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Requirements Engineering & Management

Core Activities – Elicitation II

Prof. Dr. Klaus Pohl

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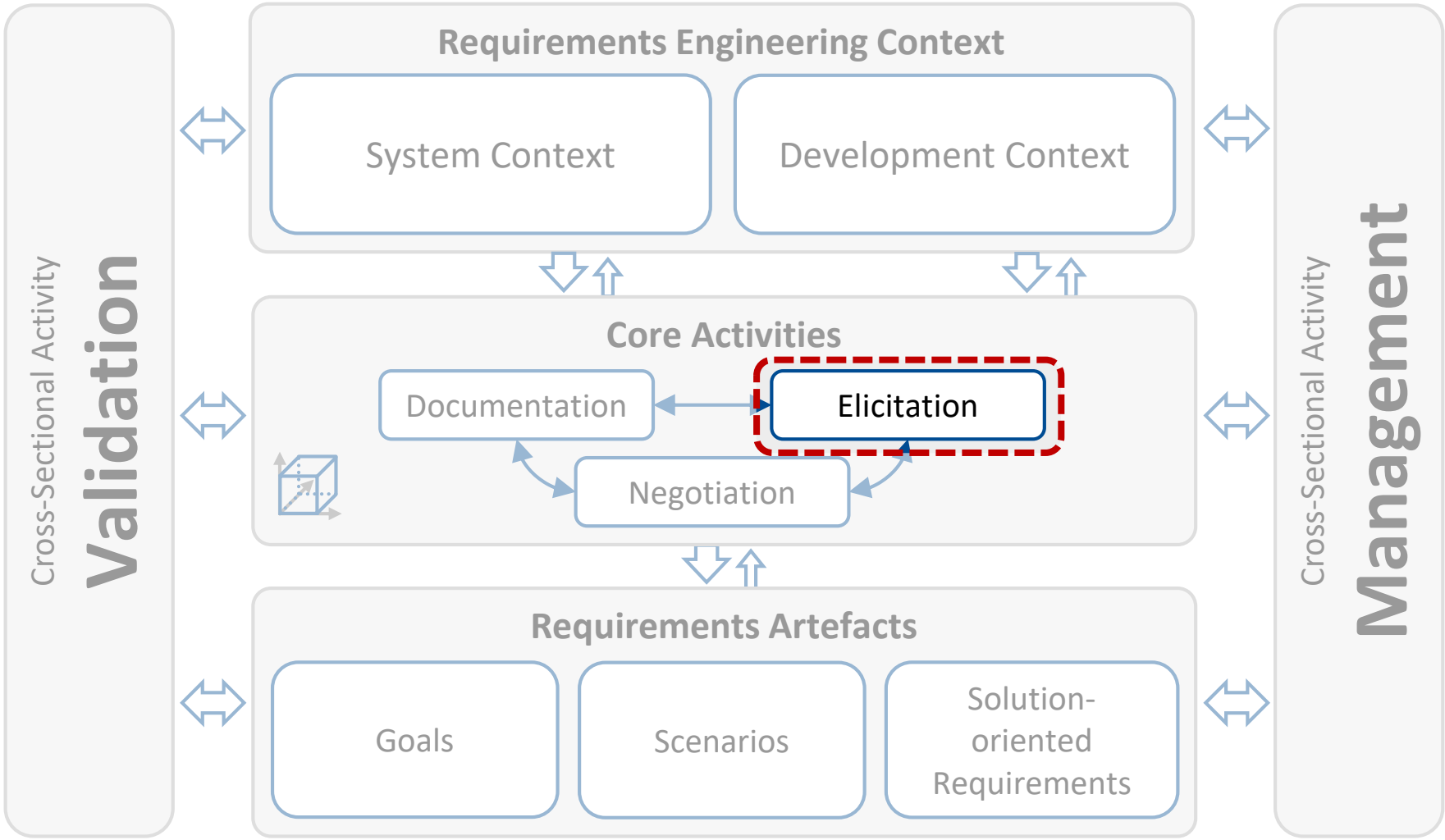
PALUNO
The Ruhr Institute for Software Technology

Requirements Engineering Framework



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Agenda

1. Kano Classification of Requirements
2. Overview of Common Elicitation Techniques
3. Interviews
4. Workshops
5. Assistance Techniques for Elicitation

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1. Kano Classification of Requirements

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Principle

- According to Kano, **requirements and system features** should be **classified** based on their effect on **customer satisfaction**.
- This classification can be used during requirements elicitation
  - to **decide which requirements** should be **elaborated next**.
  - to **focus the elicitation activities on one class** of customer satisfaction.
  - to establish a **good balance of requirements** (or system features) **between the different classes** of customer satisfaction.

based on [Kano et al. 1984]

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Requirements Categories according to Kano

Requirements artefacts are **classified** according to their influence on customer satisfaction into:

- **Dissatisfier** (a must-be requirement)
  - The system **must realize** this requirement to enable market entry.
  - **Missing one dissatisfier** leads to **dissatisfaction** of the **customer**.
  - A high degree of fulfilment of requirements classified as dissatisfiers does not guarantee high customer satisfaction.
- **Satisfier** (a one-dimensional customer requirement)
  - The customer consciously demands the realization in the system.
  - **Satisfiers positively influence** the **degree** of customer **satisfaction**.
  - Not fulfilling a satisfier reduces customer satisfaction (but to a much lower degree than missing a dissatisfier).
- **Delighter** (an attractive requirement)
  - Customers are not aware of this requirement or do not expect its realization.
  - Customer **satisfaction increases disproportionately**, if the system realizes delighter.

based on [Kano et al. 1984]

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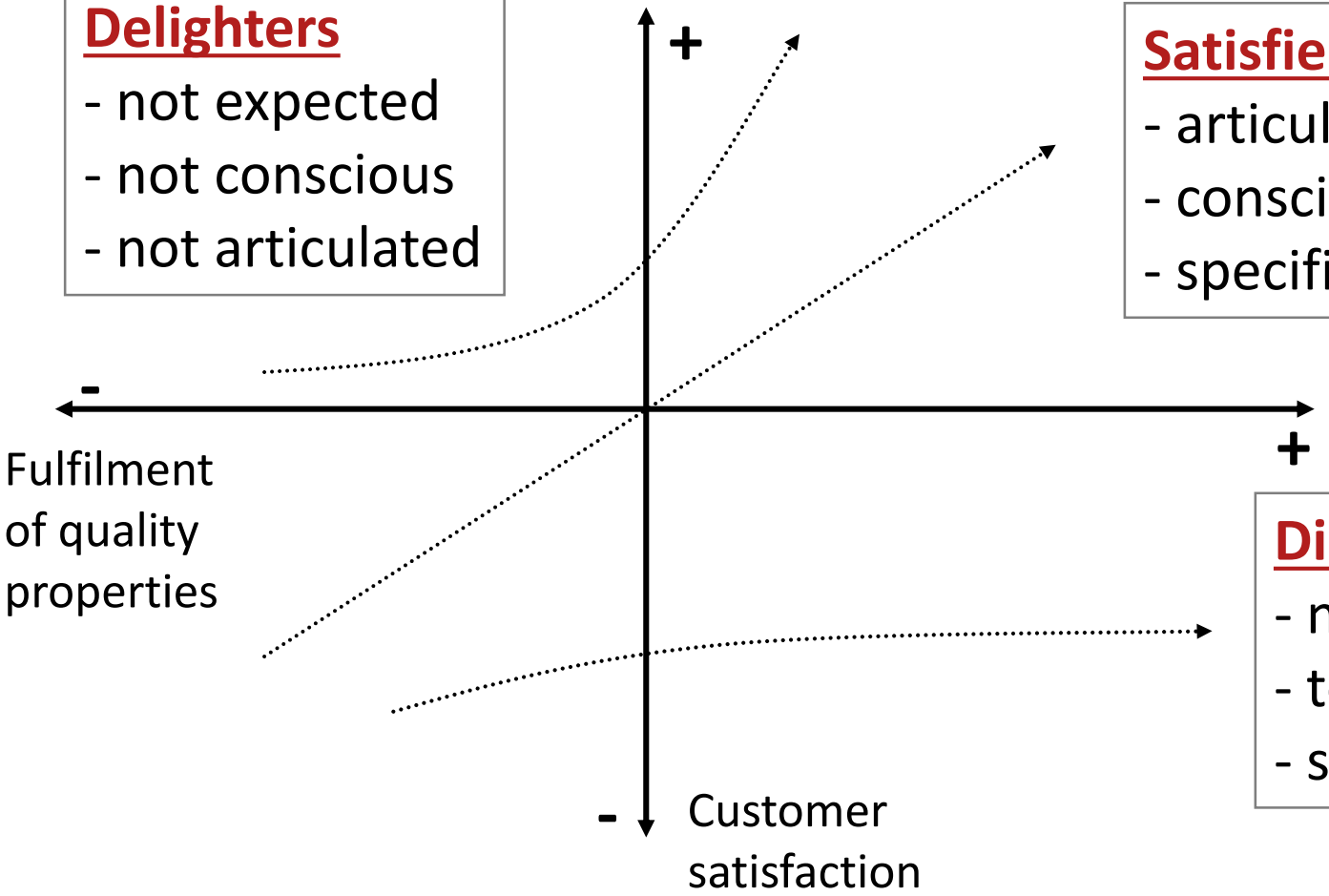
Effect of Categories on Customer Satisfaction

Delighters
- not expected
- not conscious
- not articulated

Satisfiers
- articulated
- conscious
- specified



Dissatisfiers
- not articulated
- tend to be unconscious
- self-evident

based on [Kano et al. 1984]

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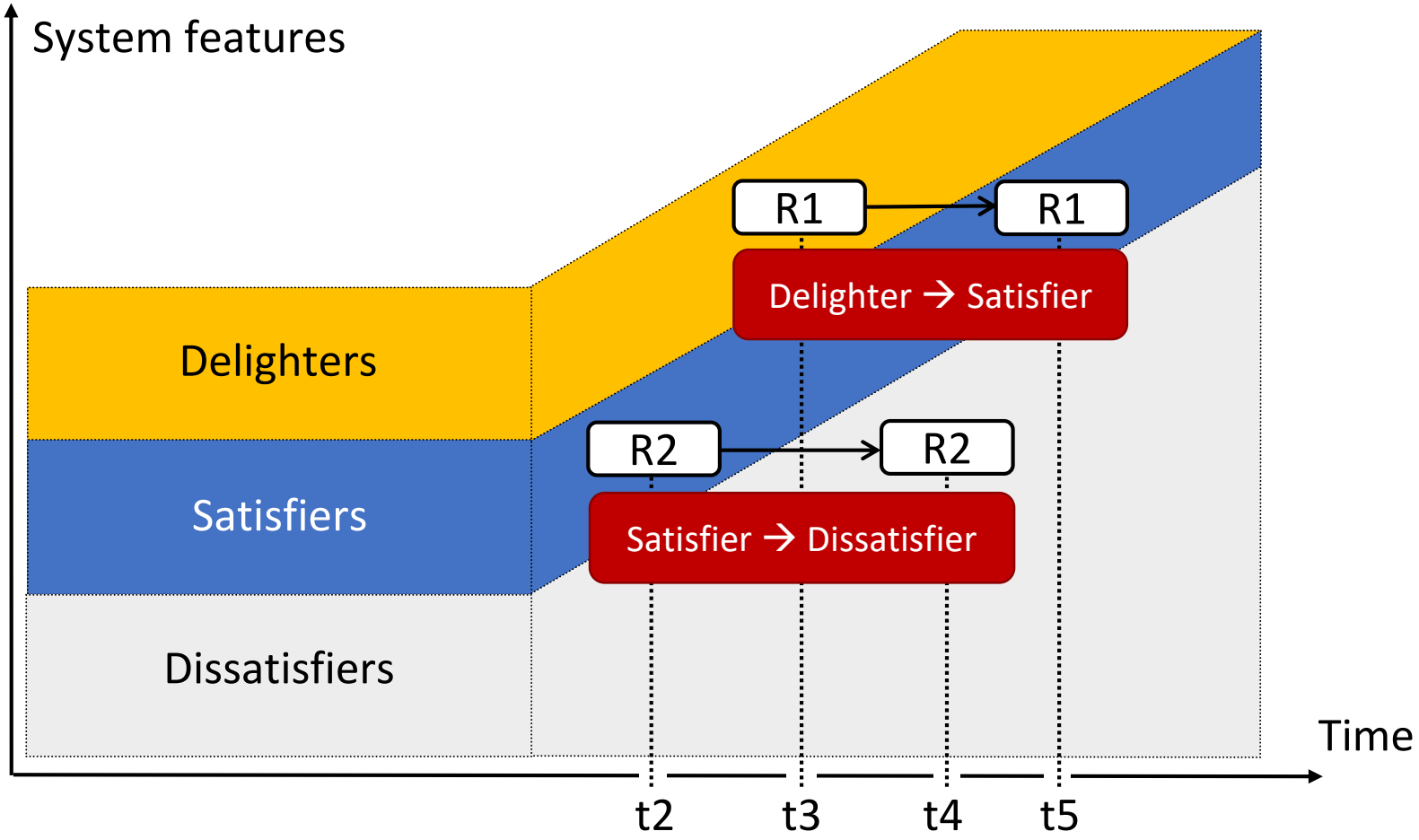
Evolution over Time



based on [Kano et al. 1984, Walden 1993]

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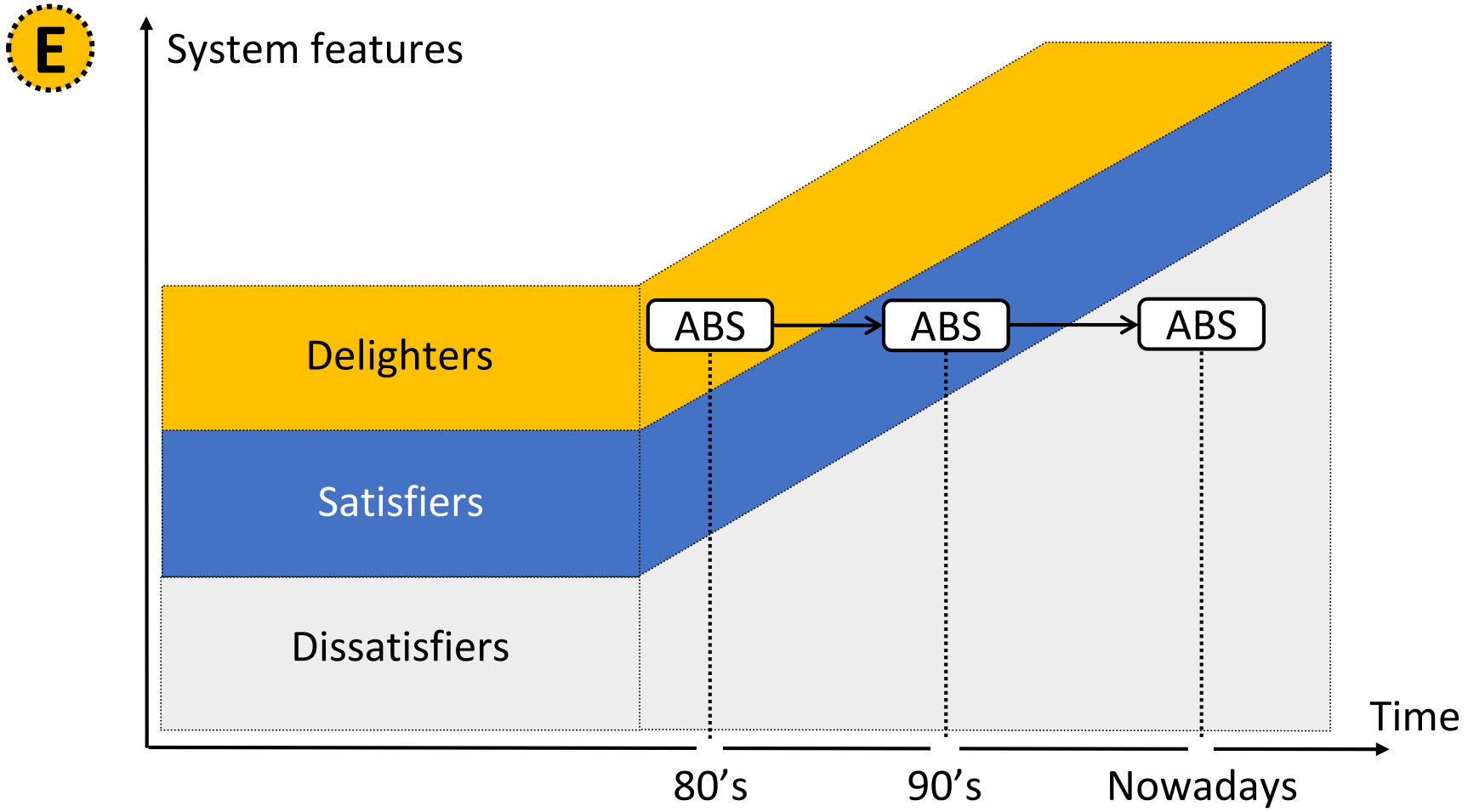
Evolution over Time – Antilock Braking System



based on [Kano et al. 1984, Walden 1993]

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Classification Process

- **Step 1**: **Identify a set of requirements** to be classified.
- **Step 2**: **Create a questionnaire** to determine for each requirement/feature how a potential customer would feel if
  - the requirement is **realized** in the system
  - the requirement is **not realized** in the system
- **Step 3**: **Analyse the answers** and calculate the average values.
- **Step 4**: **Classify** each requirement accordingly.

based on [Kano et al. 1984]

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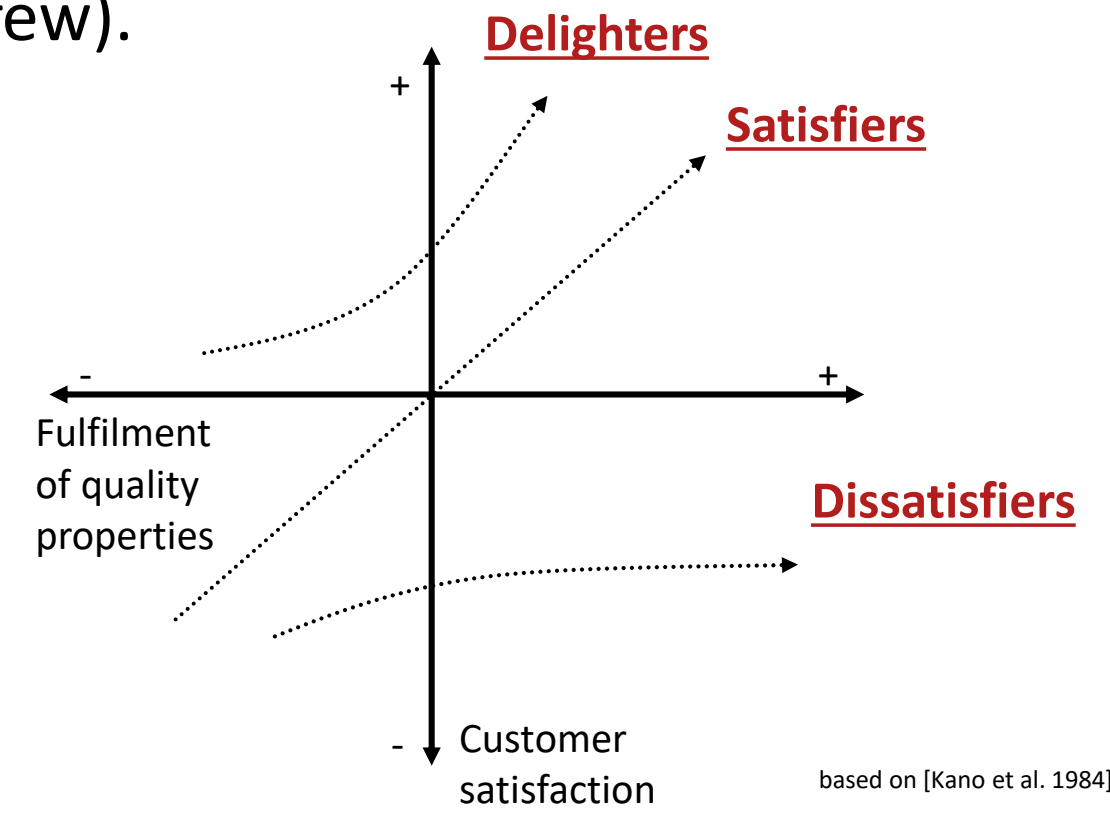
Hints for Elicitation

- **Don’t miss a dissatisfier!**
- Collect a **decent set of satisfiers** (no problem if you miss a few).
- Make sure to **include some delighters!**



based on [Kano et al. 1984]

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2. Overview of Common Elicitation Techniques

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Elicitation Techniques and Assistance Techniques

- **Elicitation techniques** support
  - the elicitation of **existing requirements**.
  - the creation of **innovative requirements**.
  - to **elicit requirements sources**.

- **Assistance techniques support** the different **elicitation techniques**, e.g., by developing new ideas or experiencing feature of the future system.

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Six Common Requirements Elicitation Techniques

- **Interview**
  Elicitation of requirements and context information from a stakeholder or a group of stakeholders.
- **Workshop**
  A group of stakeholders develops requirements for a system.
- **Focus Groups**
  A group of stakeholders focus on a specific item to identify the requirements regarding this item.
- **Observation**
  An observer elicits requirements by observing stakeholders or existing systems.
- **Questionnaire**
  A stakeholder writes down his requirements by answering predefined questions.
- **Perspective-based Reading**
  A stakeholder reads a document from a previously defined perspective, e.g., from the perspective of a user or from the perspective of a tester.

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Rough Classification

Technique	Effort	Suitable for…		
		Identifying requirement sources	Eliciting existing requirements	Developing innovative requirements
Interview	Medium to high	X	X	(X)
Workshop	High to very high	X	X	X
Focus groups	Medium to high		X	X
Observation	High to very high		X	
Questionnaire	Low to medium	X	X	
Perspective-based reading	Medium to high		X	

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Template for Descripting Elicitation Techniques

Application

1. **Preparation** (common/specific)

   Necessary actions for preparing the execution of the technique.

2. **Execution**

   Essentials of performing the technique.

3. **Follow-Up**

   Necessary actions to be executed after having performed the technique.

4. **Critical success factors**

Key characteristics

5. **Benefits** for the requirements engineering activity.

6. **Effort** as rough estimation for the application of the technique.

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3. Interviews

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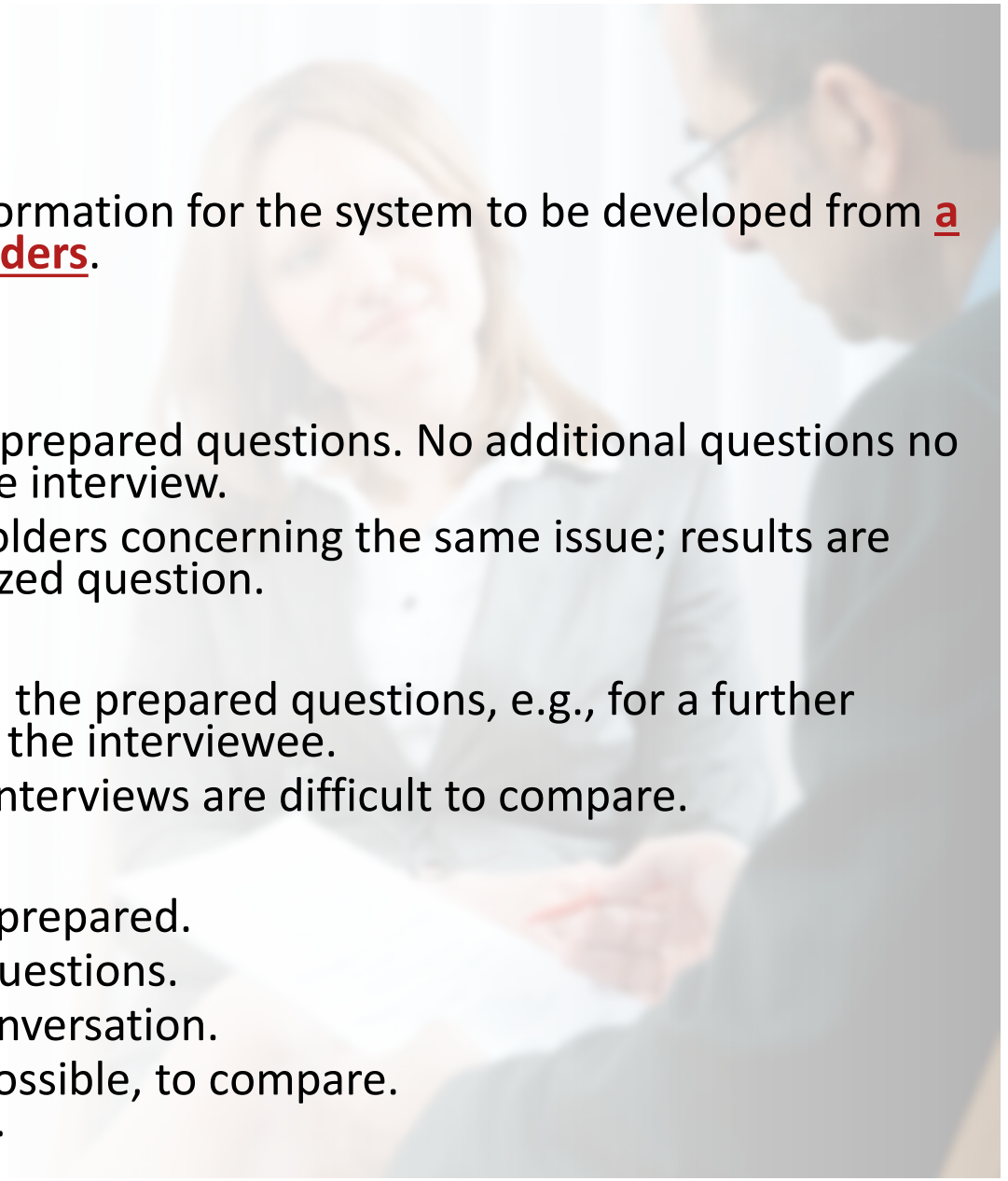
Interview



Goal: Elicit requirements and context information for the system to be developed from a stakeholder or a group of stakeholders.

Three kinds of interviews:

- **Standardized interview**
  - The interviewer strictly follows the prepared questions. No additional questions no adjustments of questions during the interview.
  - Collect opinions from many stakeholders concerning the same issue; results are easier to compare due to standardized question.
- **Exploratory interview**
  - The interviewer might deviate from the prepared questions, e.g., for a further enquiry regarding some answers of the interviewee.
  - Results from different exploratory interviews are difficult to compare.
- **Unstructured interview**
  - Typically no detailed questions are prepared.
  - The interviewer freely asks broad questions.
  - The interviewee should lead the conversation.
  - Results are very difficult, if not impossible, to compare. Well suited for exploratory settings.

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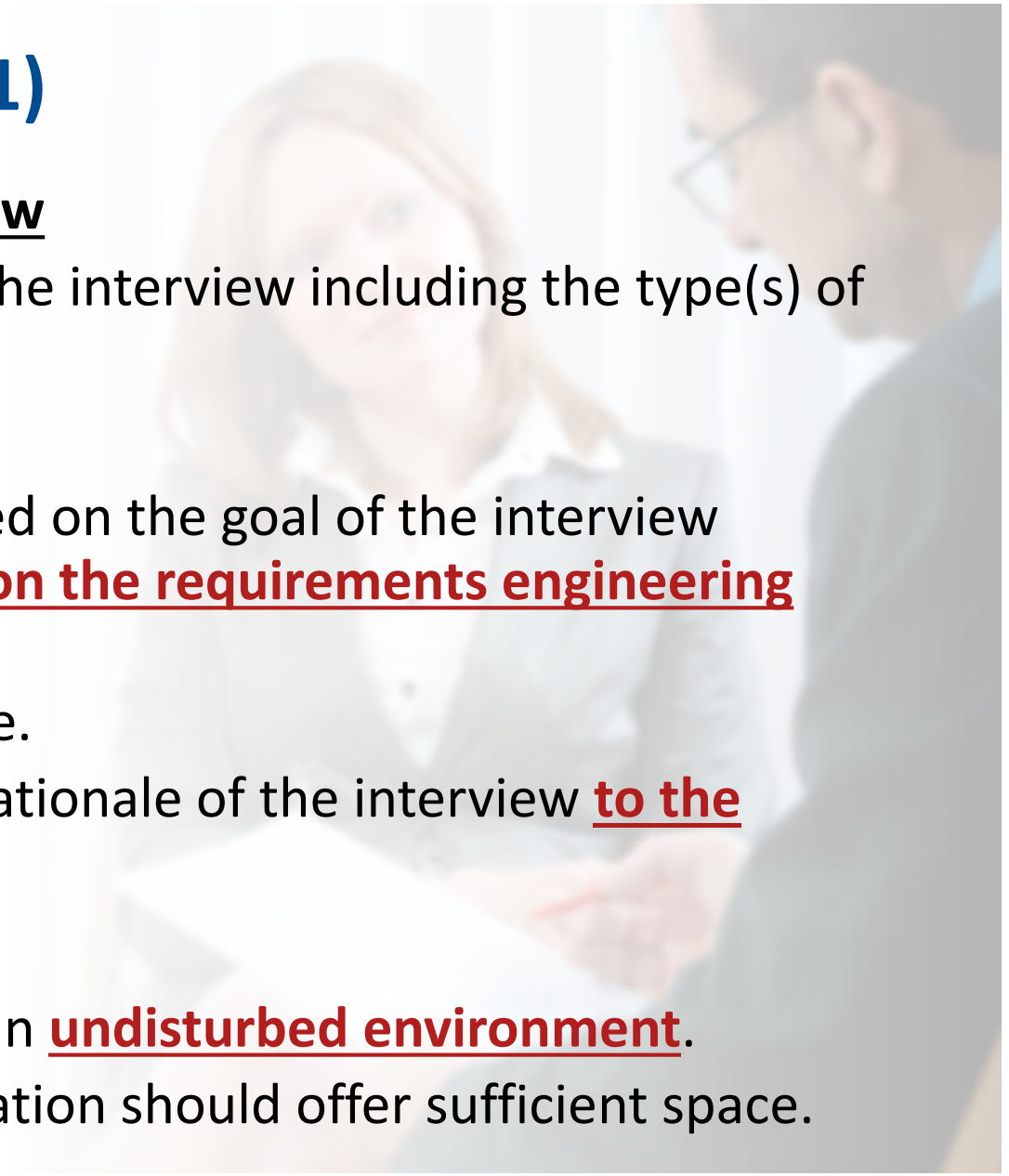
Interview – Preparation (1)



1. **Define the goal of the interview**
   - **Explicitly define the goal** of the interview including the type(s) of requirements to be elicited.
2. **Select and invite participants**
   - **Choose the participants** based on the goal of the interview considering **all perspectives on the requirements engineering context**.
   - Invite participants in due time.
   - **Communicate the goal** and rationale of the interview **to the participants** in the invitation.
3. **Choose the interview location**
   - Choose a location providing an **undisturbed environment**.
   - For group interviews, the location should offer sufficient space.

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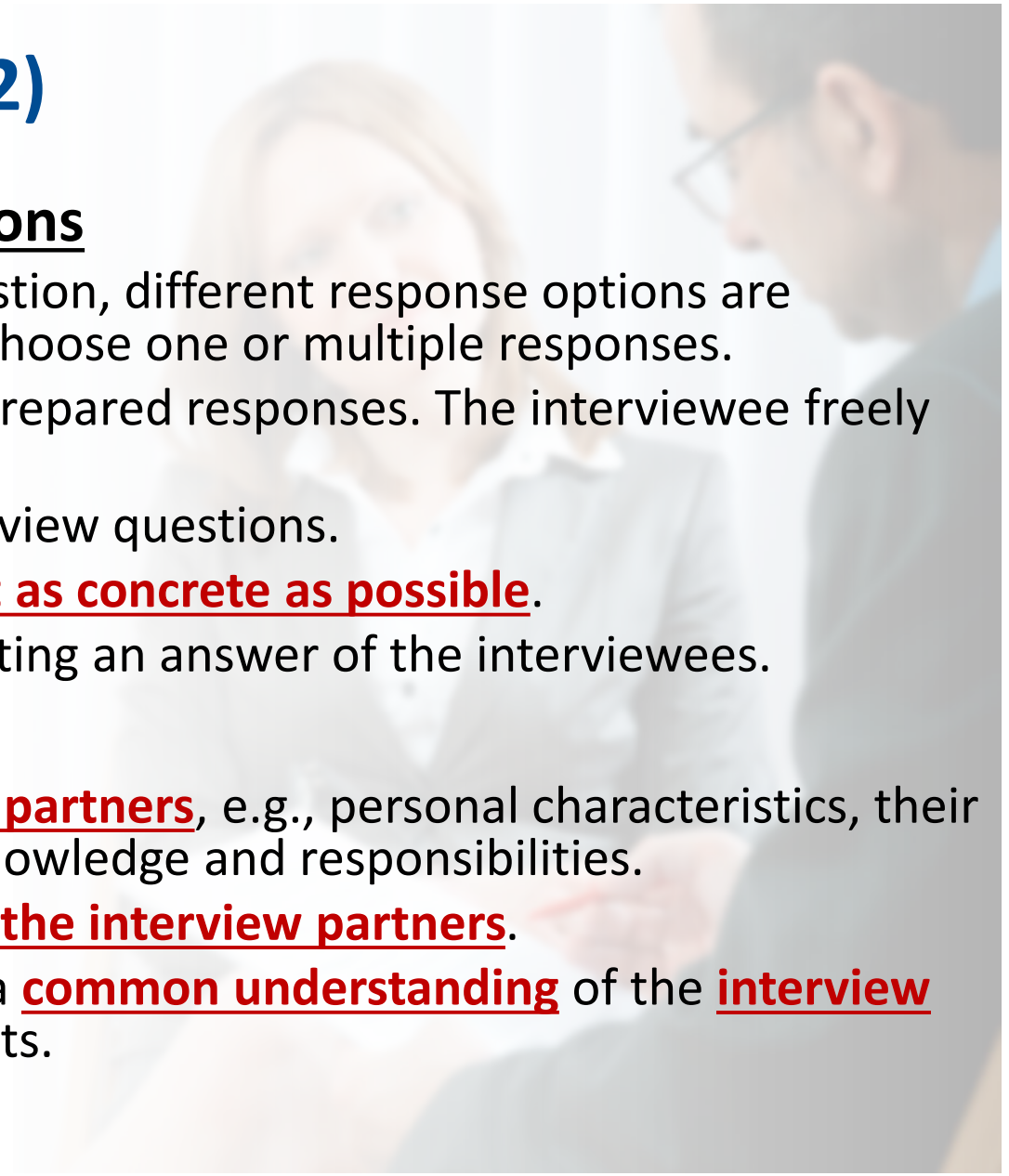
Interview – Preparation (2)



4. Define the interview questions

- **Closed questions**: For each question, different response options are provided. The interviewee can choose one or multiple responses.
- **Open questions**: There are no prepared responses. The interviewee freely answers to the questions.
- Use open as well as closed interview questions.
- Put the questions into a **context as concrete as possible**.
- **Avoid leading questions** suggesting an answer of the interviewees.

5. Prepare for the interviews

- **Get familiar with the interview partners**, e.g., personal characteristics, their role in the organization, their knowledge and responsibilities.
- Understand the **terminology of the interview partners**.
- For group interviews, establish a **common understanding** of the **interview questions** among the participants.

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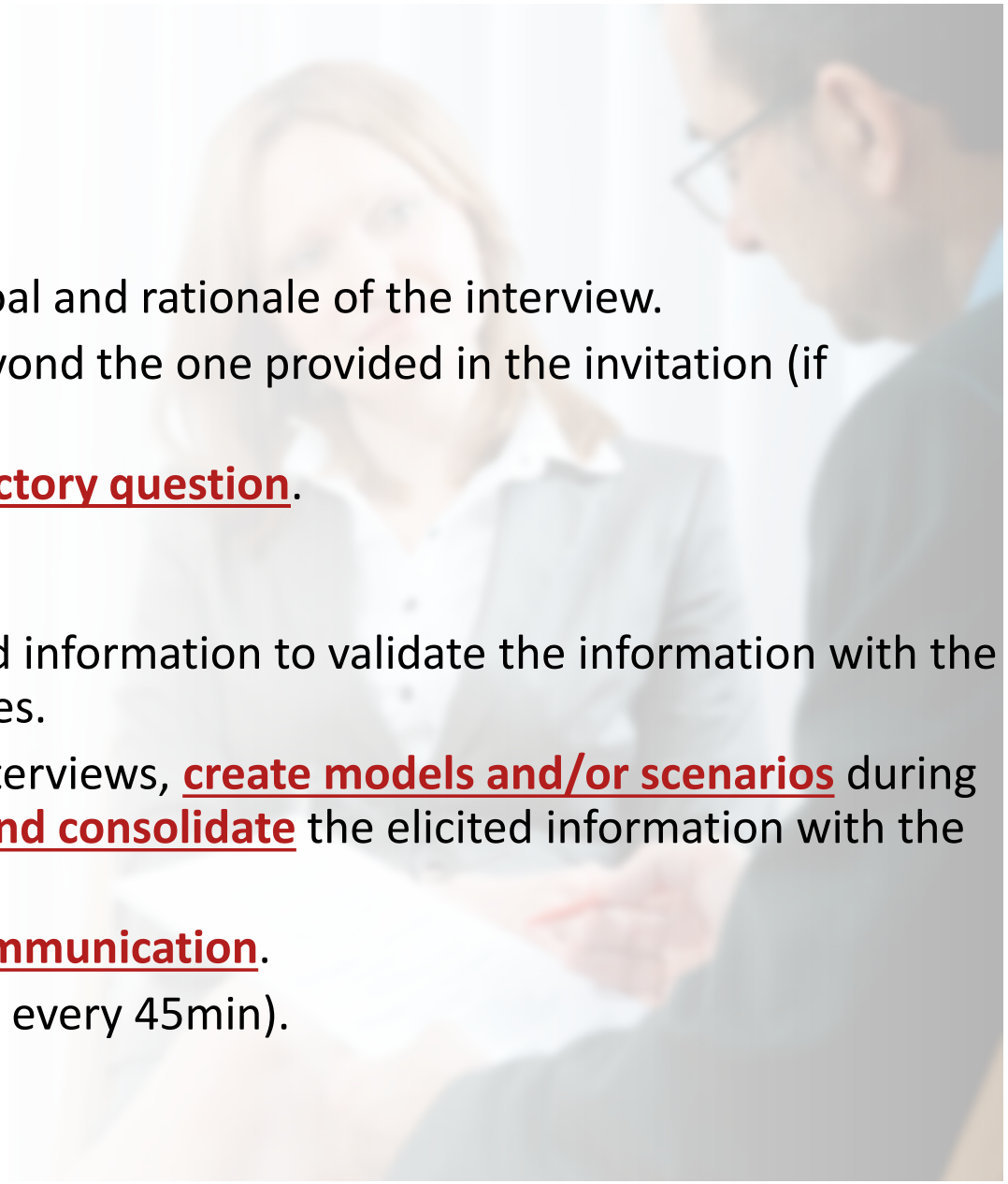
Interview – Execution (1)



1. Introduction

- At the beginning, summarize the goal and rationale of the interview.
- **Provide additional information** beyond the one provided in the invitation (if possible).
- Start the interview with an **introductory question**.

2. Main activities

- **Provide a summary** of the collected information to validate the information with the interviewee. Clarifying unclear issues.
- In **exploratory** and unstructured interviews, **create models and/or scenarios** during the interview in order to **validate and consolidate** the elicited information with the interviewee.
- Pay attention to the **non-verbal communication**.
- Take **regular breaks** (approximately every 45min).
- **Do not wander off the topic**.

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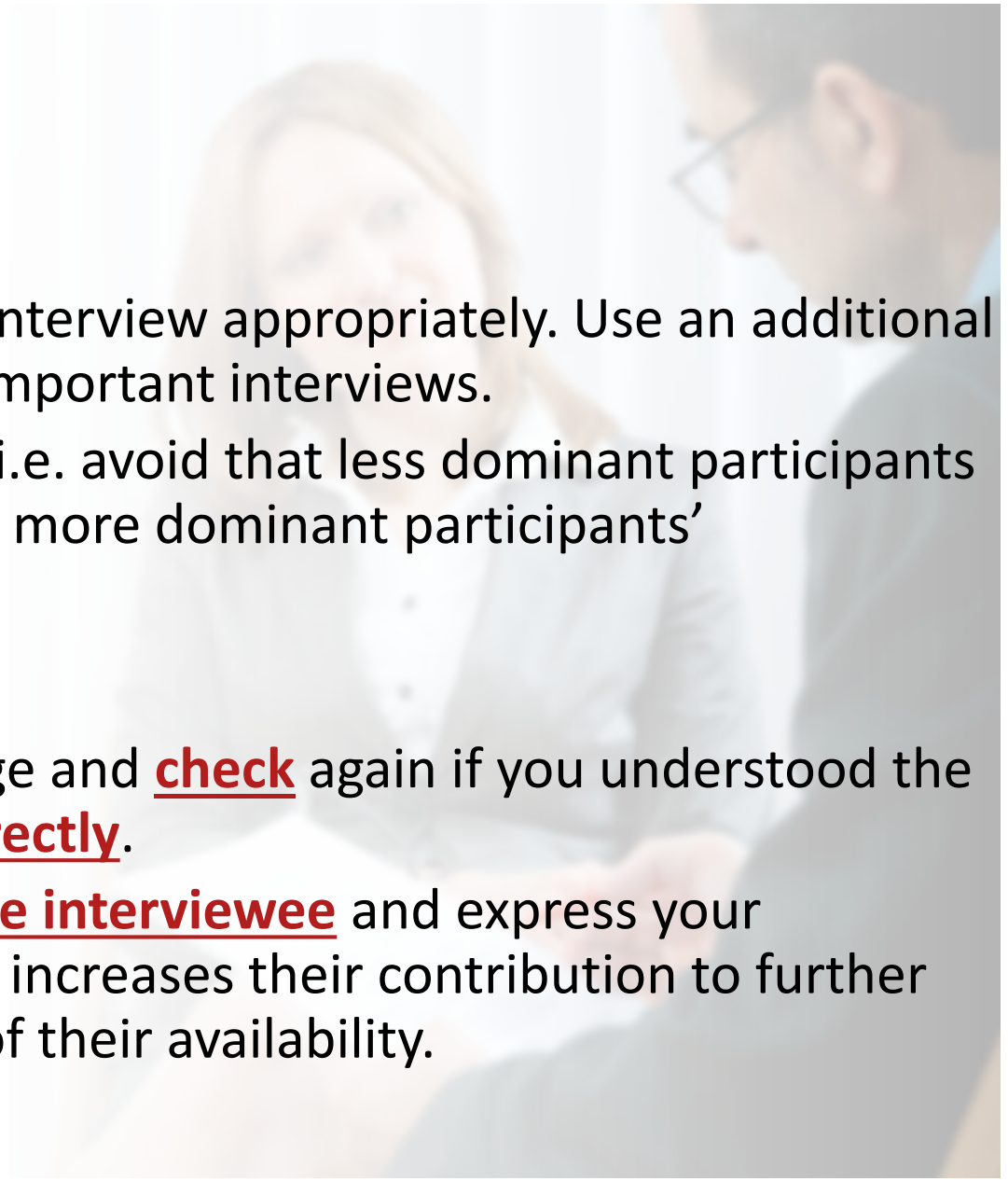
Interview – Execution (2)



2. Main activities (cont.)

- Document the results of the interview appropriately. Use an additional **minute-taker**, especially for important interviews.
- **Avoid** the **groupthink effect**, i.e. avoid that less dominant participants due (prematurely) agree with more dominant participants' suggestions.

3. Wrap-up

- **Sum up** the elicited knowledge and **check** again if you understood the interviewees **statements correctly**.
- **Value the contributions of the interviewee** and express your gratitude. Among others, this increases their contribution to further enquiries and the likelihood of their availability.

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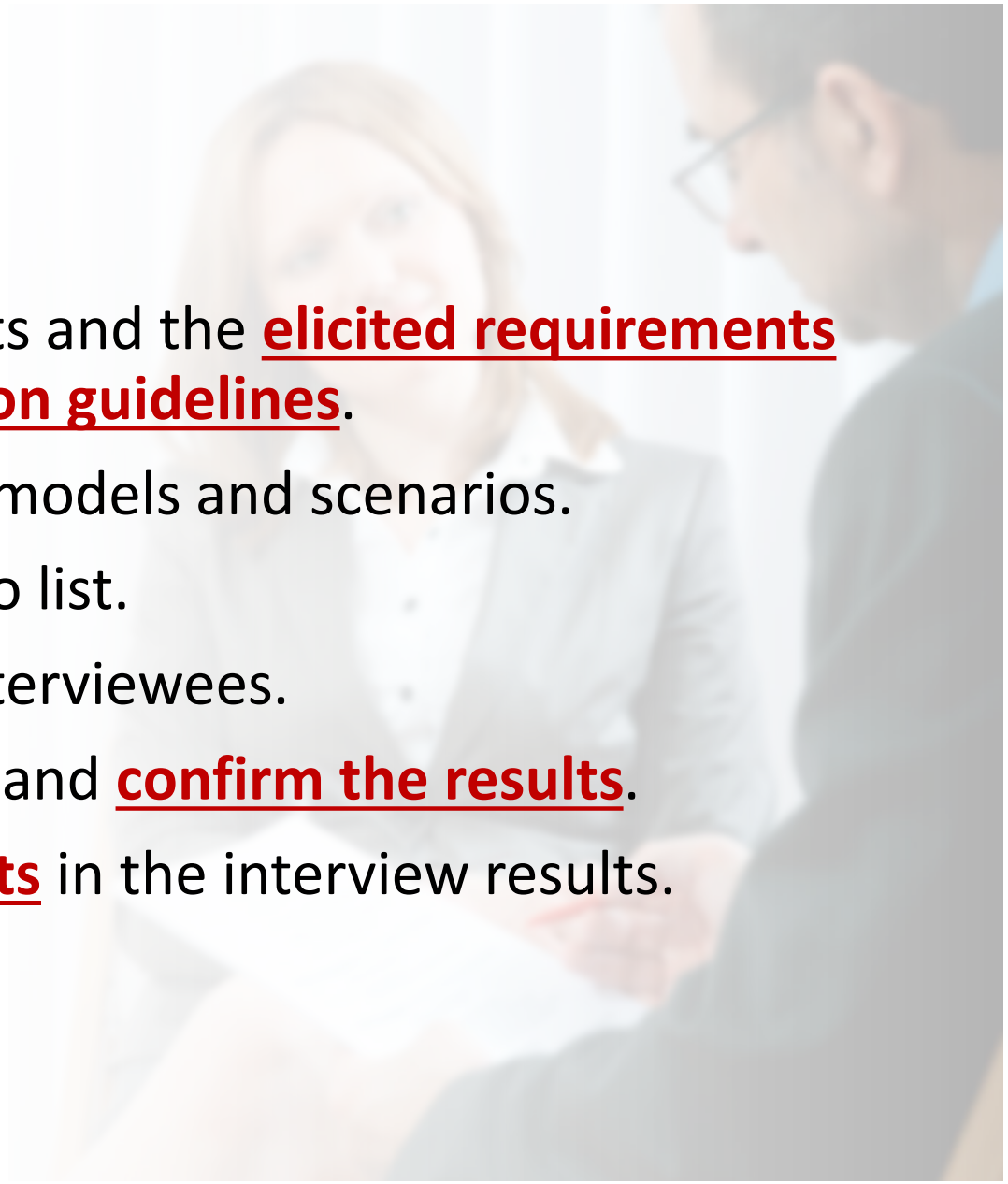
Interview – Follow-up



- Finalize the interview minutes.
- **Document** the interview results and the **elicited requirements** according to the **documentation guidelines**.
- If required, revise the created models and scenarios.
- Organize **open issues** in a to-do list.
- Distribute the results to the interviewees.
- Ask the **interviewees** to check and **confirm the results**.
- **Identify** and document **conflicts** in the interview results.

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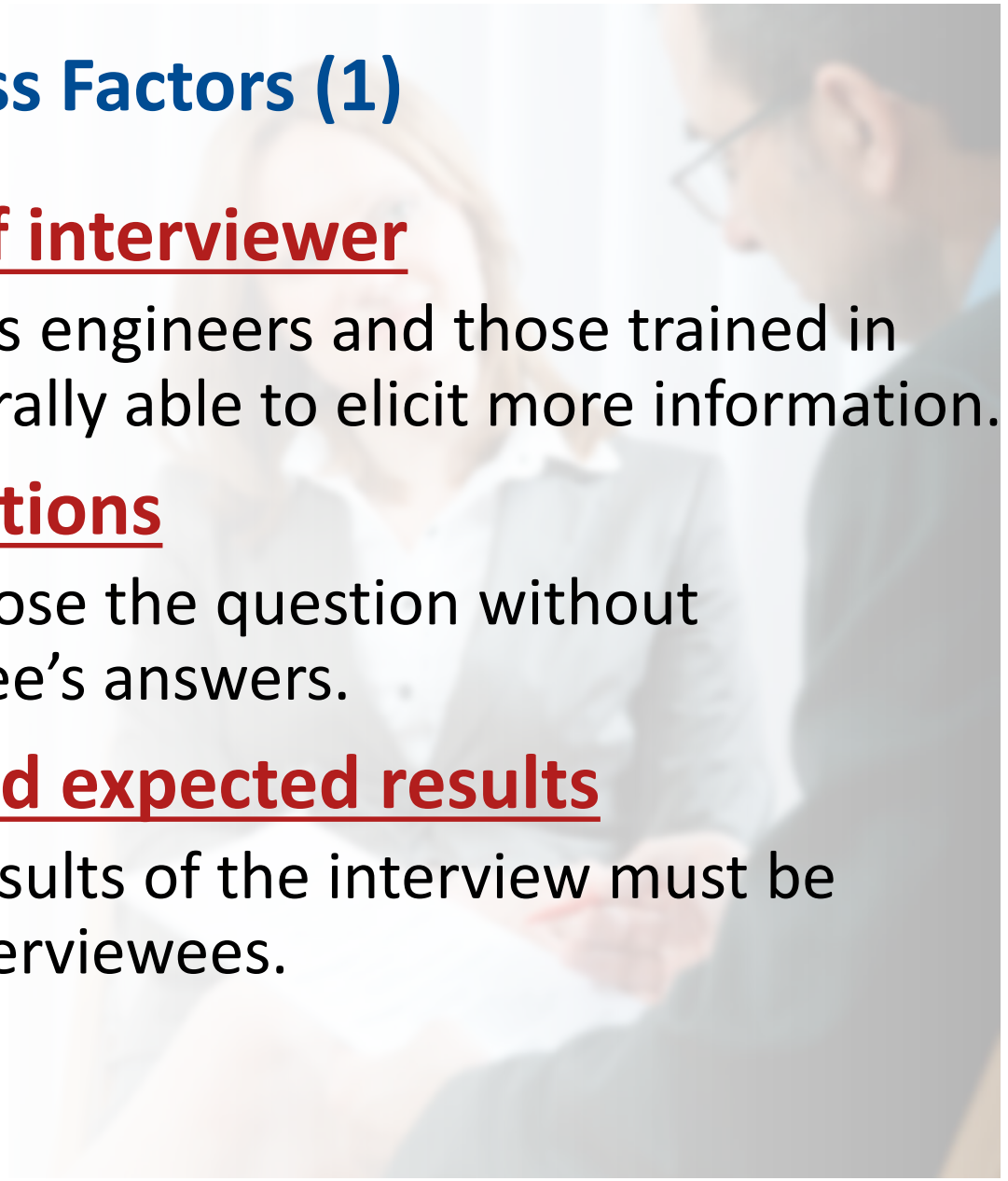
Interview – Critical Success Factors (1)



- **Communication skills of interviewer**
  - Experiences requirements engineers and those trained in communication are generally able to elicit more information.
- **Avoidance leading questions**
  - The interviewer should pose the question without suggesting the interviewee's answers.
- Clearly **defined goals and expected results**
  - The goal and expected results of the interview must be communicated to the interviewees.

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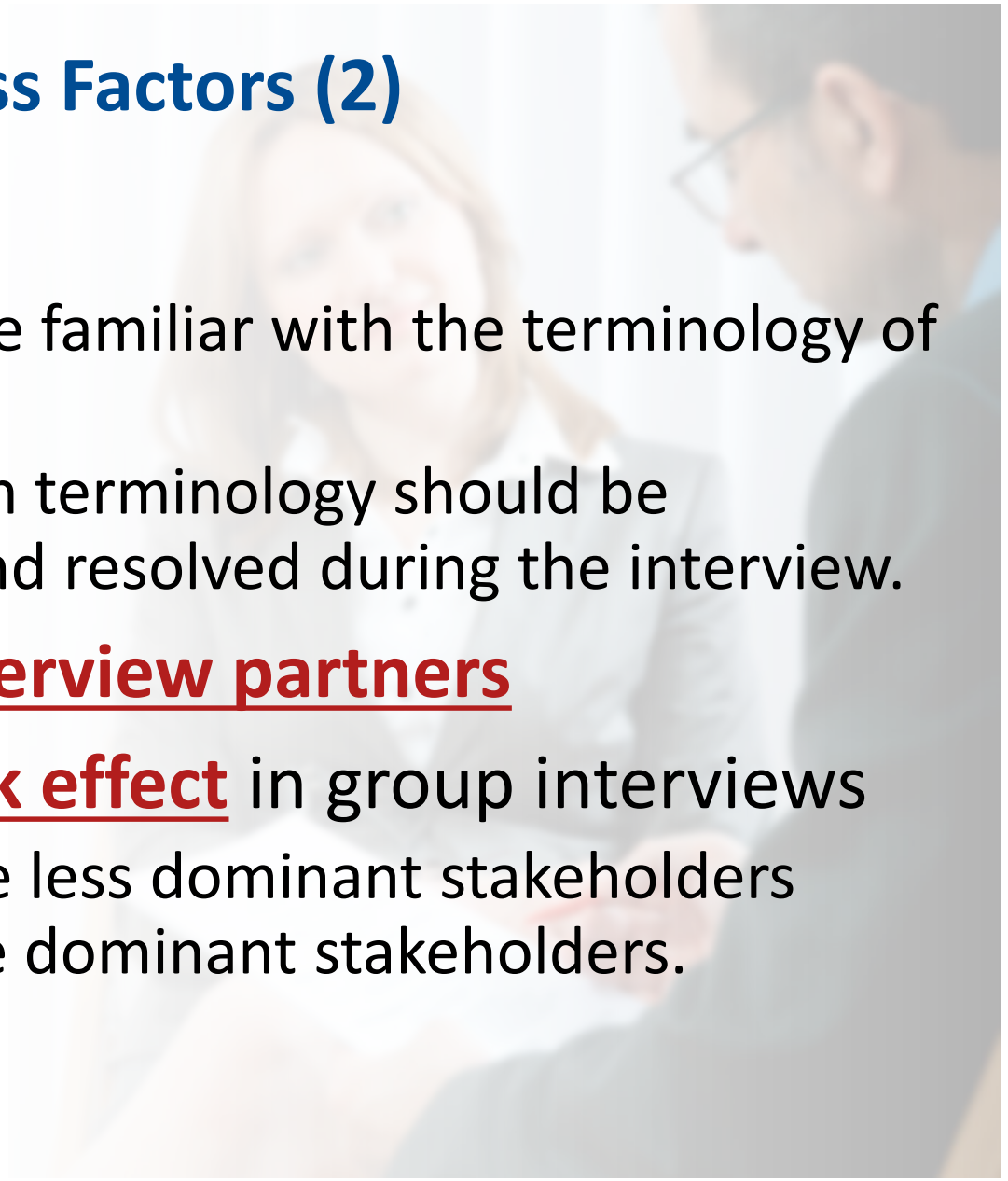
Interview – Critical Success Factors (2)



- **Common Terminology**
  - The interviewer should be familiar with the terminology of the interviewee.
  - Ambiguities or conflicts in terminology should be immediately identified and resolved during the interview.
- **Getting to know the interview partners**
- Avoidance of **groupthink effect** in group interviews
  - Consider interviewing the less dominant stakeholders separately from the more dominant stakeholders.

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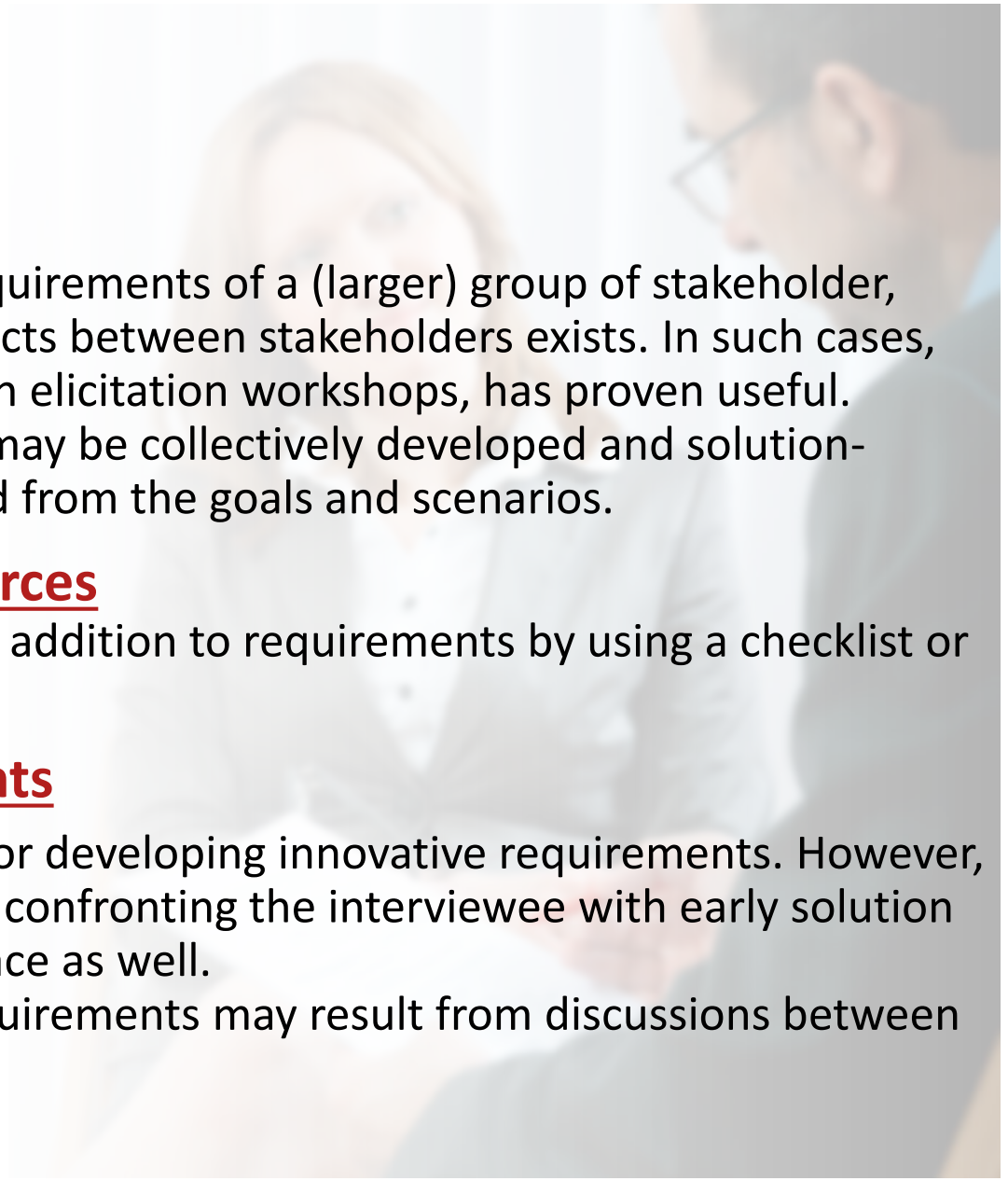
Interview – Benefits



Eliciting existing requirements

- Interviews are well suited to elicited requirements of a (larger) group of stakeholder, especially if their views differ or if conflicts between stakeholders exists. In such cases, performing interviews before running an elicitation workshops, has proven useful.
- During interviews, goals and scenarios may be collectively developed and solution-oriented requirements might be derived from the goals and scenarios.

Identification of requirements sources

- Requirements sources can be elicited in addition to requirements by using a checklist or appropriated questions.

Developing innovative requirements

- **Interviews are not** primarily **intended** for developing innovative requirements. However, by using skilful (open) questions and by confronting the interviewee with early solution ideas innovative requirements can surface as well.
- During group interviews, innovative requirements may result from discussions between the participants.

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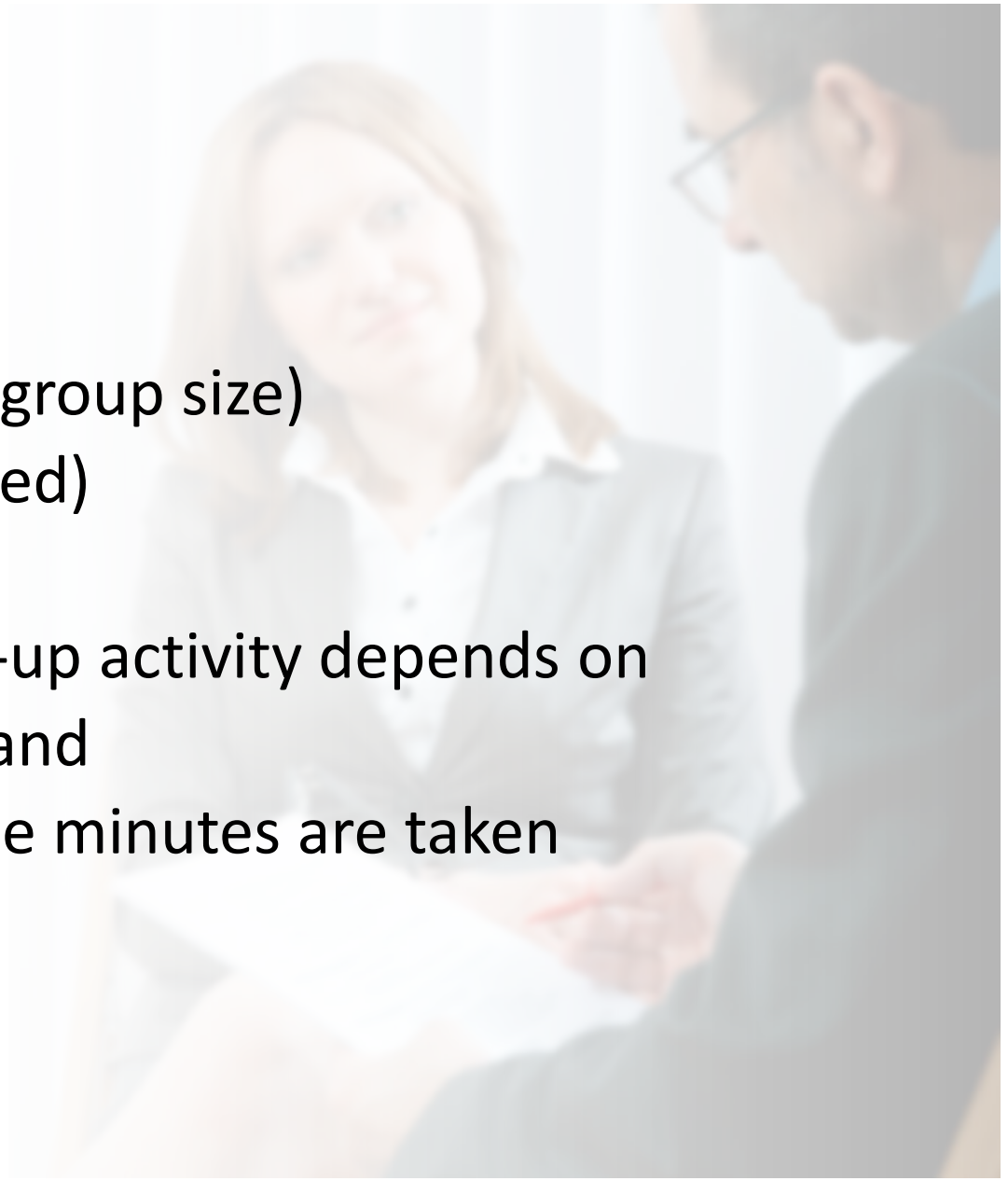
Interview – Effort



- Overall: **Medium to high**
- Depending on
  - number of interviewees (group size)
  - question style (open/closed)
  - way of taking minutes
  - Effort required for follow-up activity depends on
    - the type of interview and
    - the way of in which the minutes are taken

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4. Workshops

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Workshop

Goal: Elicit and develop requirements with **a group of stakeholders**.

- In workshops requirements are jointly developed, validated, detailed and prioritized by a group of stakeholders.
- There is **no standardized procedure** for conducting a workshop session. Each workshop session is **designed according to its purpose**
- A Workshop is typically **supported using assistant techniques**.
- A well prepared and well conducted **workshop** is a **very successful technique for eliciting existing** and **developing innovative** requirements.

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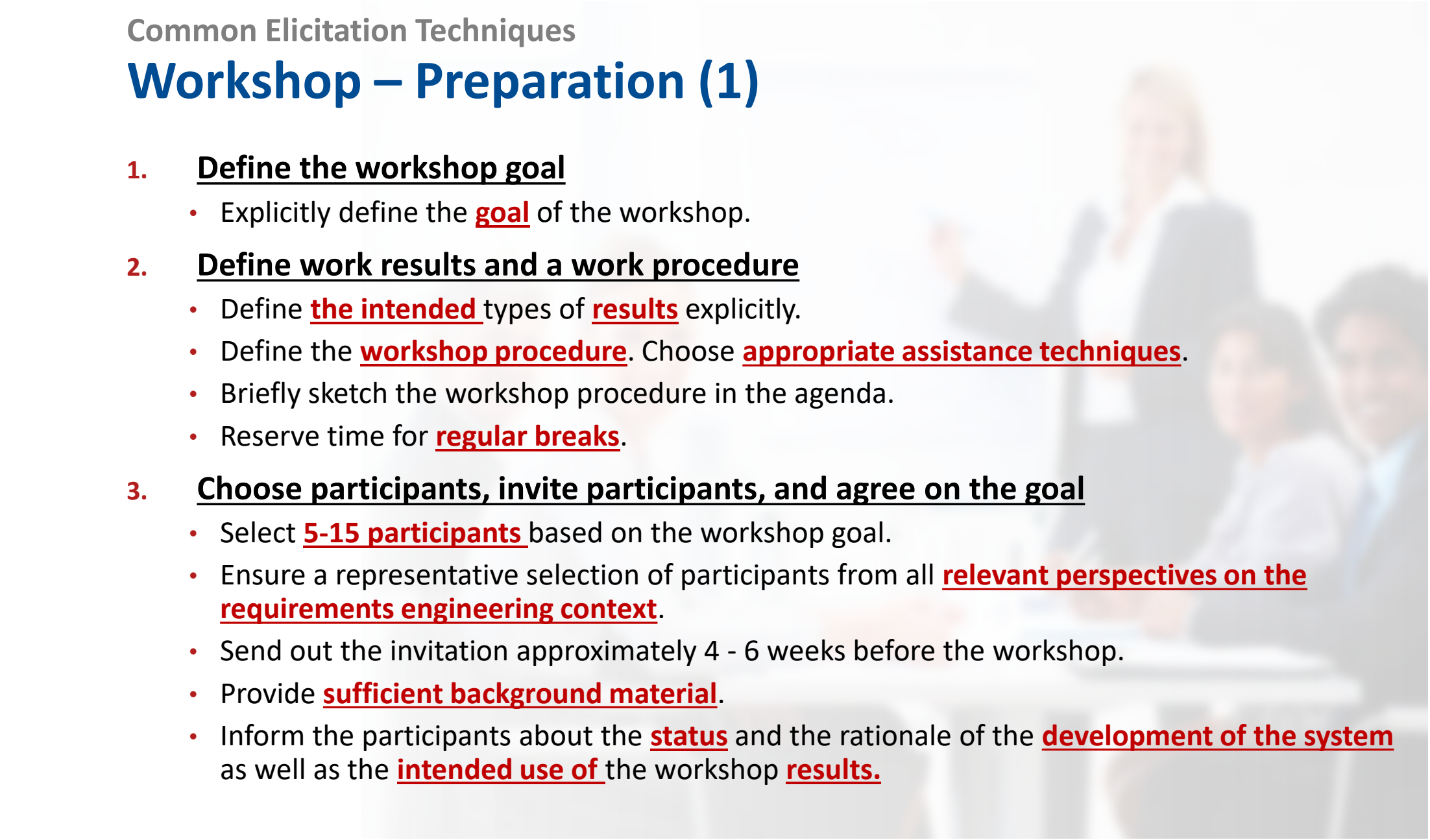
Workshop – Preparation (1)



1. **Define the workshop goal**
   - Explicitly define the **goal** of the workshop.
2. **Define work results and a work procedure**
   - Define **the intended** types of **results** explicitly.
   - Define the **workshop procedure**. Choose **appropriate assistance techniques**.
   - Briefly sketch the workshop procedure in the agenda.
   - Reserve time for **regular breaks**.
3. **Choose participants, invite participants, and agree on the goal**
   - Select **5-15 participants** based on the workshop goal.
   - Ensure a representative selection of participants from all **relevant perspectives on the requirements engineering context**.
   - Send out the invitation approximately 4 - 6 weeks before the workshop.
   - Provide **sufficient background material**.
   - Inform the participants about the **status** and the rationale of the **development of the system** as well as the **intended use of** the workshop **results.**

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Workshop – Preparation (2)

4. **Choose a workshop location**
   - Chose an adequate room which accommodates all participants and provides an **undisturbed working environment**.
   - Ensure the availability of **appropriate technical equipment** (whiteboard, projector, flipchart, etc.)
5. **Appoint a moderator**
   - The **moderator**
     - shall be able **detect conflicts** between the participants' views and support the participants in resolving these conflicts.
     - should ensure that the **activities** executed **contribute to** attaining the workshop **goal**.
     - should be accepted by all participants as an authority.
     - should be **neutral**.
   - **Conflicts and contradictions** that surface in a workshop should be regarded as **opportunities** for developing innovative ideas and solutions.
   - Invite an external moderator, if possible.
6. **Appoint a minute-taker**
   - Appoint an external **minute-taker** (preferably someone with the necessary expert knowledge), if possible.

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Workshop – Execution (1)

1. Introduction

- Present the **workshop goal**, the expected results and the agenda at the beginning of the workshop.
- Allow for a **discussion of** the workshop **goal**, the **expected results** and the agenda.
- **Explain** the **assistance techniques** to be applied during the workshop.
- Define and present the **conversation rules** for the workshop.
- Let the participants **vote on each rule**.

2. Main activities

- The moderator should ensure that the
  - participants **adhere to the agenda**.
  - participants **follow the conversation rules**.
- The minute-taker is responsible for documenting all intermediate and final results.
- Pay attention to **documenting conflicts** identified during the workshop.
- If possible, try to **resolve conflicts using negotiation techniques** (e.g. Win-Win approach).
- Document decision explicitly.

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Workshop – Execution (2)

3. Wrap-up

- Ensure that all **open issues are documented**.
- Define, if possible, a **procedure** for **resolving** each **open issue**.
- **Collect feedback** of the participants about the workshop (positive, negative, improvements).
- Thank all participants for their contributions and commitments.

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Workshop – Follow-up

- **Consolidate** the **results** of the workshop.
- Organize **open issues** in a to-do list.
- Organize **detected conflicts** and arguments in a conflict lists. Initiate actions to resolve the conflicts.
- **Distribute** the original **workshop results** (including intermediate results) together with the consolidated results to the participants.
- Ask each **participant** to **approve**
  - the original **workshop results**.
  - the **consolidated** work **results**.

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Workshop – Critical Success Factors (1)

An **excellent moderator** is key for a successful workshop.

- Recognition of **strength and weaknesses of individual participants**.
- **Skilfully involving** the participants.
- Detection and **mediation of conflicts**.

Avoid the **groupthink effect**.

Undisturbed and creative workshop location

- Interruptions should be excluded as far as possible, e.g., choose a location outside the participants' workplace.
- The location should support the participants' creativity.
- The right equipment e.g. flipcharts or whiteboards is essential.

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Workshop – Critical Success Factors (2)

Inviting the "right" participants:

- **Expertise**
  Participants must possess the right expertise with respect to the workshop goal.
- **Context coverage**
  A stakeholder relevant from each perspective on the requirements engineering context should participate.
- **Motivation**
  Participants should be motivated to contribute to the workshop goals.
- **Decision-making authority**
  The participants should have the decision-making power to decided about the requirements for the desired system.
- **Soft skills**
  The participants should have good social skills. Social skills have an impact on the workshop results.

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Workshop – Benefits

- Workshops typically **produce substantial results** in terms of
  - Development of **innovative requirements**, e.g. using brainstorming, 100-dollar-tests, etc.
  - **Identification of requirements sources**, e.g. using brainstorming
  - **Elicited existing requirements**, e.g., using iterative goal-scenario refinement in sub-groups.
  - **Alignment** and **understanding** of **different expectations** about the system.
  - Contribution to **team-building**.
  - Detection of **conflicts**.
  - **Consensus reached**.
- Splitting up in **smaller sub-group increases the effectivity** and facilitates the parallel development of different viewpoints or alternatives.

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Workshop – Effort

- **High to very high**
  - Man-hours spend during the workshop (duration of workshop multiplied by number of participants).
  - Additional preparation and follow-up effort.
  - External moderator; dedicated minute-taker.
- The high effort is often **justified by**
  - **substantial results**,
  - contribution to **team-building**,
  - **consensus** reached
  - alignment and **understanding of expectations** about the system of different stakeholders.

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5. Assistance Techniques for Elicitation

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Assistance Techniques for Requirements Elicitation

- **Brainstorming**
  Creativity technique performed with a group of stakeholders to generate a large number of potentially new/innovative ideas/requirements.
- **Prototyping**
  Prototypes allow the stakeholders to experience how the future system would look like, i.e. the experience a potential realization of their requirements.
- **KJ method**
  Supports a group of stakeholder in developing new/innovative ideas by sketching ideas on file cards and grouping the cards.
- **Mind mapping**
  Allows a easy to comprehend, structured presentation of information in graphical and textual form.
- **Elicitation checklists**
  Document relevant items for a given purpose as questions or statements to support the stakeholders (e.g., requirements source checklists, Osborn checklist to support creativity).

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Assistance Techniques for Requirements Elicitation

Technique	Effort	Suited for…		
		Identifying requirement sources	Eliciting existing requirements	Developing innovative requirements
Brainstorming	Very low	X		X
Prototyping	Depending on realization technology		X	X
KJ method	Very low	X	X	(X)
Mind mapping	Very low	X	X	X
Checklists for elicitation	Very low	X	X	X

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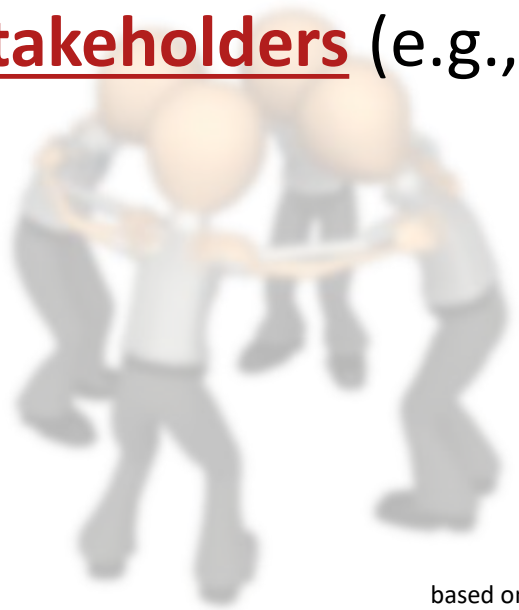
Brainstorming

Goal: Generate a large number of potential new/innovative ideas and requirements

- Brainstorming is a **creativity technique**.
- Brainstorming is performed with **a group of stakeholders** (e.g., during a workshop).



based on [Osborn 1948] [2]

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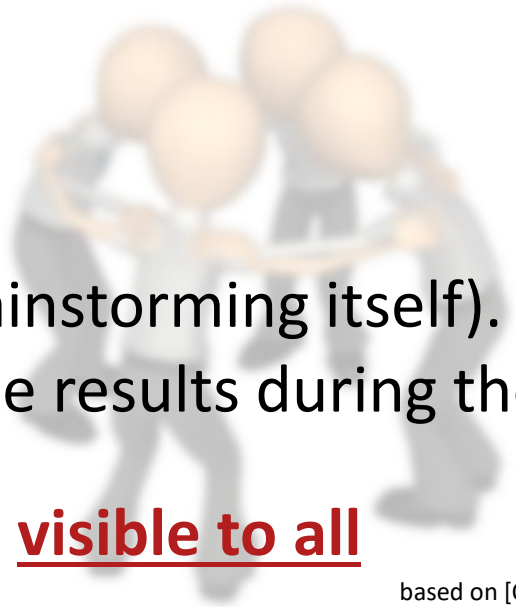
Brainstorming – Preparation

- **Define** the **subject** or problem.
- **Select** the **stakeholders** according to the brainstorming goal or subject – consider **all perspectives of the requirements engineering context**.
  - If appropriate, **focus** the brainstorming on **one perspective** of the requirements engineering context at a time to reduce complexity.
- Reserve a suitable room.
- Invite the participants.
- Provide **visualization media**.
- Appoint a **moderator** (not contributing to the brainstorming itself).
- Appoint a **minute-taker** to immediately record the results during the brainstorming.
- To **facilitate synergy** effects the **results** should be **visible to all participants immediately**.



based on [Osborn 1948] [2]

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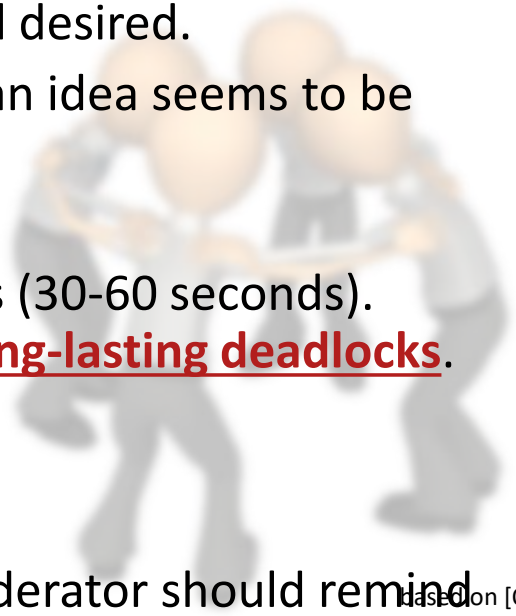
Brainstorming – Preparation

- The moderator should **explain** the **goal** of the session.
- Make the **goal** of the session **clearly visible in the room**.
- Present and **explain the brainstorming rules** to the stakeholders:
  1. **Quantity** over quality.
  2. **Free association** and **visionary thinking** are explicitly desired.
  3. Taking on and **combining expressed ideas** is allowed and desired.
  4. **Criticizing** other participants' ideas **is forbidden** even if an idea seems to be absurd.
  5. Questions for clarification are allowed.
  6. Don't stop the session if there is a long-lasting deadlocks (30-60 seconds). Stimulate the participants and **overcome at least two long-lasting deadlocks**.
  7. Wait until the brainstorming comes to a natural end.
- Let the stakeholders vote on the rules.
- If during the brainstorming a participant breaks a rule, the moderator should remind the participants of the brainstorming rules.



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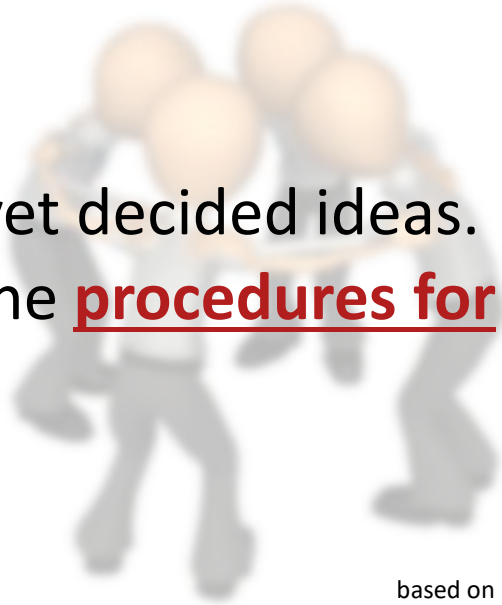
Brainstorming – Follow-up

- Go through the collected ideas and **allow clarification questions** (no discussions).
- The group **categorizes** the **collected ideas:**
  - **Usable** ideas.
  - **Not-decided** category, i.e. ideas which need to be worked on to decide if useable or not.
  - **Unusable** ideas.
- Discard unusable ideas.
- Define how to **proceed** with the usable and not-yet decided ideas.
- Create the **minutes** to **document the ideas** and the **procedures for further processing** of the ideas.
- **Distribute** the **minutes** to the participants.
- **Collect** their **feedback** to the minutes.



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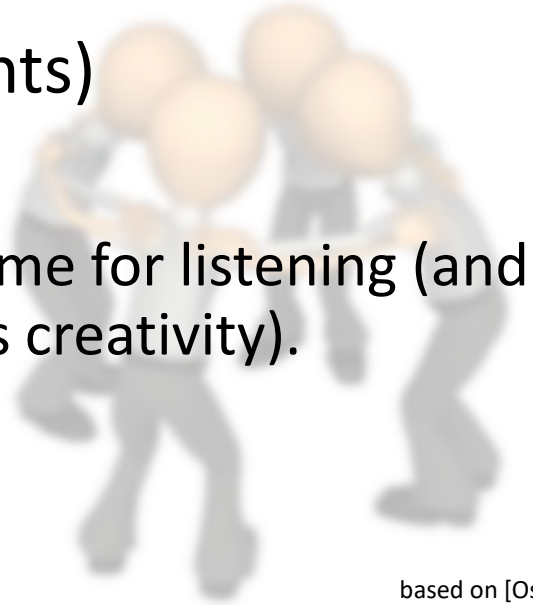
Brainstorming – Critical Success Factors

- Adherence to the **brainstorming rules**.
- **Focus** on **ONE subject** in each brainstorming session
- **Contributions from shy people**.
- **Number of participant**
  (small groups of approximately 5-8 participants)
- **Succinct description** of ideas
  - Facilitates the creation of ideas by reducing the time for listening (and thus blocks the long-term memory and stimulates creativity).



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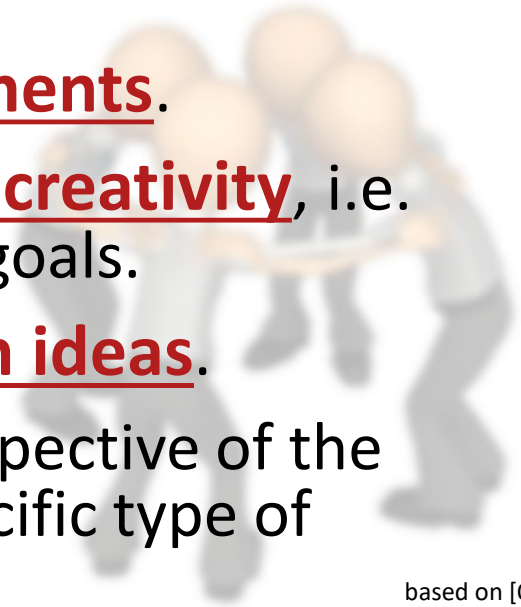
Brainstorming – Benefits

- Simple, **cheap and effective** creativity technique.
- **Stimulates the generation** of new/innovative ideas and requirements.
- Well suited for **identifying** potentially relevant **requirements sources**.
- **Not well suited for eliciting existing requirements**.
- Broad brainstorming subject creates **leeway for creativity**, i.e. supports the identification of potential relevant goals.
- Narrow subjects support **generation** of **solution ideas**.
- The brainstorming can focus on one specific perspective of the requirements engineering context or on one specific type of requirements source.



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Brainstorming – Effort

- **Very low**
  - No substantial activities for the preparation or follow-up.
  - Little time required for execution.

based on [Osborn 1948] [2]

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Summary

- The Kano classification categorizes requirements based on the impact on user satisfaction. Requirements differ in their impact on user satisfaction!
- Common elicitation techniques are used to elicit existing requirements and to develop innovative requirements. They are supported by specific assistance techniques.
- Interviews (standardized, exploratory or unstructured) are well suited to elicit requirements and context information for the system to be developed from a stakeholder or a group of stakeholders.
- A workshop is an appropriate technique for eliciting existing and developing innovative requirements.
  - There is no standardized procedure for conducting a workshop session. Each workshop session is designed according to its purpose.
- Assistance techniques, such as brainstorming, are used to support elicitation techniques.
- Brainstorming is a creativity technique, performed with a group of stakeholders (e.g., during a workshop) to generate a large number of potential new ideas/requirements.

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Legend

Definition

Example

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