

Lecture 6 & 7: Establishing Requirements

Overview

- The importance of requirements
- Data gathering for requirements
- Techniques in data gathering
- Data gathering guidelines
- Establishing requirements
- Different kinds of requirements
- Data interpretation and presentation

Based on material from:

1) Preece, J., Rogers, Y. and Sharp, H. (2015). *Interaction Design Beyond Human-Computer Interaction*. 4th Ed. Sussex: John Wiley & Sons Ltd.

Learning Outcomes

- Explain and describe the process of data gathering (how to plan and run a successful data gathering program)

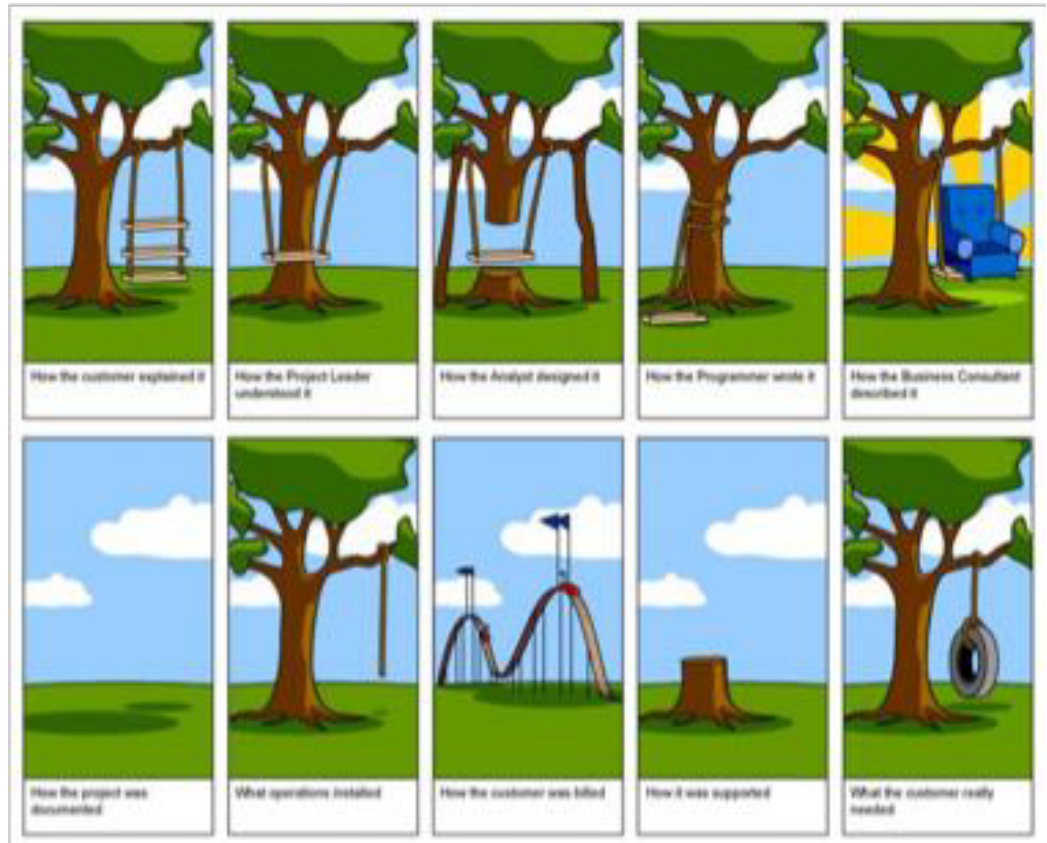
Requirement: What, How and Why?

- What
 - Two aims:
 1. Understand as much as possible about users, task, context
 2. Produce a stable set of requirements
- How:
 - Data gathering activities
 - Data analysis activities
 - Expression as 'requirements'
 - All of this is iterative

What, How and Why?

Why:

- Requirements definition: the stage where failure occurs most commonly
- Getting requirements right is crucial



Data gathering: Five key issues

1. Setting goals
 - Decide how to analyze data once collected
2. Identifying participants
 - Decide who 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
5. Pilot studies
 - Small trial of main study

Data gathering for requirements

1) Interviews:

- Props, e.g. sample scenarios of use, prototypes, can be used in interviews
- Good for exploring issues
- But are time consuming and may be infeasible to visit everyone

Focus groups:

- Group interviews
- Good at gaining a consensus view and/or highlighting areas of conflict
- But can be dominated by individuals

Interviews

- Unstructured/open-ended - are not directed by a script. Rich but not replicable
- Structured - are tightly scripted, often like a questionnaire. Replicable but may lack richness
- Semi-structured - guided by a script but interesting issues can be explored in more depth. Can provide a good balance between richness and replicability
- Group interviews – small group guided by a facilitator

Interview questions

- Two types:
 - 'closed questions' have a predetermined answer format, e.g., 'yes' or 'no'
 - 'open questions' do not have a predetermined format
- Closed questions are easier to analyze
 - Given similar questions to all participants (standardized)
 - Short and worded exactly the same to all participants
 - Consists pre-determined options
 - Eg: Which of the following web sites do you visit most frequently: amazon.com, MPH.com,?
 - How often do you visit this web site: every day, once a week?

Interview questions (cont)

Open questions eg:

Which music websites do you visit most frequently?<answer.....stresses on particular web site)

Why?<Answer>

Tell me more.....

Interview questions (cont)

Avoid:

- Long questions
- Compound sentences - split them into two
- Jargon and language that the interviewee may not understand
- Leading questions that make assumptions e.g., why do you like ...?
- Unconscious biases e.g., gender stereotypes

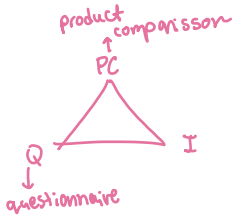
Running the interview

- Introduction – introduce yourself, explain the goals of the interview, reassure about the ethical issues, ask to record, present any informed consent form.
- Warm-up – make first questions easy and non-threatening.
- Main body – present questions in a logical order
- A cool-off period – include a few easy questions to defuse tension at the end
- Closure – thank interviewee, signal the end, e.g, switch recorder off.

Enriching the interview process



Props - devices for prompting interviewee, e.g., a prototype, scenario



Data gathering for requirements (cont)

2) Questionnaires:

- Often used in conjunction with other techniques
- Can give quantitative or qualitative data
- Good for answering specific questions from a large, dispersed group of people

Questionnaires

- Questions can be closed or open
- Closed questions are easier to analyze, and may be done by computer
- Can be administered to large populations
- *older PPI* → Paper, email and the web used for dissemination
- Sampling can be a problem when the size of a population is unknown as is common online

Questionnaire design

- The impact of a question can be influenced by question order.
- Do you need different versions of the questionnaire for different populations?
- Provide clear instructions on how to complete the questionnaire.
- Strike a balance between using white space and keeping the questionnaire compact.
- Decide on whether phrases will all be positive, all negative or mixed.

Questionnaire & response format

*3 likert scale
agree, undecided, disagree*

- 'Yes' and 'No' checkboxes
- Checkboxes that offer
 - many options
- Rating scales
 - Likert scales
 - semantic scales
 - 3, 5, 7 or more points?
- Open-ended responses

6. Please rate the Package Image

	-3	-2	-1	0	1	2	3	
A. Low Quality	☐	☐	☐	☐	☐	☐	☐	High Quality
B. Economical	☐	☐	☐	☐	☐	☐	☐	Luxurious
C. Masculine	☐	☐	☐	☐	☐	☐	☐	Feminine
D. Flavorless	☐	☐	☐	☐	☐	☐	☐	Flavorful
E. Mild	☐	☐	☐	☐	☐	☐	☐	Powerful
F. Light	☐	☐	☐	☐	☐	☐	☐	Rich
G. Cold	☐	☐	☐	☐	☐	☐	☐	Warm
H. Delicate	☐	☐	☐	☐	☐	☐	☐	Bold
I. Impersonal	☐	☐	☐	☐	☐	☐	☐	Personal
J. Contemporary	☐	☐	☐	☐	☐	☐	☐	Traditional
K. New	☐	☐	☐	☐	☐	☐	☐	Established
L. Casual	☐	☐	☐	☐	☐	☐	☐	Formal
M. Wholesome	☐	☐	☐	☐	☐	☐	☐	Exotic
N. Serious	☐	☐	☐	☐	☐	☐	☐	Fun
O. Standard	☐	☐	☐	☐	☐	☐	☐	Unique
P. Integrity	☐	☐	☐	☐	☐	☐	☐	Unworthy
Q. Child	☐	☐	☐	☐	☐	☐	☐	Adult

Encouraging a good response

- Make sure purpose of study is clear
- Promise anonymity
- Ensure questionnaire is well designed
- Offer a short version for those who do not have time to complete a long questionnaire
- If mailed, include a stamped addressed envelope
- Follow-up with emails, phone calls, letters
- Provide an incentive
- 40% response rate is high, 20% is often acceptable

Example of an online questionnaire

D. Internationally-agreed development goals outlined in the Millennium Declaration : Is this activity relevant to achieving the MDGs listed below? (see www.un.org/millenniumgoals/ and the targets for each goal) ☒ Yes ☐ No
If yes, please tick all goals that apply

- ☐ Eradicate poverty and hunger
- ☐ Achieve Universal Primary Education
- ☐ Promote gender equality & empower women
- ☒ Reduce child mortality
- ☐ Improve maternal health
- ☐ Combat HIV/AIDS, Malaria and other diseases
- ☐ Ensure environmental sustainability
- ☐ Develop a global partnership for development

E. More Information : Please provide a website for this activity
Website (URL) :

F. Geographical Coverage * : Please tick a box to indicate the geographical coverage
☐ Local ☐ National ☐ Regional ☒ International
Please specify coverage :

G. Timescale * : Please tick a box to indicate the timescale of the activity
☐ Completed ☐ Planned for future ☐ Ongoing
Specify dates using the format day/month/year (dd/mm/yyyy) :
From: To:

H. Activity Type * : Please tick one or more boxes to indicate the type of activity described above
☐ Project ☐ Programme ☐ WSIS Thematic Meeting ☐ Conference ☐ Publication ☐ Training initiative
☐ Guidelines ☐ Tool-kit ☐ Website ☐ Database
Other (please specify) :

Figure 7.8 An excerpt from a web-based questionnaire showing check boxes, radio buttons, and pull-down menus

Advantages of online questionnaires

- Responses are usually received quickly
- No copying and postage costs
- Data can be collected in database for analysis
- Time required for data analysis is reduced
- Errors can be corrected easily

The screenshot shows a web-based questionnaire interface. On the left is a navigation menu with links: Careers, Can You Change, How It, Transition, What You Need, Career, Services Center, General Info, Schools, Research & Non, Public, Counseling, etc., Career Services, Public Sector, Recruiters, Colleague Center, General Info, Activities, Local Chapters, My Dashboard, Career Letter, My Homepage, Occasions, Shipping Center, Publications, and Search & Index. The main content area has a header with a privacy statement: "Information from this site and related materials: your privacy and anonymity are guaranteed as a CareerRedesign Colleague." Below this is a registration prompt: "Not registered? Register Now! It's free and secure! Please enter your Colleague ID: [text box]". The main form is titled "Option 1" and "By Profile". It contains a dropdown menu for "Option 2" with "None" selected, and a "Criteria" section with a dropdown menu for "Career Change Process Step" with "None" selected. Below this is a "Thrive in Transition" section with a dropdown menu for "By Geography" with "State" selected. A "Post Colleague" button is at the bottom. On the right, there is a "Share Your Experience" section with links: "Add to the website site", "Personal experience", "Article or article review", "Book review", and "Test tool or tip". Below this is a "Recommend a" section with links: "Service Center Provider", "Career Advisor", "Success Story Candidate", and "Rate this website". At the bottom right is a "Ask Online" button and a list of services: "Use our directory, email service or our online discussion groups to make contacts, solve problems and find someone who listens" and "Ask us a question".

Problems with online questionnaires

- Sampling is problematic if population size is unknown
- Preventing individuals from responding more than once
- Individuals have also been known to change questions in email questionnaires

Data gathering for requirements (cont)

3) Researching similar products:

- Good for prompting requirements

4) Observation:

- the action or process of observing something in order to gain information

Observation

Direct observation: *time consuming* *(abundant)*

- Gain insights into stakeholders' tasks
- Good for understanding the nature and context of the tasks
- But, it requires time and commitment from a member of the design team, and it can result in a huge amount of data

Indirect observation: *metadata*

- Not often used in requirements activity
- Good for logging current tasks

- Direct observation
 - Think aloud techniques
- Indirect observation – tracking users' activities
 - Diaries
 - Interaction logs
 - Web analytics → system, measures and analyze web data
- Video, audio, photos, notes are used to capture data in both types of observations

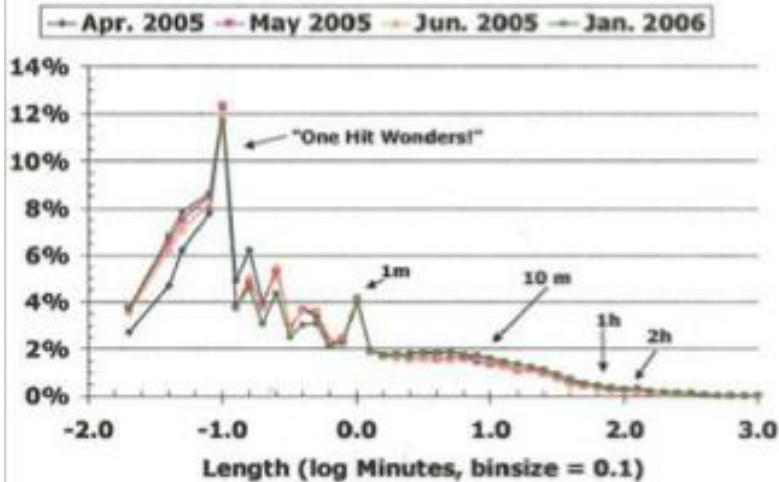
Web analytics

↳ direct observation

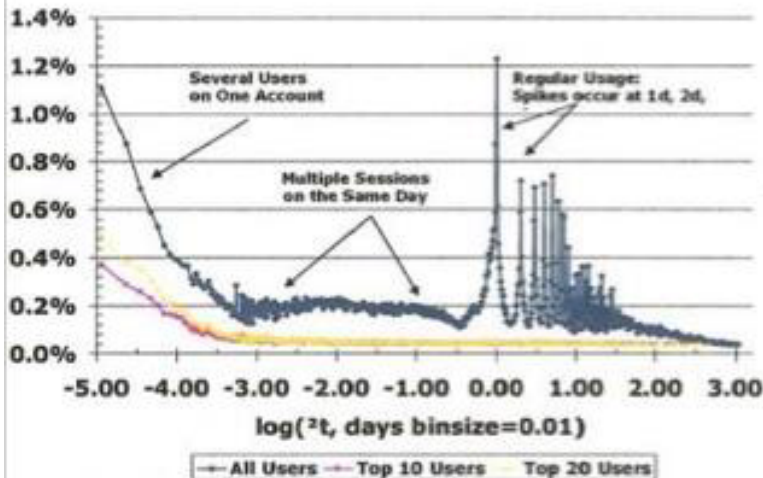
- A system of tools and techniques for optimizing web usage by:
 - Measuring,
 - Collecting,
 - Analyzing, and
 - Reporting web data
- Typically focus on the number of web visitors and page views.

help figure out
duration of session

Session Length



Login Frequency Histogram



Web analytics

Structuring frameworks to guide observation

- - The person. Who? → users that match (user profile)
 - The place. Where?
 - The thing. What?
- The Goetz and LeCompte (1984) framework:
 - Who is present?
 - What is their role?
 - What is happening?
 - When does the activity occur?
 - Where is it happening?
 - Why is it happening?
 - How is the activity organized?

Two sets of techniques that include users

Ethnography

- Ethnography is a philosophy with a set of techniques that include participant observation and interviews
- Debate about differences between participant observation and ethnography
- Ethnographers immerse themselves in the culture that they study
- A researcher's degree of participation can vary along a scale from 'outside' to 'inside'
- Analyzing video and data logs can be time-consuming
- Collections of comments, incidents, and artifacts are made

Ethnography (cont)

- Co-operation of people being observed is required
- Informants are useful
- Data analysis is continuous
- Interpretivist technique
- Questions get refined as understanding grows
- Reports usually contain examples

Ethnography



(a)



(b)

Figure 7.10 (a) The situation before MERboard; (b) A scientist using MERboard to present information

Source: J. Trimble, R. Wales and R. Gossweiler (2002): "NASA position paper for the CSCW 2002 workshop on Public, Community and Situated Displays: Merboard".

Online Ethnography

- Virtual, Online, Netnography
- Online and offline activity
- Interaction online differs from face-to-face
- Virtual worlds have a persistence that physical worlds do not have
- Ethical considerations and presentation issues are different

An Ethnography project for you..

- Join www.ActiveWorlds.com or go to another chat room of your choice
- ActiveWorlds is a 3-D chatroom environment in which you can visit different environments and chat with the people that you meet there
- To use ActiveWorlds you will need to check the instructions that they provide and download the appropriate software to run on your computer

An Ethnography project for you.. (cont)

- Select one of the worlds to visit and choose an avatar (a graphical personification) to represent you.
- Spend one to two hours doing an ethnographic study.
- Use one of the frameworks discussed in the previous slides to guide you and write a one or two page report about your study.
- Also notice and report on any usability issues you encounter and on user experiences in this environment.

Contextual Inquiry

- An approach to ethnographic study where user is expert, designer is apprentice
- A form of interview, but
 - at users' workplace (workstation)
 - 2 to 3 hours long
- Four main principles:
 - Context: see workplace & what happens
 - Partnership: user and developer collaborate
 - Interpretation: observations interpreted by user and developer together *Sit together to interpret*
 - Focus: project focus to understand what to look for

Data gathering for requirements (cont)

5) Studying documentation: *Not time consuming*

- Procedures and rules are often written down in manuals
- Good source of data about the steps involved in an activity, and any regulations governing a task
- Not to be used in isolation
- Good for understanding legislation, and getting background information
- No stakeholder time, which is a limiting factor on the other techniques

Choosing and combining techniques

Not one specific method that's better

- Depends on
 - The focus of the study
 - The participants involved
 - The nature of the technique
 - The resources available
 - Time available

PC: no user involved



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Need							Share						
Mon	Tue	Wed	Thur	Fri	Sat	Sun	Mon	Tue	Wed	Thur	Fri	Sat	Sun
You needed: ☒ Info ☐ Advice ☐ Other							What did you want to share? ☒ Advice ☐ Info ☐ Other						
What did you need? ☒ Advice ☐ Info ☐ Other							Why did you want to share it? ☒ Advice ☐ Info ☐ Other						
Why did you need it? ☒ Advice ☐ Info ☐ Other							Where were you? ☒ Home ☐ Other						
Where were you? ☒ Home ☐ Other							What were you doing? ☒ Reading ☐ Other						
What were you doing? ☒ Reading ☐ Other							I want to share the information with:						
What I needed was very important.							People around me: ☒ People who use the location: ☒ Other: ☐						



Cultural probes

Summary

- The observation main data gathering methods: interviews, questionnaires,
- 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
- Techniques can be combined depending on study focus, participants, nature of technique and available resources

Techniques in data gathering

- Recorded audio/video
- Taking notes
 - Notes plus photographs
 - Audio plus photographs
 - Video



Data Recording

- By this week:
- modify consent form
 - consent of real users this week
 - Finish up interview questions
 - Open up hello account
 - ↳ invite Dr.
 - Who has shared drive?
 - ↳ appendices included
 - ① Recordings
 - ② Consent forms signed
 - ③ Transcripts

- Notes + still camera
 - Adv: handwritten notes (pen & paper less intrusive than a keyboard; flexible)
 - Disadv: notes –tiring and difficult to type/write & listen & observe at the same time; easy to lose concentration; biases creep in; handwritten difficult to understand; speed of writing/typing is limited
 - solution: having partner or another observer

Data Recording (cont)

- Audio + photographs *if user asks how many times: 3
milestone 2: audio w/ snapshots
(interacting w/ low fidelity prototype)*
 - Useful alternative to note taking; less intrusive than video
 - In observation – allows observers to focus on activity rather than spoken word.
 - In interview – allows the interviewer to pay more attention to the interviewee rather than taking notes while listening
 - Transcribing audio data – time consuming but may be not all only sections needed
 - Supplemented by images/pictures

Data Recording (cont)

issues:

• different response since they're trying their best to impress interviewer

So... make them comfy

- Video

audio maybe different

- Advg: - capture both audio and video.
- Issues on video:- where to fix the video position or use roving recorder (depend on activity and purpose of what need to be recorded)
- Where to point the camera in order to capture what it is required.
- Understanding the impact of the recording on participants – impact on behavior when they are recorded.

Problems with data gathering

- Identifying and involving stakeholders:
end-users directly interact
users, *any1 else is stakeholder* managers, developers, customer reps, union reps, shareholders
- Involving stakeholders: workshops, interviews, workplace studies, co-opt stakeholders onto the development team
- 'Real' users, not managers:
traditionally a problem in software engineering, but better now

Problems with data gathering (cont)

- Requirements management: version control, ownership
- Communication between parties:
 - within development team
 - with customer/user
 - between users... different parts of an organisation use different terminology
- Domain knowledge distributed and implicit:
 - difficult to dig up and understand
 - knowledge articulation: how do you walk?
- Availability of key people

Must have rights of our product if external interaction



no one objects

consent form wording
must be clear

Problems with data gathering (cont)

- Political problems within the organisation

- Dominance of certain stakeholders

other stakeholder
demands smthn

SH dominates
prototype

- Economic and business environment changes → many developers produced
multi products

but pandemic made re
need for contactless
higher so must recode

- Balancing functional and usability demands

Data gathering guidelines

- Focus on identifying the stakeholders' needs
- Involve all the stakeholder groups
- Involve more than one representative from each stakeholder group
- Use a combination of data gathering techniques

Triangulation
(diff pov)

Data gathering guidelines (cont)

① Interview : qualitative

② product comparison : qualitative

- Support the process with props such as prototypes and task descriptions
- Run a pilot session
- You will need to compromise on the data you collect and the analysis to be done, but before you can make sensible compromises, you need to know what you'd *really* like
- Consider carefully how to record the data

Can categorize based on theme

Establishing requirements

- What do users want? What do users 'need'?
 - Requirements need clarification, refinement, completion, re-scoping
 - Input: requirements document (maybe)
 - Output: stable requirements
- Why 'establish'?
 - Requirements arise from understanding users' needs
 - Requirements can be justified & related to data

Different kinds of requirements

- Functional:
 - What the system should do
 - Historically the main focus of requirements activities
- (Non-functional: memory size, response time...)
- Data:
 - What kinds of data need to be stored?
 - How will they be stored (e.g. database)?

Different kinds of requirements (cont)

- Environment or context of use:
 - physical: dusty, noisy, vibration, light, heat, humidity (e.g. OMS insects, ATM)
height accommodates wheelchair users
 - social: sharing of files, of displays, in paper, across great distances, work individually, privacy for clients
 - organisational: hierarchy, IT department's attitude and remit, user support, communications structure and infrastructure, availability of training

Different kinds of requirements (cont)

- **Users: Who are they?**

- Characteristics: ability, background, attitude to computers
- System use: novice, expert, casual, frequent
- Novice: ^{learnability} ~~step-by-step~~ (prompted), constrained, clear information
- ^{shortcut} ~~Expert~~: flexibility, access/power ^{intermediate: memory}
- Frequent: short cuts
- Casual/infrequent: clear instructions, e.g. menu paths

What are users' capabilities?

- Humans vary in many dimensions:

iPad target users: on-the-go workers
actual users: children (make durable)



- size of hands may affect the size and positioning of input buttons
- motor abilities may affect the suitability of certain input and output devices
- height if designing a physical kiosk
- strength - a child's toy requires little strength to operate, but greater strength to change batteries
- disabilities (e.g. sight, hearing, dexterity)

Kinds of requirements

- What factors (environmental, user, usability) would affect the following systems?
- Self-service filling and payment system for a petrol (gas) station
- On-board ship data analysis system for geologists searching for oil
- Fashion clothes website

Persona

empathy: in their shoes

Virtual imaginary user
exhibits similar user profile

each member works on persona
based on real person (every 1 follow same
template)

persona must be convincing
↳ to get empathy

- Capture user characteristics
- Not real people, but synthesised from real user characteristics
- Should not be idealised
- Bring them to life with a name, characteristics, goals, personal background
- Develop multiple personas

can't claim this persona

Persona

BACKGROUND

- 15, Female
- Ongoing Private Education
- Ambitious
- Comfortable using technology to communicate

MOTIVATIONS

- Keeping in touch with her network
- Fashion/street cred
- Keeping up with peers.

FRUSTRATIONS

- Sad people trying to be 'friends' on Facebook
- Having to be in bed @ 11pm
- Being swamped in friends updates
- Missing important status updates

Ginnie

Receives private tutoring in Maths and English as these are not her strong subjects. Enjoys playing for the school's 2nd teams for netball and Lacrosse and is good at art.

She loves recording her favourite shows: ER and Sun Valley High on Sky+ and spends some of her time on her Laptop that Daddy bought her watching videos on YouTube, downloading music, keeping up to date with her friends on Facebook and chatting via MS IM to her cousin who is at University in Leeds.

She loves Ugg boots and Abercrombie & Fitch and uses the Internet to shop and find the cheapest prices.

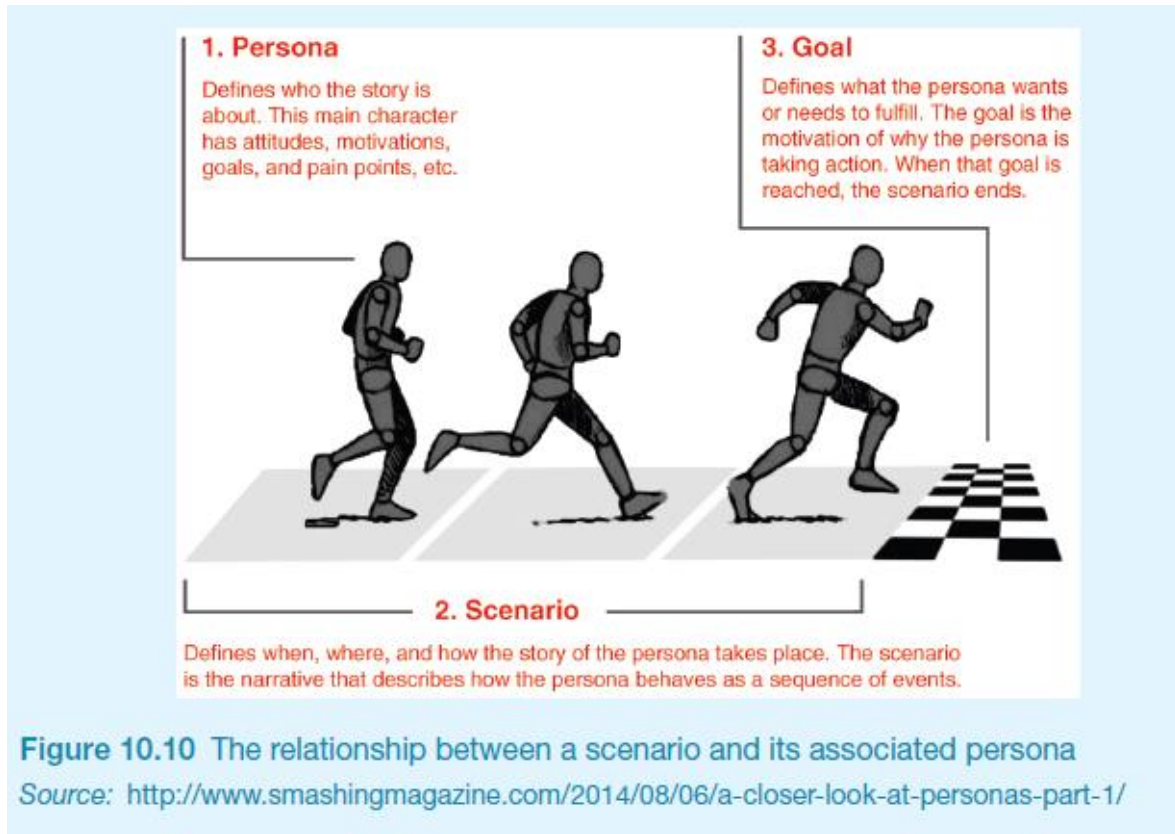
CAPLIN



"I want to easily hook up with my friends whilst watching TV"



Scenarios and Personas



Task descriptions

Scenarios

an informal narrative story, simple, 'natural', personal, not generalisable

Use cases

assume interaction with a system

assume detailed understanding of the interaction

Essential use cases

abstract away from the details

does not have the same assumptions as use cases

Scenario

“The Thomson family enjoy outdoor activities and want to try their hand at sailing this year. There are four family members: Sky (10 years old), Eamonn (15 years old), Claire (35), and Will (40). One evening after dinner they decide to start exploring the possibilities. They all gather around the travel organizer and enter their initial set of requirements – a sailing trip for four novices in the Mediterranean. The console is designed so that all members of the family can interact easily and comfortably with it. The system’s initial suggestion is a flotilla, where several crews (with various levels of experience) sail together on separate boats. Sky and Eamonn aren’t very happy at the idea of going on vacation with a group of other people, even though the Thomsons would have their own boat. The travel organizer shows them descriptions of flotillas from other children their ages and they are all very positive, so eventually, everyone agrees to explore flotilla opportunities. Will confirms this recommendation and asks for detailed options. As it’s getting late, he asks for the details to be printed so everyone can consider them tomorrow. The travel organizer prints out a summary of the different options available.”

Travel organizer: finds sailing trip for 4 newbies
suggests flotilla
display description of flotilla from children
print summary

Use Case

1. The system displays options for investigating visa and vaccination requirements.
2. The user chooses the option to find out about visa requirements.
3. The system prompts user for the name of the destination country.
4. The user enters the country's name.
5. The system checks that the country is valid.
6. The system prompts the user for her nationality.
7. The user enters her nationality.
8. The system checks the visa requirements of the entered country for a passport holder of her nationality.
9. The system displays the visa requirements.
10. The system displays the option to print out the visa requirements.
11. The user chooses to print the requirements.

Alternative courses for travel organizer

Some alternative courses:

6. If the country name is invalid:

6.1 The system displays an error message.

6.2 The system returns to step 3.

8. If the nationality is invalid:

8.1 The system displays an error message.

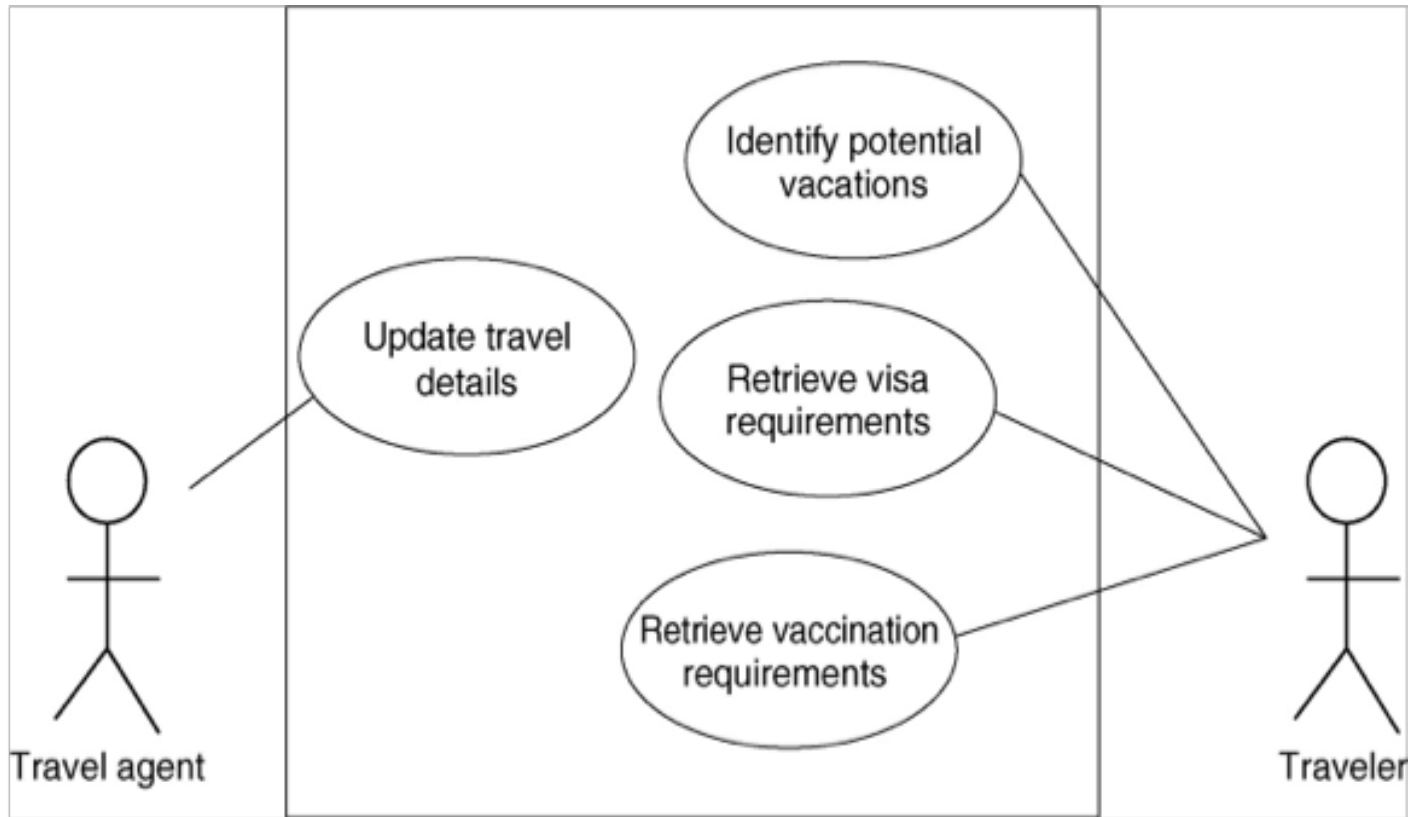
8.2 The system returns to step 6.

9. If no information about visa requirements is found:

9.1 The system displays a suitable message.

9.2 The system returns to step 1.⁵⁹

Example use case diagram for travel organizer



Example essential use case for travel organizer

retrieveVisa

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

Task Analysis

- Task descriptions are often used to envision new systems or devices
- Task analysis is used mainly to investigate an existing situation
- It is important not to focus on superficial activities
 - What are people trying to achieve?
 - Why are they trying to achieve it?
 - How are they going about it?
- Many techniques, the most popular is Hierarchical Task Analysis (HTA)

Hierarchical Task Analysis

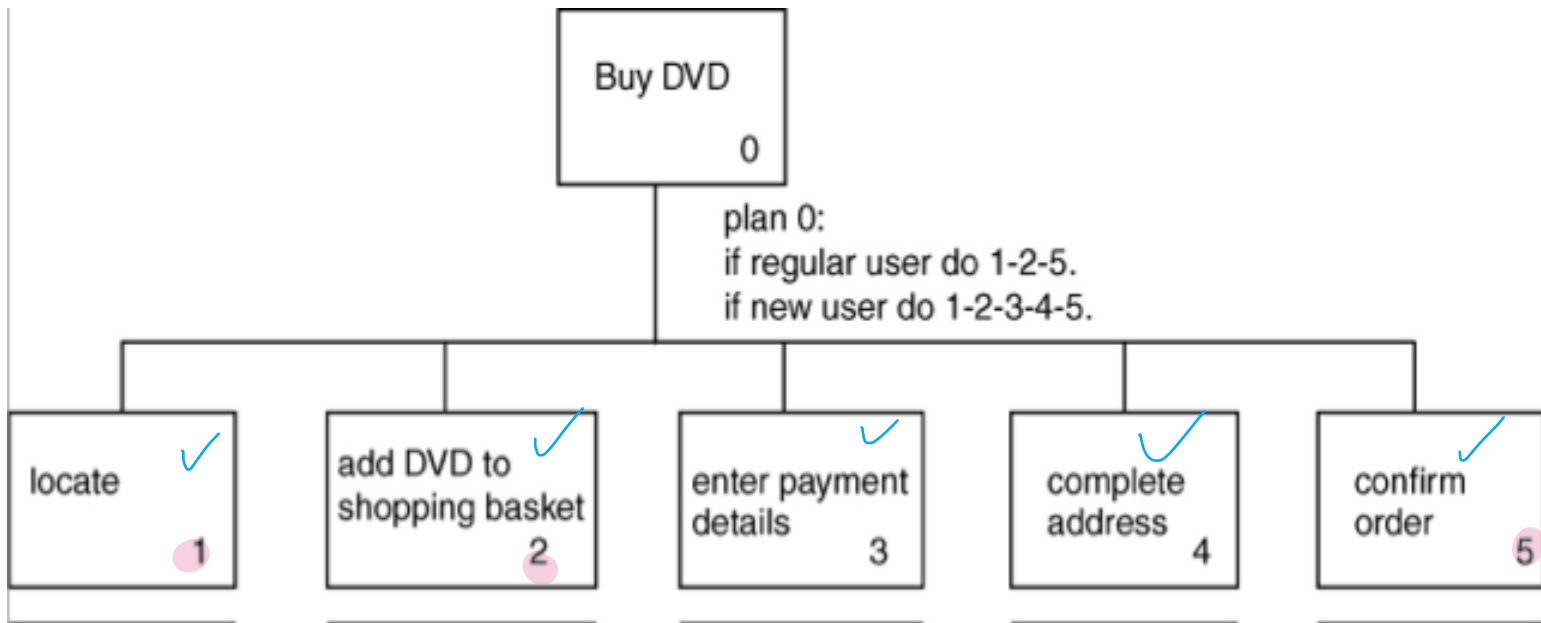
- Involves breaking a task down into subtasks, then sub-sub-tasks and so on. These are grouped as plans which specify how the tasks might be performed in practice
- HTA focuses on physical and observable actions, and includes looking at actions not related to software or an interaction device
- Start with a user goal which is examined and the main tasks for achieving it are identified
- Tasks are sub-divided into sub-tasks

Example Hierarchical Task Analysis

0. In order to buy a DVD
1. locate DVD
2. add DVD to shopping basket
3. enter payment details
4. complete address
5. confirm order

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

Example Hierarchical Task Analysis (graphical)



Summary

- Getting requirements right is crucial
- There are different kinds of requirement, each is significant for interaction design
- The most commonly-used techniques for data gathering are: questionnaires, interviews, focus groups, direct observation, studying documentation and researching similar products
- Scenarios, use cases and essential use cases can be used to articulate existing and envisioned work practices.
- Task analysis techniques such as HTA help to investigate existing systems and practices

Data interpretation and analysis

- Start soon after data gathering session
- Initial interpretation before deeper analysis
- Different approaches emphasize different elements
e.g. class diagrams for object-oriented systems,
entity-relationship diagrams for data intensive
systems

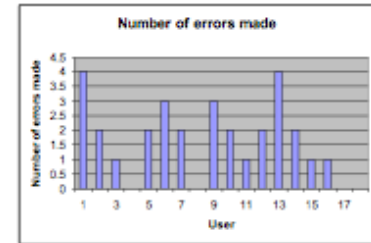
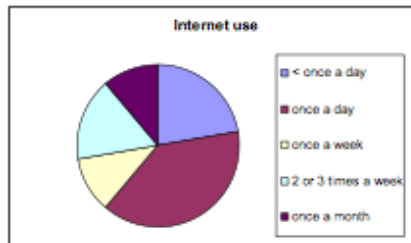
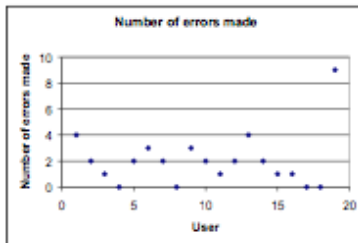
some ERD → entity relation
UCD → use case

Quantitative and Qualitative

- Quantitative data – expressed as numbers
- Qualitative data – difficult to measure sensibly as numbers, e.g. count number of words to measure dissatisfaction
- Quantitative analysis – numerical methods to ascertain size, magnitude, amount
- Qualitative analysis – expresses the nature of elements and is represented as themes, patterns, stories
- Be careful how you manipulate data and numbers!

Simple Quantitative Analysis

- Averages
 - Mean: add up values and divide by number of data points
 - Median: middle value of data when ranked
 - Mode: figure that appears most often in the data
- Percentages
- Graphical representations give overview of data



Visualizing log data

Interaction profiles of players in online game

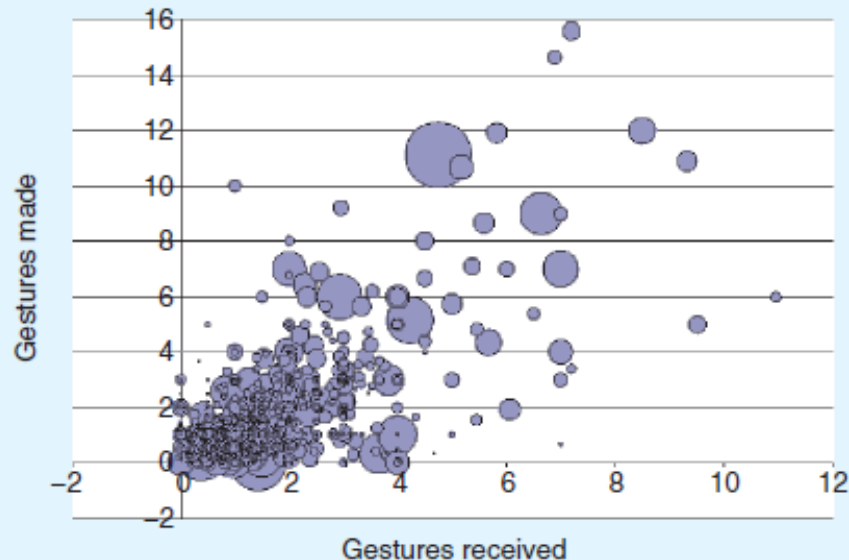


Figure 8.6 Interaction profiles of players in the cantina

Source: N. Ducheneaut and R.J. Morris (2004): "The social side of gaming: a study of interaction patterns in a massively multiplayer online game" in *Proceedings of CSCW 04*. ©2004 Association for Computing Machinery, Inc. Reprinted by permission.

Visualizing log data

Log of web page activity

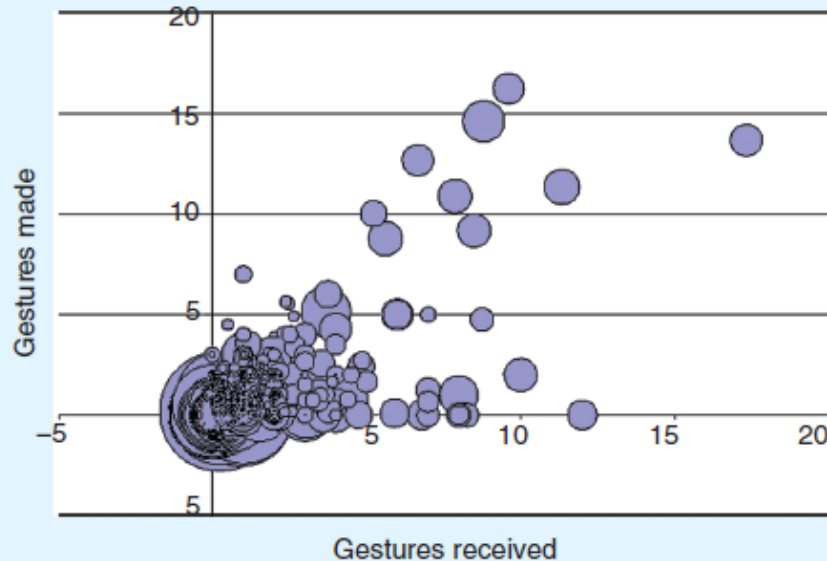


Figure 8.7 Interaction profiles of players in the starport

Source: N. Ducheneaut and R.J. Morris (2004): "The social side of gaming: a study of interaction patterns in a massively multiplayer online game" in *Proceedings of CSCW 04*. ©2004 Association for Computing Machinery, Inc. Reprinted by permission.

Simple Qualitative Analysis

- Recurring patterns or themes
 - Emergent from data, dependent on observation framework if used
- Categorizing data
 - Categorization scheme may be emergent or pre-specified
- Looking for critical incidents
 - Helps to focus in on key events

Simple Qualitative Analysis



Figure 8.8 Building the affinity diagram of Indian ATM usage

Source: Figure 1, A. DeAngeli, U. Athavamker, A. Joshi, L. Coventry and G.I. Johnson (2004) "Introducing ATMs in India: a contextual inquiry", *Interacting with Computers* 16(1), 29–44. Reproduced with permission.

Tools to support data analysis

- Spreadsheet – simple to use, basic graphs
- Statistical packages, e.g. SPSS
- Qualitative data analysis tools
 - Categorization and theme-based analysis, e.g. N6
 - Quantitative analysis of text-based data
- CAQDAS Networking Project, based at the University of Surrey
(<http://caqdas.soc.surrey.ac.uk/>)

Theoretical frameworks for qualitative analysis

- Basing data analysis around theoretical frameworks provides further insight
- Three such frameworks are:
 - Grounded Theory
 - Distributed Cognition
 - Activity Theory

Grounded Theory

- Aims to derive theory from systematic analysis of data
- Based on categorization approach (called here 'coding')
- Three levels of 'coding'
 - Open: identify categories
 - Axial: flesh out and link to subcategories
 - Selective: form theoretical scheme
- Researchers are encouraged to draw on own theoretical backgrounds to inform analysis

Code book used in grounded theory analysis

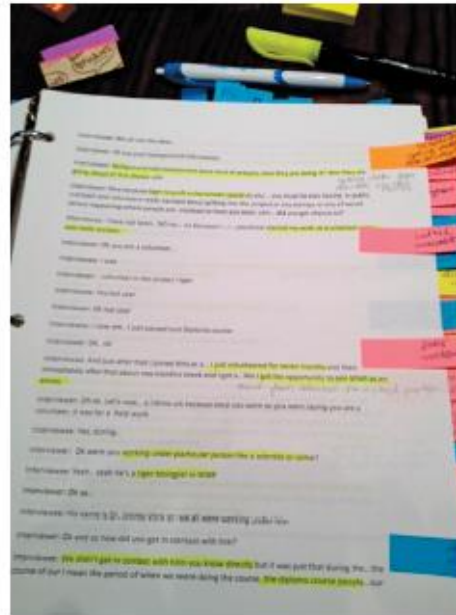


Figure 8.13 Code book used in a grounded theory analysis of citizens' motivations to contribute to citizen science

Source: Rotman, D. et al (2014). Does motivation in citizen science change with time and culture? In *Proceedings of the companion publication of the 17th ACM conference on Computer supported cooperative work & social computing (CSCW Companion '14)*. ACM, New York, NY, USA, 229–232. ©2014 Association for Computing Machinery, Inc. Reprinted by permission.

Excerpt showing axial coding

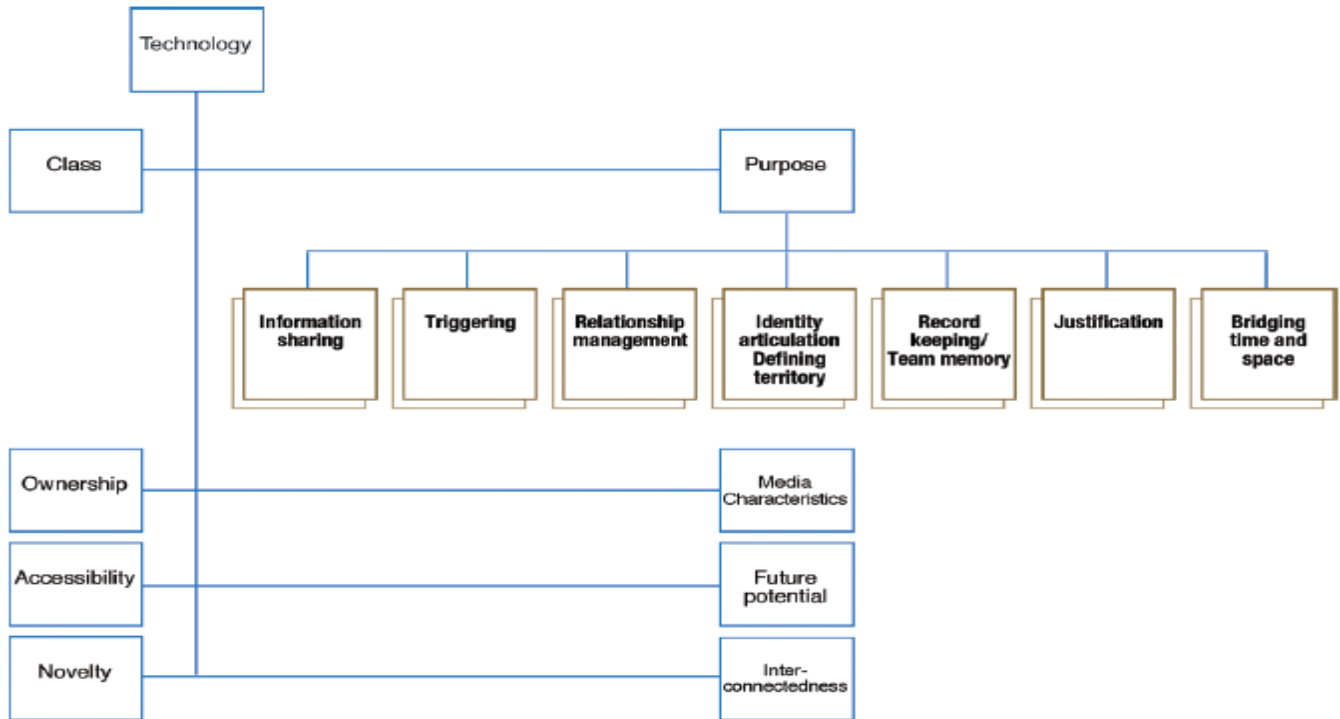


Figure 8.14 Axial coding for the technology category

Source: S. Sarker, F. Lau and S. Sahay (2001): "Using an adapted grounded theory approach for inductive theory building about virtual team development". *The Data Base for Advances in Information Systems*, 32(1), pp. 38–56 ©2001 Association for Computing Machinery, Inc. Reprinted by permission.

Activity Theory

- Explains human behaviour in terms of our practical activity in the world
- Provides a framework that focuses analysis around the concept of an 'activity' and helps to identify tensions between the different elements of the system
- Two key models: one outlines what constitutes an 'activity'; one models the mediating role of artifacts

Individual model

Activity – Motive



Action – Goal



Operation – Conditions

Presenting the findings

- Only make claims that your data can support
- The best way to present your findings depends on the audience, the purpose, and the data gathering and analysis undertaken
- Graphical representations (as discussed above) may be appropriate for presentation
- Other techniques are:
 - Rigorous notations, e.g. UML
 - Using stories, e.g. to create scenarios
 - Summarizing the findings

- Tomorrow:
- cont. procedures pre/during/after
 - consent form personalized

Summary

- The data analysis that can be done depends on the data gathering that was done
- Qualitative and quantitative data may be gathered from any of the three main data gathering approaches
- Percentages and averages are commonly used in Interaction Design
- Mean, median and mode are different kinds of 'average' and can have very different answers for the same set of data
- Grounded Theory, Distributed Cognition and Activity Theory are theoretical frameworks to support data analysis
- Presentation of the findings should not overstate the evidence **IMP !!**