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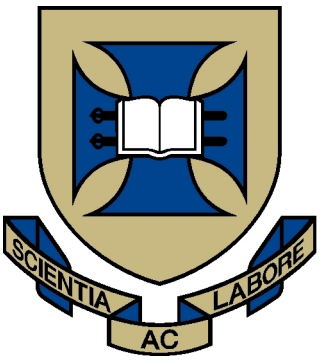

University of Queensland

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

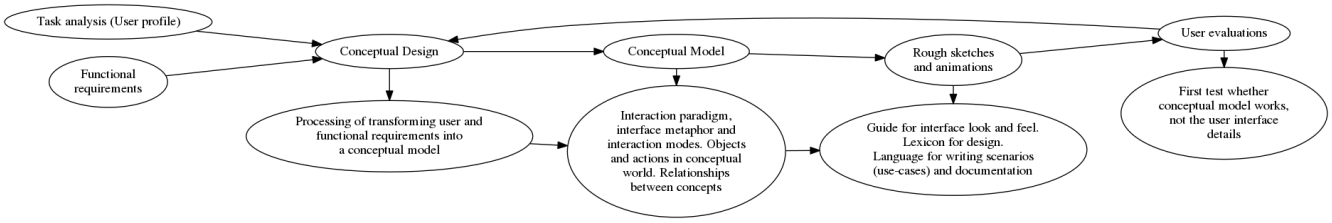

Figure 1: Interaction Design Process

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

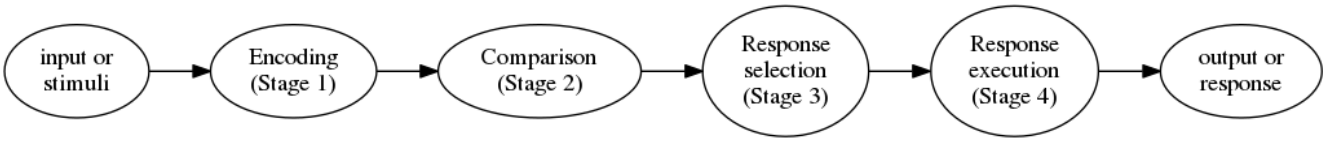

Figure 2: Information-processing metaphor

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

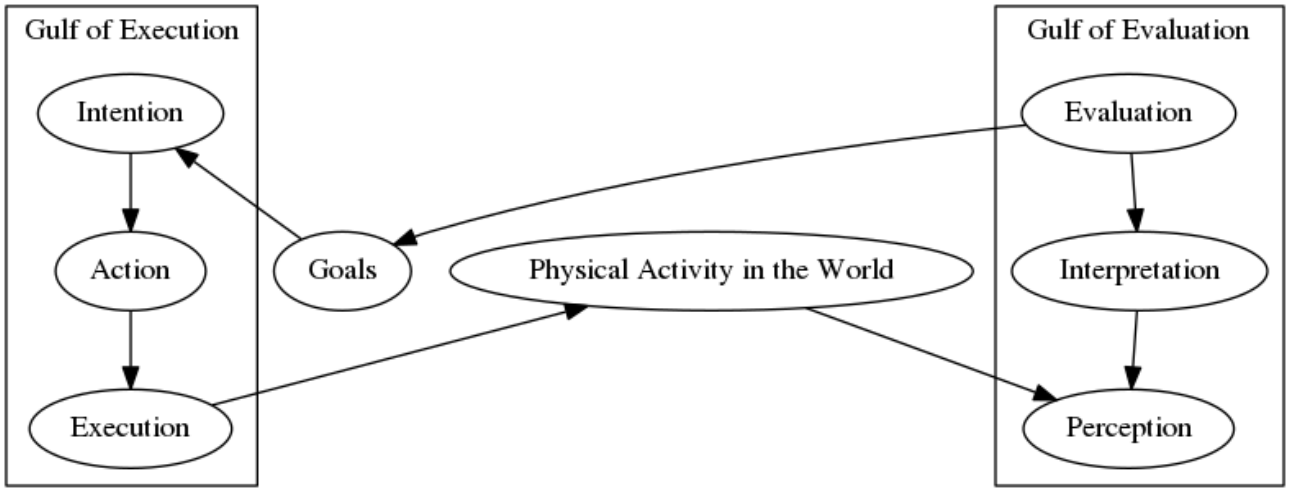

Figure 3: Seven stages of action

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

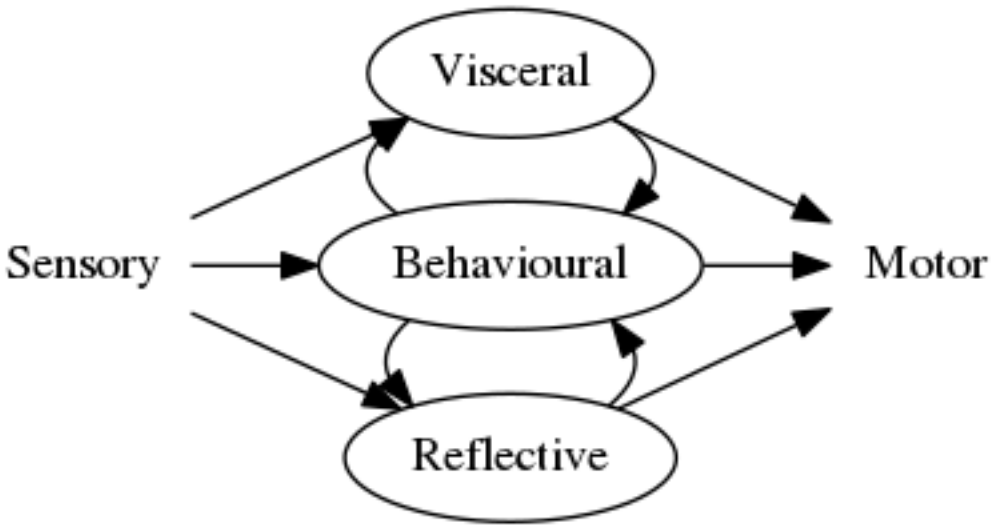

Figure 4: Norman, Ortony and Revelle (2004) model of emotion

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

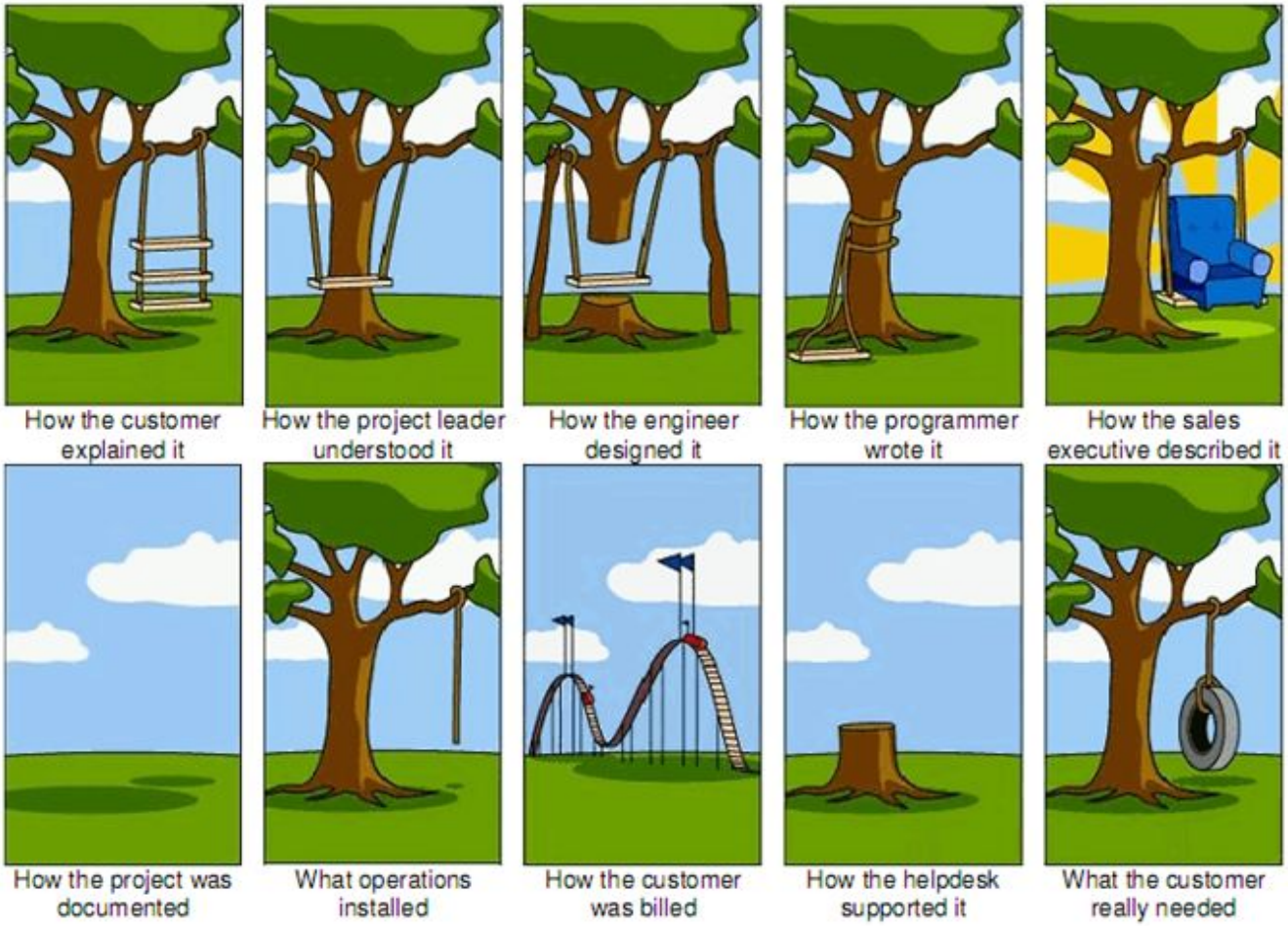

Figure 5: Requirements Engineering

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

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