Final Review Notes

SOEN 357: User Interface

1. Introduction

- **Usability:** Easy to learn, effective to use and provide an enjoyable experience
- 5 Es of a good interface:
    - Easy to use
    - Engaging
    - Effective
    - Efficient
    - Error Tolerant
- UI design requires knowledge about:
    - Users profile, behavior, individual's background and skill level
    - Tasks users will be performing
    - Work context and social environment
    - Technological feasibility
- UI design is difficult because of:
    - Diversity amongst users
    - Understanding the user requirements is both time consuming and the process itself is not precise
    - Getting the 'right' set of users to conduct the UI requirements study is not easy in real life
    - Evaluating the UI is expensive in terms of time and cost
    - Most software developers do not give importance to UI design in early stages of system analysis
- Design takes into account:
    - Who the users are
    - What the activities are
    - Where the interaction takes place
- HCI: Human computer interaction
    - HCI academic disciplines:
        - Psychology
        - Social Science
        - Computer Science
        - Engineering
        - Economics
        - Informatics
- Professionals in the interaction design business
    - interaction designers

    - Usability engineers
    - Web designers
    - Information architects
    - User experience designers

2. Interaction Design Principles

- Design principles generalizable abstractions for thinking about different aspects of design
- **Design Principles:**
    - **Simplicity**
    - **Structure**
    - **Consistency**
        - Design interfaces to have similar operations and use similar elements for similar tasks
            - Inconsistency adds learning burden on user
        - **Internal consistency** refers to designing operations to behave the same within an application
        - **External consistency** refers to designing operations, interfaces, etc., to be the same across applications and devices
    - **Tolerance**
    - **Visibility, affordance, feedback**
        - Visibility: Ability to tell how stuff works
        - Affordance: Refers to an attribute of an object that allows people to know how to use it
        - Feedback: Sending information back to the user about what has been done
- **Constraints** help restrict the possible actions that can be performed
    - Prevents user from selecting incorrect options
- **Usability Principles:** Like design principles but more prescriptive.
        - Used mainly as the basis for evaluating systems
        - Framework for heuristic evaluation
    - **Visibility of system status**
    - **Match between system and the real world**
    - **User control and freedom**
    - **Consistency and standards**
    - **Help users recognize, diagnose and recover from errors**
    - **Error prevention**
    - **Recognition rather than recall**
    - **Flexibility and efficiency of use**
    - **Aesthetic and minimalist design**
    - **Help and documentation**

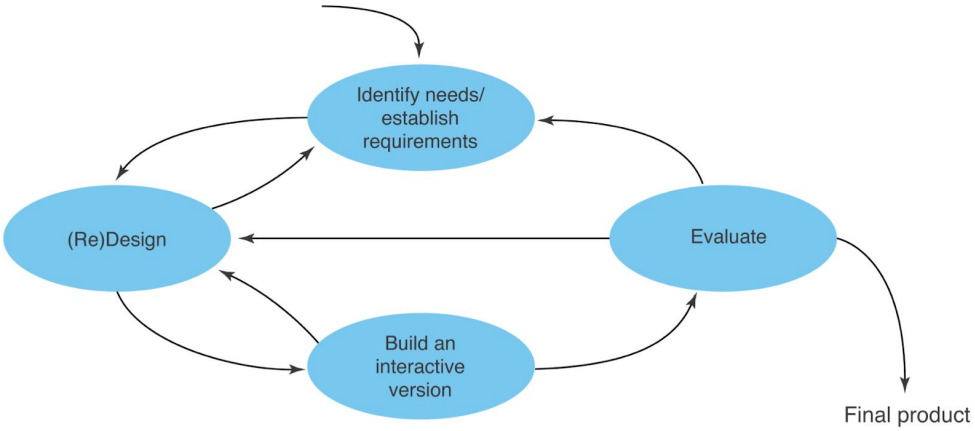
- **User experience:** How a product behaves and is used by people in the real world
    - Cannot design a user experience, only design for a user experience
- Good UI:
    - Enhances human productivity
    - Reduces training/learning time and costs
    - Increases end-users' satisfaction
    - Improves work quality
    - Help minimizing errors in task performance

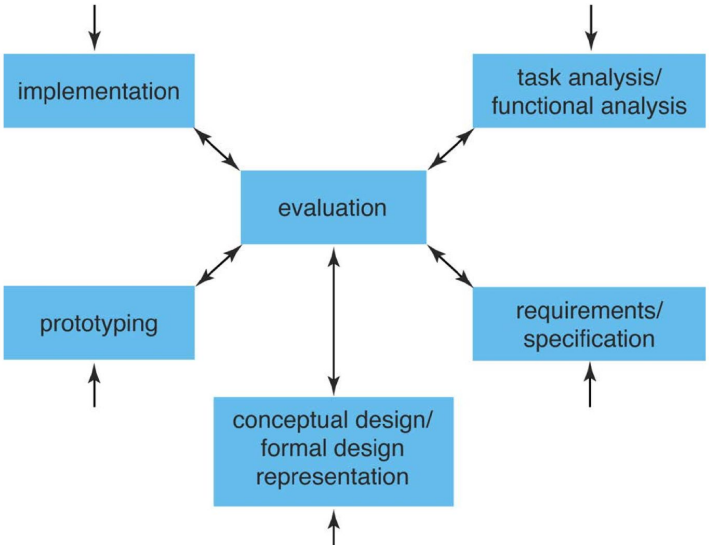
3. Interaction Design Process

- Steps:
    - **Identifying needs and establishing requirements** for the user experience
    - Developing **alternative designs** to meet these requirements
    - Building **interactive prototypes** that can be communicated and assessed
    - **Evaluating** designs
- **Four approaches to interaction design:**
    - user-centered design
        - Early focus on users and tasks: directly studying cognitive, behavioral, anthropomorphic & attitudinal characteristics
        - Empirical measurement: users' reactions and performance to scenarios
        - Iterative design
    - activity-centered design
    - systems design
    - genius design
- **User-centered design rests on three principles**
    - Early focus on users and tasks
    - Empirical measurement using quantifiable & measurable usability criteria
    - Iterative design
- Importance of involving users
    - Expectation management
    - Ownership
        - Make the users active stakeholders
        - More likely to forgive or accept problems
- Degree of user involvement:
    - Full time
    - Part time
    - Short term
    - Long term
- Three categories of users
    - Primary
    - Secondary: Occasional or via someone else

    - Tertiary: Affected by its introduction
- Choosing among alternatives:
    - Technical feasability
    - Quality Thresholds: Usability goals lead to usability criteria set early on and check regularly
        - Safety
        - Utility
        - Effectiveness
        - Efficiency
- Users rarely know what is possible
    - Instead, look at existing tasks:

Lifecycle Models

- Show how activities are related to each other
- 

- **Star Model**: No particular ordering of activities; development may start in any one
    - 

4. UI Requirements

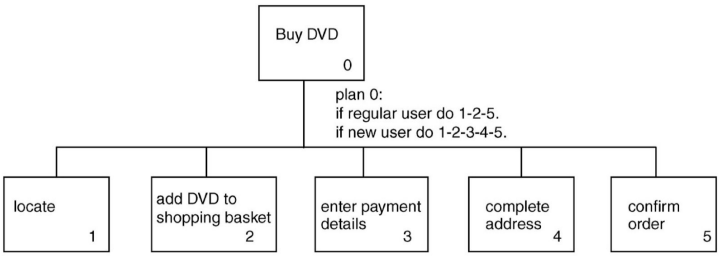
- Kinds of requirements:
    - Functional: What the system should do
    - Non-functional: memory size, performance, etc.
    - Data
- Environment or context of use:
    - Physical
    - Social
        - sharing of files, of displays, in paper, across great distances
    - Organizational
        - hierarchy, IT department's attitude and remit
- Users: Who are they?
    - Characteristics
    - System use: novice, expert, casual, frequent
- **Personas** are used to capture different user characteristics

- Task description methods:
    - Scenarios
        - An informal narrative story, simple, 'natural', personal, not generalizable
    - Use Cases
        - assume interaction with a system
    - Essential use case
        - abstract away from the details
        - does not have the same assumptions as use cases

USER INTENTION	SYSTEM RESPONSIBILITY
find visa requirements	request destination and nationality
supply required information	obtain appropriate visa info
obtain copy of visa info	offer info in different formats
choose suitable format	provide info in chosen format

Task analysis

- Often used to envision new systems or devices
  - used mainly to investigate an existing situation
  - Many techniques, the most popular is Hierarchical Task Analysis (HTA)
- **Hierarchical Task Analysis (HTA)**
  - Involves breaking a task down into subtasks, then sub-sub-tasks and so on.
  - Start with a user goal which is examined and the main tasks for achieving it are identified
  - 0. In order to buy a DVD
    1. locate DVD
    2. add DVD to shopping basket
    3. enter payment details
    4. complete address
    5. confirm order

    plan 0: If regular user do 1-2-5.
    If new user do 1-2-3-4-5.
  - 

Data Gathering for Requirements

- Interviews
  - Good for exploring issues
  - time consuming and may be infeasible to visit everyone

- Focus Groups
    - Good at gaining a consensus view and/or highlighting areas of conflict
    - Can be dominated by individuals
- Questionnaires
    - Often used in conjunction with other techniques
    - Can give quantitative or qualitative data
    - Good for answering specific questions from a large, dispersed group of people
- Researching similar products
    - Good for prompting requirements
- Direct observation
    - Good for understanding the nature and context of the tasks
    - It requires time and commitment from a member of the design team
- Indirect observation
    - Good for logging current tasks
- Studying documentation
    - Good source of data about the steps involved in an activity
    - Good for understanding legislation, and getting background information
    - No stakeholder time
- Contextual Inquiry
    - An approach to ethnographic study where user is expert, designer is apprentice
    - Interview at user's workplace
    - 4 principles:
        - Context: see workplace & what happens
        - Partnership: user and developer collaborate
        - Interpretation: observations interpreted by user and developer together
        - Focus: project focus to understand what to look for
- The most commonly-used techniques for data gathering are: questionnaires, interviews, focus groups, direct observation, studying documentation and researching similar products

Difficulties with Data Gathering

- Requirements management: version control, ownership
- Communication between parties
- Domain knowledge distributed and implicit
- Availability of key people
- Political problems
- Dominance of certain stakeholders
- Economic and business changes
- Balancing functional and usability demands

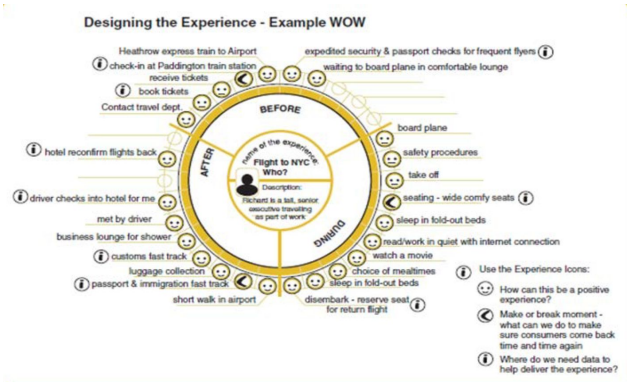
Guidelines

- Focus on identifying the stakeholders' needs

- Involve all the stakeholder groups
- Involve more than one representative from each stakeholder group
- Use a combination of data gathering techniques
- Support the process with props such as prototypes and task descriptions
- Run a pilot session
- You will need to compromise on the data you collect and the analysis to be done, but before you can make sensible compromises, you need to know what you'd really like
- Consider carefully how to record the data

5. Design and Prototyping

- **Mental model**: Users develop an understanding of a system through learning about and using it
    - People make inferences using mental models of how to carry out tasks which are evoked through proper metaphors
- **Interface Metaphor:** combine familiar knowledge with new knowledge in a way that will help the user understand the product.
    - 3 steps:
        - understand functionality
        - identify potential problem areas
        - generate metaphors
- **Interaction types:**
    - Instructing
    - Conversing
    - Manipulating
    - Exploring
- In interaction design a prototype can be:
    - a series of screen sketches
    - a storyboard, i.e. a cartoon-like series of scenes
    - a Powerpoint slide show
    - a video simulating the use of a system
    - a lump of wood (e.g. PalmPilot)
    - a cardboard mock-up
    - a piece of software with limited functionality written in the target language or in another language
- **Storyboards** are a series of sketches showing how a user might progress through a task using the device
    - Are often used with scenarios, bringing more detail, and a chance to role play
    - **Can be generated from scenarios**
- **Low fidelity prototypes** use a medium which is unlike the final medium
    - **Sketching**
    - **Card-based prototypes**

        - Each card represents a screen or part of a screen
    - **'Wizard-of-Oz' prototyping**
        - The user thinks they are interacting with a computer, but a developer is responding to output rather than the system.
        - Done early in design to understand users' expectations
- **High Fidelity Prototyping**
    - Uses materials that you would expect to be in the final product.
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
- Prototype compromises
    - 'horizontal': provide a wide range of functions, but with little detail
    - 'vertical': provide a lot of detail for only a few functions
- Use personas, card-based prototypes or stickies to **model the user experience**
    - Visual representation called:
        - design map
        - customer/user journey map
        - experience map
    - Two common representations
        - Wheel
        - 

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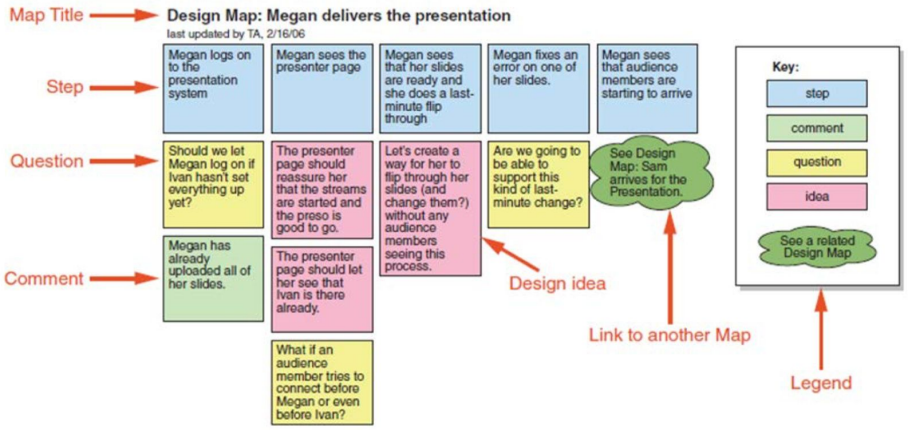
- Timeline
  - 

6. UI evaluation

- Test your design ideas with representative end-users in as natural an environment as possible
- Discovers how good/bad your design is in as many ways as possible
- The opportunity to ask end-users about the why behind their actions and opinions with respect to your design
- A de-risking activity and a diagnostic tool
  - Check that design assumptions are valid
  - Detect and fix usability issues early in the cycle
  - Identify potential issues
- Verify that you have achieved usability goals
- UI evaluation is **not** a design review with team members or stakeholders
  - **not** QA of the software
  - **not** a rubber stamp of approval
- **Iterative design and evaluation** is a continuous process that examines:
  - Why: to check that users can use the product and that they like it
  - What: a conceptual model, early prototypes of a new system and later, more complete prototypes
  - Where: in natural and laboratory settings
  - When: throughout design; finished products can be evaluated to collect information to inform new products
- Types of evaluation
  - Controlled settings involving users
    - usability testing and experiments in laboratories and living labs
      - evaluations that are too difficult to do in a usability lab are done in living labs
  - Natural settings involving users
    - Field studies

    - Any settings not involving users
        - consultants critique
- **Things to consider when interpreting data**
    - Reliability: does the method produce the same results on separate occasions?
    - Validity: does the method measure what it is intended to measure?
    - Ecological validity: does the environment of the evaluation distort the results?
    - Biases: Are there biases that distort the results?
    - Scope: How generalizable are the results?
- **Evaluation approaches**
    - Usability testing
    - Field studies
    - Analytical evaluation
    - Combining approaches
    - Opportunistic evaluations
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	Usability testing	**Field studies**	**Analytical evaluation**
Users	do task	natural	not involved
Location	controlled	natural	anywhere
When	prototype	early	prototype
Data	quantitative	qualitative	problems
Feed back	measures & errors	descriptions	problems
Type	applied	naturalistic	expert

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Method	**Usability testing**	**Field studies**	**Analytical evaluation**
Observing	x	x	
Asking users	x	x	
Asking experts		x	x
Testing	x		
Modeling			x

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- **Triangulation** involves using a combination of techniques to gain different perspectives, or analyzing data using different techniques.

7. Usability Testing

- Involves recording performance of typical users doing typical tasks.
    - Controlled environment

    - Users are observed and timed
    - User satisfaction is evaluated using questionnaires and interviews.
    - Field observations may be used to provide contextual understanding.
- Usability testing is applied experimentation
    - Developers check that the system is usable by the intended user population for their tasks.
- Goals and questions focus on how well users perform tasks with the product.
- Focus is on time to complete task and number and type of errors.
- User satisfaction questionnaires and interviews provide data about users' opinions.
- **Testing conditions**
    - Usability lab or other controlled space
    - Emphasis on:
        - selecting representative users;
        - developing representative tasks.
    - Tasks usually last no more than 30 minutes
    - The test conditions should be the same for every participant
- Types of data to measure:
    - Time to complete a task
    - Time to complete a task after a specified time away from the product
    - Number and type of errors
    - Number of errors per unit time
    - Number of navigations to online help or manuals
    - Number of users making a particular error
    - Number of users completing task successfully
- Typically 5-10 participants for user testing
- **Experimental Designs**
    - Different participants - single group of participants is allocated randomly to the experimental conditions
    - Same participants - all participants appear in both conditions
    - Matched participants - participants are matched in pairs
    -

Design	Advantages	Disadvantages
Different	No order effects	Many subjects & individual differences a problem
Same	Few individuals, no individual differences	Counter-balancing needed because of ordering effects
Matched	Same as different participants but individual differences reduced	Cannot be sure of perfect matching on all differences

- **Field studies** are done in natural settings.
    - Aim is to understand what users do naturally and how technology impacts them

    - Observation and interviews are used to collect field studies data
- **Think aloud protocol** is a method that allows researchers to understand the thought process of testers/participants as they use a given product or device
    - **Concurrent Think Aloud (CTA)**: participants are asked to explain their thoughts as they are testing the product.
        - Tends to involve less biased thoughts since users are asked to verbalize their thinking process during task performance.
        - More observed problems are revealed during task completion as opposed to the RTA
        - Users might potentially feel uncomfortable verbalizing their thoughts
        - Participants have an extra burden in speaking their thoughts while performing the tasks
    - **Retrospective Think Aloud (RTA)**, participants are asked to perform a set of tests silently(while being video taped) and then verbalize their experience at the end of the testing session
        - Participants are not burdened with the extra task of verbalizing their thoughts
        - Potential decrease in reactivity since participant can execute a task at their own pace and are not rushed in a way that can affect their normal software usage
        - Might not be as precise in the user experience description as CTA since users are asked to describe their experience after.
        - Overall session time is longer in RTA than it is in CTA
- **Categorization** and **theory-based techniques** are used to analyze the data

8. Analytical Evaluation

- **Inspections**
    - Experts use their knowledge of users and technology to review software usability
    - Expert critiques can be formal or informal
    - Heuristic evaluation is a review guided by a set of heuristics
    - Walkthroughs involve stepping through a preplanned scenario noting potential problems

Heuristic evaluation

- Design guidelines form a basis for developing heuristics
- Types of heuristics
    - Visibility of system status.
    - Match between system and real world.
    - User control and freedom.
    - Consistency and standards.
    - Error prevention.

        - Recognition rather than recall.
        - Flexibility and efficiency of use.
        - Aesthetic and minimalist design.
        - Help users recognize, diagnose, recover from errors.
        - Help and documentation.
- Referred to as **discount evaluation** when 5 evaluators are used.
    - On average 5 evaluators identify 75-80% of usability problems
- 3 stages of evaluation:
    - Briefing session to tell experts what to do
    - Evaluation period of 1-2 hours
        - Experts work separately
        - Take one pass to get a feel for the product
        - Second pass to focus on specific feature
    - Debriefing session in which experts work together to prioritize problems
- Ethical and practical issues to consider because users not involved
- Difficult and expensive to find experts
- Best experts have knowledge of application domain and users
- Important problems may get missed
- Many trivial problems are often identified
- Experts are biased

Cognitive Walkthrough

- Designer presents an aspect of the design and usage scenarios
- Expert is told the assumptions about user population, context of use, task details
- One or more experts walk through the design prototype with the scenario
- Experts are **guided by three questions**
    - Will the correct action be sufficiently evident to the user?
    - Will the user notice that the correct action is available?
    - Will the user associate and interpret the response from the action correctly?

Pluralistic Walkthrough

- Performed by a carefully managed team
- A panel of experts begins by working separately
- Then, managed discussion that leads to agreed decisions

Evaluation using analytics

- method for evaluating user traffic through a system or part of a system
    - Eg: Google analytics

Predictive Models

- Provide a way of evaluating products or designs without directly involving users
- Usefulness limited to systems with predictable tasks
- Based on expert error-free behavior
- Less expensive than user testing

GOMS

- **Goals** - the state the user wants to achieve e.g., find a website.
- **Operators** - the cognitive processes and physical actions needed to attain the goals, e.g., decide which search engine to use.
- **Methods** - the procedures for accomplishing the goals, e.g., drag mouse over field, type in keywords, press the go button.
- **Selection** rules - decide which method to select when there is more than one.
- GOMS has also been developed to provide a quantitative model - **the keystroke level model.**
    - allows predictions to be made about how long it takes an expert user to perform a task

Fitt's Law

- Predicts that the time to point at an object using a device is a function of the distance from the target object and the object's size
- The further away and the smaller the object, the longer the time to locate it and point to it

9. Data Gathering Techniques

- **5 key issues**
    - Setting goals
    - Identifying participants
    - Relationship with participants
    - Triangulation
        - Use more than 1 approach
    - Pilot studies
        - Small trial of the main study
- 3 main techniques:
    - interviews, questionnaires, observation

Interviews

- **Unstructured**
    - Not directed by a script

    - Rich but not replicable
- **Structured**
    - tightly scripted, often like a questionnaire.
    - 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**
- Interview questions
    - **closed questions** have a predetermined answer format
        - Eg: yes, no
        - Easier to analyze
    - **open questions** do not have a predetermined format
- Running the interview:
    - Introduction
    - Warm up
        - make first questions easy and nonthreatening.
    - Main body
    - Cool-off period
        - include a few easy questions to defuse tension at the end
    - Closure

Questionnaires

- Questions can be closed or open
- Can be administered to large populations
    - Paper, email and the web used for dissemination
- Sampling can be a problem when the size of a population is unknown
- Question formats
    - ‘Yes’ and ‘No’ checkboxes
    - Checkboxes that offer many options
    - Open-ended responses
- 40% response rate is high, 20% is often acceptable
- **Advantages of online questionnaires**
    - Relatively easy and quick to distribute
    - Responses are received quickly
    - No postage costs
    - Data can be collected in database for analysis
    - Time required for data analysis is reduced
    - Errors corrected easily
- **Problems with online questionnaires**
    - Sampling is problematic if population size is unknown
    - Preventing individuals from responding more than once

    - Individuals have been known to change questions in email questionnaires

Observation

- Direct observation in the field
- Direct observation in controlled environments
- Indirect observation: tracking users' activities
    - Diaries, interaction logging

Ethnography

- Philosophy with a set of techniques that include participant observation and interviews
- Debate about differences between participant observation and ethnography
- A researcher's degree of participation can vary along a scale from 'outside' to 'inside'
- Collections of comments, incidents, and artifacts are made
- Co-operation of people being observed is required
- Data analysis is continuous
- Interpretivist technique
- Questions get refined as understanding grows

Observations in a controlled setting

- Direct observation: think aloud techniques
- Indirect observation – tracking users' activities
    - Diaries, logs, analytics
- Video, audio, photos, notes are used to capture data in both types of observations

Web Analytics

- A system of tools and techniques for optimizing web usage by:
    - Measuring, collecting, analyzing and reporting web data

10. Data Analysis Techniques

- Quantitative data – expressed as numbers
    - Quantitative analysis – numerical methods to ascertain size, magnitude, amount
        - Mean, average, median, mode (Figure that appears most often)
- Qualitative data – difficult to measure sensibly as numbers
    - Qualitative analysis – expresses the nature of elements and is represented as themes, patterns, stories
        - Unstructured - are not directed by a script. Rich but not replicable.
        - Structured - are tightly scripted, often like a questionnaire. Replicable but may 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.
            - Simple qualitative analysis
                - Recurring patterns or themes
                - Categorizing data
                - Looking for critical incidents
- Tools for data analysis
    - Spreadsheet
    - Statistical packages
    - Qualitative data analysis tools
- Theoretical frameworks for qualitative analysis
    - Grounded Theory
        - Aims to derive theory from systematic analysis of data
        - Based on categorization approach
        - Three levels of ‘coding’
            - Open: identify categories
            - Axial: flesh out and link to subcategories
            - Selective: form theoretical scheme
    - Distributed Cognition
        - The people, environment & artefacts are regarded as one cognitive system
        - Used for analyzing collaborative work
        - Focuses on information propagation
    - Activity Theory
        - Explains human behavior in terms of our practical activity with the world
        - Provides a framework that focuses analysis around the concept of an ‘activity’ and helps to identify tensions between the different elements of the system
        - Two key models: one outlines what constitutes an ‘activity’; one models the mediating role of artifacts
- Presentation of the findings should not overstate the evidence

11. Understanding Interaction

- Benefits of **conceptualization**
    - Orientation: Enables design teams to ask specific questions about how the conceptual model will be understood
    - Open-minded: Prevents design teams 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.
- Enables designers to straighten out their thinking before they start laying out their widgets
- Helps the design team orient themselves towards asking questions about how the conceptual model will be understood by users
- **Main components**
    - Major metaphors and analogies that are used to convey how to understand what a product is for and how to use it for an activity
    - Concepts that users are exposed to through the product
    - The relationships between the concepts
    - The mappings between the concepts and the user experience the product is designed to support

Interface Metaphors

- Designed to be similar to a physical entity but also has own properties
    - Exploit user's familiar knowledge
- Benefits
    - Makes learning new systems easier
    - Helps users understand the underlying conceptual model
- Problems
    - Break conventional and cultural rules
    - Can constrain designers
    - Conflict design principles
    - Forces users to only understand the system in terms of the metaphor
    - Can inadvertently use bad existing designs
    - Limits designers imagination

Interaction Types

- **Instructing**
    - issuing commands using keyboard and function keys and selecting options via menus
    - Main benefit of instructing is to support quick and efficient interaction
        - Good for repetitive tasks
- **Conversing**
    - interacting with the system as if having a conversation
    - Differs from instructing in that it is more like two-way communication, with the system acting like a partner rather than a machine that obeys orders
    - include search engines, advice-giving systems and help systems

    - Allows users, especially novices and technophobes, to interact with the system in a way that is familiar
- **Manipulating**
    - interacting with objects in a virtual or physical space by manipulating them
    - Exploit's users' knowledge of how they move and manipulate in the physical world
    - Good for 'doing' types of tasks, e.g. designing, drawing, flying, driving, sizing windows
    - **Direct Manipulation** proposes that digital objects be designed so they can be interacted with analogous to how physical objects are manipulated
        - Continuous representation of objects and actions of interest
        - Physical actions and button pressing instead of issuing commands with complex syntax
        - Rapid reversible actions with immediate feedback on object of interest
- **Exploring**
    - moving through a virtual environment or a physical space
    - 3D desktop virtual worlds, CAVEs, physical context aware worlds

Paradigms, Models, Frameworks and Theories

- **Paradigms** are a general approach adopted by a community for carrying out research
- **Theories** are explanation for phenomenons
    - Can help identify factors
    - Tend to simplify some aspect of human–computer interaction
- **Models** are a simplification of an HCI phenomenon
    - abstracted from a theory coming from a contributing discipline
    - intended to make it easier for designers to predict and evaluate alternative designs
    - tend to be comprehensive, explaining human–computer interactions
- **Frameworks** are a set of interrelated concepts and/or specific questions for 'what to look for'.
    - Tend to be prescriptive, providing designers with concepts, questions, and principles to consider

12. Understanding Users*

- Interacting with technology is cognitive
- Cognition involves several processes including **attention**, **memory**, **perception** and **learning**
- Encoding is first stage of memory
- The more attention paid to something, and the more it is processed in terms of thinking about it and comparing it with other knowledge, the more likely it is to be remembered
- Context affects the extent to which information can be subsequently retrieved

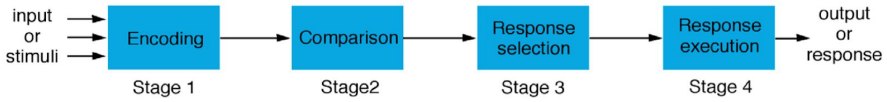
- Command-based interfaces require users to recall from memory a name from a possible set of 100s
    - GUIs provide visually-based options that users need only browse through until they recognize one
- George Miller's theory of how much information people can remember **7+2**
    - Present only 7 options on a menu
    - Present only 7 icons in a tool bar
    - …
    - Using this theory in interface design is an inappropriate application of the theory
        - People can scan lists of bullets, tabs, menu items till they see the one they want
- Memory involves 2 processes
    - Recall-directed and recognition-based scanning
    - File management systems should be designed to optimize both kinds of memory processes

Norman's Theory of Action

- Proposes 7 stages of an activity, eg: Read news on website
    - Establish a goal
        - decide on news website
    - Form an intention
        - Check BBC
    - Specify an action sequence
        - move cursor to link on browser
    - Execute an action
        - click on mouse button
    - Perceive the system state
        - see a new page pop up on the screen
    - Interpret the state
        - read that it is the BBC website
    - Evaluate the system state with respect to the goals and intentions
        - read breaking news
- Human activity does not proceed in such an orderly and sequential manner
- Theory is only approximation of what happens and is greatly simplified
- **Gulfs** explain the gap that exist between the user and the interface
    - The gulf of execution: Distance from the user to the physical system
    - The gulf of evaluation: Distance from the physical system to the user

Information Processing

- Conceptualizes human performance in metaphorical terms of information processing stages



- **External Cognition** is concerned with explaining how we interact with external representations

13. Social Interaction

- Conversational rules
  - Sacks et al. (1978) work on conversation analysis describe three basic rules
    - the current speaker chooses the next speaker by asking an opinion, question, or request
    - another person decides to start speaking
    - the current speaker continues talking
  - Turn-taking used to coordinate conversation
    - A: Shall we meet at 8?
    - B: Um, can we meet a bit later?
    - A: Shall we meet at 8?
  - Back channeling to signal to continue and following
    - Uh-uh
  - Farewell rituals
    - Bye then, see you
  - Implicit and explicit cues
- Telepresence
  - New technologies designed to allow a person to feel as if they were present in the other location
  - Hypermirror: allows people to feel as if they are in the same virtual place even though in physically different spaces
- **Schedules** used to organize regular activities in large organizations
- **Formal rules**, like the writing of monthly reports enable organizations to maintain order and keep track
- **Conventions**, like keeping quiet in a library, are a form of courtesy to others
- **Shared external representations** are common method used to coordinate collaborative activities
- **Awareness mechanisms** involves knowing who is around, what is happening, and who is talking with whom

Emotional Interaction

- HCI has traditionally been about designing efficient and effective systems (usability)
  - Now more about how to design interactive systems that make people respond in certain ways

- **Emotional interaction** is concerned with how we feel and react when interacting with technologies
- Norman, Ortony and Revelle (2004) model of emotion claims our emotional state changes how we think
    - when frightened or angry we focus narrowly and body responds by tensing muscles and sweating
    - when happy we are less focused and the body relaxes
- **Expressive Interfaces**
    - Provide reassuring feedback that can be both informative and fun
    - can also be intrusive, causing people to get annoyed and even angry
- **Gimmicks** are amusing to the designer but not the user
- **Facial coding** is measuring a user's emotions as they interact with a computer or tablet
    - Uses this to gauge how engaged the user is
    - 6 core expressions - sadness, happiness, disgust, fear, surprise and anger
- **Anthropomorphism** is attributing human-like qualities to inanimate objects
- Reeves and Naas (1996) found that computers that flatter and praise users in education software programs results in positive impact on them
- Virtual characters
    - Can lead people into false sense of belief, enticing them to confide personal secrets with chatterbots
    - Annoying and frustrating
    - May not be trustworthy