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 loans
→ 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 inflated reactions of managers, clients,
% Wishful thinking
  response to hopes or possible gains.
% Attribution
  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
  - Interviews
  - Meetings

→ Contextual (social) approaches
  - Ethnographic techniques

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

→ Cognitive techniques
  - Task analysis
  - Protocol analysis
  - Knowledge Acquisition Techniques
    - Card Sorting
    - Laddering
    - Reportory Grids
    - Priority Scaling Techniques

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.

“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 population 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 follow-up 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)

**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)

**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.

**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?”
**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 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

- 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
  - Thin cloud vs. retrospective protocols
  - Advantages
    - Direct verbalisation of cognitive activities
    - Embedded in the work context
  - 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)

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, “-of” taxonomies).
    - Knowledge is represented in
      standardised format
    - can elicit structural knowledge
    - suitable for automation.
  - Disadvantages
    - assumes hierarchically arranged
      knowledge.