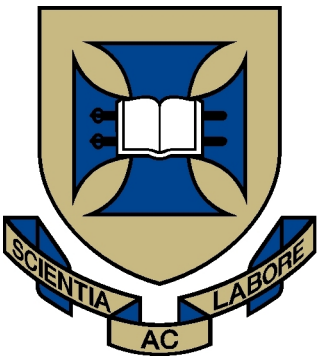
Daniel **Fitz**
43961229



University of Queensland

DECO2500 – Human Computer Interaction Design

Lecture Summary

Table of Contents

What is interaction design

1. Explain difference between good and poor interaction design
2. Describe what interaction design is and how it relates to human-computer interaction etc
3. Explain relationship between user experience and usability
4. Describe what and who is involved in interaction design
5. Outline different forms of guidance used in interaction design
6. Enable you to evaluate an interactive product and explain what is good and bad about it in terms of the goals and core principles of interaction design

What are HCI and ID

Human-computer interaction (HCI)

Concerned with the design, evaluation, and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them

One set of usability principles (Norman 1998):
Visibility can you see your options for action? *Externalising cognition – Gulf of Execution*
Feedback can you see the effect of what you did? *Goal directed activity – Gulf of Evaluation*
Constraints is your activity usefully shaped towards successful paths? *Focusing attention – Gulf of Execution*
Mapping is there a natural relation between your actions and their effects on the world? *Mental model – Gulf of Execution*
Consistency are there similar operations and similar elements for similar tasks? *Learning and memory – Gulf of Execution*
Affordance do interfacce elements correctly "signal" how they are to be used? *Gulf of Execution*

Another set of usability principles (Nielsen 2001):

- Visibility of system status – *Externalising cognition*
- Match between system and real world – *Mental model*
- User control and freedom – *Goal-directed activity*
- Consistency and standards – *Learning and memory*
- Error prevention – *Focusing attention*
- Recognition rather than recall – *Learning and memory*
- Flexibility and efficiency of use – *Information processing*
- Aesthetic and minimalist design – *see Emotional design*
- Help users recognize, diagnose and recover from errors – *Goal-directed activity (7-stages)*
- Help and documentation

Interaction Design (ID)

Designing interactive products to support the way people communicate and interact in their everyday and working lives

Key Components of ID process

- Establishing user requirements
- Developing alternatives
- Prototyping
- Evaluating

Interaction Design Process

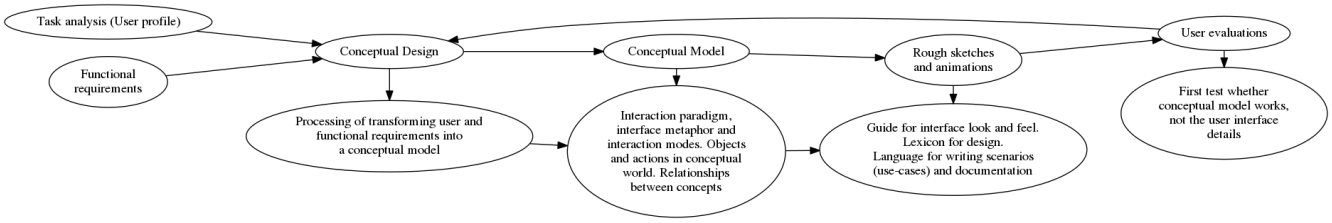


Figure 1: Interaction Design Process

Users shoud be involved throughout the project. Specific usability and user experience goals should be identified, clearly documented and agreed at start of project, and *tracked empirically throughout development*. Iteration is needed through the core activities

Help designers:

- Match what people want, need, and may desire
- Appreciate that one size does not fit all (e.g. teenagers very different from adults)
- Correct incorrect assumptions about user groups (e.g. not all old people want or need big fonts)
- Know people's sensitivities and capabilities

Architecture vs Engineering Analogy (ID vs soft engg)

Architects are specialists in how people will interact with spaces. Engineers are specialists in specifying and constructing the spaces

User Experience (UX)

How people feel about a product and their pleasure and satisfaction when using it, looking at it, holding it, and opening or closing it. It includes their overall impression of how good it is to use, right down to the sensual effect small details have on them, such as how smoothly a switch rotates or the sound of a click and the touch of a button when pressing it

Can't design user experience; can only design for it

Usability Goals

- Effective to use
- Efficient to use
- Safe to use
- Have good utility
- Easy to learn
- Easy to remember how to use

Understanding and Conceptualising Interaction

1. Explain what is meant by the problem space
2. Explain how to conceptualize interaction
3. Describe what a conceptual model is and how to formulate one
4. Discuss interface metaphors as part of a conceptual model
5. Outline core interaction types for informing development of a conceptual model

Conceptual Design

Processing of transforming user and functional requirements into a conceptual model before starting physical design. "Designing what to design"

1. Problem space
2. Conceptual model
3. Interface metaphor
4. Design space

Intial Problem Space

"In the process of creating an interactive product, it can be tempting to begin at the nuts and bolts level of design…better to make thses kinds of decisions after articulating the nature of the problem space; (that is, after) understanding and conceptualizing what is currently the user experience/product and how this is going to be improved or changed" Preece et al., p.37

- Question the assumptions
- Challenge the claims
  - Are there problems with existing product or user experience?
  - If so, what are they?
  - Why do you think there are problems?
  - How do you think your proposed design ideas might overcome these?
  - If designing for a new user experience how do you think your proposed design ideas support, change, or extend current ways of doing things?
- Get others to challenge your ideas – hard to do it yourself

Conceptual Model

- **Will the user understand the underlying conceptual model?**

"A description of the proposed system in terms of a set of integrated ideas and concepts about what it should do, behave and look like, that will be understandable by the users in the manner intended." (Preece, et al., 2002)

Three considerations when developing a conceptual model:

1. Interaction paradigm – ICT framework experienced
   - ICT framework within which interaction takes place (WIMP, mobile, ubiquitous computing, etc)
   - May be familar or novel to user
2. Interaction mode/type – what does the user have to DO?
   - How does the user interact with the system?
   - Helps user know what to do, in particular
3. Interface metaphor – exploiting user experience
   - How is the user's prior knowledge used?
   - Helps user know what to do and how to interpret feedback

- Not same as "user interface"
  - It's the concepts people need to understand in order to *use* the interface
- Not same as "user's mental model"
  - It's the conceptual basis for the user's mental model
- Not same as "use-cases"
  - It focuses on *system as a whole*, not individual tasks
- Not same as "implementation architecture"
  - It involves *abstract* constructs, not technical or implementation-level constructs

Formulating a Conceptual Model

- **Will the user understand the underlying conceptual model?**
- What will users be doing when carrying out tasks?
- How will the system support those activities?
- What kind of *interface metaphor* is appropriate?
- What kinds of *interaction modes* and styles to use?

Interaction mode/interaction type

- Giving instructions
  - Issuing commands using keyboard and selecting options via menus
- Conversing
  - Interacting with the system as if having a conversation
- Manipulating and navigating
  - Acting on objects and interacting with virtual objects
- Exploring and browsing
  - Finding out and learning things

Interface metaphor

"This works like a …"

Cognition

Cognition is operations involved with sensing and functioning mentally in the world

- Attention
- Perception and recognition
- Memory
- Cognition – internal or personal
  - Mental models
  - Gulfs of execution and evaluation
  - Information processing
- Cognition – external or shared
  - Distributed cognition
  - External cognition

Attention

- Processes by which we focus our minds and our senses on one thing/set of things from all possibilities around us
  - Visual attention (usually works serially)
  - Auditory attention (eyes-free, time-shared)
  - Focal/focused attention
  - Divided attention
  - Pre-attentive processes (not in full focal attention)
  - Peripheral awareness (background awareness)
- "Attention-aware computing"
- "Cocktail party effect"
- Possible to perform multiple tasks without one or more of them suffering?
- Depends on task and individual differences
- Heavy vs light multi-taskers
  - Heavy more distractible than light
  - Heave find it difficult to filter irrelevant information
- "Distracted doctoring"/"Distracted driving"

Perception and recognition

How information is acquired from world through senses and transformed into experience

Memory

We encode and then retrieve knowledge. We remember what we have attended to. Context is an important cue to memory retrieval. We recognize things

Myth of 7 +/- 2 in design

- Miller's (1956) theory of how much information people can remember
- Based on how many items you can remember from a spoken or briefly shown list (average = 7 +/- 2)
- But some designers say:

- "Present only 7 options on a menu"
- "Display only 7 icons on a tool bar"
- "Place only 7 tabs on the top of a website page"

This is wrong!

Information-processing Metaphor

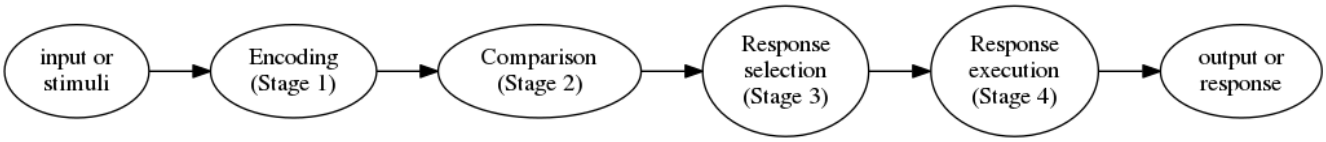


Figure 2: Information-processing metaphor

Stages of processing assumed:

- Stage 1 and Stage 4 – Modaltiy of input and output affects performance
- Stage 2 and Stage 3 – Options to select amongst affect performance

Information Processing Models

"Model Human Processor"

- Based on mental activities only
- Models human interacting with computer
- Estimates time to do tasks
- Models highly constrained tasks – telephone operators
- Does not model how people interact with computers and other devices in less constrained contexts

GOMS – Card, Moran & Newell (1983) - Goals (what you're trying to achieve) - Operators (actions you can do) - Methods (ways to assemble Operators) - Selection rules (ways to choose Methods)

Cognitive Frameworks For HCI

Cognitive frameworks for HCI are concepts and models that explain cognitive aspects of human-computer interaction and interaction design issues

Mental Models

- User develops understanding of system through learning about and using it
- User's knowledge is somtimes described as "mental model":
  - How to use the system
  - How to handle unfamiliar system or unexpected situations
- People make inferences using mental models
- Mental models often wrong or only partially right
- Refrigerator example

Seven Stages of aciton

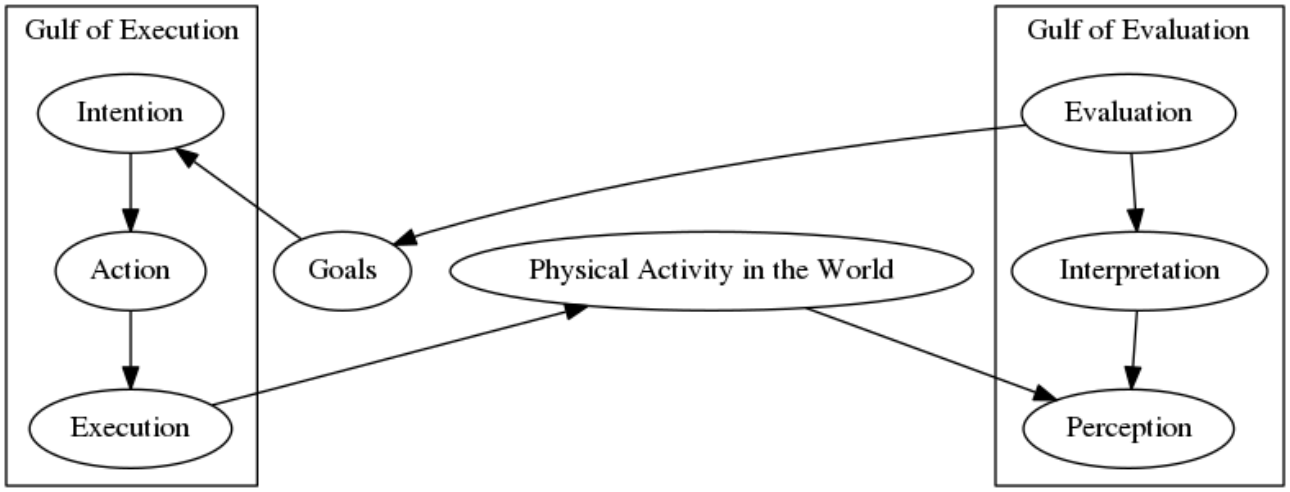


Figure 3: Seven stages of action

Norman's (1986) seven stages of action. "Seven stages" decompose interaction into steps. Each step may be well or poorly supported

Gulf of Execution

Difference between user's formulation of actions to reach a goal and actions allowed by system. If actions allowed by system match user's intention, then interaction will be effective.

Gulf of Evaluation

Distance between physical presentation of system state and expectation of user. If user can readily evaluate presentation in terms of goals, the gulf of evaluation is small

External Cognition

Explains how we interact with external respresentations (e.g. maps, notes, diagrams, tools, instruments, notations). How they extend our cognition. How they help us solve difficult problems

Distributed Cognition

- Shared/distributed problem-solving that takes place
- Role of verbal and *non-verbal* behaviour
- Coordinating mechanisms people use (e.g. rules, procedures)
- Communication that takes place as collaborative activity progresses
- How knowledge is shared and accessed
  - Taking bearings in narrow waterways
  - Micronesian navigation across the Pacific
- How cognitive phenomena work across individuals, artifacts, and internal and external representations (Hutchins, 1995)
- Propagation across representational states
- Information *transformed* through different media (computers, displays, paper, heads)
- Role of verbal and non-verbal behaviour

Conversation analysis

Fundamentals of conversations:

- Openings and greetings

- Personal space/distance
- Topic introduction
- Turntaking
- Making disclosures
- Admitting others
- Trouble and repair
- Closings and farewells

Rules

Sacks et al. (1978) describe three rules:

Rule 1 current speaker chooses next speaker by asking opinion, question, or request

Rule 2 another person decides to start speaking

Rule 3 the current speaker continues talking

Affordances of Media

- How does different media affect the fundamentals and pragmatics of conversation?
  - Compare how you finish a conversation on an audio-only channel (phone call) vs an audiovisual channel (Facetime, Skype, etc)
  - Compare how you correct a misunderstanding on email vs on a phone call vs on Facetime or Skype
- How do we select amongst different media for conversations of different kinds?
  - Number of other people
  - Familiarity with other people
  - Sensitivity of issue to be discussed
  - Simplicity/complexity of issue/purpose of communication

Telepresence

- Shared space
- 3 by 8 ft 'picture-window' between two sites with video and audio
- People interacted but strange things happened (Kraut, 1990)
  - Talked constantly about system
  - Spoke more to people in same room than in other room
  - When tried to get closer to someone in other place had opposite effect – went out of range of camera and microphone
- Technologies designed to allow a person to feel as if they were present in the other location
  - Projecting body movements, actions, voice and facial expressions to other location or person
- Superimpose images of other person on a workspace
  - Transparent board that shows other person's facial expression on your board as you draw
    - Users did not feel comfortable "looking down" at the other person
- Most forms of videoconferencing lead to:
  - Longer conversational turns
  - Fewer interruptions of each other
  - Turn-taking more explicit
  - Greetings and farewells longer and more ritualised
- Video gives more intimacy than audio phone
- Low overhead to adopt
- Works in personal spaces
- Works well for already-acquainted people but also lets people get to know each other

Presence

Lifelogging

- Low cost audiovisual data collection and storage
- Can go beyond perpetual sharing and broadcasting of personal information to lifelogging

Google Glass

- Socially and cognitively problematic
- Distraction issues (display), privacy issues (forward camera)
- Banned in cars, cinemas, theatres, casinos, strip clubs, restaurants, cafes, etc
- "Glassholes"
- Current focus on enterprise applications only

Online Presence

- Rapid switching between media and applications to notify and be notified
- Selection of medium for message type, speed, cost, and urgency

Awareness Mechanisms

Involves knowing who is around, what is happening, and who it talking to whom

- Peripheral awareness
  - Keeping an eye on things happening in the periphery of vision
  - Overhearing and overseeing – allows tracking of what others are doing without explicit cues
- Notification systems
  - User notify others as opposed to being constantly monitored
  - Provide information about shared objects and progress of collaborative tasks

Emotional Interaction

"Emotional interaction is about considering what makes us happy, sad, annoyed, anxious, frustrated, motivated, delirious, and so on, and using this knowledge to inform the design of different aspects of the user experience, from when we first want something to when we no longer interact with it or need to replace it." Preece et al. (2015) p.133

Affect quick automatic reaction without reflection

Conscious emotion considered and conscious reaction

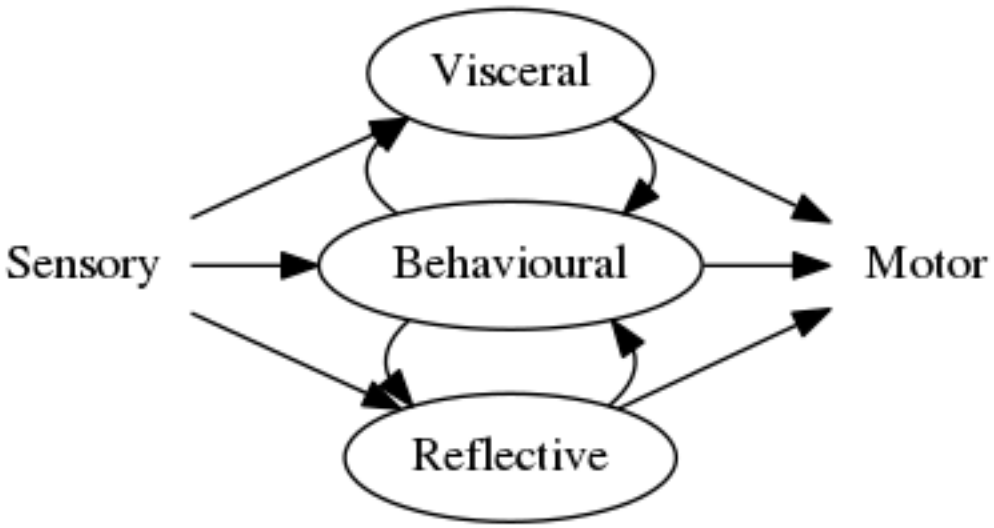


Figure 4: Norman, Ortony and Revelle (2004) model of emotion

Consequences of Emotions

Emotional state changes how people think

- When frightened or angry we focus narrowly; body tenses
  - More likely to be less tolerant
- When happy we are less focused; body relaxes
  - More likely to overlook minor problems and be more creative

Norman's (2004) views

- Designers "can get away with more" for leisure products than those designed for serious task
- Interfaces/devices to be used in stressful situations require extremely careful design

Visual Appeal – at visceral level

"Visual appeal can be assessed within 50ms, suggesting that web designers have about 50ms to make a good first impression." Lindgaard et al., (2004) p.115

Frustrating Interfaces

- Application does not work properly or crashes
- System does not do what the user wants it to do
- The user's expectations are not met
- System does not provide sufficient information to let the user know what to do
- Error messages pop up that are vague or condemning
- Pop up advertisements that are difficult to dismiss
- Appearance of interface is garish, noisy, gimmicky or patronizing
- System requires users to carry out many steps, only to discover a mistake was made earlier and they need to start over
- Poorly laid out interface and/or over-use of graphics and sound
- They voilate principles of user interface design that we studied earlier

Detecting Emotions

- Heart rate and heart rate variability
- Facial expressions
- Galvanic skin response
- Pupillometry
- Gestures, body motion
- Word use, speech pattern

Persuasive technologies

Novel forms of interactive technologies that monitor, nag, or send personalized messages intermittently to a person. Non-interactive methods, such as placement of warning signs, labels, or ads in prominent positions. Social norms vs affordances

Anthropomorphism

Attributing or inserting human-like qualities into inanimate objects (e.g. cars, computers)

Criticism

- Deceptive, makes people feel anxious, inferior or stupid
- People do not like screen characters who speak:
  - "Now Chris, that's no right. You can do better than that. Try again"
- Many prefer impersonal interaction:
  - "Incorrect. Try again"
- Personalized feedback is considered less honest and makes users feel less responsible for their actions (Quintanar, 1982)

Zoomorphism

Computers and robots in the form of an animal

- Use recreationally as pets
- Learning for children through play
- Use in clinical psychology situations

Summary

- Concerned with how interactive systems make people respond in emotional ways
  - Well-designed interfaces can elicit good feelings
  - Expressive interfaces provide reassuring feedback
  - Badly designed interfaces make people angry and frustrated
- Anthropomorphism is attribution of human qualities to objects

- Increasingly popular anthropomorphism is interface agents and robot pets
- Models of affect help us conceptualise emotional and pleasurable aspects of interaction design

Data Gathering

Interaction design

- Early focus on users and tasks
  - What is the user's world – their goals and objectives?
  - "User acceptance testing" at end is too late! Reduce risks early
- Develop specific usability/user experience criteria
  - Identify and document specific usability and user experience goals
- User empirical measurement
  - Do "usability regression testing"
  - Users' performance with current tools and future prototypes are observed, recorded and analysed for later comparisons
- Iterate
  - Needed because of "unknowability" of all user requirements

Five key data gathering issues

1. Setting goals for gathering
   - Decide kind of answers needed (qualitative, quantitative)
2. Identifying potential participants
   - Decide who/roles to gather data from
3. Relationship with participants
   - Clear and professional
   - Informed consent when appropriate
4. Triangulation
   - Look at data from more than one perspective or collect different kinds of data
5. Pilot studies
   - Run small trial of survey/interview/observation to make sure it runs OK and data collected will be interpretable

Ethical Treatment of Participants

- Institutional approval from independent body representing scientific and community standards (can be waived for low risk educational projects).
- (In an organisation) Agreements about who gets to see employee data and when, and who does not
- Informed consent read and signed before data collected
- Participants have a right to:
  - Know goals of study
  - Know what they will be asked to do and how long their involvement will last
  - Possible risks (aim for minimal risk)
  - What will happen to findings and who sees them
  - Privacy of their personal information and recordings
  - Not be quoted without their agreement
  - Leave when they wish without hindrance or questioning
  - By treated politely and with respect…

Techniques

Data-gathering techniques have different advantages and disadvantages. Customize approach to the resources available

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

Interviews

- Unstructed
  - Not directed by script
  - Rich but not replicable
- Structured
  - Tightly scripted, like questionnaire
  - Replicable but may lack richness
- Semi-structured
  - Guided by script but interesting issues explored in more depth
  - Balances richness vs replicability
- Contextual interview
  - Occurs in work/activity context

- Avoid complex sentences requesting complex judgments
  - Poor: "How do you like this smartphone app compared with previous ones that you have owned?"
  - Better: "How do you like this smartphone app?" "Have you owned other smartphone apps?"
  - If so, "Why did you like them?"
- Keep questions neutral
  - Bad: "Why do you like this style of interaction?"
  - Assumes person does like it
  - Discourages some interviewees from stating their real feelings
  - Good: "Do you like this style of interaction?"

Running the interview

- Introduction – introduce yourself, explain goals, reassure about ethical issues, ask to record, do any informed consent
- Warm-up – make first questions easy
- Main body – present questions in logical order
  - Open vs closed format
  - Simple language
  - No leading questions (not "Why do you like…?" "How would you use…?")
  - Avoid stereotypes (cultural, gender, age, etc)
- Cool off – include some easy questions
- Closure – thank interviewee, signal end, turn recorder off

Questionnaires

- Questions can be closed (choose option) or open form
  - Closed-form questions are easier to analyze
  - Closed-form scoring can be done by computer
- Can be administered to large populations
  - Paper, email and social media used for dissemination
  - Important issue is response rate and sampling bias
    - 40% response is "acceptable"
    - But how typical are respondents?
- Online questionnaires
  - Potential for large samples, but also capricious responding
  - Quality of some answers questionable
  - Automated scoring more possible
  - Sampling bias is a problem

Question and response formats

- The impact of a question can be influenced by question order
- Offer open-ended responses as optional extras
- Keep all questions on a topic on the same page
- Positive at right, negative at left (be consistent)
- Consider different versions of the questionnaire for populations with different knowledge/background
- Provide clear instructions on how to complete questionnaire
- Strike balance between using white space vs staying compact
- Radio buttons can offer many options or just "yes"/"no"
- Checkboxes can collect multiple responses to a question
- Rating scales
  - Likert scales with 3, 5, 7 or more points
  - Semantic scales

Getting good questionnaire response

- Ensure questionnaire is:
  - well-motivated (purpose is clear to respondent)
  - well designed
  - error free
  - as short as possible (short form can be offered)
  - easy to respond to (online, stamped addresses envelope)
- Promise anonymity (and deliver on that)
- Follow up
  - Provide incentives
  - Emails, phone calls, letters
- 40% response rate is acceptable

Naturalistic Observation

- People cannot articulate everything about their work
- Spend time with people in their day-to-day tasks, observing activity as it happens
  - Gain insights into motivations and tasks
  - Good for understanding nature and context of tasks
  - Requires time and commitment
  - Can result in much data
- Ethnography is one form
  - "Participant observation"
  - Immersion and acceptance in work culture
  - A philosophy, set of techniques, and style of reporting

Frameworks Guiding Observation

- The person. Whe? User
- Their goal. Why? Purpose
- Their location. Where? Context
- The things they use. What? Artifact

Goetz and LeCompte (1984) framework:

- Who is present?
- What is their role?
- What is happening?
- When does that activity occur?
- Where is it happening?
- Why is it happening?
- How is the activity organized?

Robson (2011) framework:

Space What is the physical space like and how is it laid out?
Actors What are the names and relevant details of the people involved?
Activities What are the actors doing and why?
Objects What physical objects are present, such as furniture?
Acts What are specific individual actions?
Events Is what you observe part of a special event?
Time What is the sequence of events?
Goals What are the actors trying to accomplish?
Feelings What is the mood of the group and of individuals?

Ethnographic Study

Ethnography is a method associated with cultural anthropology. Observe a situation without imposing any a priori structure or framework upon it, and view everything as 'strange'

- Gather what is available, what is 'ordinary', what people do, say, how they work
  - Collect documents, make notes of your own, pictures, room layout sketches
  - Snippets of conversation and descriptions of rooms, meetings, what someone did, or how people reacted to a situation
  - Make the most of opportunities as they present themselves
  - Interesting phenomena do not reveal themselves immediately
  - Get to know people in the workplace and bond with them
- Participants should understand why you are there, what you hope to achieve, and how long you plan to be there
  - Go to lunch with them, buy coffee, and bring small gifts
  - Informal gatherings may produce key information
  - Show interest in stories, gripes, and explanations
  - Step back if phone rings, someone else enters workspace, or something happens that needs the person's immediate attention

Summary

- Three main data gathering methods: interviews, questionnaires, observation
- Five key issues of data gathering: goals, choosing participants, triangulation, participant relationship, pilot
- Interviews may be structured, semi-structured or unstructured
- Questionnaires may be on paper, online or telephone
- Observation may be direct or indirect, in the field or in controlled setting
- Online analytics can provide valuable quantitative data on patterns of usage
- Techniques can be combined depending on study focus, participants, nature of technique and available resources

Data Analysis, Interpretation and Presentation

Quantitative and Qualitative

Quantitative data expressed as numbers
Qualitative data expressed as ideas
Quantitative analysis numerical methods to ascertain size, magnitude, amount
Qualitative analysis expresses the nature of elements and is represented as themes, patterns, stories

Type of Analysis	Usual raw data	Sample qualitative data	Sample quantitative data	Initial Processing
Interviews	- Audio recordings - Interviewer notes - Video recordings	- Responses to open questions - View pictures - Respondent's opinions	- Age, job role, years of experience - Responses to closed questions	- Transcription of recordings - Expansion of notes
Question-naires	- Written responses - Online database	- Responses to open questions - Responses in "further comments" field - Respondent's opinions	- Age, job role, years of experience - Responses to closed questions	- Clean up data - Filter into different data sets
Observation	- Observer's notes - Photographs - Audio and video recordings - Data logs - Think-aloud	- Records of behaviour - Description of a task as it is undertaken - Copies of informal procedures	- Demographics of participants - Time spent on a task - The number of people involved in an activity	- Expansion of notes - Transcription of recordings - Syncronization between data recordings

Simple Qualitative Analysis

- Categorizing data
  - Prespecified categories or categories emerge from data
- Recurring patterns or themes
  - Sequences or frequencies of events or actions
- Looking for critical incidents
  - Seek key events
  - Each may happen only once

Qualitative analysis – Theory-guided

- Aims to derive theory from systematic analysis of data
- Analysis based on categorization (called 'coding')
- Three levels of 'coding'
  - Open: identify categories
  - Axial: flesh out categories and link them to subcategories
  - Selective: form theoretical schemes (principles, generalisations)
- People, environment, and artefacts viewed as one cognitive system
- Data gathered focuses on who creates information, where they get it from, who they pass it to, how other people add further information that adds value, and so on…

Simple Quantitative Analysis

- Central tendency
  - Mean
  - Median
  - Mode
- Standard deviation or variance
- Percentages
  - Useful to compare across prototypes or occasions
- Graphical representations give overview of data

Presenting Findings

- Only make claims that your data can support
- Best way to present findings depends on audience, purpose, and data gathering and analysis undertaken
- Graphical representations are always powerful
- Other techniques:
  - Rigorous notations (eg UML, OSD) but too rigid?
  - Using storyboards and personas to create scenarios

Summary

- Data analysis depends on data gathered
- Qualitative and quantitative data may be gathered from any data gathering approaches
- Quantitative
  - Percentages, mean/median/mode, standard deviation
- Qualitative
  - Coding, Grounded Theory, Distributed Cognition
- Presentation of findings should not overstate evidence

User-centered Approach to Development

Four basic activities in ID:

1. Establishin requirements
2. Designing alternatives
3. Prototyping
4. Evaluating

User-centered design rests on three principles:

1. Early focus on users and tasks
   - Directly studying cognitive, behavioural, anthropomorphic and attitudinal characteristics
2. Empirical measurement
   - Users' reactions and performance to scenarios, manuals, simulations and prototypes are observed, recorded and analysed
3. Iterative design

- When problems are found in user testing, fix them and carry out more tests

Why Involve Users

- Expectation management
  - Realistic expectations
  - No surprises, no disappointments
  - Timely training
  - Communication, but no hype
- Ownership
  - Make users active stakeholders
  - More likely to forgive or accept problems
  - Makes big difference to acceptance and success

How to Involve Users

- User(s) as member of the design team
  - Full time: constant input, but lose touch with other users
  - Part time: patchy input, and very stressful
  - Short term: inconsistent across project life
  - Long term: consistent, but lose touch with other users
- Newsletters and other dissemination devices
  - Reach wider selection of users
  - Need communication both ways
- After product is released
- Combination of approaches

Practical Issues

Who are users/stakeholders

- Many kinds:
  - those who interact directly with the product
  - those who manage direct users
  - those who receive output from the product
  - those who make the purchasing decision
  - those who use competitor's products
- Three categories of user (Eason, 1987):
  - **Primary:** frequent hands-on
  - **Secondary:** occasional or via someone else
  - **Tertiary:** affected by its introduction, or influence purchase

What do we mean by needs

- Users rarely know what is possible
- Users can't say what they "need" to achieve goals
- Look at existing tasks:
  - context
  - information they require
  - who collaborates to achieve the task
  - why task is achieved the way it is
- Envisioned tasks:
  - can be rooted in existing behaviour
  - can be described as future scenarios

How to generate alternatives

- Humans stick to what they know works
- Considering alternatives is important
- Designers trained to consider alternatives, software people generally not
- How do you generate alternatives?

  - "Flair and creativity": research and synthesis
  - Seek inspiration: similar products or different products

Choosing among alternatives

- Evaluation with users or with peers
- Technical feasibility: some not possible
- Quality thresholds: Usability goals lead to usability criteria set early on and check regularly
  - safety: how safe?
  - utility: which functions are superfluous?
  - effectiveness: appropriate support? task coverage?
  - efficiency: perform measurements
  - learnability: time to learn acceptable?
  - memorability: can infrequent users remember steps?

Integrating ID into other models

- Needs careful planning
- Software engineering lifecycle models considered
- Integrating with Agile is promising
  - stresses the importance of iteration
  - champions early and regular feedback
  - handles emergent requirements
  - aims to strike balance between flexibility and structure

Interaction Design in Practice

AgileUX

"We are uncovering bettew ways of developing software by doing it and helping others do it. Through this work we have come to value…

- **Individuals and interactions** over processes and tools
- **Working software** over extensive documentation
- **Customer collaboration** over contract negotiation
- **Responding to change** over following a plan"

(Manifesto for Agile Software Development)

- Integrates techniques from UX and Agile
- As implementation proceeds:
  - requirements are re-prioritised by vote
  - requirements are elaborated
- All UX techniques still relevant but re-arrange them
  - focus on end-point, not design, as deliverable
  - cross-functional teams
- Three practical areas: user research, aligning work practices, documentation

Top 10 tips for UX success with Agile development: 1. Allow time for release planning/story mapping – plan early 2. Conduct US activities ahead of the (development) sprint 3. Cultivate a collaborative culture – use design thinking 4. Think iteration, not perfection – start with low fidelity 5. Participate in scrum meetings – especially daily standups 6. Turn user research into team-driven events – weekly! 7. Secure strong stakeholder engagement and involvement 8. Set explicit roles and responsibilities – especially for UX 9. Host training and onboarding sessions – esp for new people 10. Modify your UX method until it works – focus on outcomes

Agile Development

- Short (one to three week) timeboxes of iterative development (sprint, iteration, cycle)
- Early and repeated customer/user feedback
- Re-prioritisation of work based on customer/user so that emergent requirements can be handled

- Commitment to releases on specific dates
- Many approaches, e.g. eXtrememem Programming (XP), Scrum, DSDM

User research

- Characterise users through data collection and analysis
- Agile's timeboxing approach does not support long periods of user research
- User evaluations will fit into a timebox
- Start user research in iteration 0, before implementation
- Have ongoing programme of user research

Aligning Work Practices

- Designing complete product upfront causes problems
- Some upfront work is needed (technical and UX)
- Use parallel tracks approach:
  - create product vision before development starts (conceptual design, etc)
  - do design work one iteration ahead of development
  - some teams work two iterations ahead
- Advantages of parallel tracks approach:
  - no design time wasted on features not implemented
  - usability testing and contextual inquiry done on same customer visit
  - timely feedback on the designs received
  - Agile flexibility supports schedule changes
- Parallel tracks approach commonly used

Documentation

- Most common communication approach for UX designers
- Agile prefers discussion
- Agile only uses documentation where needed
  - Who will read it?
  - Who will use it?
  - What is the minimum needed?
  - Is there duplication anywhere?
  - How polished does it need to be?

Design Patterns

- Capture design experience:
  - solution to a problem in a context
  - can be instantiated in many ways; generative
- Patterns may be found in languages, in catalogues, galleries, or libraries
- Patterns often associated with software components, findable in repositories
  - Github
  - Platform websites
- Capture design experience, but that doesn't necessarily mean good design:
  - anti-patterns: don't do it this way!
  - dark patterns: deliberate tricks

Open Source Resources

- Free, and freely usable by others
- Components, frameworks, languages, systems
  - Python, Swift, Ruby, Webkit
- Community-driven
- Available for interaction design:
  - Design pattern libraries
  - Bootstrap framework as example

Tools for Interaction Design

- Tools support all aspects of design process:
  - creativity, sketching, simulation, brainstorming, library search, mindmapping, video capture
- Tools integrate to speed up prototyping
- Interactive wireframes or mockups with design tools
  - balsamiq
  - axure
  - invision
- Higher fidelity prototypes
  - Link interactive wireframe to design pattern library with software components

Summary

- AgileUX refers to approaches that integrate UX design and agile development
  - Requires change in mindset by designers and developers
  - Requirements repeatedly re-prioritised: avoid wasted effort
  - UX design activities need rethinking: when, how much, how to progress
- Design patterns present solution to a problem in context
- Open source resources make development of standard applications easier and quicker
- Many tools are available to support ID

Establishing User Needs/Requirements Prototyping

User Needs and Prototyping

Establishing Requirements

User needs – problem to be solved, usability and UX goals, one-sentence problem statement, proforma test plans, identifying personas and identifying user stories

Designing Alternatives

Conceptual design process plus conceptual and concrete scenarios to envisage ways to meet user needs and requirements

Prototyping

Horizontal or vertical prototypes to test conceptual model and determine whether specified user needs are met

What Do We Mean by User "Needs"

- Users rarely know what is possible
- Users can't tell you what they "need" and can't be expected to
- Look at existing tasks and activities:
  - Context and motivation of activity
  - Information required for activity
  - Who collaborates with whom
  - Why task is achieved the way it is
- Envisioned/possible future tasks:
  - Can be rooted in existing behaviour
  - Can be suggested by new technologies
  - Can be described as future scenarios

How are the Needs Expressed

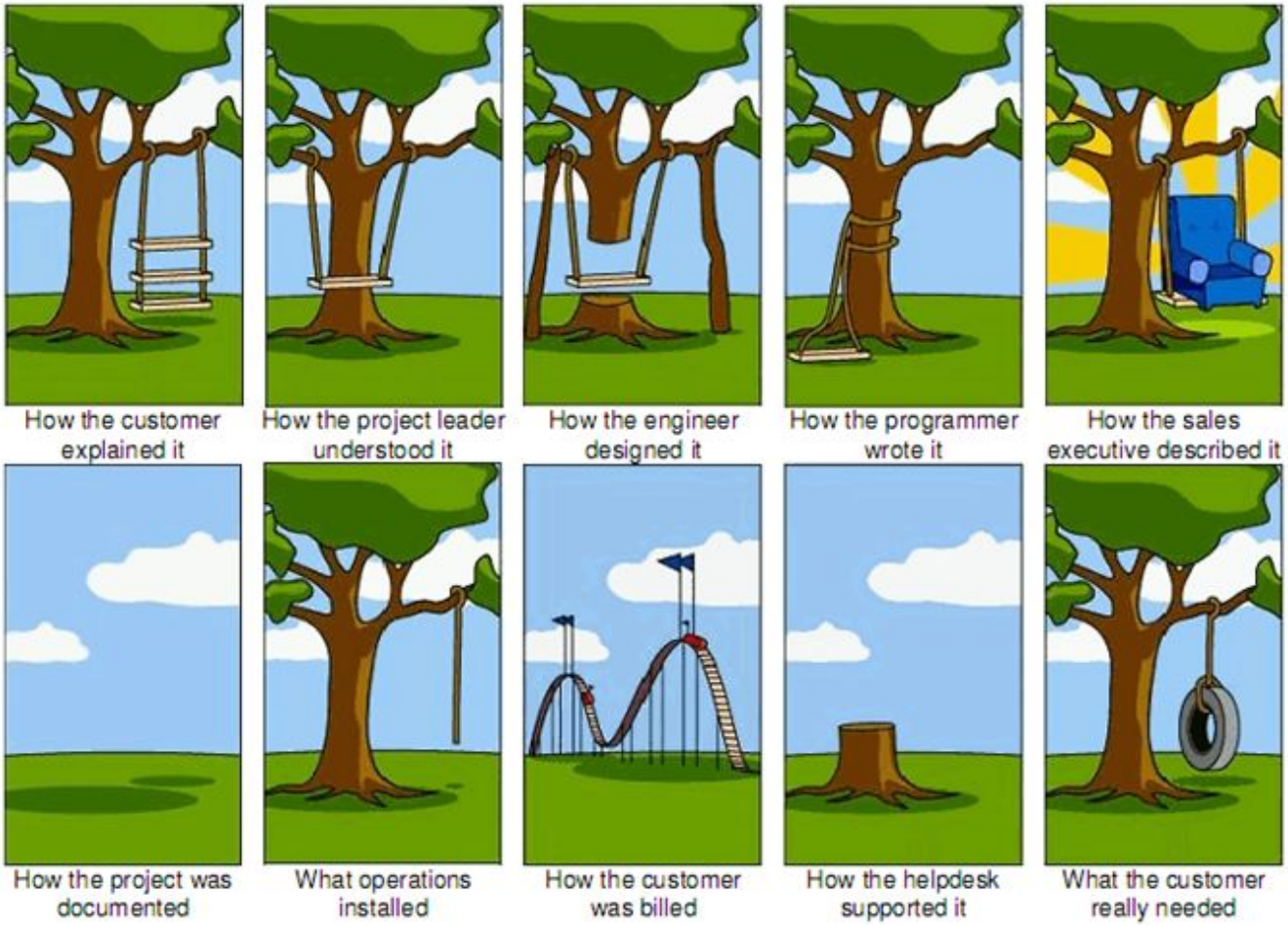


Figure 5: Requirements Engineering

Requirements

- Different kinds of requirements (e.g. Volere model)
- Requirements data gathering
  - Questionnaires, interviews, focus groups, direct observation, studying documentation and researching similar products
- Express current and envisioned work practices
  - Scenarios, personas
  - Use cases
  - Essential use cases

Formalisation of Usability Goals

- Identify situation of concern
  - Where is the mismatch?
- Prepare one-sentence problem statement
  - Activity to be supported
  - Form of the solution
  - Identity of the users
  - Level of user support
- Expand one-sentence problem statement to build user-centered requirements with clearly identified usability goals

  - Usability goals become template for specifying usability tests
  - Usability goals become template for reporting test results

One sentence problem statement

- Situation of concern
  - "Car park users find parking ticket payment machines difficult to use, requiring long use sessions, frequent unsatisfactory results, and necessitating a uniformed attendant."
- One-sentence problem statement
  - "Design a parking ticket payment machine that car park users should be able to complete a transaction in one minute or less without requiring help."
- Pro-forma test plan
  - "We intend to carry out laboratory user-based tests of the prototype to confirm that at least 90% of users can perform transactions via each payment method in 1 minute or less."
- Pro-forma test report
  - "Test results with 20 members of the driving public ages 18-60 years confirmed that 80% of users could perform transactions via each payment method in 1 minute or less but that 20% of users became confused with credit card payments."

Data Gathering for Requirements

1. Interviews
   - Sample scenarios of use, prototypes, can be used in interviews
   - Good for exploring issues
   - Development team members can connect with stakeholders
2. Focus groups
   - Groups interviews
   - Gather factual information
   - Gain consensus view and/or highlighting areas of conflict
   - Can be dominated by individuals
3. Questionnaires
   - Often used in conjunction with other techniques
   - Quantitative or qualitative data
   - Can get input from large, dispersed group of people
4. Researching similar products
   - Good for prompting requirements
5. Direct observation
   - Gain insights into stakeholders' tasks
   - Good for understanding the nature and context of the tasks
   - Requires time and commitment
   - Can result in huge amount of data
6. Indirect observation
   - Not often used in requirements activity
   - Good for logging current tasks
7. Studying documentation
   - Procedures and rules in manuals
   - Indicate steps involved in an activity, and
   - Indicate regulations governing a task
   - **May be out of date, inaccurate!**
   - Not to be used in isolation
   - Good for understanding legislation
   - Good for background information
   - No stakeholder time required
8. Cultural probes
   - Participants answer questions using items in wallet (Postcards, maps, stories, photos…)

Gaver et al. (1999)

User Stories

- Real world experiences, ideas, anecdotes and knowledge
- Captured in any form
- Small snippets of activities and the context in which they occur
- May include:
  - Videos
  - Diary entries
  - Photographs
  - Documents
  - Results of observations/interviews
- Rich in context
- May capture “trivial” details

Scenarios

Conceptual Scenario

- More abstract than user stories
- Context details stripped away
- Abstraction
  - Aggregation
  - Classification
- Similar user stories grouped together
- Good for:
  - Understanding requirements
  - Generating initial design ideas
  - Selecting interaction paradigm
  - Selecting interaction mode

Concrete Scenario

- Starting to develop form of solution (i.e., design)
- Conceptual design commitments firm up
- Details:
  - Menu decisions
  - Two weeks of detail
  - Many design decisions still to be made…

Concrete Scenarios with Envisagement

- Concrete scenarios help to envision or evaluate specific interactions
- Can be made more effective by
  - Complementing with visual tools
  - Including real data and materials
  - Providing rich contextual background
  - Using personas
- Not a systematic representation of users
- Show tasks without considering users’ goals, motivations

Personas can Improve Scenarios

- Persona = Fictitious character embodying prototypical attributes of target user
- Persona aggregates most relevant information about target user class
- During design and development, specific decisions are made about persona
- Persona-driven design allows “artisan-like” design to target a wider audience

Personas’ Goals and Motivations

- Motivations/goals inferred from qualitative data
- Personas capture motivations as goals

    - Motivations drive behaviour
- Goals point to specific usage patterns
    - Also provide a reason why behaviours exist
- Goals turn personas into a design tool
    - How and why personas desire to use a product
    - Interface metaphors that might be effective

But dangers:

- Personas are not a systematic representation of users
- Personas may actually hide disengagement from real users
- Personas may contain stereotypes of questionable validity

Persona vs Scenario vs Goal

Persona

Defines who the story is about. This main character has attitudes, motivations, goals, and pain points, etc

Scenario

Defines when, where, and how the story of the persona takes place. The scenario is the narrative that describes how the persona behaves as a sequence of events

Goal

Defines what the persona wants or needs to fulfil. The goal is the motivation of why the persona is taking action. When that goal is reached, the scenario ends.

Storyboards

Storyboards start to link requirements to a vision of the future. Storyboarding is a link between requirements and design. Series of sketches showing how the user might progress through the task using the device. Introduce more detail, and chance to role play. Used early in design

Storyboards to Prototypes

Progress from storyboard to low-fidelity prototype to high-fidelity prototype

Prototyping

Can be:

- Screen sketches
- A storyboard
- A powerpoint slide show
- Video simulating use of system
- A lump of wood
- A cardboard mock-up
- Software with limited functionality

Why and What

- Supports iterative evaluation and feedback
    - Stackholders can interact with a prototype
    - Helps team members communicate effectively
    - Answers questions
    - Helps designers choose between alternatives
- Focus of prototypes
    - Technical issues
    - Workflow, how people will do tasks
    - Screen layouts and information display
    - Difficult, controversial, risky, critical areas

Scope Compromises

Common compromises:

Horizontal proved a wide range of functions, but with little detail

Vertical provide a lot of detail for only a few functions

Low-fidelity Prototyping

- Medium unlike final medium (e.g. Paper, cardboard)
- Quick, cheap, easily changed
  - Sketches of screens
  - Task sequences
  - Post-it notes
  - Storyboards

High-fidelity Prototyping

- Uses materials that would be in the final product
- Looks more like final system
- Danger that users think they have a full system
- Software-based prototyping
  - Slower response
  - Sketchy icons
  - Limited functionality

Considering Conceptual Design

- Which **interaction paradigm** provides insight?
  - WIMP, shareable, augmented reality, etc
- Which **interaction mode**?
  - How the user invokes actions
  - Instructing, conversing, manipulating or exploring
- Which **interface metaphor**?
  - Understand functionality
  - Identify potentiall problem areas
  - Generate potential metaphors that might help
- Evaluate metaphor with 5-step framework (Erickson, 1990):
  1. How much structure does metaphor provide?
  2. How much is relevant to the problem?
  3. Is metaphor easy to represent?
  4. Will the audience understand metaphor?
  5. How extensible is metaphor?

Expanding the Conceptual Model

- What functions will product perform?
  - What will product do?
  - What will human do (task allocation)?
- How are functions related to each other?
  - Sequential or parallel
  - Categories of functions
- What information needs to be available?
  - What data is required to perform task?
  - How is data transformed by system?

Using Scenarios in Conceptual Design

- Create proposed or imagined situations of use
- Use throughout design
  - Scripts for user evaluation of prototypes
  - Concrete examples of tasks
  - Support cooperation across professional boundaries
- “Plus and minus” scenarios to explore extreme cases:
  - Most positive aspects – best case consequences of use
  - Most negative aspects – worst case consequences of use

Evaluation

Role in interaction design

- Why
  - Check user requirements
  - Check users can use product and like it
- What
  - Conceptual model
  - Early paper or electronic prototypes of new system
  - Later more complete prototypes
- Where
  - Laboratory settings
  - Natural settings
- When
  - Throughout design (formative)
  - At end of design (summative)
  - Evaluate finished product to guide design of new products

Case Study: The Butterfly Ballot

"Theresa LePore, the supervisor of elections in Palm Beach County Florida, received much criticism for the ballot she designed for the 2000 presidential election. Actually she made several good decisions. For example, she attempted to improve the ballot for older voters by making the characters larger. Also, she wanted to have all presidential candidates on one page. Her solution was to use what has become known as the 'butterfly ballot' "

- People who designed the ballot were designers, not users
- Voters saw things differently
  - Focused on just one candidate and punching hole next to his/her name
  - No reason for Gore voters to focus on right hand column
  - Saw just single column with dedicated column of radio buttons
- 4000 people punched second hole on ballot
  - Believed second hold represented second candidate
- 19000 people punched more than one hole
  - Both holes were directly alongside their candidate
- How much user testing would have been needed in Palm Beach?
  - It appears that one out of ten users have some problem with this design, with approximately one in one hundred failing completely
  - A professional usability tester running twenty subjects in a 10 minute test each would have amply shown that something was seriously amiss
  - Would such a test be cost-effective? Certainly in Florida it would have. What happened there cost millions. Even in a plain old election, the benefits are manifold

D.E.C.I.D.E

- **D**etermine goals the evaluation addresses
- **E**xplore specific questions to be answered
- **C**hoose evaluation paradigm and techniques to answer the questions
- **I**dentify practical issues
- **D**eal with ethical issues
- **E**valuate, interpret and present data

Determine the goals

- Goals should guide an evaluation
  - "Does this feature help people understand how to complete transactions better?"
  - "Help clarify user needs"
  - "Determine best interface metaphor for conceptual design"
  - "Fine-tune interface details"

  - "Examine how technology changes work practice"
  - "Inform how the next version of a product should be changed"
- We operationalise those goals into a proforma test plan with measurable outcomes

Explore the questions

- Define questions that need to be answered
  - User requirements/usability goals
  - Where might "usability bugs" be?
  - Can people get answer in "X" seconds
- Sub-questions
  - Is there an interface problem?
  - Is the system difficult to navigate?
  - Is the terminology confusing?

Choose evaluation paradigm and techniques

- Goals influence evaluation paradigm
  - Empirical – laboratory tests with users
  - Empirical – field tests with users
  - Analytical – expert analysis
- Evaluation paradigm determines techniques chosen
  - User test, interview, observation, questionnaire
  - Heuristic evaluation, cognitive walkthrough, pluralistic walkthrough
- Combinations of techniques – triangulation
  - Tells story from different perspectives
  - Triangulation reveals a broad picture

Identify the practical issues

- Users
  - Finding representative users
  - Deciding how users will be involved
- Facilities and equipment
- Schedule and budget constraints
  - Compromises may be necessary
- Expertise of testers/evaluators
  - May impose limits

Deal with ethical issues

- Institutional approval from an independent body representing scientific and community standards is the norm for research and commercial work
- Have agreements for who sees/does not see employee data
- Develop written informed consent form
- No data collection until consent read and signed
- Participants have a right to:
  - know the goals of the study, possible risks (aim for minimal risk), what will happen to the findings and who sees them, privacy of personal information, not to be quoted without their agreement, leave when they wish without hindrance or questioning, be treated politely and with respect
- Focus: "The software is being tested, not you!"

Evaluate, interpret, and present data

- Decide what data to collect, how to analyse it, and how to present the findings
- Other issues
  - **Reliability** – good steady estimates of what's happening?
  - **Validity** – are comparisons between conditions or prototypes logical?
  - **Biases** – representative questions/scenarios/personas?
  - **Scope** – covering all situations needed?
  - **Ecological validity/Representativeness** – relevant to real world use?

Key Points

Chapter 1

- Interaction design is designing interactive products to support how people communicate and interact in their everyday and working lives
- Interaction design is multidisciplinary
- User Experience is central to interaction design
- "Optimizing" interaction requires taking into account context of use, types of activity, accessibility, cultural difference, and user groups
- Specifying usability and user experience goals helps design of good products
- Design principles are useful heuristic for analyzing and evaluating an interactive product

Chapter 3

- Social media change how we organise and conduct our lives
- Communications technology changes how we interact with each other:
  - We adjust to the new affordances or the removal of affordances in new forms of communication
- Social mechanisms have evolved to smooth out conversations, assist coordination of activities, and support mutual awareness of each others' activities
- Focus on
  - Conversations
  - Telepresence
  - Awareness mechanisms

UQAttic Summary

Chapter 1 – What is interaction design?

Main aims of the chapter:

- Explain the difference between good and poor interaction design
- Describe what interaction design is and how it relates to human-computer interaction and other fields
- Explain what usability is
- Describe what is involved in the process of interaction design
- Outline the different forms of guidance used in interaction design
- Enable you to evaluate an interactive product and explain what is good and bad about it in terms of the goals and principles of interaction design

The aim of interaction design is to bring usability into the design process. It is about developing interactive products that are easy, effective and enjoyable to use – from the user's perspective.

When considering usability, it is important to take into account *who* will be using it and *where* it will be used.

- Take into account what people are good and bad at
- Consider what might help people with the way they currently do things
- Think through what might provide quality user experience
- Listen to what people want and get them involved in the design
- Use "tried and tested" user-based techniques during the design process

Process of interaction design

1. Identifying needs and estabishing requirements
2. Developing alternative designs that meet those requirements
3. Building interactive versions of the designs so that they can be communicated and assessed
4. Evaluating what is being built throughout the process

Key characteristics of interaction design

1. Users should be involved through the development of the project

2. Specific usability and user experience goals should be identified, clearly documented, and agreed upon at the beginning of the project
3. Iteration through the four activities (process of interaction design) is inevitable

Usability can be broken down into the following goals/criteria

- effectiveness
- efficiency
- safety
- utility
- learnability
- memorability

User experience goals include

- satisfying
- enjoyable
- fun
- entertaining
- helpful
- motivating
- aesthetically pleasing
- supportive of creativity
- rewarding
- emotionally fulfilling

Design principles include

- visibility
- feedback
- constraints
- mapping
- consistency
- affordances

Chapter 2 – Understanding and conceptualizing interaction

Main aims of the chapter:

- Explain what is meant by the problem space
- Explain how to conceptualize interaction
- Describe what a conceptual model is and explain the different kinds
- Discuss the pros and cons of using interface metaphors as conceptual models
- Debate the pros and cons of using realism versus abstraction at the interface
- Outline the relationship between conceptual design and physical design

Understanding the nature of the problem space is conceptualizing what you want to create and articulating why you want to do so. Clarifying your usability and user experience goals is a central part of working out the problem space. Problem space can be open-ended – when there's identifiable problem that need to be improved or fixed.

Interaction Modes

Instructing Telling a system to perform operations. Can vary from pressing buttons to typing strings of characters

Conversing System acts as a dialog partner. Reflects a more two-way communication process (e.g. search engines, help facilities). Main benefit is to enable people, especially beginners, to interact with the system in a more natural way. (e.g. asking Siri a question in a natural language, rather than inputting keywords in a search engine)

Manipulating and navigating Manipulating objects includes moving, selecting, opening, closing and zooming. This is generally used on your computer (e.g. opening folders, moving windows)

Exploring and browsing Used by web-pages, e-commerce

Websites like Google uses conversing rather than browsing – you can't browse from the home page of Google to find search results you are looking for! You have to input keywords and then instruct Google to search for it.

Using multiple interaction modes

Advantages User will have multiple ways of achieving a desired goal (e.g. being able to copy text in a word document by using the menu bar, right-clicking and pressing copy, using keyboard shortcut)

Disadvantages The conceptual can end up being more complex and ambiguous, which can make it harder for the user to learn and understand how to use it

Conclusion When designing a new system based on little or no prior knowledge, it may be a good idea to keep the conceptual model simple. That is limit the ways a user may be able to achieve certain goals, to avoid confusing them. Since computer systems are based on a lot of prior knowledge, it is okay to have a more advanced conceptual model. Letting a user perform a certain task in multiple ways is not an issue.
Opposition to interface metaphors Breaks the rules : e.g. on the computer desktop, the trash can icon is located on the desktop. In the real world the trash can would be underneath the desk

Too constraining Can make certain tasks inefficient. e.g. if you have nested folders on your computer, each with hundreds or more folders/files, then locating the right file in the right folder can take a long time. A more efficient method would be to type in the filename to open the file. That way all thousands of files could be easily and quickly accessed

Conflicts with design principles Designers may be forced to make bad design solutions that conflict with basic design principles

Not being able to understand the system functionality beyond the metaphor May put the user in a sort of isolated world, where they believe everything on the device will work as the physical object they are based off. In that way the user may not learn how to use functions on the system which aren't part of the metaphor

Overly literal translation of existing bad designs e.g. the virtual calculator is designed to work in the same way a physical calculator does. But there are far more efficient ways to do calculations on a computer. e.g. WolframAlpha allows the user to manipulate the calculate input even after typing it in

Limits the designer's imagination in conjuring up new paradigms and models Designers may be fixated on old ideas, instead of thinking up new more powerful ways

Interaction paradigms

WIMP Windows, icons, menus, pointers

Touchscreen Drag, swipe

Wearable computing e.g. virtual reality glasses. The world becomes the interaction paradigm

Ubiquituous computing Interacts by tracking you and providing feedback based on your physical movements. e.g. Kinect for Xbox

Pervasive computing e.g. a smart fridge which signals the user when stocks are low

Virtual Reality Interacts by simulating an environment to the user by stimulating different senses (Sight, Noise, Touch through haptic feedback)

Chapter 3 – Understanding users

Main aims of the chapter:

- Explain what cognition is and why it is important for interaction design
- Describe the main ways cognition has been applied to interaction design
- Provide a number of examples in which cognitive research has led to the design of more effective interactive products
- Explain what mental models are
- Give examples of conceptual frameworks that are useful for interaction design
- Enable you to try to elicit a mental model and be able to understand what it is

Cognition

Cognition is often described in terms of processes such as:

- attention
- perception and recognition
- memory
- learning
- speaking
- listening
- problem solving
- planning
- reasoning
- decision making

In many cases one activity will involve several cognitive processes. E.g. studying requires perceiving the material, recognize it, read it, think about it, and try to remember it.

Memory – design implications

- Do not overload users' memories with complicated procedures for carrying out tasks
- Design interfaces that promote recognition rather than recall by using menus, icons and consistently placed objects
  - e.g. the "file" button is consistently placed in the left part of the menu bar – on Windows and Mac. It is consistently called "file" regardless of what app it is in. That way the user easily recognises the menu item
- Provide users with a variety of ways of encoding electronic information (e.g. files, emails, images) to help them remember where they have stored them, through the use of colour, flagging, time stamping, icons, etc

Learning – design implications

- Design interfaces that encourage exploration
- Design interfaces that constrain and guide users to select appropriate actions
- Dynamically link representations and abstractions that need to be learned

Reading, Speaking, Listening – design implications

- Keep the length of speech-based menus and instructions to a minimum. Research has shown that people find it hard to follow spoken menus with more than three or four options. Likewise, they are bad at remembering sets of instructions and directions that have more than a few parts
- Accentuate the intonation of artificially generated speech voices, as they are harder to understand than human voices
- Provide opportunities for making text large on a screen, without affecting the formatting, for people who find it hard to read small text

Problem-solving, Planning, Reasoning, Decision-making – design implications

Provide additional hidden information that is easy to access for users who wish to understand more about how to carry out an activity more effectively

Conceptual frameworks for cognition (conceptualising how the mind works)

Mental Models

- How the user imagines the system will work
- Erroneous/incorrect mental models are surprisingly common. e.g. when people push the button at a pedestrian crossing multiple times
- Incorrect mental models often lead to frustration
- The following promotes better mental models for users:
  - Useful feedback in response to user input
  - Easy-to-understand and intuitive ways of interacting with the system

    - Clear and easy-to-follow instructions
    - Appropriate online help and tutorials
    - Context-sensitive guidance for users, set at their level of experience, explaining how to proceed when they are not sure what to do at a given stage of a task
- Information processing
    - Information is thought to enter and exit the mind through a series of ordered processing stages
        * Stage 1 – Encoding
        * Stage 2 – Comparison
        * Stage 3 – Response selection
        * Stage 4 – Response execution
    - This approach is based on modelling mental activities that happen exclusively inside the head
- External cognition
    - People interact with or create information through using a variety of external respresentations (books, newspapers, web pages, etc)
    - Avoiding memory overload
        * This includes using sticky-notes, calendars
            · Reminding them to do something
            · Reminding them what to do
            · Reminding them when to do something
    - Computational offloading
        * When people use external tools to help compute something
        * This includes when people use paper and pen to solve advanced math problems
            · Multiplying single digit numbers in your head can easily be done by most people
            · To multiply multiple digit numbers, most people will require an external tool, so they can break up the task into easier individual steps
    - Cognitive tracing
        * Involves externally manipulating items into different orders or structures
            · Includes ordering the cards in a card game hand by suit and number to easily keep track of which card to play next
            · In Scrabble shuffling around letters in the tray helps a person work out the best word. Seeing the letters in a new order can break the mind's way of putting certain letters together

Chapter 4 – Designing for collaboration and communication

Main aims of the chapter:

- Explain what is meant by social interaction
- Describe the social mechanisms that are used by people when communicating and collaborating
- Discuss how social media has changed the ways in which we keep in touch, make contact, and manage our social and work lives
- Explain what is meant by telepresence
- Give an overview of shareable technologies and some of the studies showing how they can facilitate collaboration and group participation
- Describe some of the new forms of social behaviour that have emerged as a result of using new social media and communication technologies

Three main categories of social mechanisms

- The use of conversational mechanisms to facilitate the flow of talk and help overcome breakdowns during it
- The use of coordination mechanisms to allow people to work and interact together
- The use of awareness mechanisms to find out what is happening, what others are doing and, conversely, to let others know what is happening

Three types of CMC

Synchronous communication

- Where conversations in real time are supported by letting people talk with each other either using their voices or through typing
- e.g. video conferencing, text messaging, instant messaging
- Benefits:
  - Not having to physically face people may increase shy people's confidence
  - Allows people to keep up to date in an organisation without having to move from their office
  - Enables users to send text and images instantly
  - IM enables instant question and response rather than the delay of an email
- Problems:
  - Poor bandwidth can break up video conferences and result in dropouts
  - Difficult to establish eye contact
  - Being able to hide behind a username in a chatroom allows people to behave differently – sometimes in a more aggressive or intrusive way

Asynchronous communication

- Communication takes place remotely and at different times
- e.g. email, bulletin boards, newsgroups, etc
- Benefits:
  - Ubiquity: Can read any place, any time
  - Flexibility: Greater control of when and how to respond
  - Powerful: Can send same message to many people
  - Makes some things easier to say: Not having to interact with person can make things like providing feedback easier
- Problems:
  - Flaming: Overreaction due to it being easier sending an email than giving such feedback face to face
  - Overload: Risk of receiving excessive amounts of emails every day. May risk overlooking the important emails in the long list of unimportant messages
  - False expectations: An assumption has evolved that people will read their messages several times a day. However many people treat their email like their postal mail checking just once

CMC combined with other activity

- Talking with each other while carrying out other activities
- Working together on an interactive tool (e.g. Google Docs)
- Networked classrooms (e.g. Interactive whiteboard)
- Benefits:
  - Supports talking while carrying out other activities allowing multi-tasking
  - Speed and efficiency: allows multiple people to be working on same document at same time
  - Greater awareness: allows users to see how one another are progressing in real time
- Problems:
  - WYSIWIS (what you see is what I see): It can be difficult to see what other people are referring to when in remote locations
  - Floor control: Users may want to work on the same piece of text or design, potentially resulting in file conflicts

Chapter 5 – Understanding how interfaces affect users

Main aims of the chapter:

- Cover how emotions relate to the user experience
- Provide examples of interfaces that are both pleasurable and useable

- Explain what expressive interfaces are and the effects they can have on people
- Describe how technologies can be designed to change people's attitudes and behaviour
- Give an overview on how anthropomorphism has been applied in interaction design
- Present well-known models and frameworks of emotion and pleasure
- Enable you to critique the persuasive impact of an online agent on customers

What are affective aspects?

Affective is the generation of an emotional response, like when someone smiles. This concept can be translated to affective computing, pioneered by Picard(1998) which includes AI research like COG and Kismet by Brezeal(1999). Interactive systems have affective aspects that provoke emotion in the user, rather than the interface showing emotion

What are expressive interface and positive emotions?

Expressive forms like icons convey emotional states and elicit an emotional response, which is the goal of affective aspects of an interactive system. A good example is the mac smiley face icon on booting the computer. Expressive interfaces are a combination of these elements. The balance between the reassuring characteristics of these interfaces, and their intrusiveness, will depend on the use and to a large degree the culture (for example Japan has a much higher threshold for audio and visual intrusiveness).
Traditionally HCI has focused on usability, but work by Mullet and Sano, and empirical studies by Tractinsky are changing that, while still focusing on finding a balance between pleasurable and usable interfaces.

What makes a interface frustrating and causes negative emotions?

Interface frustration can cause negative emotional responses Rouke(2005), and come in two broad categories. The first is functional problems like error messages, crashes and bad performance. The second and most common is basically users expectations not being met (cluttered design, not enough information, too many steps, etc).
The solutions to these problems often backfire due to again, having functional or expecation errors. A good example is Bob and Clippy, two "companion" programs from Microsoft that were failures. When dealing with the backlash from interface frustrations it's best to avoid overly expressive interfaces and focus on solving the problem rather than gimmicky aspects like the system "saying sorry".

What are persuasive technologies

Persuasive technology is basically marketing through interaction design. By not being static like a magazine it can be targeted, personalized and dynamic, and hence more persuasive as described by Fogg, a good example is Amazon 1 click payment. Can also be used for non commercial purposes like health, and example being Pocket Pickachu which is a digital pet that survives on pedometer steps.
When comparing techniques the one that normally wins is the least intrusive as per expressive interface design and the most dynamic, leveraging the advantage over static media. For example Waterbot uses colored water, sounds, and a bar graph to try and reduce water use. The bar graph is both the most dynamic, and the most obviously linked to the tap so it is the most effective. Likewise a counter on a cigarette packet is less intrusive than a picture of cancer ridden lungs. The effect of the picture wears off but the counter is dynamic so it remains persuasive.

How is anthropomorphism used in interaction design?

The propensity for users to attribute human emotions to objects is called anthropomorphism and has been exploited for a long time by traditional material, and is starting to be exploited by interaction design. The same tradeoff remains between reassuring and intrusive, however it is even more polarizing with anthro. A large body of research (Shneidernman, Oren, Quintanar) rates anthro as deceptive, artificial, dishonest, and raises user expectations over actual capabilities. Other research (Strommen, Reeves and Nass, Walker, Sproull to a degree) found that anthro can make interface more enjoyable, improve self esteem, elicit better responses and make users see themselves in a better light.
Two big variables are situation and maturity. e.g. it's nice for an interface to welcome you by name, but not to berate you by name, and toys like Barney and Amazing Amanda can have very intrusive anthro features like expressions and still be enjoyable for children.

What are interface agents, virtual pets, and interactive toys?

Express AI-like affective aspects include video game characters and virtual pets. Early examples include the Woggles (bouncing circular characters with user determined moods and AI interactions) from Bates 1994 and Silas T Dog, a virtual dog that behaves like a real dog.

These applications were mostly gimmicky but have been evolved into examples like Silar (Marti 2005) which is a virtual pet that answers calls and alerts owner about important stuff. A further example is Rea, an embodied real estate agent (Cassell 2000).

The key here is as always to balance positive characteristics while minimizing intrusiveness, while keeping in mind the anthro.

What models are used for affective aspects?

It's been established that affective aspects are very situational and variable, no correct answer. Researchers have created three models or frameworks to try and describe and think about affective aspects better.

The first is emotional design, by Norman, Ortony and Revelle (2004). This breaks experience into visceral (a spider on the floor of the bathroom), behavioural (driving a car) and reflective (thinking about the plot of a book) states. The claim is that our state changes how we think, and making people happy will help them overlook and cope with minor interface problems. It's unrealistic to adapt every interface for every state do designers need to think about the most common state for the task at hand, i.e. a nuclear control facility would have a very different state to browsing facebook.

The second framework is the pleasure model, which breaks experience into four types of pleasure. These are physio (basically visceral, a sensory experience), socio (company of others), psycho (same as behavioural from ED, shopping online at a good site) and ideo (values, buying a hybrid car to save the environment).

The third and broadest is technology as an experience, which breaks how a user "feels" into four categories. These are sensual (same as visceral in ED), emotional (angriness, happiness), compositional (answering "what happens next" in a way that makes sense), and spatio temporal (really broad category of how space and time affect experience).

Chapter 7 – Identifying needs and establishing requirements

Main aims of the chapter:

- Discuss how to plan and run a successful data gathering program
- Enable you to plan and run an interview
- Enable you to design a simple questionnaire
- Enable you to plan and execute an observation

What are the four key issues for data gathering?

The four key issues for data gathering are setting goals, building a relationship with participants (first step is a consent which defines relationship), using multiple techniques to triangulate results and running small pilot studies to test methods.

How is data recorded?

A mix of audio, notes, still camera and video, weighing up detail captured vs intrusiveness and technical setup of method.

How are interviews done?

Interviews range from completely unstructured to very structured. There should always be an agenda, but from there the tradeoff is between richness of data and closing section. There are specific forms like telephone and online interviews that can be appropriate. Its also worth keeping in mind the effect of a neutral versus an enhanced environment on the interviewee, sometimes props or a real world location can help.

How are questionnaires done?

Questionnaires provide a simple way to get information without running an interview. There are a number of methods to improve data quality, from having researchers on site to mixing up direction of scale to catch users simply filling in a column.

Most of the methods use common sense, and can be extended by using web based surveys which have more interactivity and data control.
The trade off is between quantity of data and quality of data, with the key metrics being response rate and finding a representative sample (which can be less than 20 users).

How are interviews etc observed?

Direct observation can be in a controlled lab environment or in a natural environment like a workplace. The framework is person, place, thing. On top of that framework the observer picks a style of participation, ranging from outsider to insider (participant observer). The style depends on the situation, an insider still needs to be detached. Taking lots of notes is essential, as is separating personal opinion from fact.
Ethnography is observation without a framework. The idea is to start from a blank slate and recording everything about it. It's heavily based on insider observation along with lots of direct observation.
Indirect observation includes diaries and interaction logs, can be used effectively for gathering bulk data but has the downside of less control.

How do you choose and combine techniques?

Depends on the focus of the study, the participants, nature of technique and resources.

Chapter 8 – Design, prototyping and construction

Main aims of the chapter:

- Discuss the difference between qualitative and quantitative data and analysis
- Enable you to analyse data gathered from questionnaires
- Enable you to analyse data gathered from interviews
- Enable you to analyse data gathered from observation studies
- Make you aware of software packages that are available to help your analysis
- Identify some of the common pitfalls in data analysis, interpretation, presentation
- Enable you to be able to interpret and present your findings in a meaningful and appropriate manner

What is qualitative data?

Qualitative data is mainly characterized by not being discrete. It is normally framed by theories such as grounded theory (codes to concepts to categories to theory) activity theory (tools, subjects, rules, community, object, division of labor, outcomes) and distributed cognition.

What is quantitative data?

Quantitative number is discrete, i.e. numbers and ranges. Normal statistical analysis applies here.

Which one should be used?

As always depends on situation, the most important factor being what sort of analysis and presentation is required

Chapter 9 – User-centered approaches to interaction design

Main aims of the chapter:
User–centred design approach: 1. **Early focus on users and tasks** – Study cognitive, behavioural, social, physical, emotional aspects 2. **Empirical Measurement** – Observe, record and analyse user's reactions and performance to scenarios, manuals, simulations and prototypes 3. **Iterative Design** – When user testing reveals problems, fix them and test more

Activities that make up User-centered design

Establishing requirements, designing alternatives, prototyping, evaluating

ID Issues
Who are the users? What are the needs? How to generate alternative solution options? How to choose which alternative solution option? How integrate ID activities with other models?

Needs
Users rarely know what is possible and can't tell you what they need. Use Activity theory, Ethnography and Distributed cognition. Look at existing tasks/activities and get:

- Context/motivation of activity, information required for activity
- Who collaborates with whom, why task is achieved the way it is

From this, Envisioned/possible future tasks:

- Rooted in existing behaviour, suggested by new tech, described as future scenarios

Generating alternatives
Designers trained to consider broad alternatives. Generate many initial ideas, trained design thinking, research and synthesis, seek inspiration from similar/different products

Choosing from alternatives
Usability goals – usability criteria. Evaluate prototypes with users/peers. Set criteria early and compar prototypes often. Safety: how safe? Utility: any functions superfluous? Effectiveness? task coverage, feasibility? Efficiency: performance measurements?

Requirements data gathering
Questionnaires, interviews, focus groups, direct observation, studying documentation and researching similar products. Use scenarios, use cases and essential use cases to express current and envisioned work practices.

Formalisation of usability goals
- Identify situation of concern
- One-sentence problem statement – Activity to be supported, form of solution, identify users, level of user support
- Expand one-sentence to build user-centered requirements with clearly identified usability goals
  - Usability goals – template for specifying usability tests (pro-forma test plan) and reporting test results (pro-forma test reports)
  - pro-forma test plan includes: Usability goals, Iterative CM evaluation etc
  - pro-forma test reports include: Checking if major flaws have been eliminated, usability goals met

Terms
Human-computer interaction Concerned with the design, evaluation, and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them
Usable Easy to learn, effective to use, and provide an enjoyable user experience
Interaction Design Designing interactive products to support people in their everyday and working lives
Widgets Menus, Windows, Palettes, Icons, Etc
CSCW Computer-supported cooperative work
Effectiveness How good a system is at doing what it is supposed to do
Efficiency How efficient a system is (e.g. how many steps required to perform task)
Safety Protecting users from dangerous conditions and undesirable situations. Also includes protecting users from performing unwanted tasks (e.g. giving a warning/confirmation box before deleting a file)
Utility Low utility is something that offers very limited tools/functions. High utility is when very powerful tools/functions are offered
Learnability How easy a system is to learn how to use
Memorability How easy it is to remember how to use a system (e.g. making sure you don't forget how to use it)

User Experience What the interaction with the system feels like to the user (e.g. is it fun, motivating, rewarding, entertaining, etc)

Design principles The do's and don'ts of interaction design

Visibility Ensuring functions are visibly available to the user (e.g. the user knows the functions are actually there)

Feedback Ensuring the user instantly knows the task attempted, actually happened/succeeded

Constraints Physical constraints, logical constraints and cultural constraints. Physical constraints are constraints enforced by physics (e.g. you can't insert a VHS into a CD drive). Logical constraints rely on users common sense (e.g. the user has to insert money before getting a drink from the vending machine). Cultural constraints rely on learned conventions (e.g. red is often used for errors, yellow for warnings, green means everything is fine. Just like traffic signals and many other things)

Mapping The location of controls. E.g. Arrows on a keyboard being located such that the right-key is to the right and the left-key is to the left

Consistency Ensuring similar operations are available for similar elements when you want to achieve similar tasks. (e.g. the select all function on a computer will select all text when used in a word document, select the whole image when used on an image)

Affordance Refers to an attribute of an object that allows people to know how to use it. Real affordance refers to physical objects (e.g. being able to click a button on a mouse). Virtual affordance refers to virtual objects (e.g. being able to press a link in a browser – in this case ensuring the link is highlighted in some way. Usually underlined and in a different color to rest of text)

Problem space Defining the boundaries of what you want to create/solve

Conceptual model A description of the proposed systems in terms of a set of integrated ideas and concepts about what it should do, behave and look like, that will be understandable by the users in the manner intended

Interaction mode How does the user interact with the model

Interface metaphor Design concepts the user is familiar with based on prior knowledge (e.g. search engine, spreadsheet based on ledger sheet)

Interaction paradigm The framework in which the user interactions (e.g. WIMP). It is not the way the user interactions (e.g. it is not the fact that a user clicks a button), it is the environment in which the user does it

Experiential cognition A state of mind in which we perceive, act, and react to events around us effectively and effortlessly. e.g. driving a car, reading a book, having a conversation

Reflective cognition Involves thinking, comparing and decision-making. e.g. designing, learning, or writing a book

Perception Refers to how information is acquired from the environment, via the different sense organs (e.g. eyes, ears, fingers) and transformed into experiences of objects, events, sounds and tastes

Dynalinking The process of linking and manipulating multimedia representations at the interface

CMC Computer-mediated communication

Awareness Knowing who is around, what is happening and who is talking with whom

Peripheral awareness A person's ability to maintain and update a sense of what is going on in the physical and social context, through keeping an eye on what is happening in the periphery of their vision

Affective Generation of an emotional response

Affective Computing Computers recognize and express emotions Picard(1998)

Expressive Interface Combination of icons, emoticons, sounds and other elements to elicit positive emotions without being intrusive

Interface Frustration Interface inadvertently eliciting negative emotions

Persuasive Technology Technology used to draw attention to information to change what people do or think e.g. pop up ads

Anthropomorphism Propensity to attribute human qualities to objects

Paradigm Particular approach that has been adopted by the community in terms of shared assumptions, concepts, values and practices

Ubiquitous Computing Only enters attention when required (computing that is everywhere in our lives)

Widget Standardized display representation of a control

Virtual Reality The illusion of participation in a synthetic environment rather than external observation

Presence A state of consciousness the sense of being in a virtual environment

Data Collection of facts

Information Result of analysing and interpreting data

Ethnography View everything as "strange" to find social organisation of activities, and hence to understand work

Agile softwae development Development and interaction design run in parallel tracks. Supports coherent emerging vision of interface architecture

User Stories Real world experiences, ideas, anecdotes and knowledge, in any medium (including observation/interview results). Rich in context and could capture trivial details

Conceptual Scenario More abstract than user stories, less context. Abstraction – aggregation, classification. Good for understanding requirements, generating initial design ideas, selecting interaction paradigm, selecting interaction mode

Concrete Scenario Solution beginning to develop – conceptual design commitments firm up. Help to envision/evaluate specific interactions. Made more effective by: Complementing with visual tools, including real data/materials, providing rich contextual background, using personas. Not a systematic representation – shows tasks, doesn't consider users' goals and motivations

Persona Fictitious character – represent target user. Use qualitative data to infer motivations/goals. Motivations drive behaviour, goals point to specific usage patterns and suggest why behaviours exist, goals lead to effective interface metaphors

Storyboards Begin requirements to future vision link. i.e. requirements – design