Software Requirements and Architecture (SENG404)

Matthias Galster

Lecture 3 – Requirements elicitation (part 1)

March 1, 2023

Schedule 2023

Lecture	Week	Date	Topic
1	1	February 22	Kick-off; Introduction
2	1	February 23	Instead of May 3; Requirements and requirements engineering processes
3	2	March 1	Requirements elicitation (part 1)
4	2	March 2	Instead of May 17
5	3	March 8	
6	3	March 9	Backup (Matthias *might* be away)
7	4	March 15	
8	4	March 16	Backup
9	5	March 22	Assignment 1
10	6	March 29	
		Term break	
11	7	April 26	
12	8	May 3	Matthias away
13	9	May 10	
14	10	May 17	Matthias away
15	11	May 24	Assignment 2: presentations + report
16	12	May 31	
		TBD	**Final exam**

Assignment 1

Student(s)	Topic
Saskia van der Peet	Use of design thinking in requirements engineering

- Before you start
  - What would a practitioner want to know?
  - Source(s)?
  - Key message(s) – build blog post around it
  - Provide facts and evidence; if you share opinions mark them as such

Previous lecture

1. A closer look at requirements

2. Requirements engineering activities

3. Feasibility studies

   to research if something is possible.

Reading for this session

- S. Wagner, D. Mendez Fernandez, M. Kalinowski, M. Felderer, P. Mafra, A. Vetrò, T. Conte, M.-T. Christiansson, D. Greer, C. Lassenius, T. Männistö, M. Nayebi, M. Oivo, B. Penzenstadler, D. Pfahl, R. Prikladnicki, G. Ruhe, A. Schekelmann, S. Sen, R. Spinola, J.L. de la Vara, A. Tuzcu, R. Wieringa, and D. Winkler, *Status Quo in Requirements Engineering: A Theory and a Global Family of Surveys,* Transactions on Software Engineering and Methodology, 2019, pp. 1–48, doi.org/10.1145/3306607

Questions and lessons

- Follow-up reading?

ORIGINAL ARTICLE

The state-of-practice in requirements elicitation: an extended interview study at 12 companies

Cristina Palomares[1] · Xavier Franch[1] · Carme Quer[1] · Panagiota Chatzipetrou[2] · Lidia López[1] · Tony Gorschek[3]

Abstract

Requirements engineering remains a discipline that is faced with a large number of challenges, including the implementation of a requirements elicitation process in industry. Although several proposals have been suggested by researchers and academics, little is known of the practices that are actually followed in industry. Our objective is to investigate the state-of-practice with respect to requirements elicitation, by closely examining practitioners' current practices. To this aim, we focus on the techniques that are used in industry, the roles that requirements elicitation involves, and the challenges that the requirements elicitation process is faced with. As method, we conducted an interview-based survey study involving 24 practitioners from 12 different Swedish IT companies, and we recorded the interviews and analyzed these recordings by using quantitative and qualitative methods. Several results emerged from the studies. Group interaction techniques, including meetings and workshops, are the most popular type of elicitation techniques that are employed by the practitioners, except in the case of small projects. Additionally, practitioners tend to use a variety of elicitation techniques in each project. We noted that customers are frequently involved in the elicitation process, except in the case of market-driven organizations. Technical staff (for example, developers and architects) are more frequently involved in the elicitation process compared to the involvement of business or strategic staff. Finally, we identified a number of challenges with respect to stakeholders. These challenges include difficulties in understanding and prioritizing their needs. Further, it was noted that requirements instability (i.e., caused by changing needs or priorities) was a predominant challenge. These observations need to be interpreted in the context of the study. We conclude that the relevant observations regarding the survey participants' experiences should be of interest to the industry; experiences that should be analyzed in the practitioners' context. Researchers may find evidence for the use of academic results in practice, thereby inspiring future theoretical work, as well as further empirical studies in the same area.

Keywords Requirements engineering · Requirements elicitation · Empirical studies · Interviews

1 Introduction

Requirements elicitation (RE) is typically seen as the first step in the requirements engineering process [28]. This step refers to the activities that are undertaken to reveal the requirements of a system that is to be built or a problem that is to be solved [40]. Elicitation is not merely a matter of transcribing exactly what users say [46]. Instead, elicitation should be understood as the search for, the gathering of, and the consolidation of a project's requirements.

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⚊ Springer

Reading for next session

- A. Ferrari, P. Spoletini, S. Gnesi. *Ambiguity and tacit knowledge in requirements elicitation interviews*. Requirements Engineering, 2016, pp. 333–355, doi.org/10.1007/s00766-016-0249-3
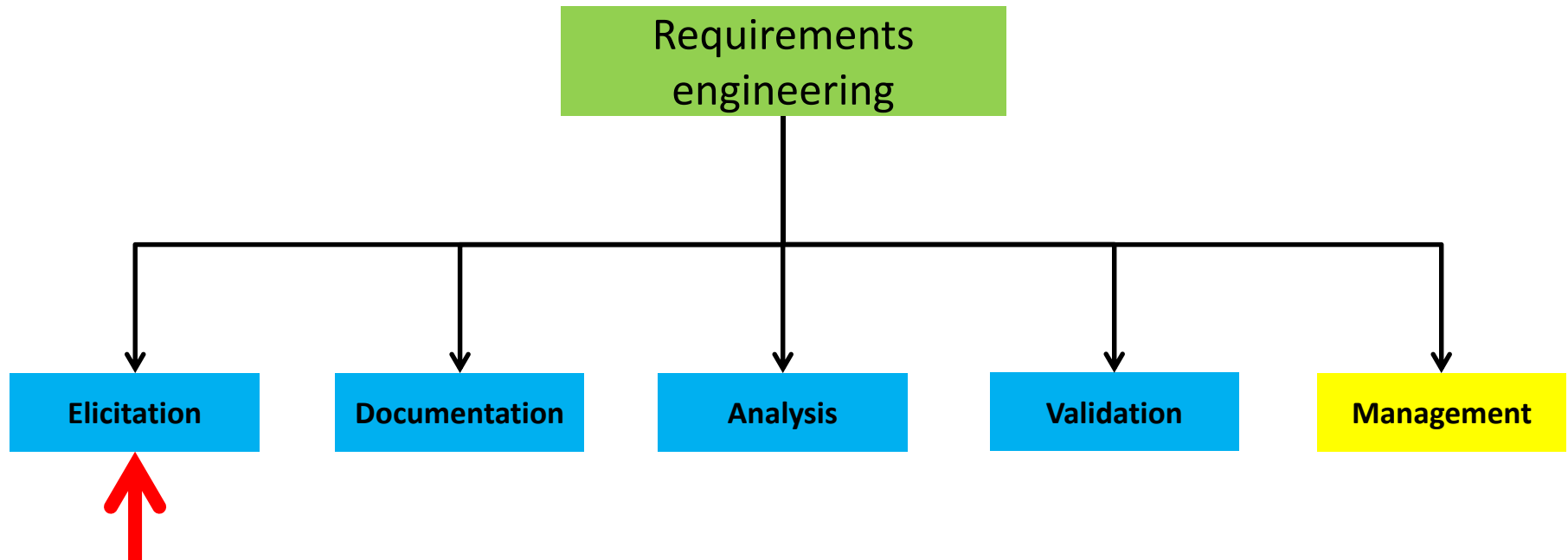
Agenda

1. Requirements elicitation – overview

   gettingrequiremnets from any sources (consumer stakeholder documents)

2. Elicitation techniques – ask

Agenda

1. Requirements elicitation – overview

2. Elicitation techniques – ask

Generic RE activities

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Requirements elicitation

- Activities related to
  - seeking and capturing desires and needs
  - from (all) available sources, and
  - consolidating them into well-documented requirements

Some initial thoughts

- "Customers don't know what they want. It's very hard to envision the solution you want without actually seeing it." *Marty Cagan (Silicon Valley Product Group)**

- "… you're asking people to […] remember past use or speculate on future use of a system." *Jakob Nielsen (usability consultant)*

- "[…] assumption that […] well ~~~~~~~ments exists, if only we take the time to understand them ~~~~~~~ *~~gwell (Scaled Agile, Inc.)*

Cannot rely only on stakeholders
- **Need multiple sources of evidence**
- **Need frequent feedback**

- "Customers don't know what's possible. Most have no idea about the enabling technologies involved." *Marty Cagan (Silicon Valley Product Group)*

- You can't just ask customers what they want […]. By the time you get it built, they'll want something new." *Steve Jobs (Apple)*

*http://www.mindtheproduct.com/2012/12/video-marty-cagans-top-10-tips-to-making-products-customers-love/
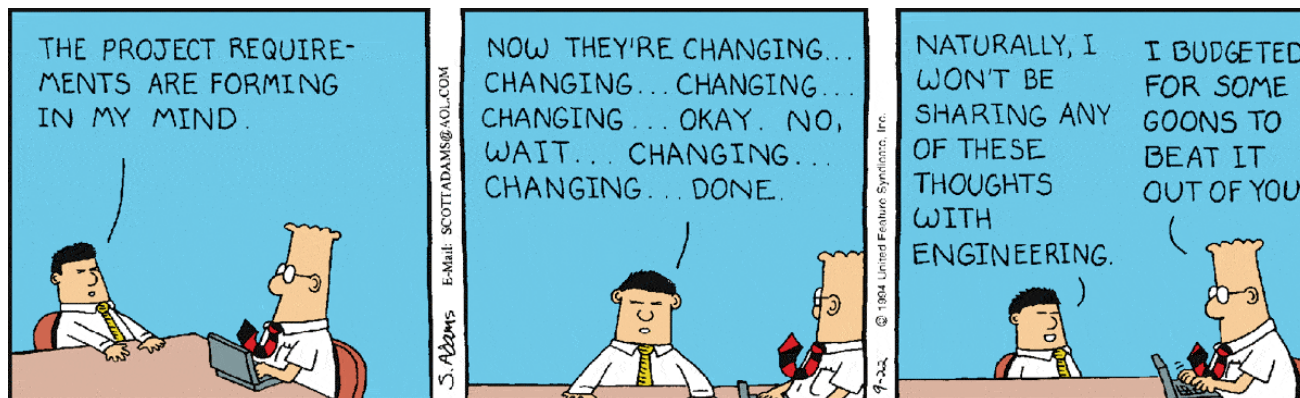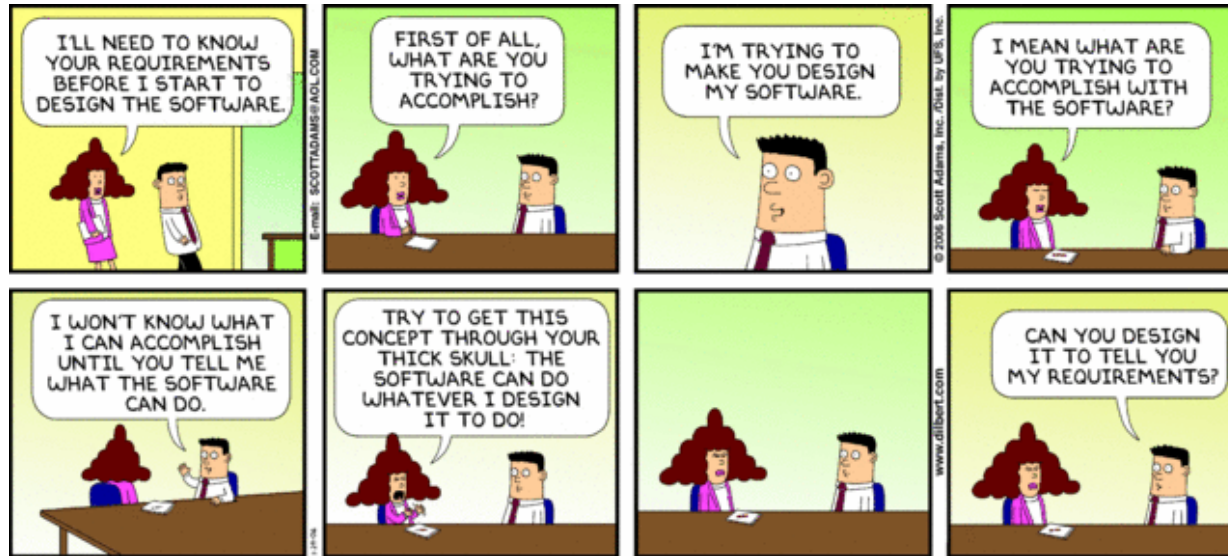
A wicked problem

- Many sources
  - E.g., stakeholders, context, documents, existing systems[1]
  - Different views and needs, different notations, mental models[2]

- Uncertainties
  - Do we know whom to talk to, what sources to consult
  - Do they know what they want, do they know what they need
  - Do they change their minds

- "Undiscovered requirements" syndrome – need for ignorance[3]
  - The more you find, the more you need to know
  - When do we have "enough" requirements?

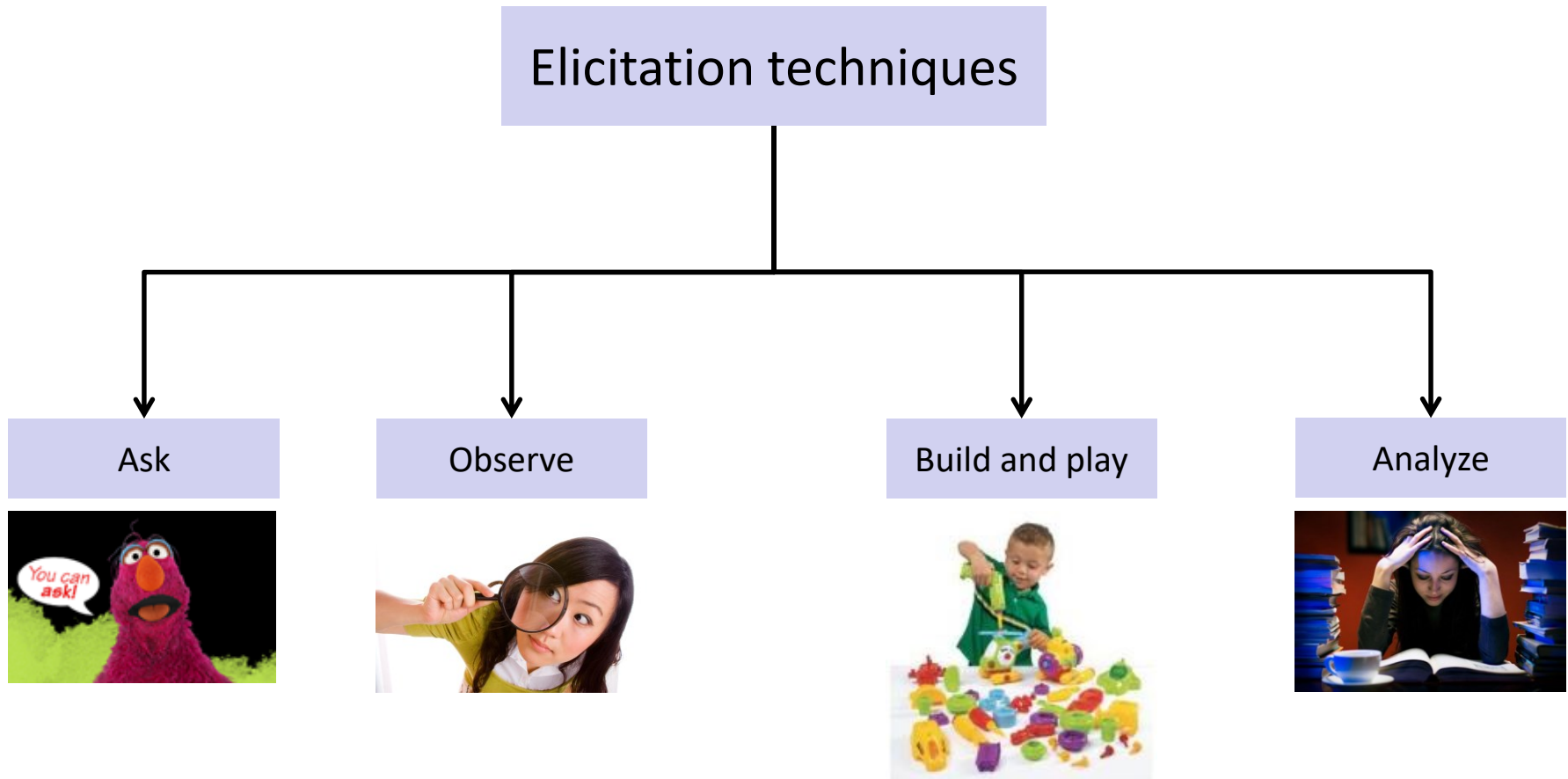[1] Requirements are about the future: analyze current state only when necessary
[2] P. Ralph and R. Mohanani: *Is Requirements Engineering Inherently Counterproductive?* TwinPeaks (2015)
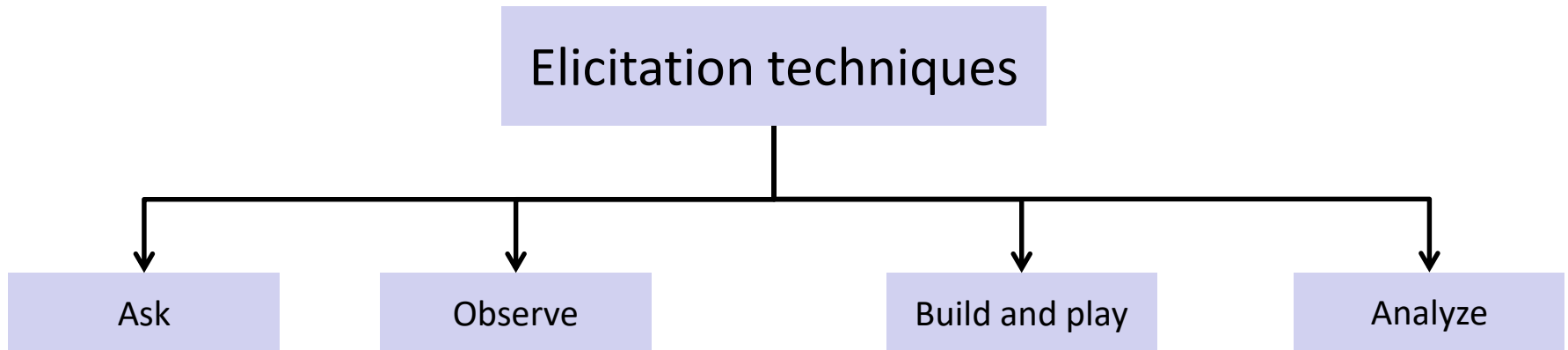[3] https://cs.uwaterloo.ca/~dberry/ignorance.html ("smart ignoramus")

In other words

Types of elicitation techniques

D. Zowghi, C. Coulin: *Requirements Elicitation: A Survey of Techniques, Approaches and Tools.* in Engineering and Managing Software Requirements: 19-46 (2005)
O. Dieste et al.: *Understanding the Customer: What do we Know about Requirements Elicitation?* IEEE Software 25(2): 11-13 (2008)
E. Gottendiener: *Requirements by Collaboration: Workshops for Defining Needs.* Addison Wesley (2002)
A. Hickey, A. Davis: *Elicitation Technique Selection: How do Experts Do It?* 11th International Requirements Engineering Conference (2003)
J. Goguen, C. Linde: *Techniques for Requirements Elicitation.* 1st International Symposium on Requirements Engineering (2003)

Agenda

1. Requirements elicitation – overview

2. Elicitation techniques – ask

Types of elicitation techniques

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   │  Ask   │  │ Observe  │       │ Build and play│  │ Analyze  │
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❑ Interviews

❑ Surveys

❑ Brainstorming

❑ Focus groups

Interviews

- One-to-one interviews
  - One of the most popular elicitation techniques

- Often considered "simple"
  - But: not simply about asking questions

Role playing exercise (1)

- Simulate parts of requirements interview

- Two (?) volunteers
  - One or two "analysts", one customer (or one customer and user)

- Customer, what problem or system do you want (e.g., Zoom)
  - Domain expertise in any area? Frequent user of a particular system?

- "Analyst(s)", customer: take 5 minutes to prepare

- Rest of class: observe

Role playing exercise (2)

- Observations and questions
  - From "analyst(s)"?
  - From user(s), customer(s)?
  - From class?

Typical phases

- Prepare (and test) interview
  - Unprepared interviews are a waste of time for all involved
  - Includes identifying interviewees
    - Different stakeholders have different knowledge and perspectives
    - Interviewees based on interviewer's information needs

- Conduct interview

- Follow up, e.g., share interview notes with the interviewee
  - Avoid misunderstandings and to get further insights + increase buy-in

- Analyze and synthesize data

Prepare interview

- Research project
  - Interviewer must understand business need, domain, etc.
  - Identify information needs

- Research interviewee
  - Professional and personal information, relationship with project
  - Understand their domain knowledge and process knowledge

- Logistics
  - Choose location (convenient for them)
  - Contact interviewee (introduce and clarify purpose)

- Design and test questions

Conduct interview

- Start "soft", clarify goal and expectations
  - Highlight benefits for interviewee and why they (and not somebody else)

- Ask if interviewee has concerns
  - Helps understand their attitude towards interview
  - Clarifies relationship in project and helps build relationship in project

- Ask meaningful questions, geared towards interviewee
  - Focus on what you need to learn
  - Listen actively and dig in
    - Helps identify "stated" and "actual" requirements
    - Clarify who, what, when and why
    - Understand underlying intent, feelings, needs

Analyze and synthesize data

- "Data"
  - Audio recordings
    - Full transcriptions
    - Selective transcriptions
  - Textual notes

- Mapping of interview answers to information needs
  - Could be based on questions
  - But: not all answers are related to questions

Forms

- Structured
  - With predefined questions
  - Agenda of fairly open questions

- Unstructured
  - With free-flowing, back-and-forth conversation
  - No pre-set agenda

- Semi-structured

Example interview questions

- "How is this project expected to support strategic goals?"
  - Business rationale
- "What are the inputs into the boarding process?"
  - Requirement
- "How does a passenger board a plane?"
  - Requirement
- "What is the rationale for the constraint?"
  - Requirement rationale
- "What is the risk of not acknowledging the constraint?"
  - Business risk
- "Who has a concerns about these constraints?"
  - Stakeholders

Concluding questions

- Is there anything else you would like to add?

- Are there any concerns that arose during the interview?

- Who else has knowledge about this issue? Who else to talk to?

Interview tips

- Ensure credibility of interviewee

- Ask if interview can be recorded

- Start interview in a comfortable atmosphere

- Ask easy questions first

- Follow up interesting (and relevant) topics

- End interview with open questions

Scoping the problem – example (1)

- Text books 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 reading lists from lecturers on time
  - Is that just a symptom or another problem? So you ask the lecturers why?
- Because lecturers aren't allocated to courses early enough
  - Is that just a symptom or another problem? So ask the admin office why?
- Because we never know who's available to teach until last minute
  - Is that just a symptom or another problem? So ask the HoD why?
- Because there's always uncertainty about who gets hired, etc.
  - Is that just a symptom or another problem? So ask the HoD why?
- Because lecturers we want to hire don't accept offers on time
  - Is that just a symptom or another problem? So ask lecturers why?

Scoping the problem – example (2)

- Because it takes the department too long to reach consensus
  - Maybe we can develop a decision support system for faculty hiring?

Keep tracking the root cause until a software solution is found
- Can this problem can be solved by software?
- Is this a problem that the stakeholders want to get solved?

Common mistakes

- Catalog of common mistakes[1]

  – Question formulation

  – Question omission

  – Order in interview

  – Analyst behaviour, communication

  – Interaction with interviewee

  – Planning

[1] https://zenodo.org/record/2625706/files/3.%20Mistake-based%20Training.pdf?download=1

Interviews: pro and con

- Pro
  - Rich collection of information; in-depth thoughts of stakeholders
  - Good for uncovering opinions, feelings, goals, hard facts
  - Probe in depth and change questions interactively

- Con
  - Hard to compare different answers (conflicts)
  - Qualitative data is hard to analyze (e.g., many "like", "prefers", "maybe")
  - Requires skilled analysts (soft skills, ability to listen and to control)
  - Requires availability and patience of interviewees

Appropriate for small project (or parts of a project) with a small(er) number of (important) stakeholders; innovative projects

Types of elicitation techniques

Elicitation techniques

| Ask | Observe | Build and play | Analyze |
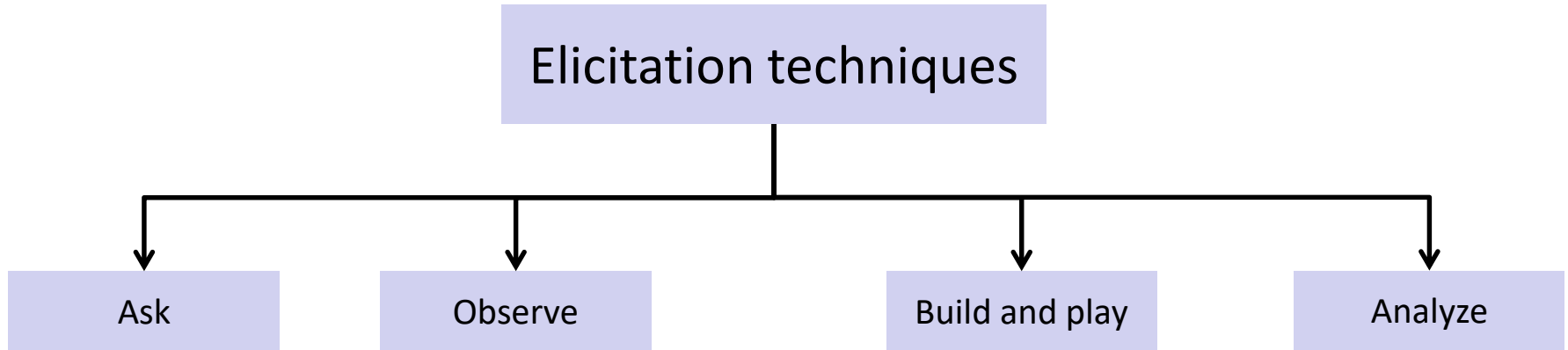
✓ Interviews

❑ Surveys

❑ Brainstorming

❑ Focus groups

Surveys

- Input from customers or potential end users
  - Large population

  also about a systmatic process. such as selecting the population. whats the goals (intersting in prioritizing, identifying confriming requirments and problem going to face, currently face?)

  identify questions - which can be trickier than interviews as dont have chnace to clarify any misunderstanding in questions

- Steps
  - Select target audience

  - Prepare questions with domain experts

  - Test (understandability, time) and revise (if needed)

    not just q understnable, but also the flow of the questions. increasing the likihood that ppl will aswer the survey. so dont want ppl to juts stop after 2 mins becuase they are bored or not relevant.

  - Distribute survey form as widely as possible

  - Collect and analyze data

    test with who?

    depending on who re target audience is may need to vary the distrubtions.

    cenus form

- Forms open ended get more answers but may require more thinking than structured. structured has quick insights. open ended need more work to go through quality analysis.
  - Structured (series of finite choices for feedback)

  - Open-ended (allows broader discovery of business need)

Question design

- Questions must be unambiguous and understandable
  - Language must be appropriate to population
  - Each question should cover exactly one concept

- Closed questions
  - Hard to give appropriate choices of answer
  - Hard to ensure all respondents understand choices the same way
  - Easy to analyze (e.g., descriptive statistics)

- Open questions
  - Hard to analyze responses
  - Time-consuming to answer
  - Detailed insights

Response categories

- Numeric values
  - E.g., number of months on the project

- Nominal categories
  - E.g., type of software being built

- Binary
  - E.g., yes / no

- Ordinal scales
  - E.g., "How strongly do you agree with the following statements?"
  - 5 – 7 points on scale (intervals must seem to be evenly spaced)
  - Label points on scale with words (end points must mean the opposite)

Typical mistakes

- Questions that participants can't answer
  - E.g., ask about decisions they were not involved in
  - Missing "n/a" or "other"

  having leading questions that help design a certain research

  multi choice that is either or other

  having i dont know as an option

- Double-edged questions

  yes definately , then ask why
  no definatly not, then ask why

  to understand rational why someone has that choice

  - E.g., "Have you used automated gate access, or would you consider it?"

  hypothetical questions try to reduce or try make as relevant to respondant as possible. could also provide a senario which could be hypothecial, and refer to that senario, instead of a hypotheical question.

- Leading questions
  - E.g., "Do planes depart late because of a delay in the boarding process"?

  even if this is true, could be weather or any other problems

- Appropriation   *interpretaing open questions and i dont know*
  - Reinterpreting participants' responses

Surveys: pro and con

- Pro   surveys that ask the same questions in different ways

  – Quick collection of information from a large number of people

  – Administrated remotely and effort propagation

- Con

  – Requires clear enough issues (no interactive/ad-hoc communication)

  – Relies on self-reporting of stakeholders, subjective, Dunning-Kruger

  – Response rate

  – Relies on well-chosen participants (sample)

Appropriate for projects with a large number of stakeholders (e.g., web applications), well understood domains

Types of elicitation techniques

Elicitation techniques

Ask	Observe	Build and play	Analyze
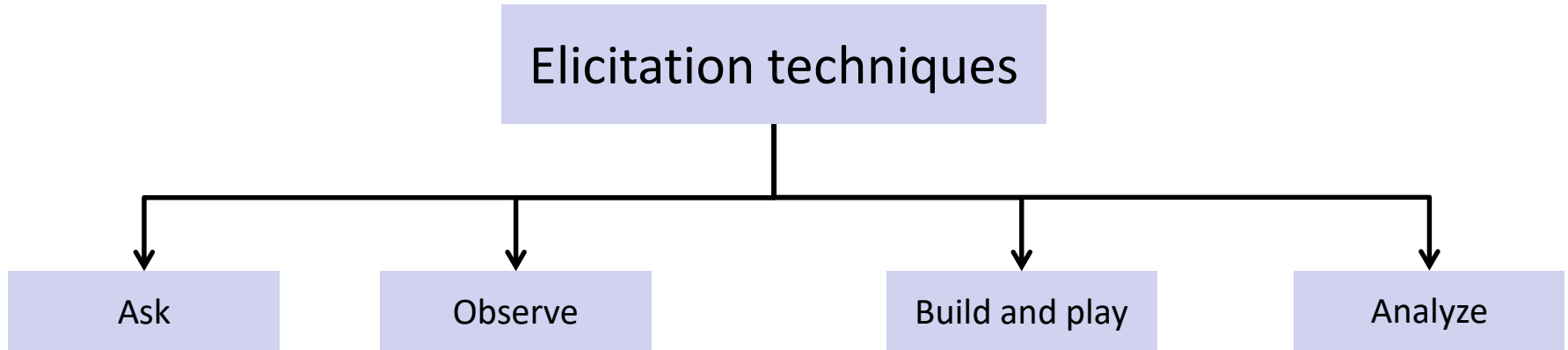
✓ Interviews

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❑ Brainstorming

❑ Focus groups

Brainstorming

- Goal
  - Produce numerous new ideas (outcome: list of ideas to "post-process")
  - Derive themes for further analysis

- Include representative from each stakeholder group

- All ideas must be recorded so that they are not lost

- Critical role: facilitator
  - Ensures that participants feel comfortable to propose new ideas, solutions
  - Ensures focus on business need at hand
  - Helps avoid scope creep, gold plating, distractions with other issues

Osborn's rule for brainstorming (1)

- There are no dumb ideas – encourage wild ideas

- Don't criticize other people's ideas
    - No "why would anybody want that…", "this doesn't work…", etc.

- Build on other people's ideas
    - Nurture each other's thought process

- Reverse the thought of "quality over quantity"
    - The more creative ideas the better

Osborn's rule for brainstorming (2)

- Stay focused on topic

- One conversation a time
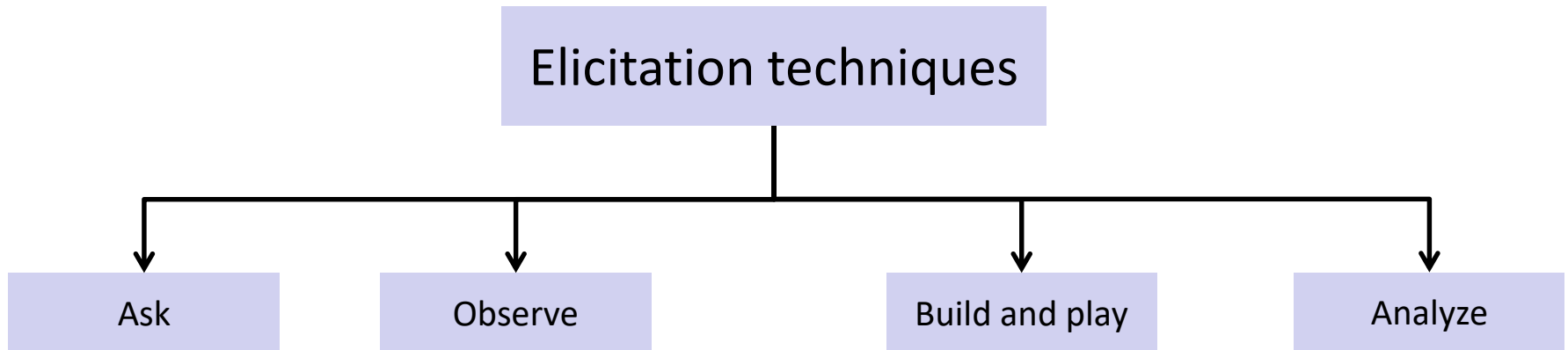
- Be visual

Brainstorming: pro and con

- Pro
  - Broad range of ideas
  - Innovation

- Con
  - Requires moderation and facilitation
  - Unclear outcome

Appropriate if project has no clear winning choice for a solution, or if existing proposed solutions are deemed inadequate

facilitator more about the process that everybody got a chance to share

Types of elicitation techniques

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✓ Interviews

✓ Surveys

✓ Brainstorming

❑ Focus groups

Focus groups

- Group interview (ask questions in interactive group setting)
  - 6 – 12 participants (mini FG: 4 – 5 participants)
  - Focus on a topic
  - Participants free to talk to other group members in in formal/natural way

- Stakeholders gather to offer ideas, motivation, perceptions
  - On the business need at hand
  - Its potential solutions

- Conducted by a trained moderator   need to understand topic of the focus group and the participants
                                       need to be suited with whats discuused in the topic
  - Requires proper preparation

- Key stakeholders should still be interviewed individually

Variations (examples)

- Dual moderator focus group
  - Moderator 1: ensures the session progresses smoothly
  - Moderator 2: ensures that all the topics are covered

- Dueling moderator focus group
  - Two moderators deliberately take opposite sides on issue

  argument may force you to need to articulate your thoughs better and reflect on the alternative

- Two-way focus group
  - One FG watches another FG; discusses observed conclusion

Focus groups: pro and con

need to make sure people on the focus group aare on the same page

- Pro

  getting lots of ppl together can get lots of info at once

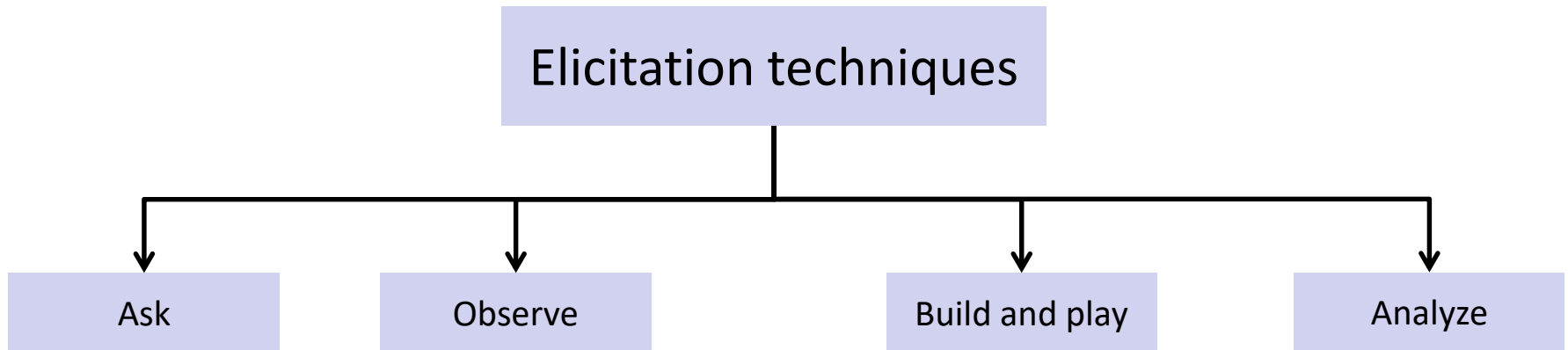 people hearing others thoughts can find their words to express themselves

  – Vocal stakeholders help others to think through and articulate solutions

  – Give time-pressed analysts to get a lot of information at once

- Con

  – Inclusion of qualified stakeholders

  – Stakeholders' difficulties in recognizing or articulating needs

  – Incorrect interpretations of analysts

Appropriate when key stakeholders are not particularly imaginative or forthcoming

Types of elicitation techniques

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✓ Interviews

✓ Surveys

✓ Brainstorming

✓ Focus groups

Summary

1. Requirements elicitation – overview ✔

2. Elicitation techniques – ask ✔