Lecture 9: Eliciting Requirements

Basics of elicitation
- Why info collection is hard
- Dealing with Bias

A large collection of elicitation techniques:
- Background Reading
- Hard data collection
- Interviews
- Questionnaires
- Group Techniques
- Participant Observation
- Ethnomethodology
- Knowledge Elicitation Techniques

Difficulties of Elicitation
- Thin spread of domain knowledge
  - The knowledge might be distributed across many sources
  - It is rarely available in an explicit form (i.e., not written down)
  - There will be conflicts between knowledge from different sources
  - Remember the principle of complementarity!
- Tacit knowledge (The "say-do" problem)
  - People find it hard to describe knowledge they regularly use
- Limited Observability
  - The problem owners might be too busy coping with the current system
  - Presence of an observer may change the problem
  - E.g., Probe Effect; Hawthorne Effect
- Bias
  - People may not be free to tell you what you need to know
  - People may not want to tell you what you need to know
    - The outcome will affect them, so they may try to influence you (hidden agendas)

Example
- Loan approval department in a large bank
  - The analyst is trying to elicit the rules and procedures for approving a loan
- Why this might be difficult:
  - Implicit knowledge:
    - There is no document in which the rules for approving loans are written down
  - Conflicting information:
    - Different bank staff have different ideas about what the rules are
  - Say-do problem:
    - The loan approval process described to you by the loan approval officers is quite different from your observations of what they actually do
  - Probe effect:
    - The loan approval process used by the officers while you are observing is different from the one they normally use
  - Bias:
    - The loan approval officers fear that your job is to computerize their jobs out of existence, so they are deliberately emphasizing the need for case-by-case discretion (to convince you it has to be done by a human!)
What is bias?

- Bias only exists in relation to some reference point
- Can there ever be "no bias?"
- All views of reality are filtered partly on personal values.

Types of bias:

- Motivational bias
  - Expert makes accommodations to please the interviewer or some other audience
- Observational bias
  - Limitations on our ability to accurately observe the world
- Cognitive bias
  - Mistakes in use of statistics, estimation, memory, etc.
- Notional bias
  - Terms used to describe a problem may affect our understanding of it

Examples of Bias

- Social pressure
  - Response to verbal and non-verbal cues from interviewer
- Group think
  - Response to reactions of other experts
- Impression management
  - Response to misguided reactions of managers, clients, etc.
- Wishful thinking
  - Response to hopes or possible gain
- Appropriation
  - Selective interpretation to support current beliefs
- Misrepresentation
  - Expert cannot accurately fit a response into the requested response mode
- Anchoring
  - Contradictory data ignored once initial solution is available
- Inconsistency
  - Assumptions made earlier are forgotten
- Availability
  - Some data are easier to recall than others
- Underestimation of uncertainty
  - Tendency to underestimate by a factor of 2 or 3.

Background Reading

Sources of information:

- Company reports, organization charts, policy manuals, job descriptions, reports, documentation of existing systems, etc.

Advantages:

- Helps the analyst to get an understanding of the organization before meeting the people who work there
- Helps to prepare for other types of fact finding
  - E.g. by being aware of the business objectives of the organization
- May provide detailed requirements for the current system

Disadvantages:

- Written documents often do not match up to reality
- Can be long-winded with much irrelevant detail

Appropriate for:

- Whenever you are not familiar with the organization being investigated

Elicitation Techniques

Traditional techniques

- Intrusive techniques
  - Elicitation
    - Participant Observation
    - Ethnography
- Structured techniques
  - Surveys/Questionnaires
  - Meetings
- Collaborative techniques
  - Focus groups
    - Brainstorming
    - 2AD/RAD workshops
  - Prototyping
  - Participatory design

Contextual (social) approaches

- Ethnographic techniques
- Conversation analysis
- Discourse analysis
- Discourse analysis

Cognitive techniques

- Task analysis
- Protocol analysis
- Knowledge acquisition techniques
  - Card sorting
  - Laddering
  - Repertory grid
  - Proximity scaling techniques

“Hard Data” and Sampling

Hard data includes facts and figures...

- Forms, Invoices, financial information...
- Reports used for decision making...
- Survey results, marketing data...

Sampling

- Sampling used to select representative set from a population
  - Purposive sampling - choose the parts you think are relevant without worrying about statistical issues
  - Simple random sampling - choose every kth element
  - Stratified random sampling - identify strata and sample each
  - Clustered random sampling - choose a representative subpopulation and sample it

- Sample size is important
  - Balance between cost of data collection/analysis and required significance

Process:

- Decide what data should be collected - e.g., banking transactions
- Determine the population - e.g., all transactions at 5 branches over one week
- Choose type of sample - e.g., simple random sampling
- Choose sample size - e.g., every 20th transaction
Example of hard data

Questions:
- What does this data tell you?
- What would you do with this data?

Interviews

- Types:
  - Structured - agenda of fairly open questions
  - Open-ended - no pre-set agenda

- Advantages
  - Rich collection of information
  - Good for uncovering opinions, feelings, goals, as well as hard facts
  - Can probe in depth, & adapt followup questions to what the person tells you

- Disadvantages
  - Large amount of qualitative data can be hard to analyze
  - Hard to compare different respondents
  - Interviewing is a difficult skill to master

- Watch for
  - Unanswerable questions ("how do you tie your shoelaces?")
  - Tacit knowledge (and post-hoc rationalization)
  - Removal from context
  - Interviewer’s attitude may cause bias (e.g. variable attentiveness)

Interviewing Tips

- Starting off...
  - Begin the interview with an innocuous topic to set people at ease
    - e.g. the weather, the score in last night’s hockey game
    - e.g. comment on an object on the person’s desk: “My… what a beautiful photograph! Did you take that?”

- Ask if you can record the interview
  - Make sure the tape recorder is visible
  - Say that they can turn it off at any time.

- Ask easy questions first
  - Perhaps personal information
    - e.g. “How long have you worked in your present position?”

- Follow up interesting leads
  - E.g. if you hear something that indicates your plan of action may be wrong,
    - e.g. “Could we pursue what you just said a little further?”

- Ask open-ended questions towards the end
  - E.g. “Is there anything else you would like to add?”

Questionnaires

- Advantages
  - Can quickly collect info from large numbers of people
  - Can be administered remotely
  - Can collect attitudes, beliefs, characteristics

- Disadvantages
  - Simplistic (presupposed) categories provide very little context
  - No room for users to convey their real needs
  - Small sample size (lack of statistical significance)
  - Open ended questions (very hard to analyze)
  - Leading questions ("have you stopped beating your wife?")
  - Ambiguous questions (I.e. not everyone is answering the same question)

Note: Questionnaires MUST be prototyped and tested!
Meetings

- Used for summarization and feedback
  - E.g. meet with stakeholders towards the end of each stage:
    - to discuss the results of the information gathering stage
    - to conclude on a set of requirements
    - to agree on a design etc.
  - Use the meeting to confirm what has been learned, talk about findings

- Meetings are an important managerial tool
  - Used to move a project forward.
  - Every meeting should have a clear objective:
    - E.g. presentation, problem solving, conflict resolution, progress analysis, gathering and merging of facts, training, planning,...
  - Plan the meeting carefully:
    - Schedule the meeting and arrange for facilities
    - Prepare an agenda and distribute it well in advance
    - Keep track of time and agenda during the meeting
    - Follow up with a written summary to be distributed to meeting participants
    - Special rules apply for formal presentations, walkthroughs, brainstorming, etc.

Group Elicitation Techniques

- Types:
  - Focus groups
  - Brainstorming

- Advantages
  - More natural interaction between people than formal interview
  - Can gauge reaction to stimulus materials (e.g. mock-ups, storyboards, etc)

- Disadvantages
  - May create unnatural groups (uncomfortable for participants)
  - Danger of Groupthink
  - May only provide superficial responses to technical questions
  - Requires a highly trained facilitator

- Watch for
  - sample bias
  - dominance and submission

Joint/Rapid Application Development

- JAD & RAD Principles:
  - Group Dynamics: use workshops instead of interviews
  - Visual Aids
    - Lots of visualization media, e.g. wall charts, large monitors, graphical interfaces
  - Organized, Rational Process
    - Techniques such as brainstorming and top-down analysis
  - WYSIWYG Documentation Approach
    - each JAD session results in a document which is easy to understand and is created and agreed upon during the session

- Notes:
  - Choose workshop participants carefully
  - they should be the best people possible representing various stakeholder groups
  - Workshop should last 3-5 days
  - Must turn a group of participants into a team - this takes 1-2 days.
  - Session leader makes sure each step has been completed thoroughly.
  - Session leader steps in when there are differences of opinion - "open issues".
  - Meeting room should be well-equipped for presentations, recording etc.

Participant Observation

- Approach
  - Observer spends time with the subjects
    - Joining in long enough to become a member of the group
    - Hence appropriate for longitudinal studies

- Advantages
  - Contextualized;
  - Reveals details that other methods cannot

- Disadvantages
  - Extremely time consuming!
  - Resulting 'rich picture' is hard to analyze
  - Cannot say much about the results of proposed changes

- Watch for
  - going native!
Ethnomethodology

- Basis
  % Social world is ordered
  - The social order may not be obvious, nor describable from common sense
  % The social order cannot be assumed to have an a priori structure
  - Social order is established on a moment-to-moment basis through participants' collective actions (no pre-existing structures)
  - i.e. social order only observable when an observer immerses herself in it.
  % Observation should be done in a natural setting
  - Need to consider how meanings develop and evolve within context

- "Use the members' own Categories"
  % Most conventional approaches assume preexisting categories
  - This may mislead the observer (e.g. appropriation)
  % Ethnography attempts to use the subjects’ own categories
  - What categories (concepts) do they use themselves to order the social world?
  - What methods do people use to make sense of the world around them?
  - Use the same methods members use during observation
  - E.g by developing a legitimate role within the community under observation.

Source: Adapted from Goguen and Linde, 1993, p158.

Ethnomethodological approach

- Ethnomethodology is a subarea of Anthropology
  % Looks for behaviours that are culture-specific
  - E.g. Frenchmen brag about sexual conquests to gain status;
  - E.g. Americans brag about money to gain status.
  - Each of these topics is taboo in the other culture

- Uses a very tightly controlled set of methods:
  - Conversational analysis
  - Measurement of body system functions - e.g. heartbeat
  - Non-verbal behaviour studies
  - Detailed video analysis

- Other observation techniques can be applied:
  % Time-motion study
  - who is where, when?
  % Communication audit
  - who talks to whom about what?
  % Use of tools - status symbols plus sharing rules

Knowledge Elicitation Techniques

- Protocol Analysis
  % based on vocalising behaviour
  - Think aloud vs. retrospective protocols
  % Advantages
  - Direct verbalisation of cognitive activities
  - Embedded in the work context
  - Good at revealing interaction problems with existing systems
  % Disadvantages
  - Essentially based on introspection, hence unreliable
  - No social dimension

- Proximity Scaling Techniques
  % Given some domain objects, derive a set of dimensions for classifying them:
  - step 1: pairwise proximity assessment among domain elements
  - step 2: automated analysis to build multi-dimensional space to classify the objects
  % Advantages
  - Help to elicit mental models, where complex multivariate data is concerned
  - Good for eliciting tacit knowledge
  % Disadvantages
  - Requires an agreed on set of objects
  - Only models classification knowledge (no performance knowledge)

- Card Sorting
  % For a given set of domain objects, written on cards:
  - Expert sorts the cards into groups...
  - then says what the criterion was for sorting, and what the groups were.
  % Advantages
  - simple, amenable to automation
  - elicits classification knowledge
  % Problems
  - suitable entities need to be identified with suitable semantic spread across domain.
  - No performance knowledge

- Laddering
  % Uses a set of probes to acquire stakeholders’ knowledge.
  - Interview the expert.
  - Use questions to move up and down a conceptual hierarchy
  - E.g. developing goal hierarchies
  % Advantages
  - deals with hierarchically and poly-hierarchies (e.g. goal trees, “is-a” taxonomies)
  - Knowledge is represented in standardised format
  - can elicit structural knowledge
  - suitable for automation
  % Disadvantages
  - assumes hierarchically arranged knowledge.