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!)
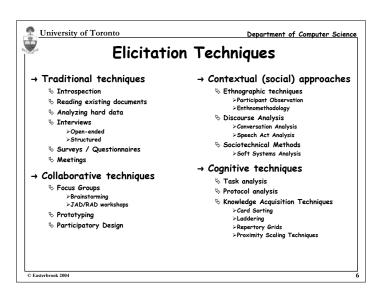

Bias

→ **What is bias?**
- ✎ Bias only exists in relation to some reference point
  - ➢ can there ever be "no bias"?
- ✎ All views of reality are filtered
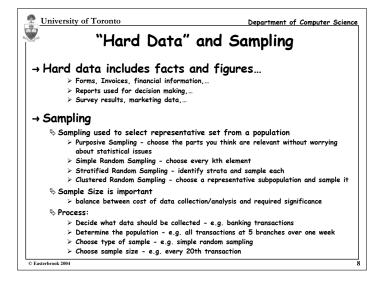- ✎ All decision making is based partly on personal values.
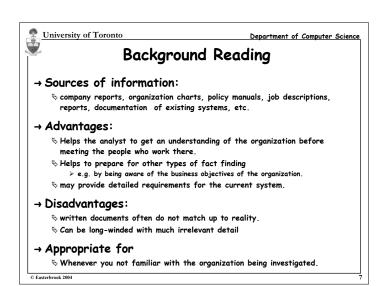
→ **Types of bias:**
- ✎ Motivational bias
  - ➢ expert makes accommodations to please the interviewer or some other audience
- ✎ Observational bias
  - ➢ Limitations on our ability to accurately observe the world
- ✎ Cognitive bias
  - ➢ Mistakes in use of statistics, estimation, memory, etc.
- ✎ Notational 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.

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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

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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.

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"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

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Example of hard data

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

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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. 10

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?"

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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. 12

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.

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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

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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.

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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!

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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. 17

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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.
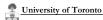 - Each of these topics is taboo in the other culture

→ **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)

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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.

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