects
  - All interfaces are shown to all participants
  - Less variability but **learning and priming**
  - Could balance this by switching order of design A & B randomly
- Scripted
  - Tasks prepared in advance

    - Controlled environment
- Observational
    - Participants might not even be notified
    - Participants are in their natural environment
    - Hard/Impossible to prove what task the user was trying to accomplish

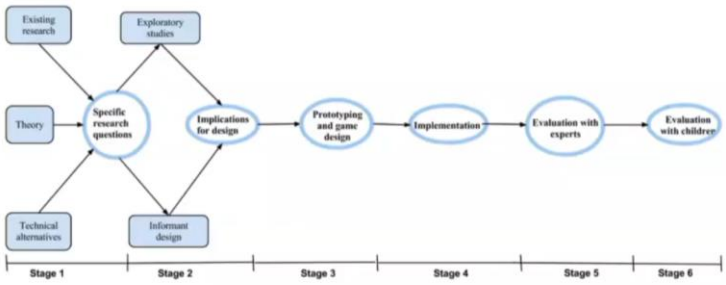
5. Evaluate the outcome

- Basic
    - Quantitative: Make scale and compare points
- Academically Sound
    - Statistical
    - Data
        - Numeric
            - Continuous / Discrete / Interval
        - Categoric
            - Binary / Ordinary / Nominal

Sample Studies

- Informed consent
- Introduction - background of participants
- SDM – short introduction
- Serious gaming – short introduction
- Participants practised SDM by playing:
    - Session 1: one scenario
    - Session 2: three scenarios
- Feedback on scenarios and design ideas
- Group discussion

-



The structure of the current project methodology – adaptation after Scaife and Rogers (2001)

SUS (System Usability Scale) - Attitudinal Data

- Get attitudinal data regarding how satisfied they are with using the system / application
- Returns just a score out of 100, not why
- For odd items subtract 1
- For even items subtract 5
- Add up all converted responses
- Multiply total by 2.5

Design Requirements:

- Always have
    - a main aim
    - a research question you try to answer

- maybe also additional aims

Study Protocols

- Example
    1. Informed consent from parents
    2. Informed assent from children
    3. Session 1 – Testing existing apps (Story Maker & ISISS)
    4. Session 2 – Brainstorming
    5. Session 3 – Prototyping
    6. Researchers analysed data
    7. Interviewer shows participant report and discusses

Study Summaries

- Want to summarize what was achieved with the study and what could be taken from that study
    - Theoretically
    - Methodologically
    - Empirically
    - Practically

Tasks and Subtasks

- High level and includes a state the user wants to achieve
    - Sometimes need multiple applications to pull the off
- Subtask is a smaller task to fulfill larger tasks
- When designing user interfaces it's important to have in mind what tasks they will be trying to complete with our tech
- Think of what the user wants to accomplish and support that task

Task Analysis

- Breaks down user's flow including actions and interactions, system response, and environment context into subtasks
- Decide on granularity of subtasks
- What are the possible scenarios

Time on task

- Measure usability as how quickly a task can be accomplished by the participant
- Average, max, min, median, mode
- Pros
    - Easy to understand and measure
    - Easy to combine with subtask analysis
- Cons
    - Cannot be combined with a Think Aloud
    - Time is not always best measure of usability
    - Times changes with experience with the interface

Selecting Participants

Things to Evaluate

User testing

- understand how an interaction might happen in the real world

- but not tested in actual real world conditions / perfectly representative users

External Validity (Generalizability)

- Ability to take the results of a study into the real world
- How general is the target audience? By how much can we extend our results from a study done with a testing audience?
- Need to find representative sample of future user group
- Or need to find user group matching target user's skills and abilities

Control vs. Generalization

- Concepts which have to be taken into account when testing with users
- Most usability methods involve controlling some aspect of the study
- More control means more certainty that the effects of the study are cause by the intervention and not something else
- **More control = less generalizability**

Selection

- Represent target audience
    - Similar skills & abilities
    - Groups you are most concerned about
    - Similar limitations
    - Close approximation
- Users can be expensive and difficult to find
    - Highly skilled, vulnerable, rare
- Participants and the design process
    - Planning, scoping, and definition
        - Talk with people who understand the problems of the user group
    - Design iteration
    - Evaluation, refinement, and production
        - Early evaluation on less expensive group
- Limitations
    - Describing how results can and cannot be interpreted

User Participation (in the design process)

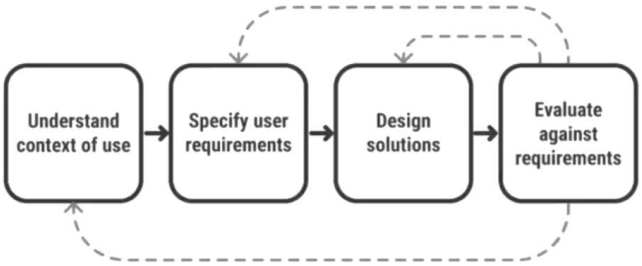
- Usability
    - Depends on features in conjunction with Users, what the users want, and the user's environment
- Understanding the user
    - Design for & with the users
    - Particularly when users have special needs
- Participation
    - Traditionally used in HCI to describe the involvement of users and stakeholders in the design process, with a purpose of distributing control to participants to shape their future UX
    - Can also be used to inform future design
- Why involve users
    - Share Control
    - Share Expertise
    - Inspire Change
    - Benefits (Damodaran, 1996)

        - Improved quality of the system arising from more accurate user requirements
        - Avoidance of costly system features
        - Improved levels of acceptance of the system

User Design Approaches

User Centered Design (UCD)

- Focuses on the thing being designed



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Participatory Design (PD) (co-design, co-creation)

- Let users be designers
- Need to find a language/method to have direct interaction with the user
- Harder (specially with special groups; children, physically/cognitively impaired people)
- Three tennets
    - Goal to improve the quality of work life
    - Orientation is collaborative
    - Process is iterative
- Stages
    - Initial exploration of work
    - Discovery Process (organizational games)
    - Prototyping (compulsory)

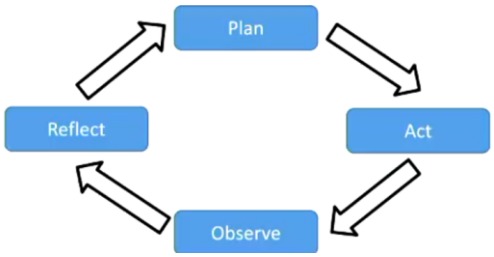
Others

Informant Design

- Between UCD & PD
- Has an **informant group**
    - Not equal voice as in PD but informing the design
- Stages
    - Define domain and problems
    - Translation of specification
    - Design low-tech materials and test
        - Partially design system to understand if it works
        - Not the full system
    - Design and test high-tech materials

Action Research (AR)

- Cyclic. Can enter at any point



- Link theory and practice

For PD / Informant Design

- Make a clear concept on how sessions are conducted and how the workflow of the whole design process will look like. Especially must have mitigation steps in planning for possible stressing scenarios for the participants (particularly for children / children with special needs)

Qualitative Data Analysis

- Used to analyze the data in order to be able to answer the research questions

Thematic Analysis with Affinity Diagrams

- Go through data and identify **themes** – these become our **outcomes**
- Affinity diagrams are one of the easiest ways to do thematic analysis with a group or by yourself
- Is important as we have to make sense of our data and understand the meaning
- However quite difficult with real data from interviews
- Pros
    - Get main concepts from the data
    - Easy for someone else to understand
    - Themes are grouped in the data with clear examples
- Cons
    - Only works with a small amount of data
    - May require more than one person to improve validity
- Two ways
    - All themes come from data (top-down)
    - Or search for topics which crystalize from the data
    - Could also be done contemporarily
- How an affinity diagram could look like
    - Themes, subthemes – nested and related themes overarching the different data

Content Coding

- Finding patterns – finding labels (codes) which we can attach to the data to describe it or say in a meaningful way what it implies for our study
- Works better on real data from surveys and interviews
- Code: typically a word or short phrase, often a noun
- Layout: Have text on the left and coding keys on the right
- **Formal:** Someone external has to look at it
- Another way
    - **In Vivo Coding**
        - Make sense of what the user actually said and find keywords in the text and use them as labels
        - Clearly summarize what user conveyed
        - Scan through the text and find keywords

        - **Process Coding**
            - Goal: Understand the process, actions, or steps people engage in
            - Code using **only "-ing" words**
        - **Emotion Coding**
            - Goal: Identify feeling or emotions in text
            - Uses emotion words / phrases as codes
        - **Dramatic Coding**
            - Goal: Identify objectives (obj), conflicts (con), tactics (tac), attitudes (att), emotions (emo), and subtexts (sub)
            - Make a drama out of the text data
        - **Open Coding**
            - *Used most of the time*
            - Researcher goes through the text and highlights passages with codes/labels summarizing what is in the text
- Once we have the codes we can do **thematic analysis**.

Code Book

- Contains
    - Codes used
    - Full description of the codes
        - With each code also present an example from the actual (text) data
    - Application on the (text) data
- How to
    - Need several people to agree on the code book
    - Give experts excerpts of your data together with the preliminary code book, make them apply them, and discuss how they applied them. Come up with full definition + examples for the codes, give them new examples from the data and let them code again but individually.
    - Then calculate **the inter-reliability**: percent of coincidence of codes which are the same for all the coders over the total number of codes.
    - Repeat and finally calculate the inter-reliability on 10% of the data.
    - Use this codebook to then code the whole data
- Then pull out the themes important to answer the research questions

Topic Coding/Analysis/Modelling

- Form of text mining
- Computer tries to cluster words by frequency in text
- However remove common (stop) words
- A topic then is a cluster of words which occur frequently together
- Computer can't make sense of these clusters however and we will have to apply one of the coding techniques above for achieving that goal
- Find percentage of documents dealing with each topic
- Helpful with large quantities of data

Ethics

Tuskegee Syphilis Experiment (1972)

- Really Bad
    - 600 African American men were given Syphilis
    - 40 years instead of 6 months
- Caused the US to put forward regulations on how participants are treated in medical, more recently social studies.

Belmont Report (1978)

- Detailed set of guidelines around what "ethical" research on humans has to look like
- Went into act 1981 for biomedical & behavioral research involving human subjects
- Key Topics

Respect for persons

- Treat each person as someone who can actively take decisions
    - Not always possible.
    - Vulnerable groups are entitled to protection
        - If person needs or has a guardian, multiple consent forms have to be distributed with different focus on how data is being used and what happens to participants
- Participation in study is voluntary and follows **informed consent**
    - Participants should be fully informed of the costs / benefits of participation
    - Implied consent still possible if person's choice is respected
- Example:
    - Good – Dancing in the classroom
    - Bad – Tuskegee Experiment

Beneficence

- Harm balancing (Risk / Benefit analysis)
- Maximize Benefits and reduce possible Harms
- Think of what could possibly get wrong
- Example: Experiment on how much oxygen babies need

Justice

- All benefits & costs should be balanced across **all** groups
- Who should bear the burdens of research and who should receive the benefits?
    - To each person an equal share
    - To each person according to individual need
    - To each person according to individual effort
    - To each person according to societal contribution
    - To each person according to merit
- Bad Example: Kinect can't identify African-Americans

Since 2010 all researchers working on US funded grants must go through ethics training

The Menlo Report (2012)

- Updates the Belmont Report focusing on information communication technology research
- Additional Topic

Respect for law and public interest

- Added to the Belmont Report to take into account the speed of today's internet / global connection.

- Be transparent in methods and results
- Be accountable for actions
- Respect public interest
- Compliance
    - Make sure you know what the laws are and don't break them
    - When braking laws is necessary, engage in due process
- Transparency and Accountability
    - Make the contents of research clear, including how data will be handled and used
    - Clearly communicate risk

Consent

- Explicit / Implicit Consent
- Starts with the advertisement
    - Be short and easy to read or decide to ignore
    - Explain main content of what participants will be asked
    - Explain costs, benefits, and risks of participating are
    - State who to contact about the research in case of concern
    - State if research had been through ethical review
- Consent Form / Participant Information Sheet
    - Who you are
    - What the study involves, what they will be asked to do
    - What kind of data will be collected and how it will be used
    - What rights the participant has Compensation, if any
    - Risks, if any beyond normal computer usage

Examples

- Experimental Evidence of massive-scale emotional contagion through social networks
    - Two groups
    - 689,003 participants
- Most detailed WWW network map
    - People maybe went to jail because their routers were attacking other routers

Informed Consent

- Consent Form
    - what the participant would be asked to do;
    - the length of time needed for the study;
    - participants' right to withdraw from the study at any time;
    - a promise that the person's identity would not be disclosed; and
    - an agreement that the data collected would be confidential and would be available to only the evaluators

Value Sensitive Design

- a way to approach technology that incorporates human values (e.g. welfare, privacy, trust, freedom from bias)
- employs an integrative and iterative tripartite methodology consist of:
  - Conceptual investigations
    - direct and indirect stakeholders are identified, followed by an analysis of how these could be harmed by or benefit from a new technology. Additionally, values implicated by the use of technology are identified and defined. As soon as values are identified and discussed, value tensions can emerge
  - Empirical investigations
    - qualitative and quantitative methods are employed to evaluate how stakeholders experience a technology with regard to the values they consider important
  - Technical investigations
    - combine insights from the other investigations and explore how a technology might be designed to support the values identified

- Case Study on Artificial Landscape Outlook for Office Workers

Key ideas from the VSD standpoint:

Direct and Indirect Stakeholders - *the watcher and the watched*

Multiple Empirical Methods - physiological data (heart rate), two types of performance data (on cognitive and creativity tasks), behavioural data (eye gaze), and reasoning data (a social-cognitive interview)

Coordinated Empirical Investigations - values that matter for direct stakeholders (physical health, emotional well-being, and creativity) and values for indirect stakeholders (privacy, informed consent, trust, and physical safety)

Multiplicity of and Potential Conflicts among Human Values - values of physical health, emotional well-being, and creativity appear to partially conflict with other values of privacy, civil rights, trust, and security

Technical Investigations - technological representations of nature can garner some psychological benefits

- we cannot with psychological impunity digitize nature and display the digitized version as a substitute for the real thing

Theory of Mind

- Sally & Anne: Why should we be looking for things where we know they aren't – partial information
- When interpreting designs, heuristics could be all fulfilled but the design might still not be usable

Mental Models

- Is what the user believes about the system at hand by considering representations of the systems and environments derived from experiences
- People understand and interact with systems by comparing the outcomes of their mental models with real-world systems
    - Ask questions to determine the understanding of the system by the participant
- Types
    - System Models
    - Interaction Models
- Large part of HCI is to understand the mental model of the situation in order to build a design appropriate for it
- Mental Models need to be aligned with what you need to do
    - Therefore sometimes we teach users wrong mental models purposefully
- Three Models
    - User Model
        - Mental Model: How the user things
        - Help user to build this through explanation and analogy
    - UI Model
        - What the system is telling the user
    - Implemented Model
        - What the product actually does
- Execution Evaluation Gulf

Communicating Results

- When providing feedback be respectful & positive
- Criticism vs. Critique is like Destructive vs. Constructive

Fitts' Laws

- Measures how hard it is to click two consecutive buttons or move the mouse between two points
- Effective for designing UIs as it makes time spent in design tractable
    - $T = k\ log_2(\frac{D}{S}) + 1.0$
    - Where
        - T = Time to move the pointer to the target
        - D = Distance between the pointer and the target
        - S = Size of the target
        - k is a constant of approximately 200ms/bit
- Idea
    - What is farther apart is harder to reach
    - But what is farther apart can also support error prevention

Accessibility

- Is for everyone
- Flexibility in user input makes interaction easier for everyone
- Well structured design (particularly with text) makes it easier to access it
- Models
    - Medical Model
        - Disabilities & Impairment as disabling factors
    - Social Model
        - Society & their surroundings as disabling factors

Accessibility Factors

- **User Impairments** – issues in body function or alteration in body structure
- **Activity Limitations** – difficulties in executing activities
- **Participation Restrictions** – problems exist in taking part in activities due to issues such as discrimination
- **Environmental Factors** – facilitators or barriers in the environment impact on the user
- **Personal Factors** – aspects such as motivation and self-esteem can influence an individual's participation.

Methods to assist and cater for disabled users

- Raising Awareness of accessibility policies & guidelines
- Develop tools to assist in accessible design
- Coordinate with disabled community
- Conduct accessibility self-assessment

Challenges

- Lack of appropriate textbook
- Difficulty in recruiting participants
- Difficulty in engaging students
- Avoiding idea that accessibility is for charitable reasons

User Impairments

- Categories
    - Visual
        - Basic Approaches
            - Larger text, UI elements, magnifying options
            - Alt text
            - Significant contrast between text & background
            - Color
            - Skip to main content link
            - Keyboard Trap
        - Tacton Design
    - Hearing
    - Physical
        - Difficulties with
            - Fine & precise motion
            - Hard to reach and/or push buttons
        - Basic Approaches
            - Limited number of interactive objects
            - Create simpler layouts
            - Touch targets in easily accessible places
    - Speech
        - Accents
    - Dyslexia
    - Autism
        - Difficulties with
            - Social Interaction
            - Communication
                - Textual language including expressions

            - Imagination
        - Computers help as they are impersonal
    - Learning disability
        - Difficulties with
            - Perception
            - Memory
            - Cognition
            - Communication
    - Age groups
        - Challenges include
            - Comprehension
            - Gross and fine motor skills
            - Motivation Issues
- Important distinction
    - **Permanent**
    - **Temporary**
    - **Situational**
- AI Technologies
    - Cognitive systems can support accessibility

Joint Attention (JA)

- Triadic process between two people and an object or event with a scope of sharing awareness of the object or event
- Two forms
    - Responding JA – imperative communicative function
        - Can be difficult particularly with **autistic** children
    - Initiating JA – declarative communicative function

Shared Decision Making (SDM)

- With a doctor (in the medical setting)
- Barriers
    - Wrong perception from the patient
    - Difficult language