

CS5127/6027: Requirements Engineering (Fall 2024)

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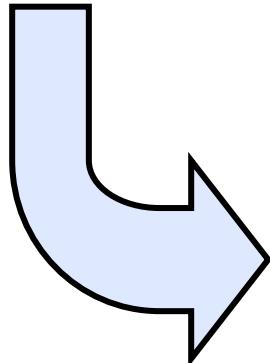
Office Hours: 10am-11am, Mondays, Rhodes 832

Today's Menu

Last Lecture (Monday 9/9):

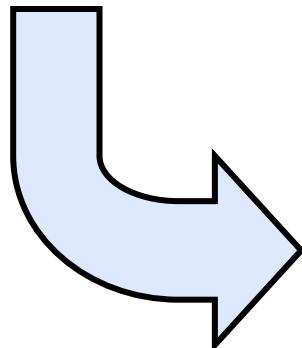
Importance of req.s

Eliciting req.s



This Lecture (Friday 9/13):

Elicitation techniques



Next Lecture for all (Friday 9/20):

Non-functional req.s (NFRs)

Next Week

Su	Mo	Tu	We	Th	Fri	Sa
15	16	17	18	19	20	21
			Quiz4 & ASN1 due by 11:59pm			

Grad term paper
ASN1 Q&As (optional)

Quiz4 & ASN1
due by 11:59pm

TODAY

13

14

20

21

NFRs

Quiz3

one of two reasons: (a) it is the only one they know, or (b) they think that a technique that worked well last time must surely be appropriate this time. This paper presents the results of in-depth interviews with some of the world's most experienced analysts. These results demonstrate how they select elicitation techniques based on a variety of situational assessments.

addresses customers' needs. Elicitation is an iterative process [31]. At any moment, conditions cause the analyst

something else using a different elicitation technique. The result of elicitation is a list of candidate requirements, or some kind of model of the solution system, or both.

Quiz3 (Cont'd)

Team-Building is a second-order elicitation technique in that it does not directly surface requirements. Instead, it

There seems to be consensus that effective elicitation requires teamwork, and when not present, team-building exercises are important.

Regardless of what technique is being used, new issues are simply appended to the list as they arise. This enables

common sense, e.g., if there are multiple customers who may not know of each other's existence, then do not gather them together in a collaborative workshop.

modeling was used as *the* elicitation technique, more and more analysts are now seeing modeling as a means to (a) facilitate communication, (b) uncover missing information, (c) organize information gathered from other elicitation techniques, and (d) uncover inconsistencies.



Requirements Elicitation

→ Elicit

- ↳ Evoke or draw out (a response, answer, or fact) from someone in reaction to one's own actions or questions
- ↳ Draw forth (something that is latent or potential) into existence

→ Gather

- ↳ Bring together and take in from scattered places or sources

→ Collect

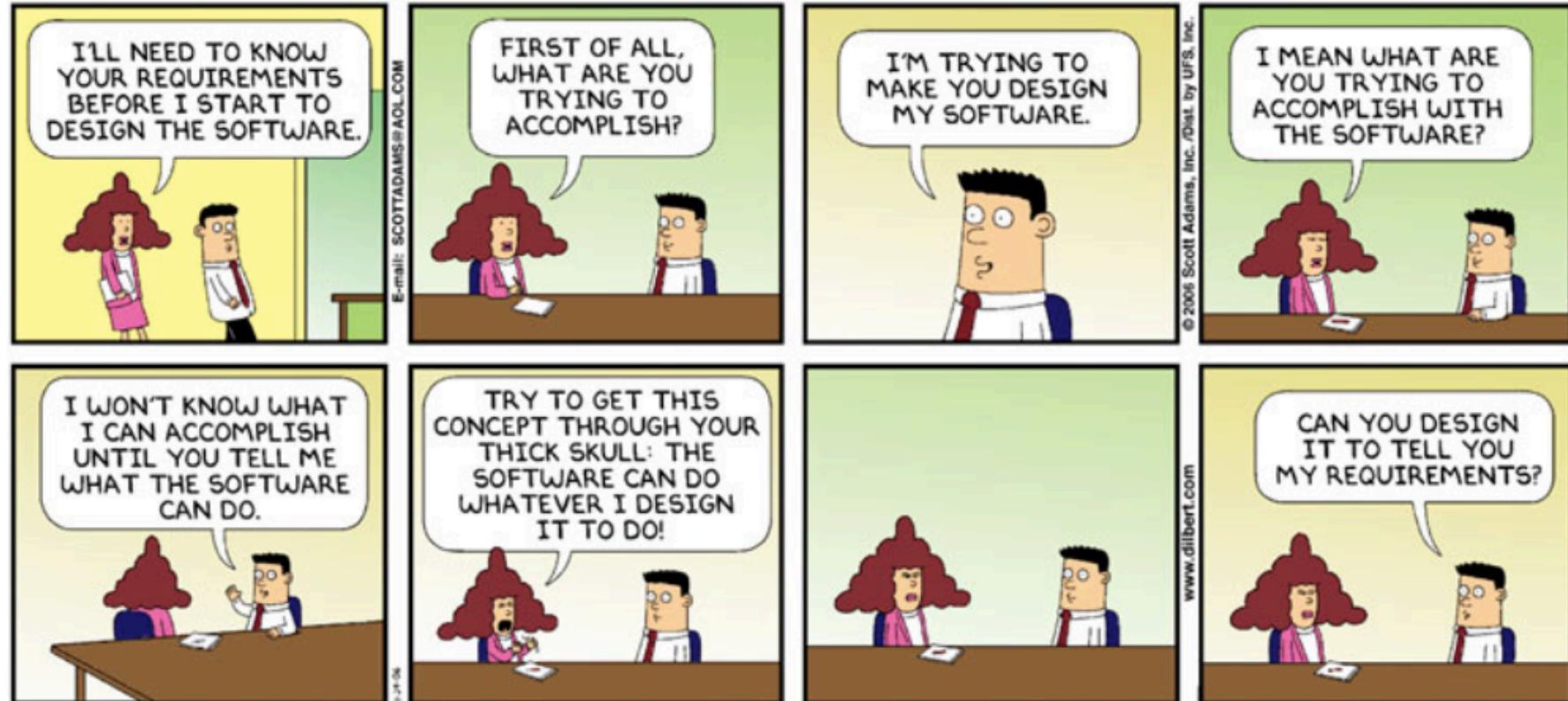
- ↳ Bring or gather together (things, typically when scattered or widespread)

→ ???

Requirements ≠ Butterflies

requirements elicitation ≠
asking the right questions

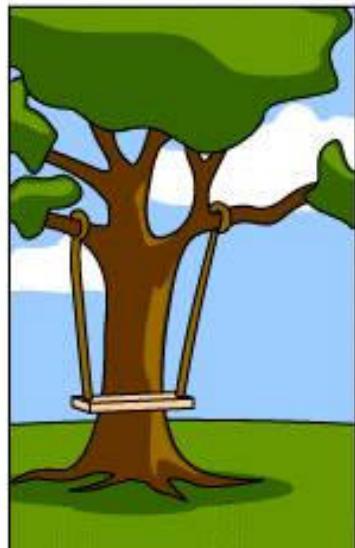
... because there's no right
QUESTION to ask



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How the customer explained it



How the Project Leader understood it



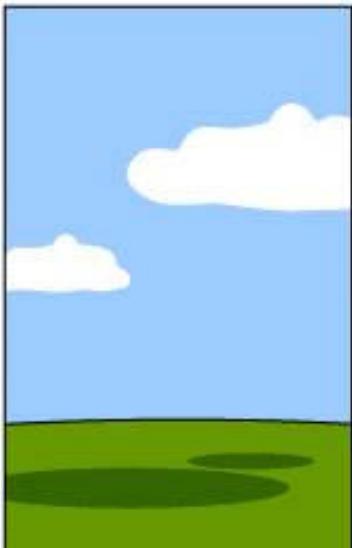
How the Analyst designed it



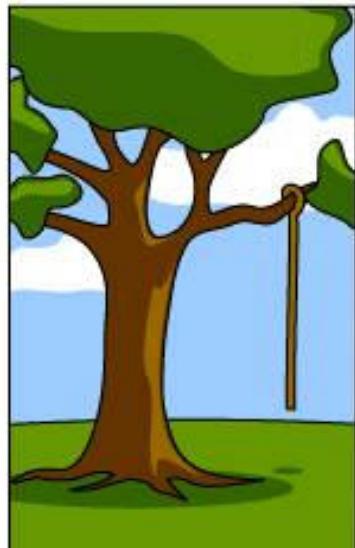
How the Programmer wrote it



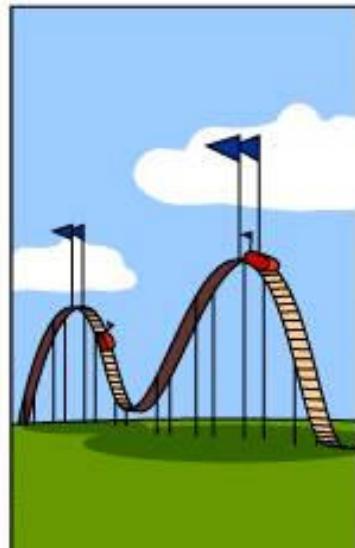
How the Business Consultant described it



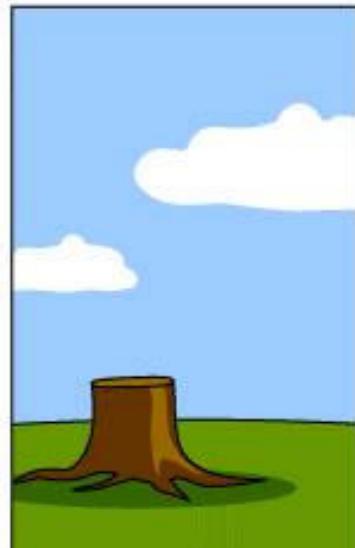
How the project was documented



What operations installed



How the customer was billed

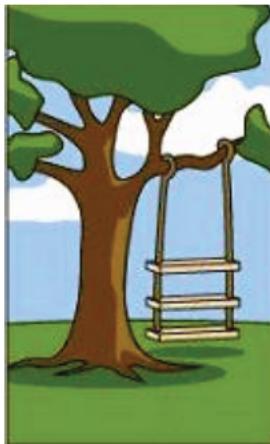


How it was supported



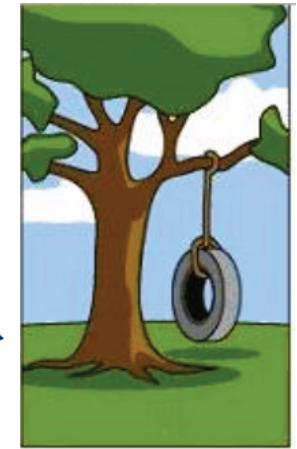
What the customer really needed

*... because there's no right
ANSWER*



How the customer explained it

What the customer really needed



*... because there's no right person
to ASK*



Nan's cell phone in 2009 versus today

“People don’t know what they want until you show it to them.”

- Steve Jobs
en.wikiquote.org/Steve_Jobs

*... because there's no right
PERSON to ask*



Scoping decision I

→ Decide the scope of the problem:

↳ e.g. Bookstore example:

“Textbooks are often not ordered in time for the start of classes”

↳ But that's just a symptom. (So you ask the manager “why?”)

“Because we don't receive the booklists from instructors early enough”

↳ Is that just a symptom of some other problem? (...so ask the instructors “why?”)

“Because the instructors aren't allocated to courses early enough”

↳ Is that just a symptom of some other problem? (...so ask the UG office “why?”)

“Because we never know who's available to teach until the last minute”

↳ Is that just a symptom of some other problem? (...so ask the dept chair “why?”)

“Because there's always uncertainty about who gets hired, sabbaticals, etc.”

↳ Is that just a symptom of some other problem? (...so ask the dept chair “why?”)

“Because instructors we want to hire don't accept our offers early enough”

↳ Is that just a symptom of some other problem? (...so ask the new recruits “why?”)

“Because some other universities seem to wait for ages before making offers”

↳ Is that just a symptom of some other problem? (...so ask Ohio State, etc, “why?”)

“Because it takes our department a long time to reach consensus on hiring”

↳ Is that just a... ...oh wait... ...maybe we can develop a decision support system for faculty hiring at Ohio State, and that will help us get our textbooks for the start of class...

How to scope the problem

→ Difficulty:

- ↳ Every problem can be seen as a symptom of some other (larger) problem
- ↳ You can keep on tracing root causes forever if you're not careful

→ Approach: (...ask yourself these questions...)

- ↳ Is there a reasonable expectation that this problem can be solved?
(...independently of the larger problem?)
- ↳ Is there a reasonable expectation that solving this problem will help?
(...without also solving the larger problem?)
- ↳ Is this a problem that the stakeholders want solved?
(do the “local experts” think this problem is the one that matters?)
- ↳ Is this a problem that someone will pay you to solve?
(Hint: a feasibility study should quantify the return on investment)

Scoping Decision II

→ Decide the scope of the solution

- ↳ Say you decided that *delay in processing booklists from instructors* is the right level of problem to tackle.
 - “So, let’s computerize the submission of textbook forms from instructors”
- ↳ But while we’re at it:
 - “it would help if we also computerized the submission of orders to the publishers”
- ↳ ...and of course:
 - “we ought to computerize the management of book inventories too, so we can quickly check stock levels before ordering new books”
- ↳ ...and in that case:
 - “we might as well computerize the archives of past years booklists so that we can predict demand better”
- ↳ ...and therefore:
 - “it would also make sense to provide a computerized used book exchange, because that has a big effect on demand for new books”
- ↳ ...and then of course there’s ... oh, wait, this is going to cost millions!
 - Bookstore manager: “tell me again how this automated used book exchange will help me order books faster?”

How to scope the solution

→ Difficulty:

- ↳ We could keep on throwing more technology at the problem forever
- ↳ It's hard to decide when to stop adding extra "bells and whistles"

→ Approach (...select among alternatives carefully...)

- ↳ Is there a reasonable expectation that this alternative can be implemented?
(...independently of all the other options?)
- ↳ Is there a reasonable expectation that implementing this alternative will (help to) solve the original problem?
(...without also having to address other aspects of the problem?)
- ↳ Is this a solution that the stakeholders can live with?
(do the "local experts" think they would use all these functions?)
- ↳ Is this a solution that someone will pay you to build?
(Hint: a feasibility study should quantify the return on investment for each alternative)

Starting Points of RE

→ Stakeholders

- ↳ If the software (read: **RE**) fails, who will suffer?

→ Boundaries

- ↳ How do you scope the problem?

→ Goals and Scenarios

- ↳ A useful way to organize initial collection of information

→ Feasibility

- ↳ How to conduct a feasibility study?
- ↳ How to choose which project to pursue?

→ Risk

- ↳ Continuous risk management
- ↳ Identifying risks through **hazard** and **fault** analysis

Functional Safety Requirements



therapeutic robotic arm

Hazard 101:
Moving the patient's arm
at an excessive velocity

Fault F1:
Velocity sensors fail to sense
excessive velocity

Fault F2:
Configuration component fails
to update correct velocity
constraints

Req 1: A system test must be run prior to each use to check that sensors are operating correctly

Req 2: All sensors must be duplicated

Req 3: Automatic stoppage of the robotic arm if arm velocity sensors disagree on current velocity by more than x mps

Req 9: Current velocity constraint is displayed on the monitor

Req 10: Current velocity constraint must match patient's personal record

Req 11: Current velocity constraint must fall under maximum allowed velocity

Requirements ≠ Butterflies

requirements elicitation ≠
asking the right questions

→ RE's 5 starting points

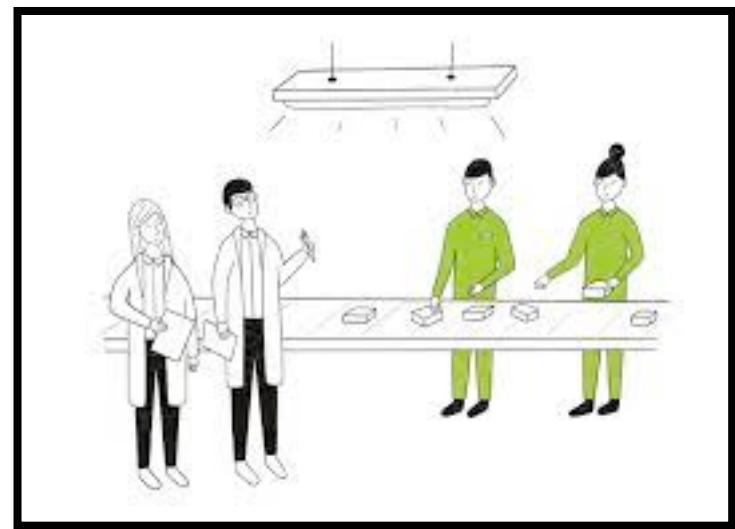
- ↳ Stakeholders
- ↳ Boundaries
- ↳ Goals and scenarios
- ↳ Feasibility
- ↳ Risk



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
 - People have conflicting goals
 - People have different understandings of the problem
- Tacit knowledge (The “say-do” problem)
 - ↳ People find it hard to describe knowledge they regularly use
 - Descriptions may be inaccurate rationalizations of expert behavior
- Limited observability
 - ↳ The problem owners might be too busy solving it using the existing system
 - ↳ Presence of an observer may change the problem
 - E.g. the Probe Effect and the Hawthorne Effect

Hawthrone Effect



Example

→ The problem area:

- ↳ 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 members of the department 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 in Requirements Elicitation

→ Bias

- ↳ People may **not be free** to tell you what you need to know
 - Political climate & organizational factors matter
- ↳ 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)

→ referring to the previous example

- ↳ 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!)

Elicitation Techniques

→ Traditional techniques

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

→ Collaborative techniques

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

→ Cognitive techniques

- ↳ Task Analysis
- ↳ Protocol Analysis
- ↳ Knowledge Acquisition Techniques
 - Card Sorting
 - Laddering
 - Repertory Grids
 - Proximity Scaling Techniques

→ Contextual approaches

- ↳ Ethnographic Techniques
 - Participant Observation
 - Ethnomethodology
- ↳ Discourse Analysis
 - Conversation Analysis
 - Speech Act Analysis
- ↳ Socio-technical Methods
 - Soft Systems Analysis

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 rationalizations)
- ↳ 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 weekend's football 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

- ↳ but put tape recorder in front of person
- ↳ say that they can turn it off 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 last

- e.g. "Is there anything else you would like to add?"



Interview as an elicitation technique

Question Tactic	Example
Task-Related	<i>Could you discuss the steps in...</i>
Guided	<i>Could you show me...</i>
Typical	<i>Could you tell me about a typical...</i>
Example	<i>Can you show me an example of...</i>
Personal Experience	<i>Could you tell me about some of your experiences?</i>
Direct Language	<i>What do you call...</i>
Hypothetical-Interaction	<i>How would you describe...</i>
Use	<i>What purpose does this feature serve?</i>

Interview design



Interview 1: Personal Experience Question

What did you like least about the website?

Sample Responses:

“Well, we had to make appointments to be able to connect with each other and stick to it.”

“Connection problems with the meeting.”

“It was all helpful.”

“I can’t remember...”

Better interview design

Interview 1: Personal Experience Question	Interview 2: Hypothetical Experience Question
<p><i>What did you like least about the website?</i></p>	<p>Scenario: <i>John currently participates in face-to-face group support for caretakers. He can either continue to go to his current support group, or try out the videoconference group.</i></p> <p>Question: <i>What would be the benefit of staying in his current support group?</i></p>
Sample Responses:	
<p>“Well, we had to make appointments to be able to connect with each other and stick to it.”</p> <p>“Connection problems with the meeting.”</p> <p>“It was all helpful.”</p> <p>“I can’t remember...”</p>	<p>“In the early stages of caregiving, face-to-face contact is more advantageous - body language, facial expressions, eyes...”</p> <p>“Sometimes it’s hard to put caregiving on pause to use the computer.”</p> <p>“Getting out of the house is good.”</p> <p>“The technical issues might get in the way of getting support.”</p>

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 system development project forward.
- ↳ Need to determine objectives for the meeting:
 - 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.

Meetings (Cont'd)

**A meeting can result in
consensus, but if the
consensus is to implement
requirements that are
inconsistent or have
unexpected consequences,
little has been gained.**



Daniel Jackson

Michael Jackson





Today's Take-Aways

- Requirements elicitation shouldn't be replaced with requirements gathering, collecting, ...
 - ↳ Requirements are not butterflies
 - Req.s elicitation is not about "asking the right questions"
- Requirements elicitation techniques
- RE's 5 starting points
- To-do
 - ↳ Review today's slides & clear Quiz3 questions
 - ↳ Grad students attend next Monday's lecture (9/16)
 - ↳ All students complete Quiz4 before 11:59pm, Wed. (9/18)
 - ↳ All students submit ASN1 before 11:59pm, Wed. (9/18)
 - ↳ All students attend next Friday's class (9/20) on NFRs