Software Requirements and Architecture (SENG404)

Matthias Galster

Lecture 4 – Requirements elicitation (part 2)

March 2, 2023

UC
UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

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; Requirements elicitation (part 2)
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. Requirements elicitation – overview

2. Elicitation techniques – ask

can be time consuming

Reading for this 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

how to use ambiguity to trigger knowledge for tactic requirementsasking right questions help clarify ambiguities, but when does it get frustrati

Questions and lessons

Reading for next session

- T. Mendes, M. de F. Farias, M. Mendonça, H. Frota Soares, M. Kalinowski, and R. Spínola. *Impacts of agile requirements documentation debt on software projects: a retrospective study.* In 31st Annual ACM Symposium on Applied Computing (SAC), 2016, pp. 1290-1295, doi.org/10.1145/2851613.2851761

Agenda

1. Elicitation techniques – observe
2. Elicitation techniques – build and play
3. Elicitation techniques – analyze
4. Requirements elicitation – summary

Agenda

1. Elicitation techniques – observe

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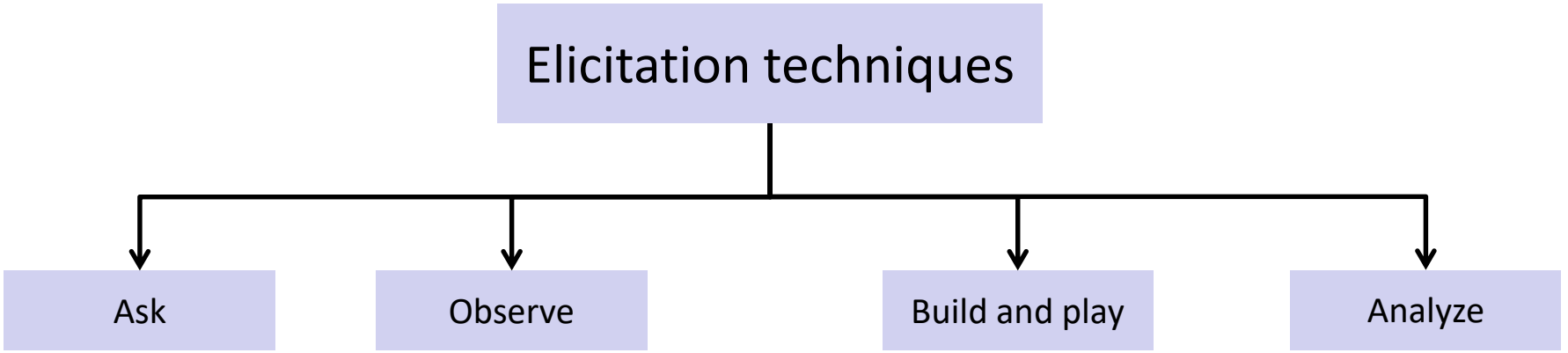
Types of elicitation techniques



- ❑ Participant observation
- ❑ [Task analysis]
- ❑ [Role-playing]
- ❑ [Conversation analysis]

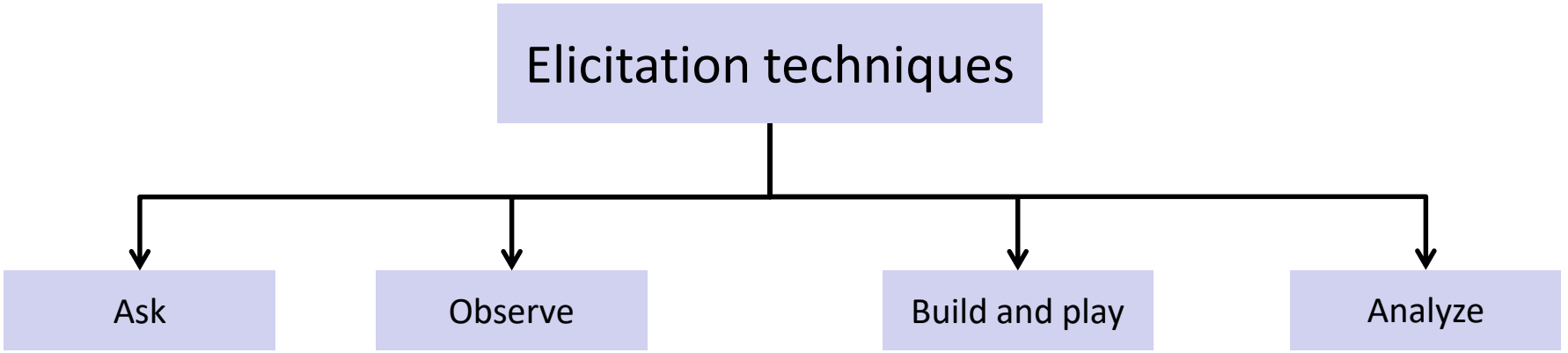
General remark

- Many observational techniques are related to ethnography
  - Well-known from sociology and social sciences

- (Groups of) people are “studied” in their natural settings
  - Analyst becomes “apprentice”
  - Recognizes that
    - people embedded in problem domain understand problem best
    - future users of system are the real experts

- Generally useful to uncover tacit knowledge and assumptions

Types of elicitation techniques



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- ❑ [Conversation analysis]

Role playing exercise (1)

- Simulate observation

- One volunteer ("observee")
  - Problem: Improve building design and consent process
  - Role: Building designer (assume you are expert, know what you are doing)
  - Task: (1) Create a map of the building, and (2) share map with public (class)
  - Tools: Anything available in the room (assume you are a civil engineer)
  - Time: ~5-10 minutes

- Rest of class ("analysts", "observers"): observe + take notes

whole processes strated with thinking about requirements,

Role playing exercise (2)

- Observations and questions
  - From “analyst(s)”?
  - From “observee”?

Participant observation (1)

- Aka “job shadowing”
  - Become a member of user group or organization
  - Observe what individuals do, how, why, without prior interpretation
  - Find out real problem and ideas to solve it (opportunities for innovation)

- What to capture
  - Steps, activities performed; artefacts created
  - Techniques, methods, tools, etc. used
  - Information needs, questions asked
  - Perceived assumptions and uncertainties
  - Interactions
  - Movements and spatial arrangements
  - Etc.

Participant observation (2)

ppl behavior may change to what they think are expected to the observer

ppl can become defensive - which maybe not a bad thing? how to deal with defensiveness or different personalities who deal with things differently.

- Passive observation
  - Analyst watches someone working but does not engage in any way

not about observing whats been done good or bad, just observing - so need to have trust in this relationship so they know they can be less likely to change their behavior

- Active observation
  - Analyst asks questions or attempts portions of work

observe in over a long time. discard first day finding as know it could be altered.

- Need to interpret what we saw
  - Are there any patterns
  - When observing multiple people or groups
    - Deviations from the general; people acting or being treated differently
  - If multiple observers: overlaps, disagreements

- Allow “observe” to review of findings

Ethical considerations

deception - doing this may produce effect where people wont alter their behavior.

justified deception, was there harm damaged?

- Not acceptable to deceive people
  - No “hidden” data collection

being observed may make people uncomfortable with what they are revealing - eg. banter of personal life with collegues

- May need to ensure confidentiality and privacy
  - Observees may be worried about data recorded from them

- Need to carefully think about how to build trust
  - Being observed impacts behaviour
  - Outcome of observation may negatively impact observee

Participant observation: pro and con

- Pro

rich in unspoken knowledge

in what situation would you use observations and which wouldn't

  - Results in contextual information
  - Reveals details that other methods may not

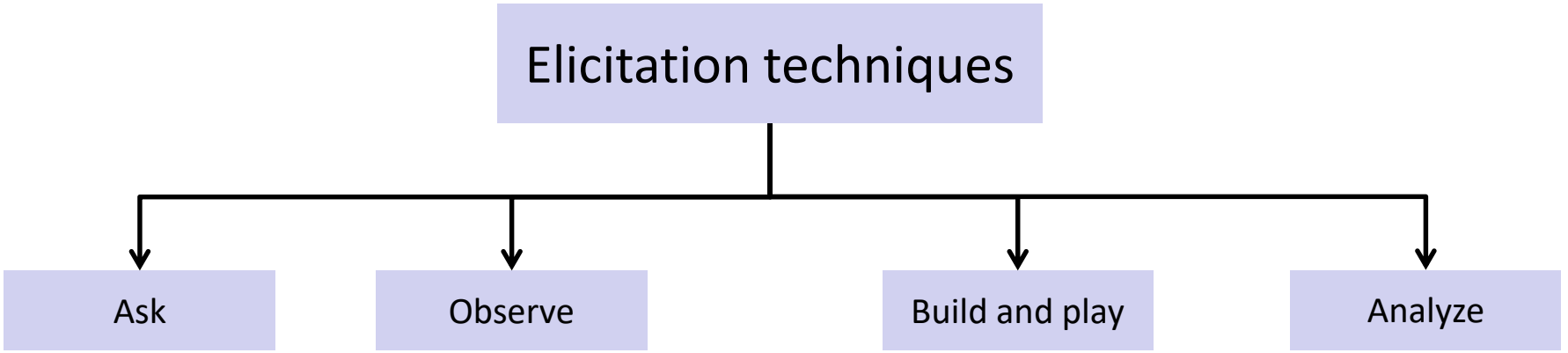
- Con

its very easy to do wrong. requiring relationship and trust building and not ignore how the individual feel.

  - Extremely time-consuming
  - Resulting “rich picture” hard to analyze; what is right level of detail
  - Willingness of stakeholders

Appropriate for a) customized software systems, b) to elicit tacit knowledge, c) when enhancing/automating current processes

Types of elicitation techniques



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pain points

what they focus on as it convo is driven by them

tone of voice insights on how things are

impact how we prioritize certain features

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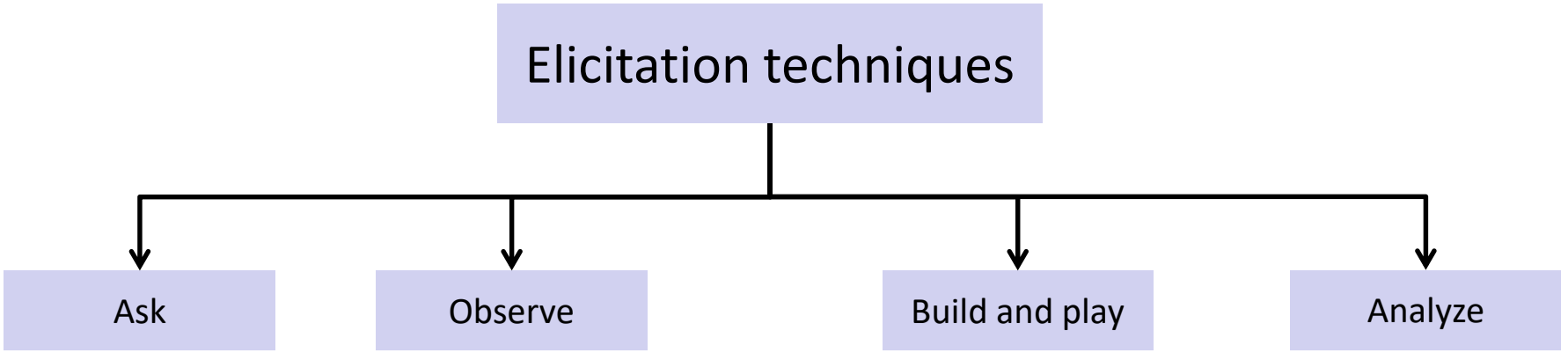
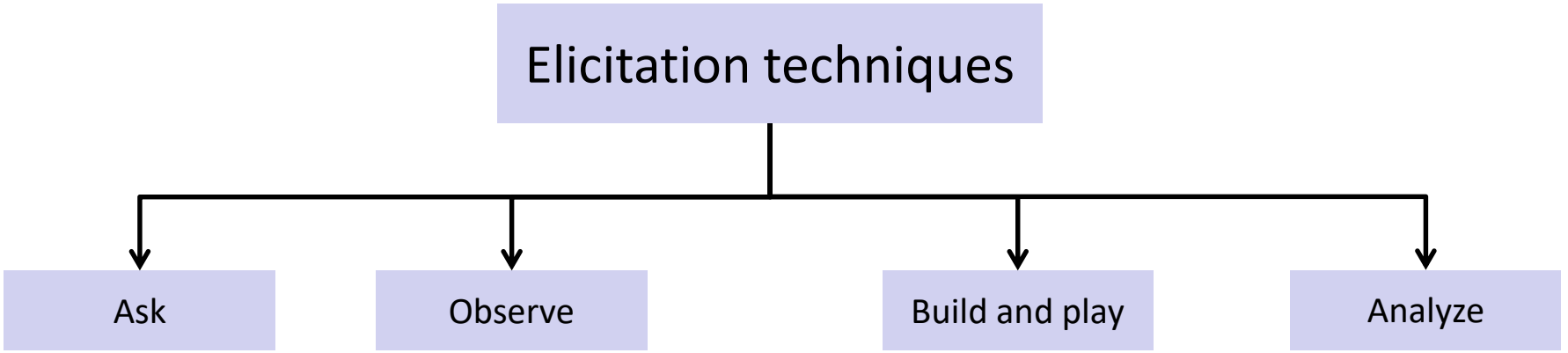


- ❑ JAD / RAD
- ❑ Prototyping
- ❑ Use cases, scenarios
- ❑ [Participatory design]

Types of elicitation techniques



- JAD / RAD
- Prototyping
- Use cases, scenarios
- [Participatory design]

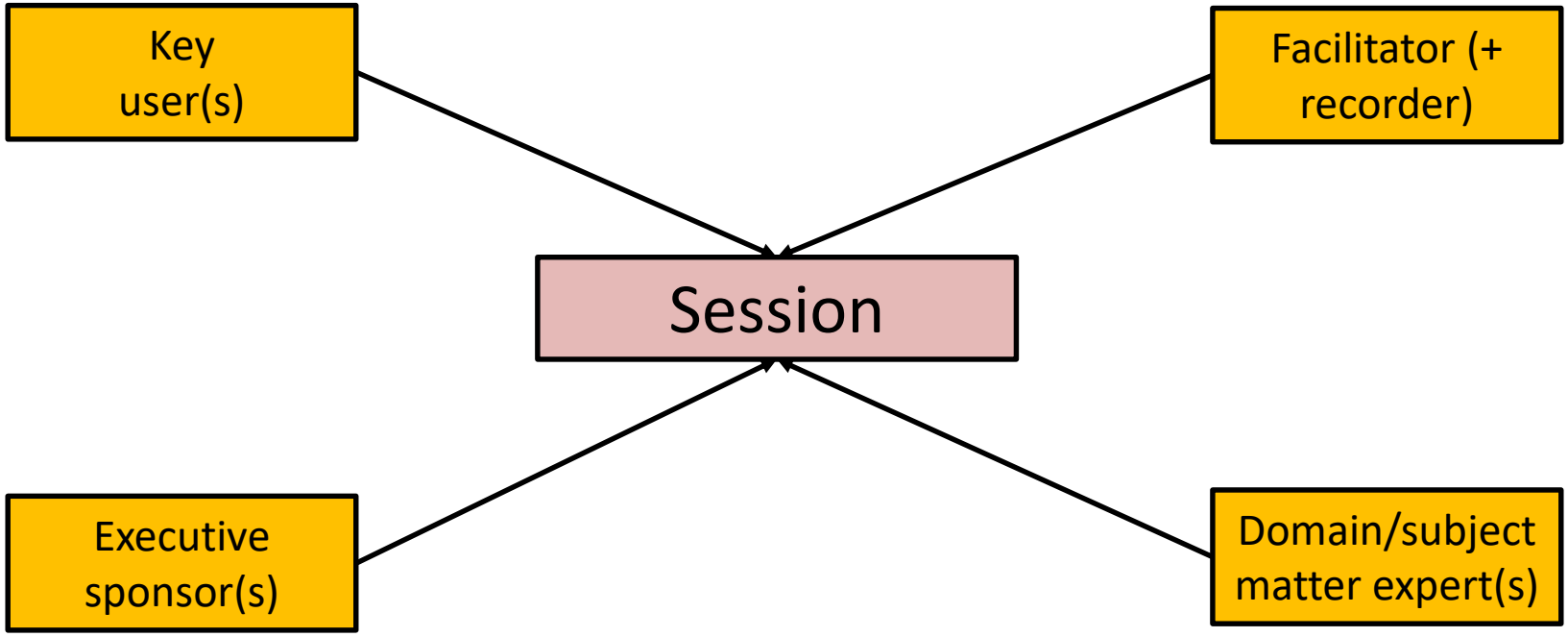
JAD / RAD – overview

- Joint / rapid application development*
  - Bring user/client and developers together
  - Involve diverse set of stakeholders

- Organized workshop with confirmed schedule
  - Structured setting for a defined amount of time
  - Elicit/refine/edit requirements
  - Result: document with consensus-based requirements

*See also requirements workshops

Typical roles (1)



ppl who are putting resources in the product and can make the project happen. altho they dont use the end product, they really care about whats happening in the system, whats being put in, and the value for their business

challenge
- scheduling
- staying on topic

*Remember stakeholder analysis

Typical roles (2)

- Key user(s)
  - Business users (more tightly aligned to IT project)
  - May represent potential end users
- Executive sponsor(s)
  - Drive project, system owner; normally from higher positions
  - Can make decisions; provide necessary strategy, planning and direction
- Domain/subject matter expert(s)
  - Business users and outside experts
- Facilitator (supported by recorder)
  - Chair, directs session; identifies issues; does not contribute information

Example

- App to diagnose disease based on photo taken of skin

- Key users
  - Users, patients

- Domain experts
  - Regulation experts
  - Medical professionals

- Executive sponsor(s)
  - Help decide about feasibility
  - Understand market forces, urgency, etc.

JAD / RAD activities

- Prepare for session
  - Define session objectives (more specific than brainstorming)
  - Open issues (assumptions, purpose, scope)
  - Research background (current system, problem)
- Confirm schedule
- Workshop (JAD/RAD session)
- Produce and refine documents for participants to review
  - Ongoing during session and after
  - May include architecture, data model, process model

JAD / RAD session

- JAD orientation
  - Familiarize participants with procedure
  - Define concepts
- Facilitator asks questions based on session objectives
  - Business strategy and plans, business processes, etc.
  - Project structure decisions, schedule and resource plans, etc.
  - Quality assurance plans, risk management plans, etc.
- Define requirements
  - Anticipated benefits, general requirements, business and legal issues
  - Allow participants to introduce new ideas
  - Make requirements as detailed as possible

JAD / RAD: pro and con

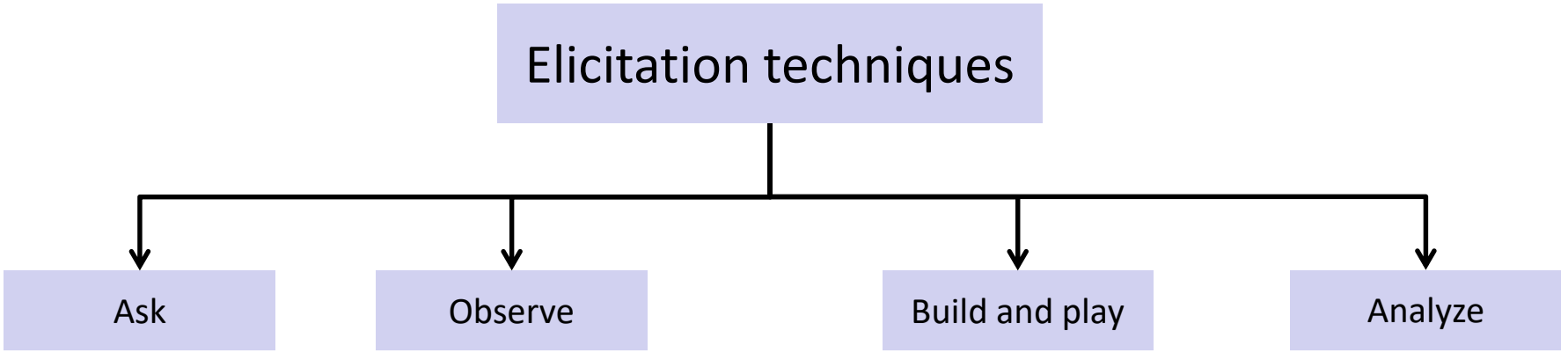
- Pro
  - Systematic user participation and involvement
  - Solve problem at the spot

- Con
  - Lots of preparation work and cost before workshop

Appropriate when key stakeholders do not understand technical aspects of requirements

people who understand the problem, and stakeholders who may not but have input

Types of elicitation techniques



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- ❑ Prototyping
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Prototyping

dont need to be fully functional application. a test that can have any level. help verbalize and validate some of the ideas. help stakeholder when there is a concrete idea for them to help visualize

- Identify, describe and validate needs
  - Iterative, improvements based on input and evaluation
- Simple prototypes may be done in initial stages of discovery
  - Detailed prototypes once more requirements have been identified
- Example prototypes
  - Throwaway prototypes (such as pencil sketches)
  - Interactive screen (normally only hypertext with no real data)
  - Mock-up (such as a PowerPoint)
  - Navigation flow (such as a Visio diagram)
  - Storyboard

Prototyping: pro and con

- Pro
  - Stakeholders can relate to a visual representation of product

- Con
  - Requires significant effort and commitment from stakeholders

too much time invested into it

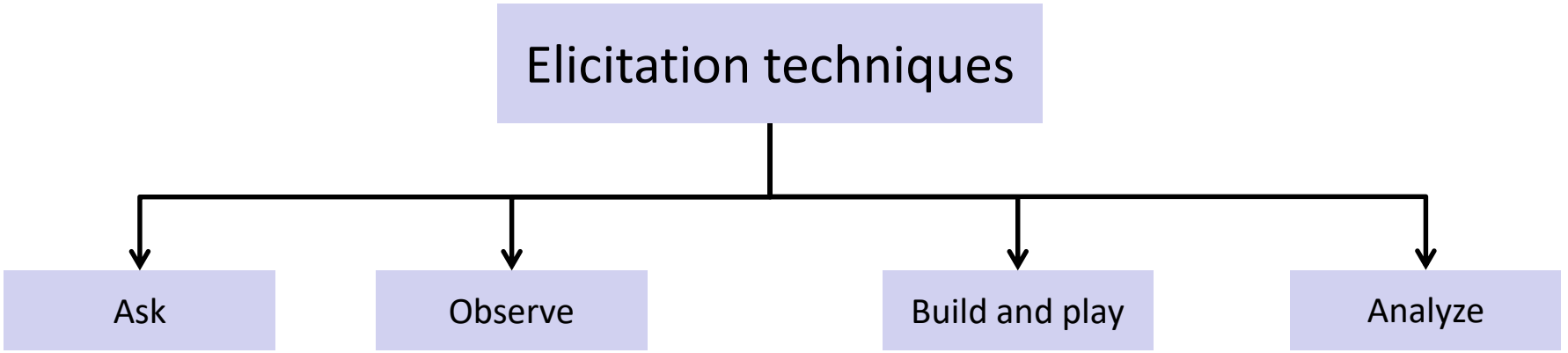
prototype is already specific to one idea, so want it to be worth it, so dont forget about other things to keep exploring

Appropriate when key stakeholders do not understand all of the technical aspects of requirements; interface design

is there a challenge to know when to stop investing time and ideas into a prototyped idea.

<<<< TODO??

Types of elicitation techniques



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Use cases and scenarios

walk through a typical scenario to know how stakeholder and user usually do as a list of steps, and can be combined in a prototype session,

- Elicitation through story telling

- Scenario
  - Story that tells how a specific task instance is executed
  - Sequence of interactions between actor and system in 3-7 steps

- “Story-telling” provides mock-up of the software
  - Serves as paper-based prototype to better understand requirements

- Focus
  - Process aspect: how system proceeds through successive states
  - User perspective: how user interact with system, functionalities offered

Scenarios: first step in writing use cases

Scenarios	Use cases
Concrete	Abstract
Specific situation	General situation
Selective with respect to key situation	Exhaustive in coverage of situations
Illustrative	Authoritive / general
Compelling	(Usually) boring for users

Scenarios: pro and con

- Pro

  natural, easier for ppl to relate as it based off natural language, can use with a non technical user quite well

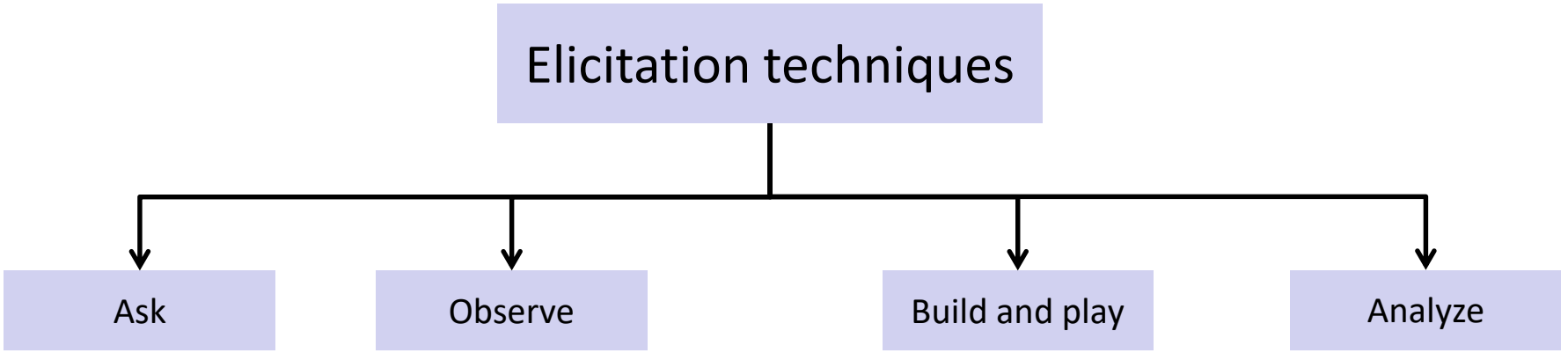
  - Natural: stakeholders tend to use them spontaneously
  - Easy to write and understand (natural representation)
  - Help in drawing system boundary and manage requirements

- Con
  - Enough scenarios to have a sufficient picture of requirements?
  - Writing good (abstract) use case requires skill and practice
  - Fair amount of domain expertise is required
  - Do not represent quality attributes and domain knowledge

concise, avoid contradiction, capture exceptional scenarios, and common errors.

Appropriate for interactive systems;
for user requirements when business goals are confirmed

Types of elicitation techniques



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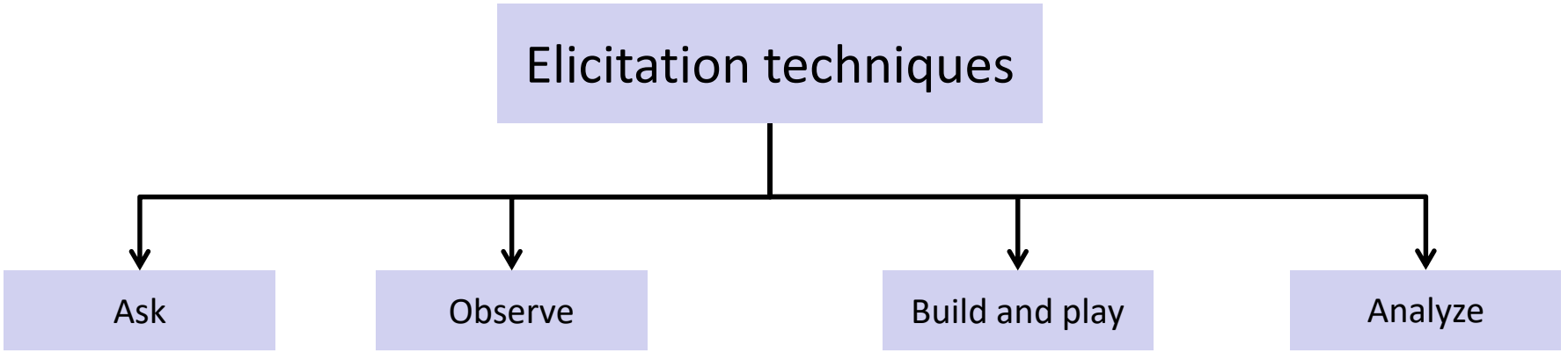

- ❑ Document analysis
- ❑ “Data” mining
- ❑ [Interface analysis]
- ❑ [Bug reports]
- ❑ [“Experiments”]

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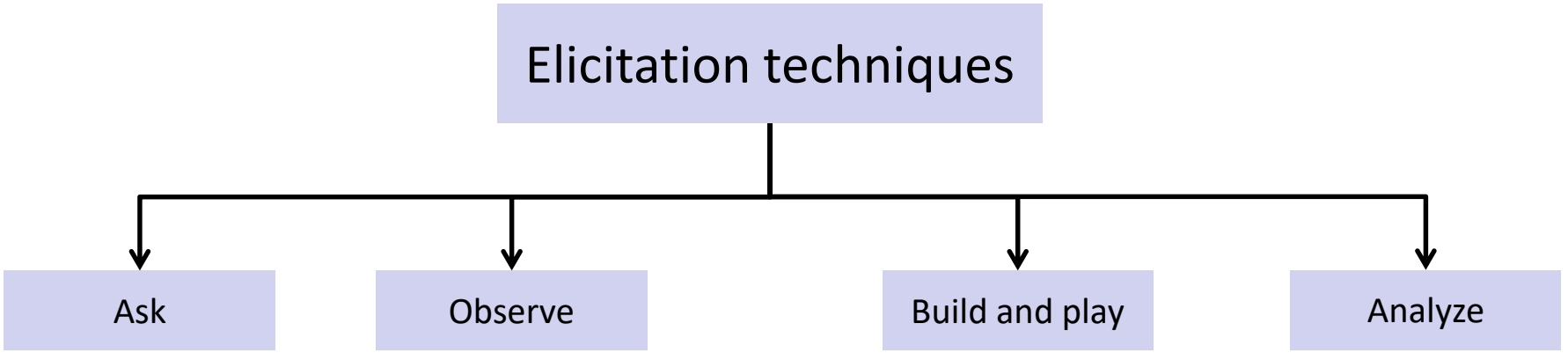

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Document analysis

info available without interacting with people.

- Gathering and reviewing of existing documentation
  - Pertinent to business objective
  - Related to relevant solution

- Analysis of existing documents
  - Company reports (business context)
  - Organizational charts (potential stakeholders)
  - Policy manuals (regulations)
  - Job descriptions (potential requirements, problems, business processes)
  - Existing system documentation (reusable requirements)
  - Forms (data requirements)

More example documents

Self-study

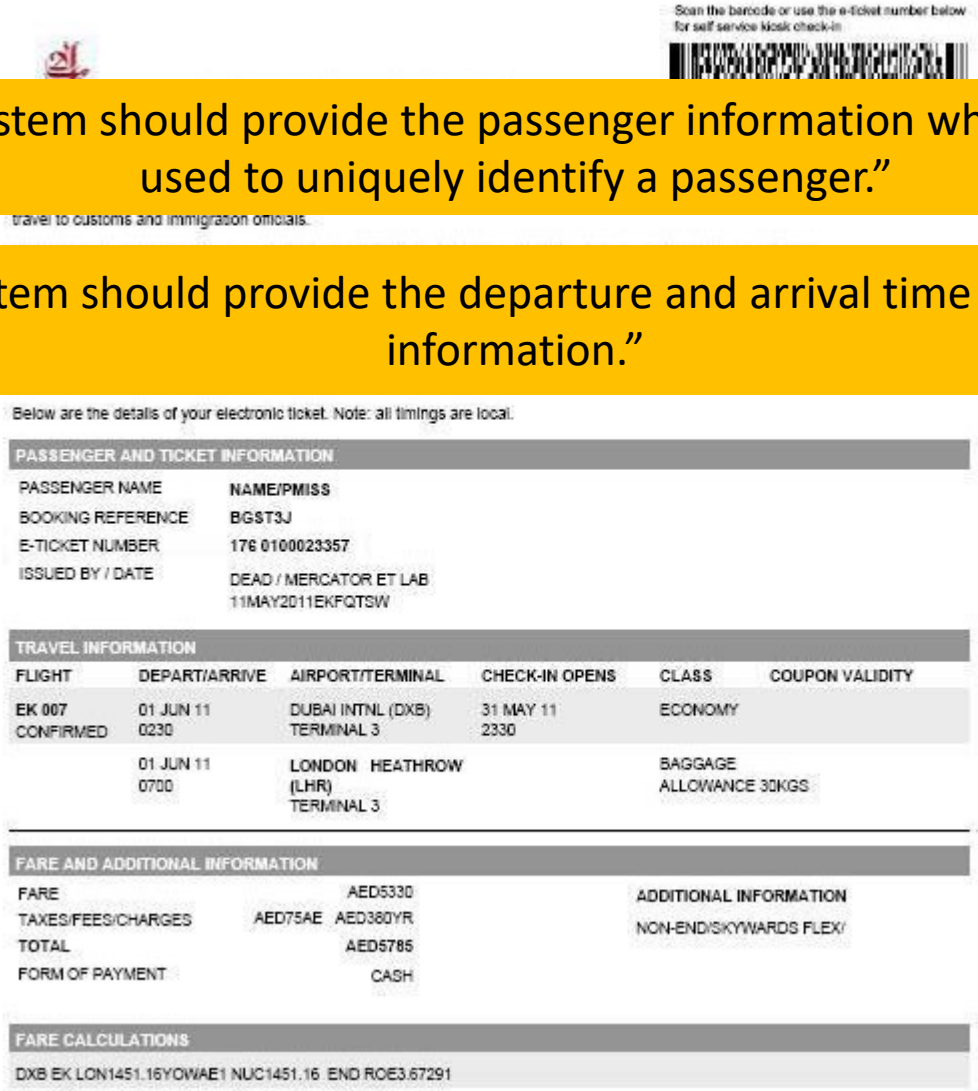
- Business plans
- Market studies, marketing data
- Contracts
- Requests for proposal
- Statements of work
- Memos
- Existing guidelines, procedures, training guides
- Competing product literature
- Published comparative product reviews
- Problem reports, customer suggestion logs
- Existing system specifications

Business context – example

"Intellibuild wants to offer a pioneering product that will revolutionize the market of tourist and visitor infotainment. These services will replace the existing model, e.g., consulting guides, physical information booths, etc. Furthermore, it will implement new services that have not been offered before, e.g., real-time notification of schedule changes."

- Elicited requirements information from business context
  - Business goal
    - Provide infotainment product
  - Risk
    - To be a pioneer is a risk in market
  - Problem
    - Replace existing information broadcasting model
  - Requirement
    - Provide real-time notification of schedule changes

Another example


Scan the barcode or use the e-ticket number below for self service kiosk check-in

travel to customs and immigration officials.

Below are the details of your electronic ticket. Note: all timings are local.

PASSENGER AND TICKET INFORMATION

PASSENGER NAME	NAME/PMISS
BOOKING REFERENCE	BGST3J
E-TICKET NUMBER	176 0100023357
ISSUED BY / DATE	DEAD / MERCATOR ET LAB 11MAY2011EKFQTSW

TRAVEL INFORMATION

FLIGHT	DEPART/ARRIVE	AIRPORT/TERMINAL	CHECK-IN OPENS	CLASS	COUPON VALIDITY
EK 007 CONFIRMED	01 JUN 11 0230	DUBAI INTNL (DXB) TERMINAL 3	31 MAY 11 2330	ECONOMY	
	01 JUN 11 0700	LONDON HEATHROW (LHR) TERMINAL 3		BAGGAGE ALLOWANCE 30KGS	

FARE AND ADDITIONAL INFORMATION

FARE		AED5330	ADDITIONAL INFORMATION
TAXES/FEES/CHARGES	AED75AE	AED360YR	NON-END/SKYWARDS FLEX/
TOTAL		AED5785	
FORM OF PAYMENT		CASH	

FARE CALCULATIONS

DXB EK LON1451.16YOWAE1 NUC1451.16 END ROE3.67291

"The system should provide the passenger information which can be used to uniquely identify a passenger."

"The system should provide the departure and arrival time and airport information."

"The system should provide flight number information."

Document analysis – pro and con

- Pro

don't need to synchronize time space with others
theoretical - what's documented of some standards but what is being practiced - from this could also identify solutions

  - Increases understanding before meeting with stakeholders
  - Resources for fact finding
  - Discovers reusable requirements

some documentations and standard could be objectives eg. fast, but what does this mean specifically

- Con

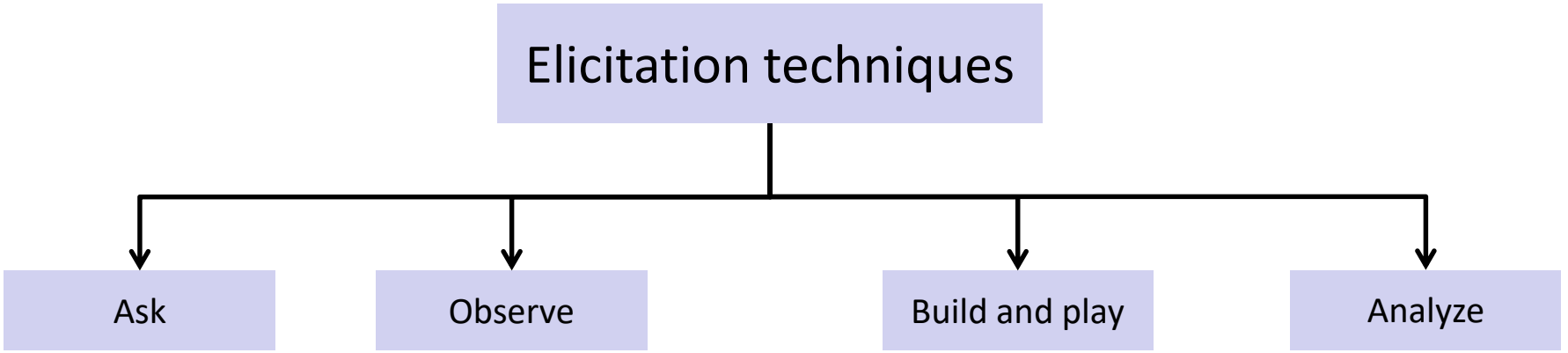
we need to know what we are looking for

confidentiality, don't prioritize it, don't want to put in hard beurcratic effort to go to it. people who have access are not at the company or on holiday. political reason. eg student advisor who dont want to support a project that may make their job redundant - hidden agendas. how much do we utilize stakeholders who job may disappear - a project that is working against their interest - esp in automation

  - Documents not always up-to-date
  - Relevant documents may be difficult to access
  - Lots of irrelevant information may result in wasted effort

Appropriate to a) understand initial business needs, b) when one is unfamiliar with the system background and context, c) goal is to update an existing system

Types of elicitation techniques



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Data mining

- Analyze large amounts (of potentially user-generated) data
  - E.g., app reviews, Twitter
  - Competitor data or own data

can use to establish a base line of features that have gap to fill or features that competitor users are extremely liking, or quality issues people don't explain explicitly in interviews.

- Could be used to identify technical requirements or features
  - E.g., claims that 40% of reviews mention quality requirements
  - Useful in particular shortly after the release of a software

- Typically rely on advanced natural language processing
  - E.g., opinion mining, sentiment analysis

J. Dabrowski et al.: *Mining and Searching App Reviews for Requirements Engineering: Evaluation and Replication Studies.* Information Systems (2023)
N. Jha, A. Mahmoud: *Mining Non-functional Requirements from App Store Reviews.* Empirical Software Engineering (2019)
G. Williams, A Mahmoud: *Mining Twitter Feeds for Software User Requirements*. In: International Conference on Requirements Engineering (2017)

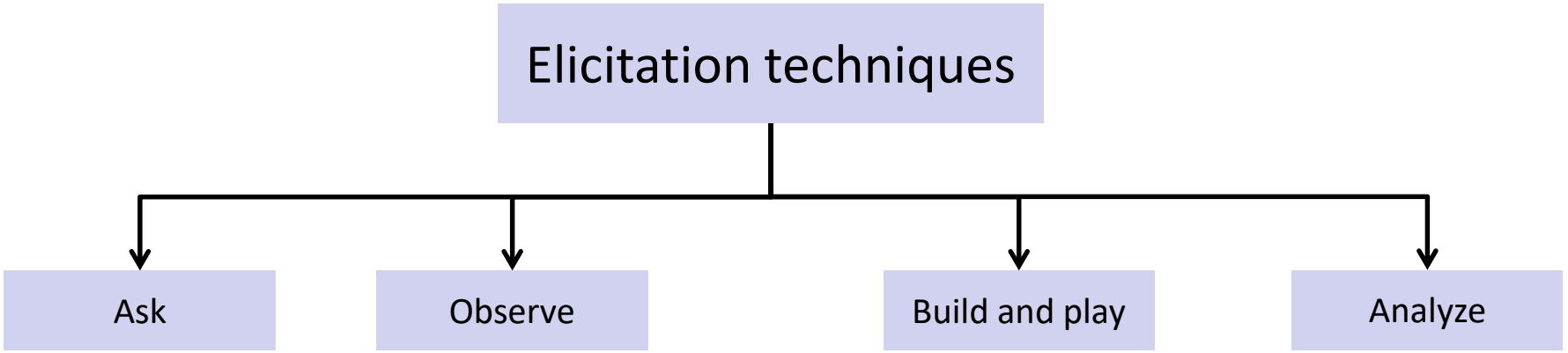
Data mining – pro and con

- Pro identify stakeholders
  - Could be automated
  - Based on “real” feedback
  - Data exists “anyway”
  - Potentially based on large amounts of data (validity)

- Con new field could not have more standardized jargon
  - Reliability and accuracy of techniques fake data or reviews to sabotage
  - Quality of analyzed data, noise (validity)
  - Runtime of techniques

Appropriate to a) understand feedback from many users, b) when feedback is shared publicly, c) when identifying features for new versions of an evolving system

Types of elicitation techniques



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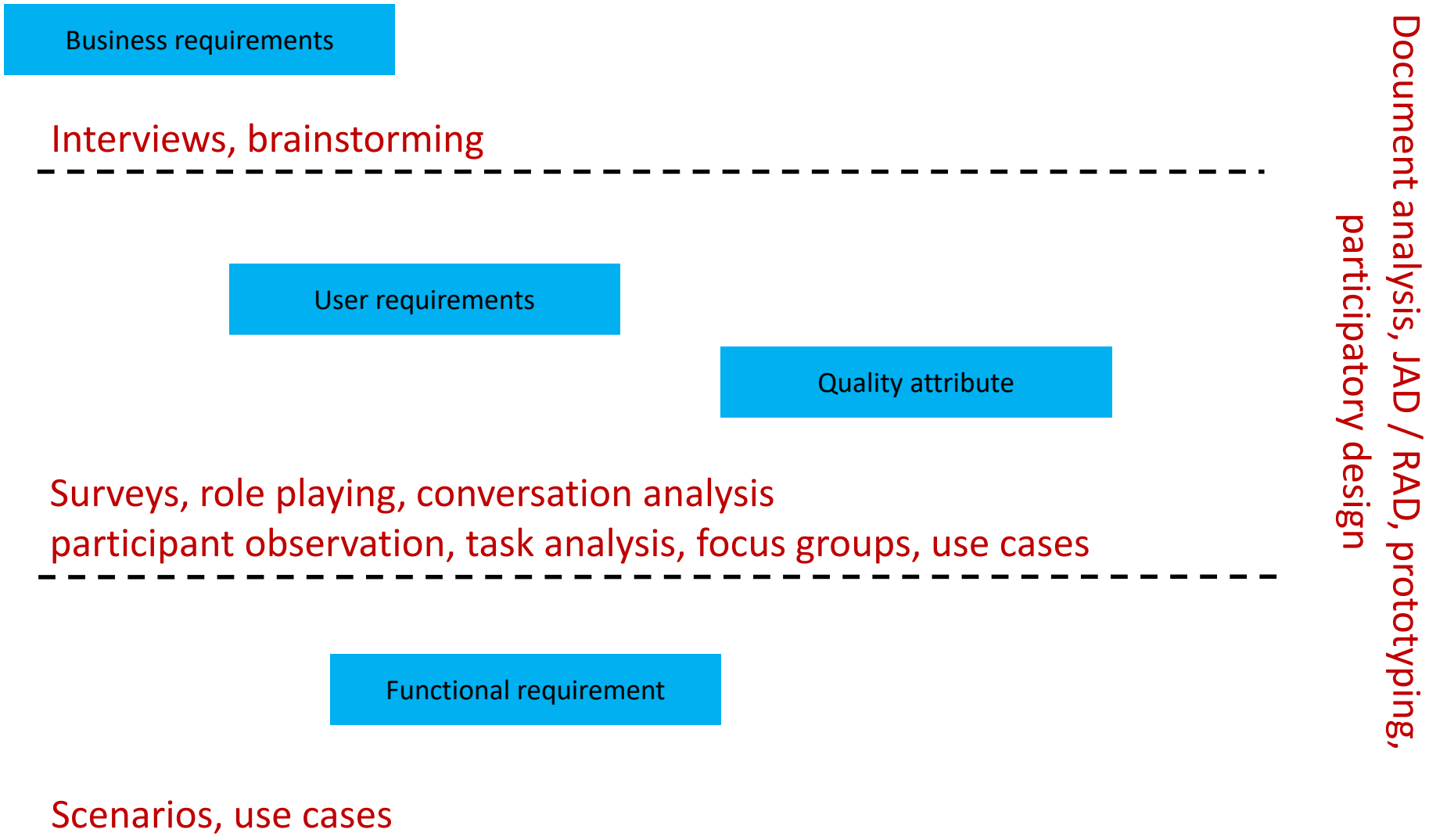
Comparison of elicitation techniques (1)

Technique	Main info source	Strong on
Interviews	User	Current
Surveys	User	Current
Brainstorming	User	Future
Focus groups	User	Current
Participant observation	Domain	Current
Task analysis	User, domain	Current
Role playing	Domain	Current
Communication analysis	Domain	Current
JAD / RAD (requirements workshops)	User	Future
Prototyping	User	Future
Use cases, scenarios	User	Current / future
Participatory design	User	Future
Document analysis	Domain	Current
“Data” mining	Users	Current / future
Interface analysis	User, domain	Current
Bug reports	User	Future
“Experiments”	User, domain	Current / future

Comparison of elicitation techniques (2)

Technique	Express needs	Demonstrate opportunities	Analyze system as-is	Explore market potential
Interviews	+	-	+	o
Surveys	o	-	+	+
Brainstorming	+	-	+	-
Focus groups	+	-	+	o
Participant observation	o	-	+	o
Task analysis	o	-	+	-
Role playing	+	o	o	-
Communication analysis	o	-	o	-
JAD / RAD (requirements workshops)	+	+	-	o
Prototyping	o	+	-	o
Use cases, scenarios	o	o	+	o
Participatory design	+	o	-	o
Document analysis	o	-	+	-
“Data” mining	+	+	+	-/o
Interface analysis	-	-	+	-
Bug reports	+	o/+	+	o/+
“Experiments”	+	+	+	+

Example of using different techniques



J. Goguen, C. Linde: *Techniques for Requirements Elicitation.* 1st International Symposium on Requirements Engineering 1993

Typical challenges – stakeholders

Self-study

- Inconsistencies among stakeholders

  identify why inconsistency was there in the first place.

- Stakeholders who don’t know their needs

- Stakeholders who know their needs, but can’t express them

- Stakeholders thinking in solutions instead of problems

- Stakeholders neglect quality attributes and constraints

Typical challenges – analysts

Self-study

- Lack of domain knowledge
- Misinterpretation
- Political and organizational factors
- Stakeholders with a hidden agenda
- Personal bias
- Tacit knowledge

Practical tips: what if stakeholders are busy

- Business process first, and then system and user requirements
- “Observe”
- Individual meetings rather than joint workshops
- Meet “keenest” people first
- Corridor conversations, lunches

Summary

1. Elicitation techniques – observe 
2. Elicitation techniques – build and play 
3. Elicitation techniques – analyze 
4. Requirements elicitation – summary