

User Centered Design

[4] Gathering and Analyzing Needs and Requirements

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- Requirements are:
 - statements about an intended technology/product which specify what it should do or how it should perform
- Requirements should:
 - be as specific, unambiguous and clear as possible
- Requirements can:
 - have different levels of abstraction

Why do we need requirements?

- Need to know
 - Users
 - ✓ Who they are, what they think, how they do things...
 - Goals
 - ✓ What does the user need/want to do? What will the technology be used for?
 - Tasks/actions
 - ✓ What things does the user need to do to accomplish their goals?
 - Context
 - ✓ Where? how? when? constraints – environment, technology?

Why do we need requirements?

- Need to keep in mind
 - Usability and user experience
 - ✓ Effectiveness, efficiency, safety, utility, learnability, memorability, fun, aesthetics
 - Data requirements
 - ✓ Type, volatility, size/amount, persistence, accuracy, value
 - Added value
 - ✓ What will the technology provide that existing solutions don't?

Not just the end-user

- Types of stakeholders
 - Primary
 - ✓ People who actually use the system
 - Secondary
 - ✓ People who receive output from it or provide input to it but don't actually use it
 - Tertiary
 - ✓ People who are directly affected by the success or failure of the system but are not primary or secondary stakeholders
 - Facilitating
 - ✓ People who are involved in the design, development and maintenance of the system

From Dix et al. 2004

Choosing a Technique

- Which technique is most appropriate will depend on
 - Focus/goal of the study
 - ✓ Technique must be compatible with goal of the study
 - ✓ Beginning requires more exploration
 - Participants involved
 - ✓ Characteristics of target group
 - ✓ Location and accessibility
 - Nature of the technique
 - ✓ Specialist equipment and training
 - ✓ Knowledge and experience required
 - Available resources
 - ✓ Time, money, people, pilot studies
- Use more than one technique to get better results

Techniques

- Diary studies
- Experience sampling
- Probes
- Interviews
- Questionnaires
- Brainstorming
- Focus groups
- Field studies
 - Observation (direct, indirect)
 - Ethnography
 - Task analysis
 - Contextual inquiry
- Discount methods
 - Ethnography-lite
 - Auto-ethnography
 - Online enquiry
 - Log analysis
 - Studying documentation
 - Researching similar products

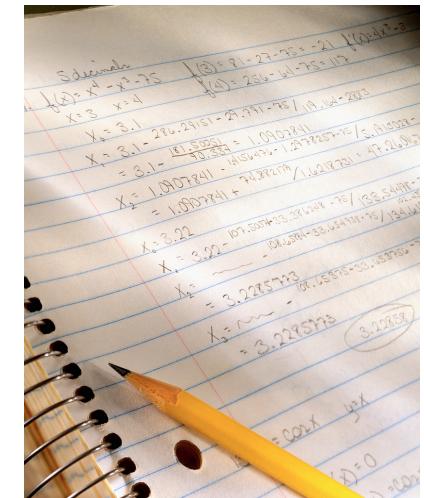
Diary Studies

- What it is:
 - User provides information about their habits, experiences, activities
 - ✓ Self-reporting technique
- Useful when:
 - Can't interact with a user
 - Want to do long-term studies
 - Want to get an idea about habits, experiences, activities, general observations

Diary Studies

■ How it's done:

- Provide participants with a way to record their entries
 - ✓ Medium depends on what's being studied
- Give instructions about
 - ✓ Types of observation
 - broad (eg. activities observed since last entry)
 - focused (eg. problems experienced since last entry)
 - ✓ Period of use
 - should cover time when significant things expected to occur
 - ✓ Frequency of entry
 - should be easy to remember and follow
- Follow-up interviews at regular intervals (during or after)
 - ✓ Can discuss experiences while fresh
 - ✓ Can solve logistical problems quickly
 - ✓ Encourages participant to make entries



Diary Studies

- Advantages

- No pressure from experimenter presence
- Participant has time to reflect on what they are writing
- Participant decides what to include
- Few resources needed
- No special equipment
- Don't require expertise
- Can use templates

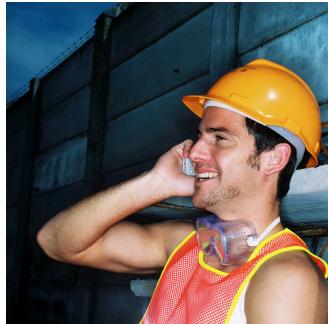
- Disadvantages

- Less controllable
- Participant decides what to include
- Rely on participants remembering to fill out diary
- Memories of events are often exaggerated

Experience Sampling

- What it is:
 - Getting information about what users are doing/thinking/experiencing at controlled or random points in time

- Useful when:
 - Can't interact with user all the time
 - Don't want to rely on user remembering to give input at specific times
 - Want to do long term studies



Experience Sampling

- How it's done:
 - Interrupt users at different times to get them to answer questions
 - ✓ Interrupting done by pager, sms etc
 - ✓ Response
 - phone back to answer a quick survey
 - phone and leave a message with answer
 - by sms, email etc.
- Advantages
 - Experimenter controls when user gives a response/reaction
 - ✓ Doesn't rely on participant remembering
- Disadvantages
 - Might miss interesting information

Probes

- What they are:

- Physical objects placed in the participant's environment that are used to generate/inspire opinions, interactions etc.

- Useful when:

- Want to explore how people see/react to things
 - Can't be with user all the time
 - Want to stimulate reactions to particular situations
 - Want more than just written/oral feedback

- How it's done: Technological/mobile probes

- Prototypes released, people's reactions/behaviour observed
 - Technologies not designed to suit a particular need - exploratory
 - Must be simple to use/operate



Probes

- How it's done: Cultural probes
 - Packages of objects designed to question informants
 - Examples:
 - ✓ Postcards with image on one side and question for informant on back
 - ✓ A disposable camera with a list of image requests printed on the back, eg. 'photograph something boring'
 - ✓ More examples:
 - <http://www.hcibook.com/e3/online/cultural-probes/>
 - Probes sent back to investigator bit by bit over a longer period of time
 - ✓ Lets designers think and reflect more slowly



Image source: <http://www.hcibook.com/e3/online/cultural-probes/>

Probes

- Advantages

- Lets participants be more creative and interactive in the exploration process
- Don't need expertise
- No pressure from experimenter

- Disadvantages

- Data can be harder to interpret and correlate
- Need to provide resources/objects to users
- Cost of sending back data

Interviews

- What they are:
 - Ways to get information from a participant by asking them questions directly
- Useful when:
 - Have specific questions
 - Have direct access to participants
 - Have a short amount of time/don't need a long-term study
- 3 different types
 - Structured
 - Semi-structured
 - Unstructured



Interviews

■ Structured

- Interviewer asks predetermined questions
- Questions usually closed-answer
- Interviewer steers the interview
- Useful when goals are understood, specific questions can be identified
- Questions should be worded the same way and asked in the same order

- Advantages
 - ✓ Good for fast interviews
 - ✓ Standardized - same questions used with each participant

- Disadvantages
 - ✓ No freedom to explore new ideas that might come up

Interviews

■ Semi-structured

- Use both closed and open questions
- Interview has basic script
 - ✓ Guidance
 - ✓ Same topics covered
- Start with pre-planned questions then probe to get additional information
- Advantages
 - ✓ Broadly replicable
 - ✓ Freedom to explore new ideas
 - ✓ Ensure answers to specific questions
 - ✓ Can get rich data
- Disadvantages
 - ✓ Some data can be hard to analyse

Interviews

■ Unstructured

- Plan of main topics
- Open questions used - exploratory
- Conversations around a particular topic
- Go into considerable depth
- Format or content of answers flexible
- Both interviewer and interviewee can steer the interview
- Balance - relevant questions answered, open to new lines of enquiry

- Advantages
 - ✓ Generate rich data
 - ✓ Might mention issues not considered before

- Disadvantages
 - ✓ Lots of unstructured data
 - time-consuming to analyse
 - ✓ Impossible to replicate

How to conduct an interview

■ Planning

- Develop a set of questions
- Check recording equipment
- Prepare forms and documents
- Figure out structure
- Find suitable time and place
- Remember!
 - ✓ What people say isn't always what they do!
 - reduce bias by choosing questions carefully, getting a large number of participants, using a combination of data gathering techniques

■ Running an interview

- Communicate aims, make interviewee feel comfortable
- Dress, act and speak in way suitable to context
- Listen more than you talk
- Possible steps: intro, warm up, main session, cool off, closing

How to conduct an interview

- General guidelines

- Avoid compound or long sentences
- Don't use jargon or complex language
- Keep body language neutral
- Don't suggest expected answers

- Forms of interviews

- Face to face
- Telephone
- Online
- Video conferencing

Questionnaires

- What they are:
 - Forms with specific questions about a topic that respondents need to answer
- Used to
 - Collect demographic data and user opinions
 - Confirm results of interviews with small groups using larger audience
 - Get initial responses or wider perspective
 - Find people to interview in depth
- Useful when:
 - Target group is very large and disparate
 - Data can be analyzed efficiently



Questionnaires

- Structure

- Generally start with demographic questions
 - ✓ Need to be relevant to the problem being studied
 - ✓ Help clarify context of answers
- Simpler questions first
- If long, subdivide questions into related topics
- Order of questions is important
- Balance between whitespace and compactness

- Good questionnaire questions are hard to create

- Can't have ambiguities
- Can't be biased/leading
- Need to be specific

Questionnaires

■ Question types

➤ Open questions

- ✓ Can explore new ideas
- ✓ Harder to analyse/interpret

➤ Negative questions

- ✓ Can be confusing and lead to false information
 - E.g:
 - Would you be for or against not allowing documentation during exams?
 - Would you be for or against allowing documents during exams?
 - but, mixing positive and negative questions can help users stay focused

➤ Closed questions

- ✓ Offer range of answers
- ✓ Usually better
- ✓ Should include 'no opinion' or 'none of these' as options

Questionnaires

▪ Closed question response formats

➤ Check boxes and ranges

- ✓ Good for discrete choices
- ✓ Range better for sensitive questions (age etc)
- ✓ Ranges shouldn't overlap

➤ Rating scales

- ✓ Good for continuous choices
 - making judgments etc.
- ✓ 7 and 5 point most common, 3 sometimes
- ✓ Order – positive first, then negative
- ✓ Longer scale = more discrimination

Gender: male female

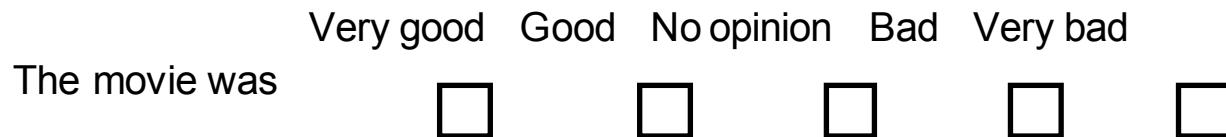
Age: ≤18 19-29 30-39 ≥40

Questionnaires

- Rating scales – 2 main types

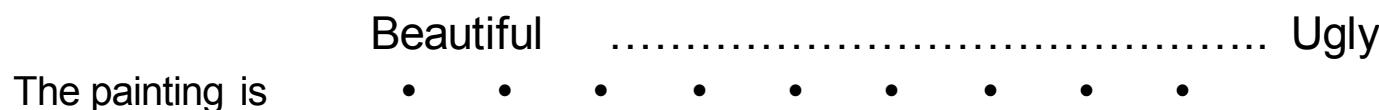
- Likert

- ✓ Used to measure opinions, attitudes, beliefs, user satisfaction
 - ✓ Set of statements representing a range of possible options



- Semantic differential

- ✓ Explore range of bipolar attitudes about an item
 - attitudes represented as a pair of adjectives



- ✓ Participant marks position between two extremes
 - ✓ Hard to find adjectives that are consistently interpretable

Questionnaires

- Administering questionnaires
 - Can have different versions for different populations
 - Need clear instructions for how to complete the questionnaire
 - Should ensure a reasonable response rate
 - ✓ On average 40% response rate for larger studies
 - ✓ Smaller studies have higher return rates
 - Method
 - ✓ Depends on context, target audience, goal etc.
 - ✓ Paper
 - ✓ Electronic
 - reach large number of people quickly and easily
 - people give more honest answers online than on paper
 - layout important
- Online resources
 - www.surveymonkey.com
 - www.questionpro.com
 - Google forms

Questionnaires

■ Advantages

- Can reach a lot of people
- Can target specific people (esp. with email)
- Data can be easy to process (electronic)
- Less pressure from experimenter
- Few additional resources needed
- Immediate validation (web)

■ Disadvantages

- Return rate can be small
- Hard to create
- Data can be hard to process (paper)
- Hard to do follow up (if anonymous)
- Random sample of respondents (web)

Brainstorming

- What it is:
 - Generating ideas in a group context
- Useful when:
 - Want to generate large number of new ideas quickly
- How it's done:
 - Participants should know goals product should support
 - Include participants from wide range of disciplines with broad experience
 - Use warm-up exercises
 - Start with a clear problem
 - No ideas should be criticized, debated or banned
 - Keep records
 - ✓ every idea should be captured without censoring
 - Build ideas on top of one another – catalysts



Focus Groups

- What it is:
 - A group discussion on a particular topic (usually by invested participants)
- Useful when:
 - Want to explore opinions about existing practices or systems
 - Want to generate new ideas or ideas for improvement
 - Need to ID conflicts in terminology or expectations between users
- How it's done:
 - Group of people (3-10) discuss a topic
 - Participants are representative of sample population
 - Led by a trained facilitator
 - Agenda guides discussion



Brainstorming and Focus Groups

- Advantages

- Generate more ideas in a group setting
- Permanent record of discussion possible

- Disadvantages

- Results depend on group dynamics
- Hard to find trained facilitators
- Harder to get group of people together
- Lots of data to analyze

Field Studies (in general)

- What they are:
 - Observing/interacting with users in a real environment/context
- Useful when:
 - Context plays an important part in the design
- Advantages
 - Give authentic reactions
 - Get lots of insight
 - Get to know/understand what it's like to be a user
- Disadvantages
 - Can be hard to really get into an environment and observe
 - Can be very tiring
 - Can be very time consuming



Observation

- What it is:

- Way to see and capture participants' actions/interactions in an environment (natural or controlled)

- Useful if:

- Want to understand user's contexts, tasks and goals
 - Have a holistic picture of interaction in an environment
 - Have a clear idea of what you want to observe

- Things to keep in mind:

- Capture as much detail as possible
 - Level of intrusion
 - Ethical and legal issues



Observation

- Structuring frameworks for observation in the field
 - Simple
 - ✓ Person: who is using the technology
 - ✓ Place: where are they using it
 - ✓ Thing: what are they doing with it
 - Detailed
 - ✓ Space: what is the physical space? How is it laid out?
 - ✓ Actors: names and relevant details of people involved
 - ✓ Activities: what are the actors doing? Why?
 - ✓ Objects: what physical objects are present (furniture, tools etc)
 - ✓ 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

From Sharp, Preece, Rogers, 2007

Observation

- Degree of participation

- Passive observer (outsider)

- ✓ Doesn't take part in the environment
 - ✓ Hard to do because you're there



- Participant observer (insider)

- ✓ Attempts to become full member of group being studied
 - hard, need a certain degree of detachment
 - have to keep the 2 roles clear and separate



- Different types

- Direct or indirect (logs)
 - Formal or informal
 - Passive or active



Observation

- Planning and conducting observations in the field
 - Need to think about
 - ✓ Level of participation
 - ✓ How to record the data
 - ✓ How to gain acceptance in the study group
 - ✓ How to handle sensitive issues (cultural differences, privacy)
 - ✓ How to ensure different perspectives are used
 - Remember to
 - ✓ Pay attention to everyone equally
 - ✓ Separate personal opinion from observation
 - Helpful hints
 - ✓ Teams help
 - ✓ Write up experiences and observations at the end of each day
 - ✓ Annotate documents – how used, what stage of activity

Observation

- Advantages
 - Get a good overall view
 - Permanent record of what happens
- Disadvantages
 - Complicated to set up
 - Can generate a lot of unnecessary data
 - Can take a very long time to analyze
 - Hard to know when to stop recording
 - Can be intrusive

Ethnography

- What it is:
 - Observation/recording of the interactions/relationships between people and between people and their environments
- Useful when:
 - Want to know about social organization and activities (understand work)
- How it's done:
 - Usually by observation
 - ✓ Interviews, questionnaires, study of artefacts
 - Observer adopts a participant role as much as possible
 - Record things that are available, ordinary, what people do/say, how they work...



Ethnography

■ Guidelines

- Start discrete (no video cameras on day 1 etc)
- Pay close attention but know when to step back
- Check whether you understand things correctly
- Report, don't speculate
- Gather as much data as possible
- People should know/understand why you're there, what you want to achieve, how long you plan to stay etc.
- Don't impose an a priori structure

Ethnography

- Advantages

- Get a very holistic picture of relationships/interactions in context
- Rich sociological perspective

- Disadvantages

- Can take weeks/months/years
- Data has many forms: docs, notes, pictures, layout sketches
- Data gathering is opportunistic
- Data analysis takes a long time
- Level of detail needed is hard to determine

Task Analysis

- What it is:
 - Process of analysing the way people do their jobs – what they do, what they act on, things they need to know
- Useful if:
 - Want to investigate an existing situation or set of practices
 - Want to analyse underlying rationale and purpose of what people are doing
- Used in:
 - Manuals and tuition
 - Requirements capture and system design
 - Detailed interface design
 - ✓ Taxonomies of tasks or objects can be used to design menus

Task Analysis

▪ Different approaches

➤ Task decomposition/hierarchical task analysis

- ✓ Looks at the way a task is split into subtasks and the order in which they are performed
 - ✓ Focuses on physical and observable actions (including actions not related to technology)
 - ✓ Starting point is user goal

➤ Knowledge based techniques

- ✓ Look at what users need to know about objects and actions involved in a task, and how that knowledge is organized



Task Analysis

- Advantages

- Detailed information about processes and tools involved in accomplishing tasks

- Disadvantages

- Hard to know when to stop the analysis
 - Hard to know if you've covered all the steps/objects
 - Hard to know from which perspective categorization needs to be done
 - Takes a lot of time

Contextual Inquiry

- What it is:

- Studying user in context, trying to capture the reality of their work culture and practice

- Useful when:

- Want to uncover requirements related to context of use

- How it's done:

- Relationship of apprentice (designer) to master (person being studied)
 - Investigator is an active observer



Contextual Inquiry

- Types
 - Interview
 - ✓ 2-3 hours, in workplace
 - ✓ Capture and record as much detail as possible
 - ✓ Collect and annotate objects, artifacts of work, sketch physical environment
 - Question/answer
 - ✓ Designer watches while participant begins some activity
 - ✓ Designer interrupts to question reasons behind a particular practice
 - ✓ Participant begins to provide commentary
- Advantages
 - Can see user in context and question directly
- Disadvantages
 - Hard to know what is important to capture
 - Data takes time to analyse

Discount Methods

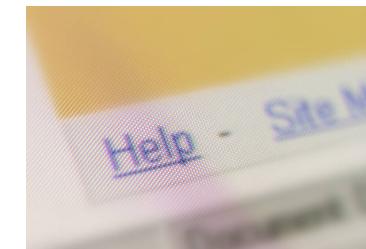
- What they are:
 - Faster/reduced ways to do requirements gathering
- Useful when:
 - Don't have time/resources to do in-depth user requirements gathering
- Ethnography lite
 - Short focused studies in the field
 - Strategically useful situations
 - No follow-up
 - Results used to target larger and more involved studies
- Auto-ethnography
 - Get people to do ethnography on themselves
 - Train by having them do ethnography on someone else



Discount Methods

■ Log analysis

- Key presses, device movements, time spent looking at help, task flow
- Advantages
 - ✓ Non-obtrusive
 - if system performance is not affected
 - ✓ Lots of data gathered automatically
- Disadvantages
 - ✓ Need a lot of data
 - ✓ Privacy concerns



■ Online enquiry

- Blogs, chat rooms, virtual environments, bulletin boards, games etc as sources
- Be careful of ethical consequences



Discount Methods

- Studying documentation
 - Manuals, instruction booklets, training manuals, rule books, job descript.
 - Good for getting background
 - Steps involved in an activity and regulations governing a task
 - Note: how you SHOULD DO something, not how something IS DONE
- Researching similar products
 - Generate alternative designs
 - Prompt requirements
- Advantages
 - Quick, low resources
- Disadvantages
 - Risk missing things



Recording Data

- Most common techniques
 - Notes, audio, photos, video
- Choice depends on context, time, sensitivity of situation ...
- Can be used individually or in combination

- Methods:
 - Notes + still camera
 - Audio + still camera
 - Video



Recruitment Methods

- Direct, unsolicited
- Advertising
- Exploit existing customer base
- Reviewing customer accounts
- Releasing prototypes
- Using colleagues
- Endorsements

Analyzing Requirements Data

- Preparatory steps

- Transcribe?
- Digitize?
- Synchronize?



- Initial analysis

- Quantitative

- ✓ Numbers
 - magnitude, amount, size of something, ratios, averages, percentages ...

- Qualitative

- ✓ Things that are difficult to measure/count
 - themes, patterns, stories, feelings, impressions, experiences ...

- Note: Most forms of data gathering produce both qualitative and quantitative data

Organizing and Interpreting Requirements

- Categorizing and organizing
 - Abstract away from detail
 - What are the general categories of requirements?
 - What are the main themes/issues that come up?
 - Make (annotated) lists!
- What do the results point at?
 - Feasibility?
 - Implications?
 - ✓ Budget, usability, user population, context...
 - Conflicts? Contradictions?
 - Ambiguities?
- Clarification
 - original source, new focused studies etc.

Organizing and Interpreting Requirements

■ Common mistakes

- Letting existing beliefs or biases influence your analysis/interpretation
- Making claims beyond what your data supports
 - ✓ Use 'many', 'often' and 'all' carefully!
 - What do 'many' and 'often' mean? Use specific numbers if possible
 - All users found... Vs. All of the users surveyed found...

■ How to show data/results

- Depends on your audience
- Common methods
 - ✓ Lists
 - ✓ Flow diagrams
 - ✓ Sketches
 - ✓ Charts



Prioritizing

- What do you need to prioritize?
 - Requirements
 - Stakeholders
- Questions to ask yourself?
 - Which stakeholders have the most ‘power’?
 - Which stakeholders will be getting the most use out of the system?
 - Which requirements are necessary? Nice to have? Useful? Cosmetic?
- Why does prioritizing help?
 - Know what to focus on first/most
 - Helps prepare work plan and resource allocation
 - Know who you answer to
 - Know whose views you need to defend most

Conceptual Design

- Conceptual model:
 - ‘an outline of what people can do with a product and what concepts are needed to interact with it’ [Sharp et al. 2007]
- No formula
- Suggested ways
 - Group reviews of requirements to get different perspectives
 - ✓ Group can be designers, users, mix of both
 - Put designers as much as possible in role of user
 - Use low-fidelity prototyping to get rapid feedback

Conceptual Design

- Some questions/issues to consider
 - Which interface metaphors are most suited?
 - ✓ What problems does the metaphor need to help with?
 - Which interaction types are best to support users and activities?
 - ✓ Do certain interface types suggest new designs or options?
 - How is workload divided between user and system?
 - How much control should user have?
 - ✓ Cognitive and social implications

Conceptual Design

- Some questions/issues to consider
 - What technologies are viable?
 - Which functions will the system perform?
 - ✓ Are functions related? How? Constraints?
 - ✓ What information is needed to support functions?
 - ✓ Which are hardware and which are software?
- Next steps
 - Low-fidelity prototyping
 - ✓ Sketches, storyboards, paper prototypes, theater etc..

What you should know by now

- Why is it important to do user requirements gathering?
- What are the different types of methods possible?
- Which methods are most appropriate for which contexts?
- Which methods are most appropriate for developing new systems?
- Which methods are most appropriate for improving existing systems?
- How can recording be done, what are advantages and disadvantages of each method?
- What are the types of simple data analysis that can be done?
- What are the basic steps needed to get from raw requirements data to a conceptual model?
- What should you consider when interpreting requirements gathering results?
- What should you think about when developing a conceptual model?

References

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