CPT208

- Design
  - Week 2 Design I
    - Interaction design
      - Goals
        - Develop usable products — Usability
        - Involve users in the design process
      - Core Characteristics
        - Users involved
        - Usability and user experience goals
        - Iteration
      - User-centered approach
      - What is involved? (L1 P25)
        - Focused on discovering requirements, designing to fulfill requirements, producing prototypes and evaluating them
        - Focused on users and their goals
        - Involves trade-offs to balance conflicting requirements
    - Usability (Objective)
      - Goals
        - Effective to use
        - Efficient to use
        - Safe to use (safety)
        - Have good utility
        - Easy to learn (learnability)
        - Easy to remember how to use (memorability)
      - Dark patterns (L2 P50)
    - User experience (Subjective)
      - How a product behaves and is used by people in the real world
      - Pragmatic 务实的 Hedonic 享乐主义的
      - Goals (L2 P46)
        - Desirable aspects
        - Undesirable aspects
    - Accessibility and inclusiveness
      - Accessible by as many people as possible — Disability
      - Accommodate people as wide as possible
    - Design principles
      - Visibility — Users need to know what all the options are, and know straight away how to access them
      - Feedback
        - Sending information back to the user about what has been done
        - The user must receive feedback after every action they perform to let them know whether or not their action was successful
      - Constraints — Restrict a particular form of user interaction with an interface
      - Consistency
        - Design interfaces to have similar operations and use similar elements fo similar tasks
        - Internal consistency — Designing operations to behave the same within an application
        - External consistency — Designing something to be the same across applications and devices
      - Affordance
        - An attribute of an object that allows people to know how to use it
        - The link between how things look and how they're used
      - Mapping — The controls for something will closely resemble their effect
      - Shneiderman's 8 golden rules — https://www.cs.umd.edu/users/ben/goldenrules.html
      - Nielsen's 10 heuristics — https://www.nngroup.com/articles/ten-usability-heuristics/
  - Week 3 Design II
    - Process of interaction design
      - Double Diamond — Discover -> define -> develop -> deliver
      - User Involvement
        - Understanding of users' goals leading to better products
        - Degrees
          - Member of the design team
          - Face-to-face group or individual activities
          - Online contributions from thousands of users
          - User involvment after product release
      - 3 Principles of User-centered Approach
        - Early focus on users and tasks (L3 P19)
        - Empirical measurement
        - Iterative design
      - Interactive design lifecycle
      - 4 Basic Activities of Interaction Design
        - Discovering requirements
        - Designing alternatives
        - Prototyping
        - Evaluating
      - Others
        - Google design sprints (L2 P92)
        - Research in the wild (L2 P93)
    - Practical issues with interaction design
      - Who are the users/stakeholders?
      - What are the users' needs? — Focus on people's goals, usability and user experience goals, rather than expect stakeholders to articulate requirements
      - How to generate alternative designs? (L3 P30)
      - How to choose among alternatives?
        - Interaction design focuses on externally-visible and measurable behavior
        - Technical feasibility
        - Evaluation with users and stakeholders
        - A/B testing — Online methods to inform choice between alternatives
        - Quality thresholds
          - Different stakeholder groups have different quality thresholds
          - Usability and user experience goals lead to relevant criteria
      - How to integrate interaction design activities with other lifecycle models? — Integrating with agile software development
    - Requirements
      - Purpose
        - Explore the problem space
        - Establish a description of what will be developed
      - Importance — To avoid miscommunication
      - What — A statement about an intended product that specifies what it is expected to do or how it will perform
      - Presentation (Forms)
        - Atomic requirement shell
        - Focuses on outcomes and user goals
        - User Stories — As a <role>, I want <behavior> so that <benefit>
      - Types (L3 P56)
        - Functional requirements
        - Non-functional requirements
      - 6 Most Common Types (L3 P60)
        - Functional requirements
        - Data Requirements
        - Environmental Requirements
        - User Characteristics
        - Usability Goals
        - User Experience Goals
    - Data gathering techniques (L3 P64)
      - Interviews (individual and group)
      - Observations (direct and indirect)
      - Questionnaires
      - Study Documentation
      - Researching Similar Products
      - Contextual Inquiry
        - Context
        - Partnership
        - Interpretation
        - Focus
    - Persona
      - A set of user characteristics (user profile)
      - Goals
        - Helps designer with design decisions
        - Reminds team about who will use the product
    - Scenario
      - Textual Desciptions
      - Animations, audio or video
      - Example animation scenarios
    - Step-by-step descriptions of interactions
    - Use cases
      - Focus on functional requirement and capture interaction
      - 2 Styles
        - Essential use cases: division of tasks, no implementation details
        - Use case with normal and alternative courses: more details
  - Week 4 Design III
    - Conceptualizing design
      - Conceptualize what the proposed product will do
      - Why
        - To scrutinize vague ideas and assumptions about the benefits of the proposed product in terms of their feasibility
        - How realistic it is to develop
        - How desirable and useful it is
      - Assumptions and Claims
        - Assumption: Taking something for granted when it needs further investigation
        - Claim: Stating something to be true when it is still open to question
      - Benefits
        - Orientation — Enables design teams to ask specific questions about how the conceptual model will be understood
        - Open-minded — Prevents design teams from becoming narrowly focused early on
        - Common ground — Allows design teams to establish a set of commonly agreed terms
    - Conceptual model
      - A high-level description of how a system is organized and operates, and what users can do with it and the concepts they need to understand how to interact with it
      - Provides a working strategy and framework of generate concepts and their interrelations
      - Core Components
        - Metaphors and analogies — History and bookmark
        - Concepts to which people are exposed to through the product — Saving, revisiting, organizing
        - Relationship and mappings between these concepts — Visit a page through history, most-frequently visited, and bookmark
      - Proceeds (Steps)
        - Understanding the problem space
        - Being clear about assumptions and claims
        - Specifying how the proposed design will support users
    - Interface metaphor
      - A set of user interface visuals, actions and procedures that exploit user's familiar knowledge
      - Purpose
        - Give the user instantaneous knowledge about how to interact with the user interface
        - To exploit user's familiar knowledge, helping them to understand "the unfamiliar"
      - Examples: conceptualizing what users are doing; a conceptual model instantiated at the interface; visualizing an operation
      - Benefits & Problems (L4 P36)
    - Interaction types
      - Instructing
        - Users instruct a system and tell it what to do
        - Benefit: quick and efficient
      - Conversing
        - Having conversation — voice recognition and natural language dialogs
        - Pros: allow user to interact in a familiar way
        - Cons: misunderstandings can arise when the system doesn't know how to parse what the user says
      - Manipulating
        - Exploits user's knowledge of how they move and manipulate in the physical world
        - Direct Manipulation — 3 Core Properties
          - Continuous representation of objects and actions of interest
          - Rapid reversible actions with immediate feedback on object of interest
          - Physical actions and button pressing instead of issuing commands with complex syntax
          - Pros & Cons (L4 P47)
      - Provide a way of thinking about how to support user's activities
      - Exploring — Involves moving through virtual or physical environments
      - Responding
        - System tasks the initial time to alert user to something that it "thinks" is of interest
        - Potential cons of system-initiated notifications (L4 P53)
    - Choosing Interaction Type (L4 P54)
      - Direct manipulation
      - Issuing instructions
      - Having a conversation
      - Hybrid conceptual models
    - Interaction Types VS Interface Styles
      - Interaction type is a description of what the user is doing when interacting with a system
      - Interface style is the kind of interface used to support the interaction
    - Provide ways of framing design and research
    - Paradigms, visions, theories, models, and frameworks
      - Pradigm
        - Inspiration for a conceptual model and general approach adopted by a community for caring out research
        - Examples
          - Ubiquitous Computing
          - Pervasive Computing
          - Wearable Computing
          - Internet of Things (IoT)
      - Visions — A driving force that frames research and developement — Future scenario
      - Theory
        - Explanation of a phenomenon
        - Can be used to predict what users will do with different interfaces
      - Model — A simplification of an HCI phenomenon
      - Framework — Set of interrelated concepts and-or specific questions for "what to look for"
    - Different kinds of interfaces (L4 P69) — 20 Kinds of Interfaces
- Prototyping
  - Week 5 Prototype I
    - Emotional Design
      - Expressive Interfaces — The expressive interface allows users to convey emotion, to provide satisfaction with empathy and to delight with contextually-aware illustrations and animations. Harnessing these techniques wins trust and helps us to create a user-centric environment for our interactive processes
      - Annoying interfaces — The lack of control and feedback makes us uncomfortable
      - Anthropomorphism — The propensity people have to attribute human qualities to animals and objects
    - Reasons/goals — Why prototype
      - Prototypes answer questions, and support designers in choosing between alternatives
      - Helps in understanding
        - Design alternatives
        - Strategy
        - User-centered process
      - Helps in communication — With the same "language", different stakeholder and no "maybe
      - Helps in test and reflection on
        - Hypotheses and assumptions
        - Other's comments: opportunity to present and promote the idea to peers
    - Fidelity
      - Types
        - Low-fidelity Prototyping
          - Quick, cheap and easily changed
          - Examples
            - Sketches
            - Storyboards
            - 'Wizard-of-Oz'
            - Index cards
        - High-fidelity Prototyping — More like the final system
      - Compromises
        - All prototypes involve compromises — the intention to produce something quickly to test an aspect of the product
        - 2 common types
          - Horizontal — Provide a wide range of functions but with little detail
          - Vertical — Provide a lot of detail for only a few functions
  - Week 6 Prototype II
    - Level of Fidelity
      - Continuum/Spectrum
      - 5 Dimensions of Fidelity
        - Visual — Most direct dimension
        - Interaction — Exactness with which real-world interactions can be reproduced
        - Breadth — The number of features covered
        - Depth — The degree of functionality
        - Content — The degree of realism for the content
        - Other dimensions
          - Autonomy: operates alone VS requires supervision
          - Platform: Interim VS final implementation
    - Concrete (VS Conceptual Design)
    - Physical design
      - Guidelines
        - Nielsen's heuristics
        - Shneiderman's eight golden rules
        - Style guides
      - Differet kinds of widgets
        - Menu design
        - Icon design
        - Screen design
          - How to split across screens
          - Individual screen design
        - Information display — Relevant information available at all times
    - Types
      - Throw-away Prototyping — Only serves to elicit user reaction
      - Incremental Prototyping — Separate components (modules)
      - Evolutionary Prototyping — Prototype altered to incorporate design changes
  - Week 8 Prototype III
    - Processes
      - Minimum viable product
        - A product with enough features to attract early adopter customers and validate a product idea really in the product development cycle
        - Steps
          - 1 Understand your users and identify the problem
          - 2 Write down the user flow
          - 3 Use the prototype to optimize the user flow
          - 4 Test, refine, iterate
      - Exploration
        - Focusing on exploration makes you spent more time in thinking rather than doing
        - Steps
          - 1 Brainstorming about issues/solutions
          - 2 Clustering and categorization
          - 3 Priority check
      - Specific audience
        - Focusing on specific audience makes you maintain a smooth communication with different stakeholder
        - Steps
          - 1 Identify your audience, purpose and fidelity
          - 2 Tools
          - 3 Present
      - Assumptions
        - Focusing on assumptions make you to improve your ideas and products
        - Steps
          - 1 Understand your audiences, issues and assumptions
          - 2 Fidelity
          - 3 Purpose of testing
          - 4 Make and test
    - Digital prototyping — Features
      - Screen
      - Responsive — mobile-based VS desktop-based
      - Interaction — how user inputs
      - Accessibility — used by anyone (visual, physical, experience or preference)
      - Animation — one of the best practice in digital products
    - Physical prototyping
      - Electronic technology
      - Compatibility
      - Material and tactility
- Evaluation
  - Week 9 Evaluation I
    - Questionnaire
      - Structure
      - Formal
      - Pros
        - Collect data from a large number of people at a relatively low cost
        - Get an overview of a population of users in a short amount of time
        - Surveys do not require any special equipment
        - Surveys are generally approved by institutional review boards because they are typically non-intrusive
      - Cons
        - Get shallow data, not good at getting deep data
        - Since surveys are usually self-administered, it is usually not possible to ask follow-up questions
        - Surveys can lead to biased data when the questions are related to patterns of usage, or feelings about a previous experience, rather than clear factual phenomena
    - Interview
      - 4 Types
        - Unstructured — Not directed by a script, rich but not replicable
        - Structured — Tightly scripted, often like a questionaire, replicable but lack richness
        - Semi-structured — Guided by a script, but interesting issues can be explored in more depth. Can provide a good balance between richness and replicability
        - Focus groups — A group interview
      - Plan and conduct
        - Interview questions — 2 Types
          - Closed questions
          - Open questions
        - Interview process
          - Steps
            - Introduction
            - Warm-up
            - Main body
            - A cool-off period
            - Closure
          - Pros
            - Go deep: encourage reflection and consideration
            - Flexible: open-ended and exploratory
          - Cons
            - Skill to manage
            - Time and resource intensive
            - Data analysis
            - Recall problems — Separated from the task and context under consideration
        - Enrich the interview experience — Use prototype, scenario
    - Observation
      - Direct observation
        - In the field
          - The person
          - The place
          - The thing
          - Materials that might be collected (L9 P57)
        - In controlled settings — Think about techniques
      - Indirect observation — Tracking users' activities
        - Diaries
        - Interaction logs
        - Web analytics
    - Choosing and combining techniques
      - Focus of the study
      - Participants involved
      - Nature of the techniques
      - Resources available
      - Time available
    - Five key issues
      - Setting goals
        - What information to collect
        - How to analyze data once collected
      - Identifying participants — Decide from whom to gather data and how many
      - Relationship with participants
        - Clear and professional
        - Informed consent when appropriate
      - Triangulation
        - Look at data from more than one perspective
        - Collect more than one type of data, for instance, quantative data from experiments and qualitative data from interviews
      - Pilot studies — A small experiment designed to test logistics and gather information prior to a larger study
  - Week 10 Evaluation II
    - Why, what, what and when to evaluate
      - Why — To check users' requirements and confirm that users can utilize the products and that they like it
      - What — A conceptual model, early and subsequent prototypes of a new system, more complete prototypes, and a prototype to compare with compatitors' products
      - Where — In natural, in-the-wild, and laboratory settings
      - When — Throughout design; finished products can be evaluated to collect information to inform new products
    - Different types of evaluation method
      - Controlled settings
        - Usability testing
          - Controlled settings
          - Quantitative performance measures (L10 P28)
          - Conditions
            - Controlled space
            - Emphasis on selecting representative users and developing representative tasks
            - Same for every participant
            - Informed consent form
        - Experimental design
          - Features
            - Test hypothesis
            - Predicts the relationship between two or more variables
            - Independent variable manipulated
            - Dependent variable influenced by the independent variable
            - Validated statistically and replicable
          - Research hypotheses
            - A precise problem statement that can be directly tested through an empirical investigation
            - Types
              - Null hypothesis — Typically states that there is no difference between experimental treatments
              - Alternative hypothesis — A statement that is manually exclusive with the null hypothesis
            - Goal — Find statistical evidence to reject the null hypothesis in order to support the alternative hypothesis
          - Types
            - Between subjects design
              - Different participants
              - Single group of participants is allocated randomly to the experimental conditions
              - Pros: No order effects
              - Cons: Many subjects and individual differences is a problem
            - Within subjects design
              - Same participants
              - All participants appear in both conditions
              - Pros: Few individuals, no individual differences
              - Cons: Counter-balancing needed because of ordering effects
          - Experimental design lifecycle
            - Identify a research hypothesis
            - Specify the design of the study
            - Run a pilot study to test the design, the system, and the study instruments
            - Recruit participants
            - Run the actual data collection sessions — Procedure (L10 P47)
            - Analyze the data
            - Report the results
      - Natural settings — Field study
        - Done in natural settings
        - "In the wild"
        - Goals
          - Identify opportunities for new technology
          - Determine design requirements
          - Decide how best to introduce new technology
          - Evaluate technology in use
      - Without users
        - Heuristic evaluation
        - Analytics
        - A/B testing
        - Predictive models
    - Practical challenges of evaluation
      - Participants' consent
        - Participants need to be told why the evaluation is being done, what they will be asked to do and informed about their rights
        - Informed consent forms provide this information and act as a contract between participants and researchers
      - Interpreting data
        - Reliability
        - Validity
        - Ecological validity
        - Biases
        - Scope
    - Usability Testing vs Experiments (L10 P37)
    - Statistical analysis (additional)
  - Week 11 Evaluation III
    - Experts knowledge codified in heuristics
    - Heuristic evaluations and walkthroughs
      - Nielsen's 10 heuristics
        - Visibility of system status — The design should always keep users informed about what is going on, through appropriate feedback within a reasonable amount of time
        - Match between systems and real world — The design should speak the users' language. Use words, phrases, and concepts familiar to the user, rather than internal jargon. Follow real-world conventions, making information appear in a natural and logical order
        - User control and freedom — Users often perform actions by mistake. They need a clearly marked "emergency exit" to leave the unwanted action without having to go through an extended process
        - Consistency and standards — Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform and industry conventions
        - Error prevention — Good error messages are important, but the best designs carefully prevent problems from occurring in the first place
        - Recognition rather than recall — Minimize the user's memory load by making elements, actions, and options visible. The user should not have to remember information from one part of the interface to another
        - Flexibility and efficiency of use — Shortcuts hidden from novice users may speed up the interaction for the expert user such that the design can cater to both inexperienced and experienced users. Allow users to tailor frequent actions
        - Aesthetic and minimalist design — Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility
        - Help users recognize, diagnose, recover from errors — Error messages should be expressed in plain language (no error codes), precisely indicate the problem, and constructively suggest a solution
        - Help and documentation — It's best if the system doesn't need any additional explanation. However, it may be necessary to provide documentation to help users understand how to complete their tasks
      - Shneiderman's 8 Golden Rules
        - Strive for consistency
        - Seek universal usability
        - Offer informative feedback
        - Design dialogs to yield closure
        - Prevent errors
        - Permit easy reversal of actions
        - Keep users in control
        - Reduce short-term memory load
      - Pros
        - Few ethical and practical issues to consider because users are not involved
        - Best experts have knowledge of application domain and uses
      - Cons
        - Can be difficult and expensive to find experts
        - Important problems may get missed
        - Many trivial problems are often identified, such as false alarms
        - Experts have biases
      - Procedures (L11 P32)
      - Cognitive Walkthroughs
        - Simulating how users go about problem-solving at each step in a human-computer interaction
        - Focus on ease of learning
        - Procedures(L11 P35)
    - Without direct involvement of users
    - Evaluation methods with users
      - Data collected remotely
      - Analytics
        - Record a variety of users' actions can be recorded by software automatically
        - Pros
          - Unobtrusive provided the system's performance is not affected
          - Large volumes of data can be logged automatically and then explored and analyzed using visualization and other tools
        - Cons — Raises ethical concerns about observing participants if this is done without their knowledge
      - Data collected remotely
      - A/B testing
        - A large-scale experiment (thousands of participants or more)
        - Offers another way to evaluate a website, app running on a mobile device
        - Often used for evaluating changes in design on social media applications
        - Compares how two groups of users perform on two versions of a design
        - May create ethical dilemmas if users don't know they are part of the test
      - Models that predict users' performance
      - Predictive models
        - Provide a way of evaluating products or designs without directly involving users, less expensive than user testing
        - Use formulas to derive various measures of user performance
        - Usefulness limited to systems with predictable tasks, for example, voicemail systems, smartphones, and dedicated mobile devices