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!)
Bias

What is bias?
- Bias only exists in relation to some reference point
  - can there ever be "no bias"?
- All views of reality are filtered
- All decision making is based 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.
- Notational 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 imagined reactions of managers, clients...
- Wishful thinking
  - response to hopes or possible gains.
- 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.

Elicitation Techniques

Traditional techniques
- Introspection
- Reading existing documents
- Analyzing hard data
- Interviews
  - Open-ended
  - Structured
- Surveys / Questionnaires
- Meetings

Collaborative techniques
- Focus Groups
  - Brainstorming
  - JAD/RAD workshops
- Prototyping
- Participatory Design

Contextual (social) approaches
- Ethnographic techniques
  - Participant Observation
  - Ethnomethodology
- Discourse Analysis
  - Conversation Analysis
  - Speech Act Analysis
- Sociotechnical Methods
  - Soft Systems Analysis

Cognitive techniques
- Task analysis
- Protocol analysis
- Knowledge Acquisition Techniques
  - Card Sorting
  - Laddering
  - Repertory Grids
  - Proximity Scaling Techniques
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 not familiar with the organization being investigated.

“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)

Source: Adapted from Goguen and Linde, 1993, p34.
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

Watch for:
- Bias in sample selection
- Bias in self-selecting respondents
- Small sample size (lack of statistical significance)
- Open ended questions (very hard to analyze!)
- Leading questions (“have you stopped beating your wife?”)
- Appropriation (“What is this a picture of?”)
- Ambiguous questions (i.e. not everyone is answering the same question)

Source: Adapted from Goguen and Linde, 1993, p154.
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.

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
    - These techniques are useful in capturing information about a social setting.

- 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

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

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more KE techniques

- **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 hierarchical knowledge, including 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.