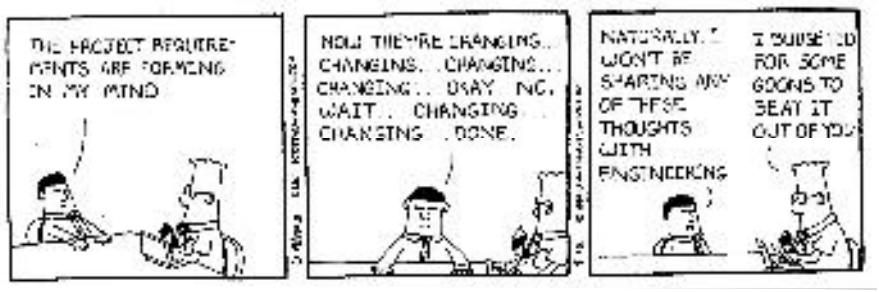

Lecture 9: Eliciting Requirements

- 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
    - Enthnomethodology
  - 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

University of Toronto

Example of hard data

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

Agate

Campaign Summary

Date	23rd February 1999
Client	Yellow Partridge Park Road Workshops Park Road Jewellery Quarter Birmingham B2 3DT U.K.
Campaign	Spring Collection 1999
Billing Currency	GB £

Item	Curr	Amount	Rate	Billing amount
Advert preparation: photography, artwork, layout etc.	GB £	15,000.00	1	15,000.00
Placement French Vogue	FFr.	47 000,00	11.35	4,140.97
Placement UK Vogue	GB £	5,000.00	1	5,000.00
Placement US Vogue	US $	15,000.00	2.47	6.072.87
Total				30,213.84

This is not a VAT Invoice. A detailed VAT Invoice will be provided separately.

210-212 Carstairs Street, Birmingham B1 5TG
Tel.0121-111-1234 Fax.0121-111-1245
Email.agate@agateltd.co.uk

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, p154.*

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)

Note: Questionnaires MUST be prototyped and tested!

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.

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
  - 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

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)

Source: *Adapted from Hudlicka, 1996.*

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.