12. Elementary Problem Analysis and Idea Generation

Prof. Dr. Uwe Aßmann
Softwaretechnologie
Fakultät Informatik
Technische Universität Dresden
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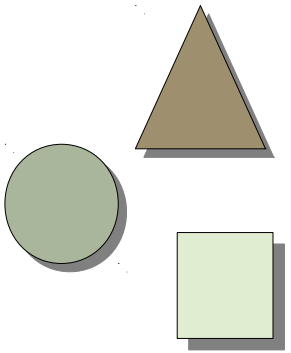
http://st.inf.tu-dresden.de/vba

1) Good Questions
2) Layered PA methods
3) Metric-based PA methods
4) Problem Analysis with POPP
5) Aspect-Oriented Question Matrices
6) Aspect-Oriented Concept Mapping
7) Writing Problem Analysis Statements, Paragraphs, Essays



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  - GTZ is a German society for development. ZOPP is a general-purpose project planning and requirements analysis method. Google for it.....

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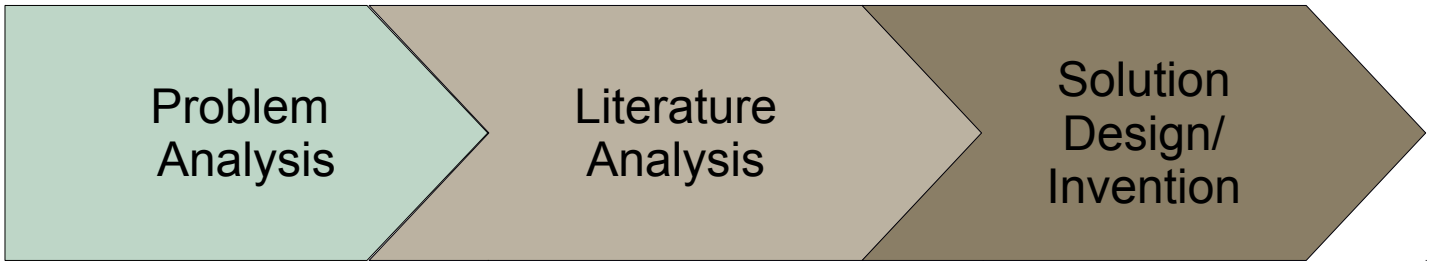
Obwohl ich diese Unterscheidungen nur zum Hausgebrauch mir zurechtgelegt habe, zur eigenen Orientierung in den verwickelten Erscheinungen meines Beobachtungskreises, muß ich hier doch ausdrücklich auf sie hinweisen, um die Gesichtspunkte meiner Ausführungen genügend erkennbar zu machen.

Ernst Abbe in Gesammelte Abhandlungen III
Vorträge, Reden und Schriften sozialpolitischen und verwandten Inhalts
Editor: S. Czapski
http://www.gutenberg.org/1/9/7/5/19755/

Eternal Problems While Inventing

- Edison tried more than 2000 different variants of the light bulb before he found a successful design in 1879
  - http://www.shapell.org/btl.aspx?2718806
- You have written the literature review – but how to find a solution for your research problem?

Use systematic methods to speed up finding a solution

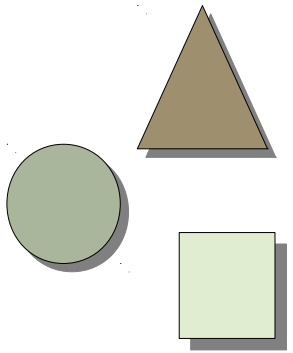


Invention and Problem Analysis

- Most often, such a problem analysis will useful for:
  - writing the introduction of your report
  - writing a problem analysis chapter
  - doing a short talk on your idea (elevator pitch)
  - presenting a convincing motivatory part of your talk
  - convince a customer of a value proposition of a product or service
  - open a startup or a new business
  - → very important for all what follows...
- Inventing a technical solution for a problem, as required by technical science, is a difficult task.
- Also, research should be relevant – how to find out?
- Important is a problem solving method, such as
  - POPP/ZOPP (Ziel-orientierte Projektplanung)
  - B-POPP (problem-blocking-factor analysis)
  - GROW (goal analysis)
  - And several more.
- These analyses help to focus the problem, develop goals for the work, find out success factors, and how to prove that the solution is working well.

12.1 Good Questions for Problem Analysis and Idea Generation

- Problem analysis is based on questions
- [Thiele, Leicher, Scherer]



... remember...

I keep six honest serving-men:
(They taught me all I knew)
Their names are What and Where and When
And How and Why and Who.
I send them over land and sea,
I send them east and west;
But after they have worked for me,
I give them all a rest.

I let them rest from nine till five.
For I am busy then,
As well as breakfast, lunch, and tea,
For they are hungry men:
But different folk have different views:
I know a person small--
She keeps ten million serving-men,
Who get no rest at all!
She sends 'em abroad on her own affairs,
From the second she opens her eyes--
One million Hows, two million Wheres,
And seven million Whys!

Rudyard Kipling „Just so stories"
http://www.gutenberg.org/cache/epub/2781/pg2781.txt

Different Types of Questions

Questions for brainstorming

- **Open questions:** basically the "honest serving men". Begin with who, why, when, which, ...
  - Good to motivate: The asked person can talk afterwards... (collect-information phase)
  - Good for idea generation, problem analysis, solution generation, papers
  - Good for concept mapping
- **Positive questions:** try to avoid negative questions, make the dialogue partner answer "Yes". They prepare other, open questions:
  - "Are there any problems on your side?" --> "What happened?"

Questions to force decisions

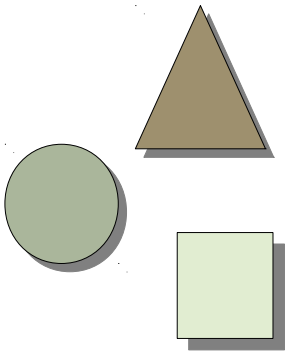
- **Closed questions:** ask for a boolean value
  - "Do you?" "Don't you?"
  - These questions force decisions and are to be answered by yes/no (commitment or conclusion phase)
  - Use rarely in papers!
- **Alternative questions** are to be answered by one of two alternatives
  - "Would you prefer alternative A or B?"
  - "is a red or blue car better?"

http://de.wikipedia.org/wiki/Fragetechnik

Maneuvering Questions – Somewhat Critical for a Paper

- **Maneuvering questions (Rangierfragen):** change the "playground", I.e, the field of discussion – do avoid further discussion on a certain subject
  - "What do you think, shouldn't we first talk about the background/side condition/cause/effects of this problem?"
  - "What do you think, how is problem X related with your problem?"
  - For dialectic, pivot paragraphs
- **Mirroring questions** mirror the attitude of the dialogue partner.
  - "So you think that this solution is not appropriate for your problem?"
  - "This means that you think that this is not your main problem?"
  - Mirroring questions transform statements into questions
  - "Our competitor is too expensive." --> "Do you also feel that our competitor is too expensive?"
- **Suggestive questions** are rhetoric, that is, not real questions, but pseudo questions
  - "Is it true that you are interested to simplify your production?"
  - Handle them with care, because they can create anger
  - Suggestive questions are dangerous, because they can make the reader angry

12.1.1 Good Problem Questions for Problem Analysis



Problem Questions are Good for Problem Analysis

- A **problem question** analyzes together with the dialogue partner (reader, listener, customer, etc.) his problems.
  - Problem questions clear the mind of the dialogue partner
  - Show him the situation more clear
  - Create interest
  - Problem questions lead to ZOPP-like development schemes
  - Examples
    - "Which functionality is your product lacking?"
    - "Which problems do you have with the tool you use these days?"
- A **blocking-factor (hindrance) question** analyzes why an objective of the dialogue partner cannot be reached
  - „What is disturbing with your supplier?"
  - "What are the obstacles to automate this function?"

State Questions for Setting the Scene in Introductions

- A **state question** asks the dialogue partner (customer) about his/her state of affairs
  - „How can I help you?"
  - „Which functions are you interested in?"
  - „With which supplier do you work these days?"
  - „How large is your budget?"
  - „How is the decision process?"
- State questions are asked first, to enter the discussion
- **State paragraphs (setting-the-scene paragraphs)** discuss a state question in the introduction, for setting the scene

- A **summarization question** summarizes the results of the analysis and attempts to get the agreement with the customer about the analysis
- For your summary or intro

Effect Questions (Auswirkungsfragen)

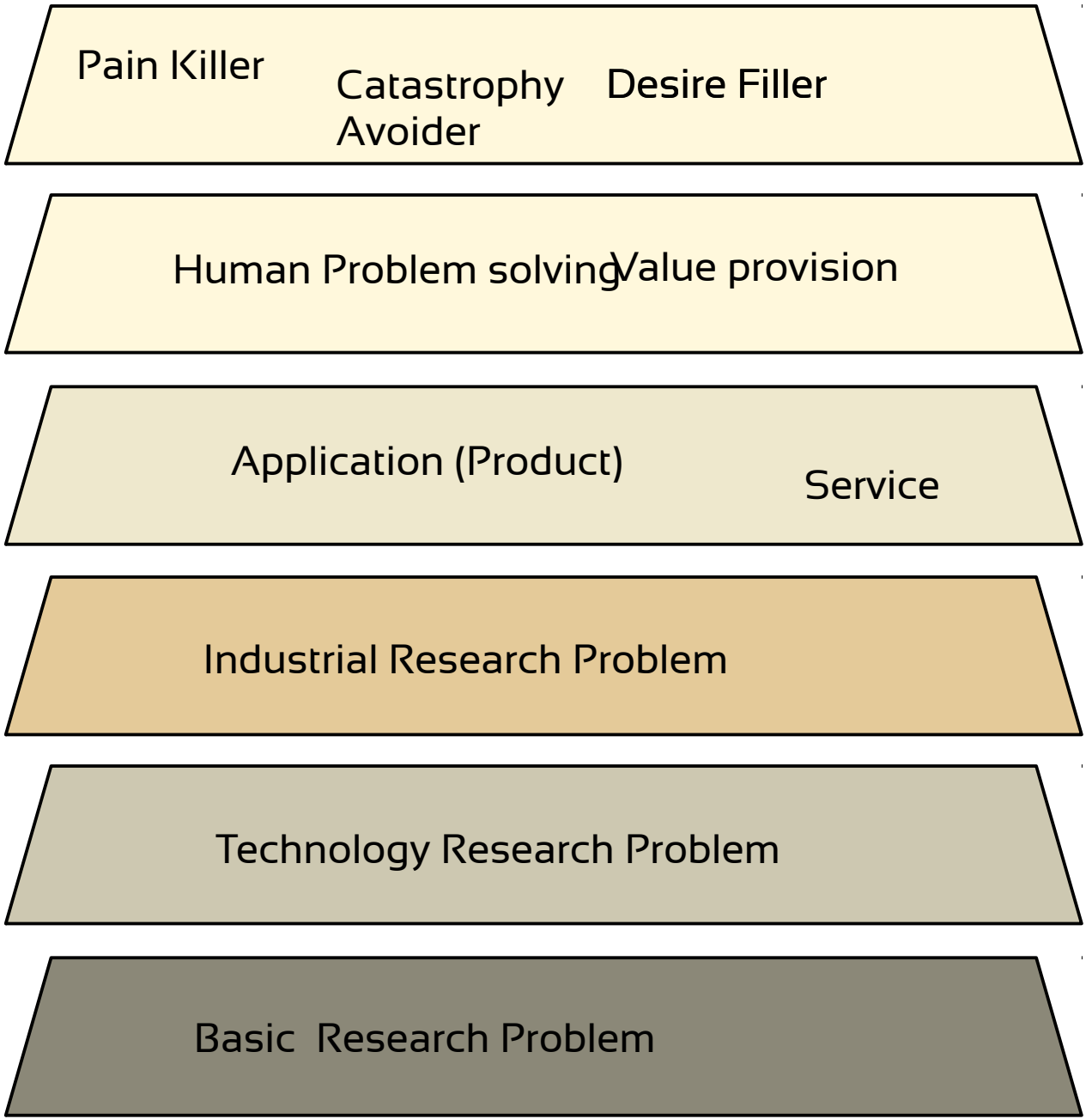
- An **effect question** analyzes together with the dialogue partner the effect of his problems and the consequences of his decisions.
  - It opens a cause-effect analysis (CEA), part of problem analysis
- Effect questions are extremely important for selling something
  - Visualize the effects of the current situation to the customer
  - Look into the future
  - Highlight trends and developments
  - Bring the customer the insight that he must solve his problem
- Examples for positive effects
  - „What is the significance of this problem with your supplier?“
  - Which other problems would this cure?
  - What should be changed to increase the effictivity of this tool?
  - What does the solution of your problem mean to the win/balance of your company?
- Examples for negative effects
  - „What is the significance if this problem is not solved?“
  - Which other problems would result if this is not solved?
  - Supposed you leave it like it is, what would result?

Benefit Questions

- A **benefit question (usefulness question)** is a special type of effect question, highlighting a benefit to the dialogue partner.
  - „Which additional space could you win buying this new machine?“
  - “Which advantages will you get from introducing this new technology?”
  - “which group of people will benefit from this new technology?” (Who)
- Benefit questions are very important to find a selling argument, USP, or technical science hypothesis
- **Olympic questions:** faster, higher, farer
  - “what do you gain with this method?” “How far do you come with this?” “How much faster are you?”
  - „How would the win of your company rise, given you buy this machine?“
- **Efficiency questions:** How much better will it be?
  - “when will you be able to achieve turnaround with this method”
  - “what do you think about this simplification?”

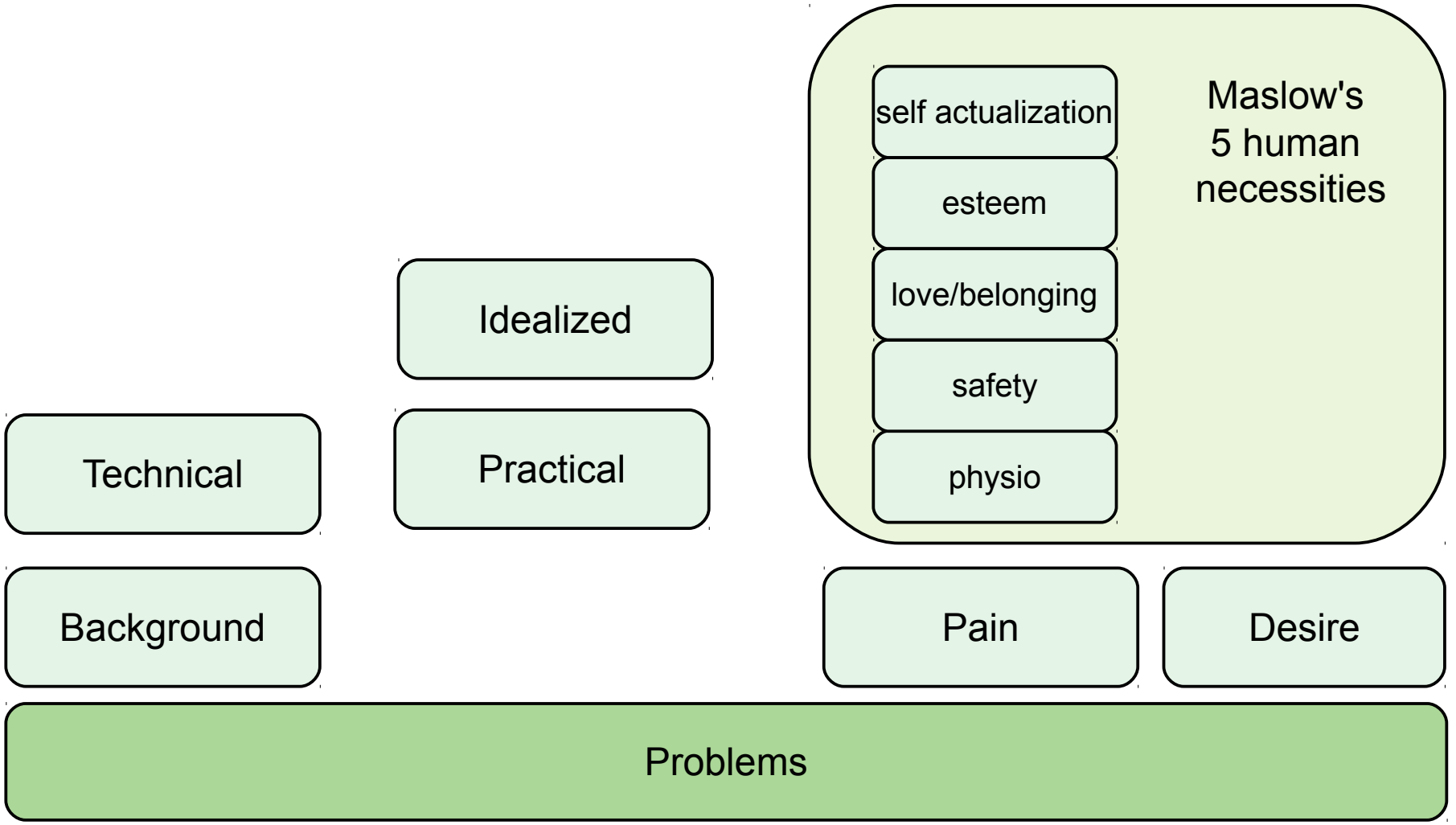
Effect and Benefit questions are very important because they lead to controlling ideas of texts and talks.

Business Pyramid of Problems



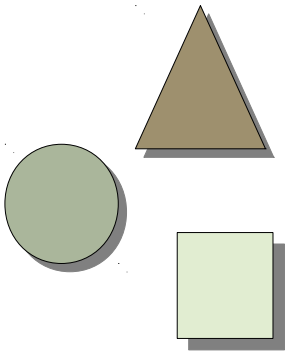
Different Kinds of Problems and Pains

- Different forms of problems generate different questions



http://en.wikipedia.org/wiki/Maslow%27s_hierarchy_of_needs

12.2. Layered PA Methods



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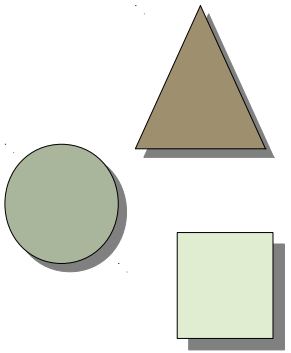
12.2.1 Problem Analysis ToPAsQO with Topic Fans (Themenfächer)

From [Esselborn-Krumbiegel]

It's not tabasco, but tobasqo



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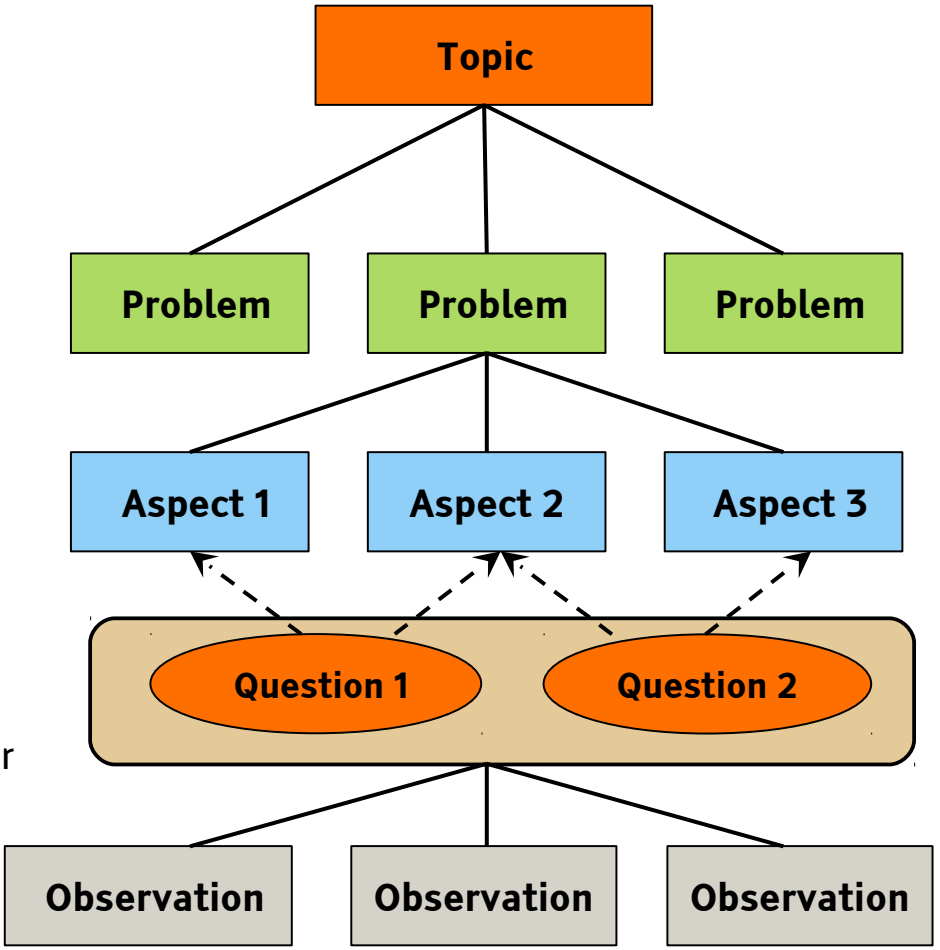
Find and Scope Topics with Topic Fans

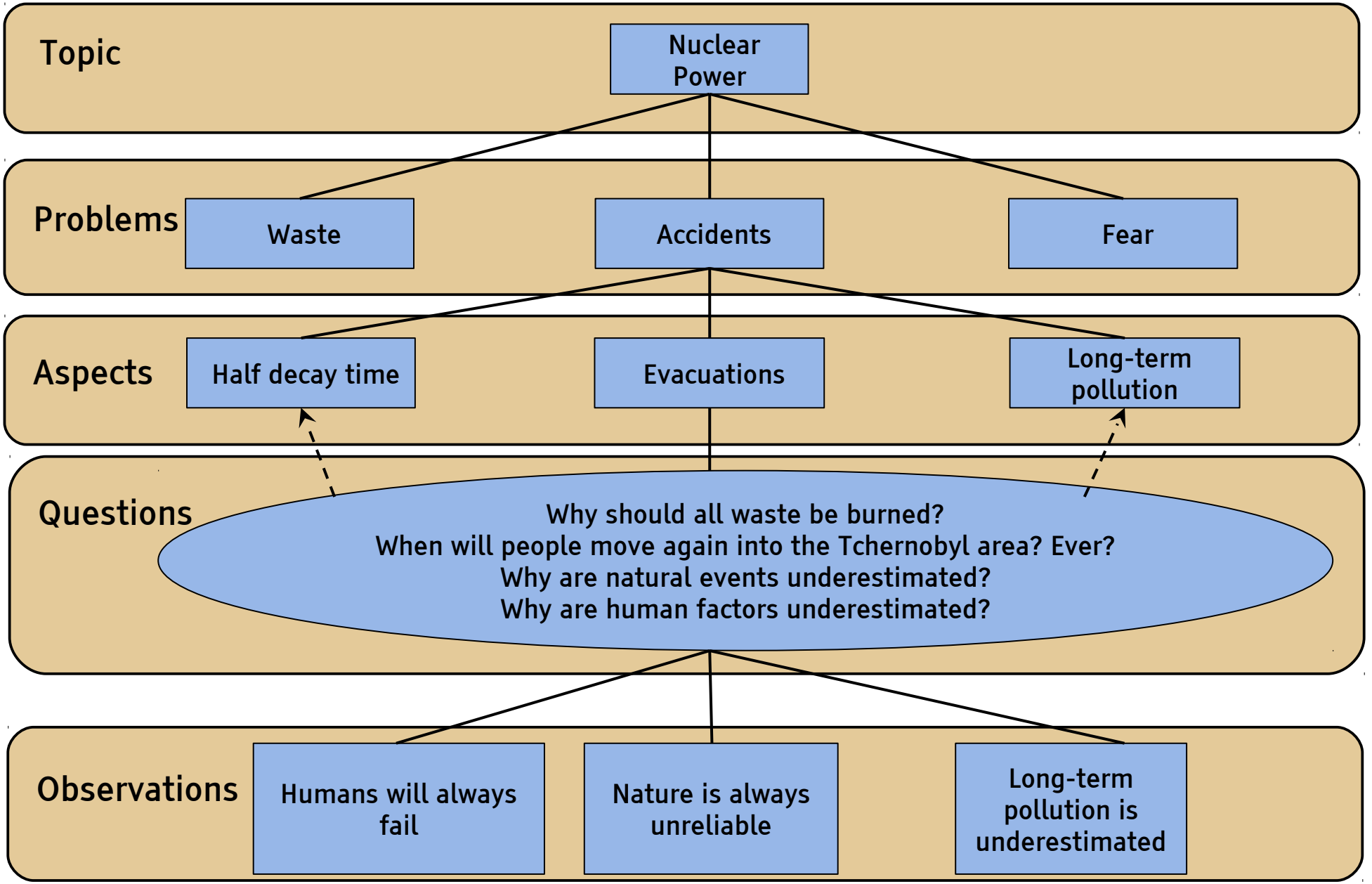
- The topic fan method is a problem analysis method between POPP and GQM
- It is a **layered method**
- It finds initial hypotheses for essays [Esselborn-Krumbiegel]
  - You may start the process of a paper with Topic Fans
  - It combines analyses the problems of a problem area, by asking problems about the problems.
- Objective:
  - Finding hypotheses for essays by a problem-aspect-question analysis of a topic (ToPAQO)
  - Analyzing texts and their topics
- Collection of aspects of the problem and related questions
- Topic fan is a **level-normalized concept map**

Topic Fans with Problem-Aspect-Question-Observation Levels (ToPAsQO)

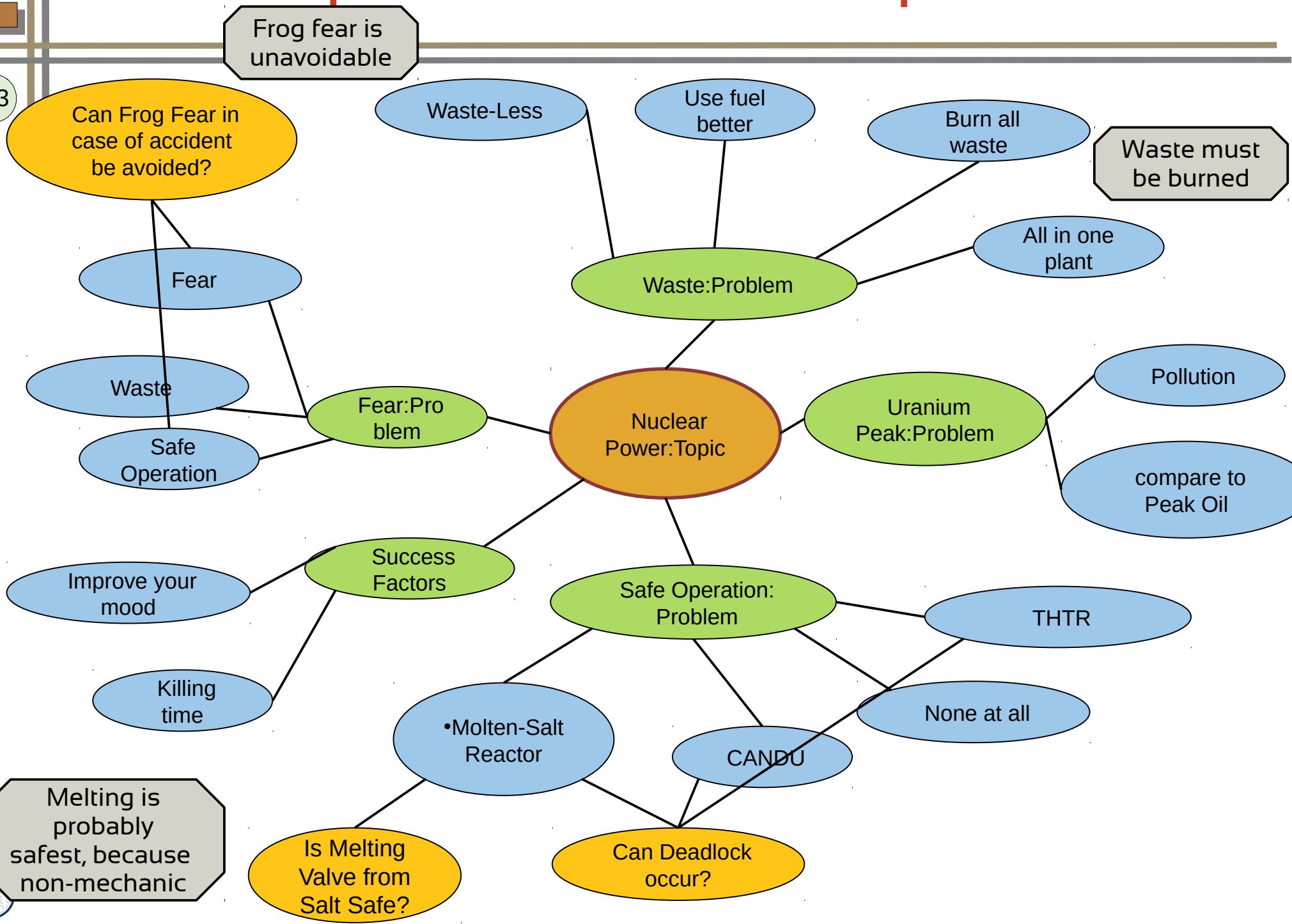
- Topic (To)
- Problems (P)
  - related to the topic
- Problem-related Aspects (As)
  - related to the problems
  - related to the context of the investigation
- Questions (Q?)
  - Questions to one or several aspects
  - Interacting aspects
- Observations (O) as initial hypotheses
  - Potential answers to questions
  - Observations to questions
  - Initial assumptions or hypotheses for further resurch



Example: ToPAsQO Topic Fan "Hypotheses about Nuclear Power"

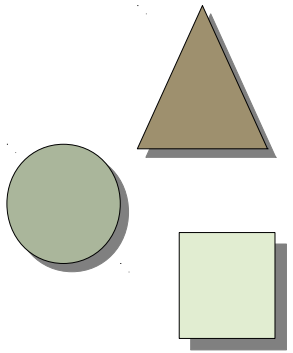


ToPAsCo Topic Fan in Form of Mindmap



12.2.2 Analogy Spirals (Morphological Spirals)

- For problems, solutions, product features, many more



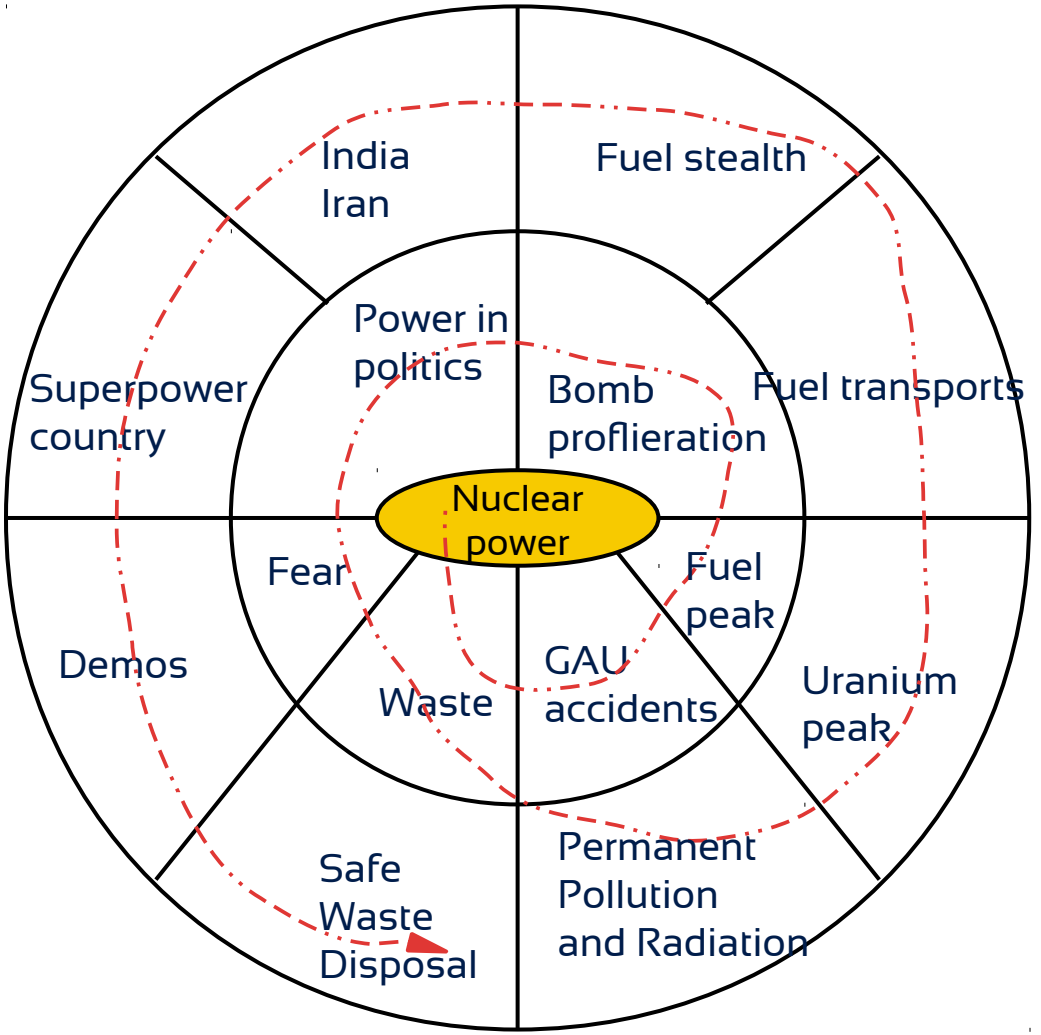
[Esselborn-Krummbiegel]

Analogy Spiral (Analogierad, Morphological Spiral)

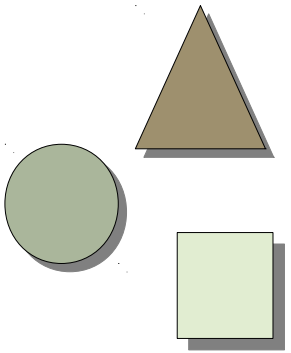
- **Objective:** Find relations and connections between aspects of a concept, idea, problem, solution, product feature
- Order associations in a set of *rings* or spirals
  - Find similar associations to the already fixed concepts
- Advantage:
  - Every ring has a certain abstraction level
  - All entries of a ring are associated again with corresponding concepts on another ring, i.e., abstraction level

Example: Analogy Spiral (Morphological Spiral) "Nuclear Power"

- Find out structural features (Merkmale) of an idea, a concept, a problem, an objective
- Recognize and associate similar and typical features, with increasing level of detail
- Go round in a spiral from inside to outside
  - Associate concepts and features
  - more and more concrete and detailed
- Note: **topic fans are topic-based analogy spirals with structured rings**



12.2.3. Metric-Based Methods



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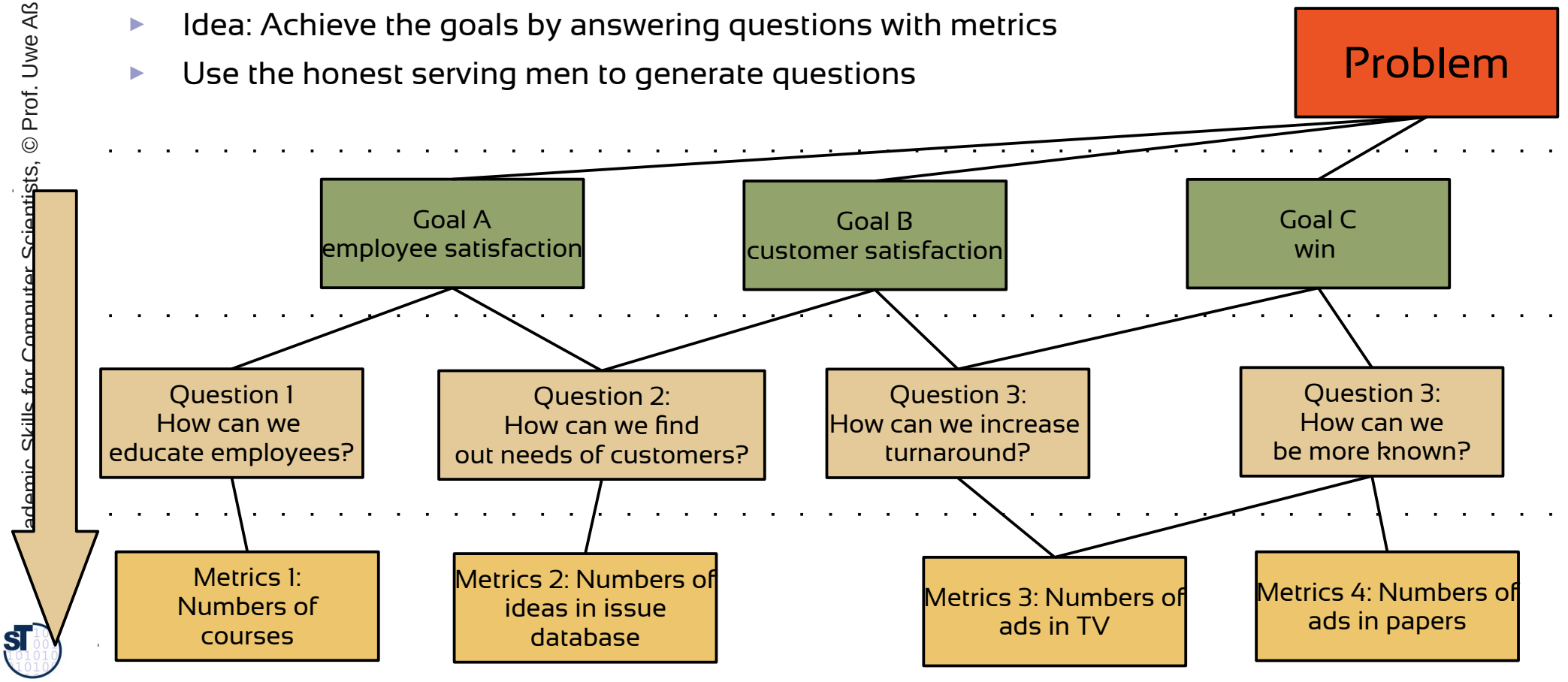
Goal-Question-Metric Approach (GQM)

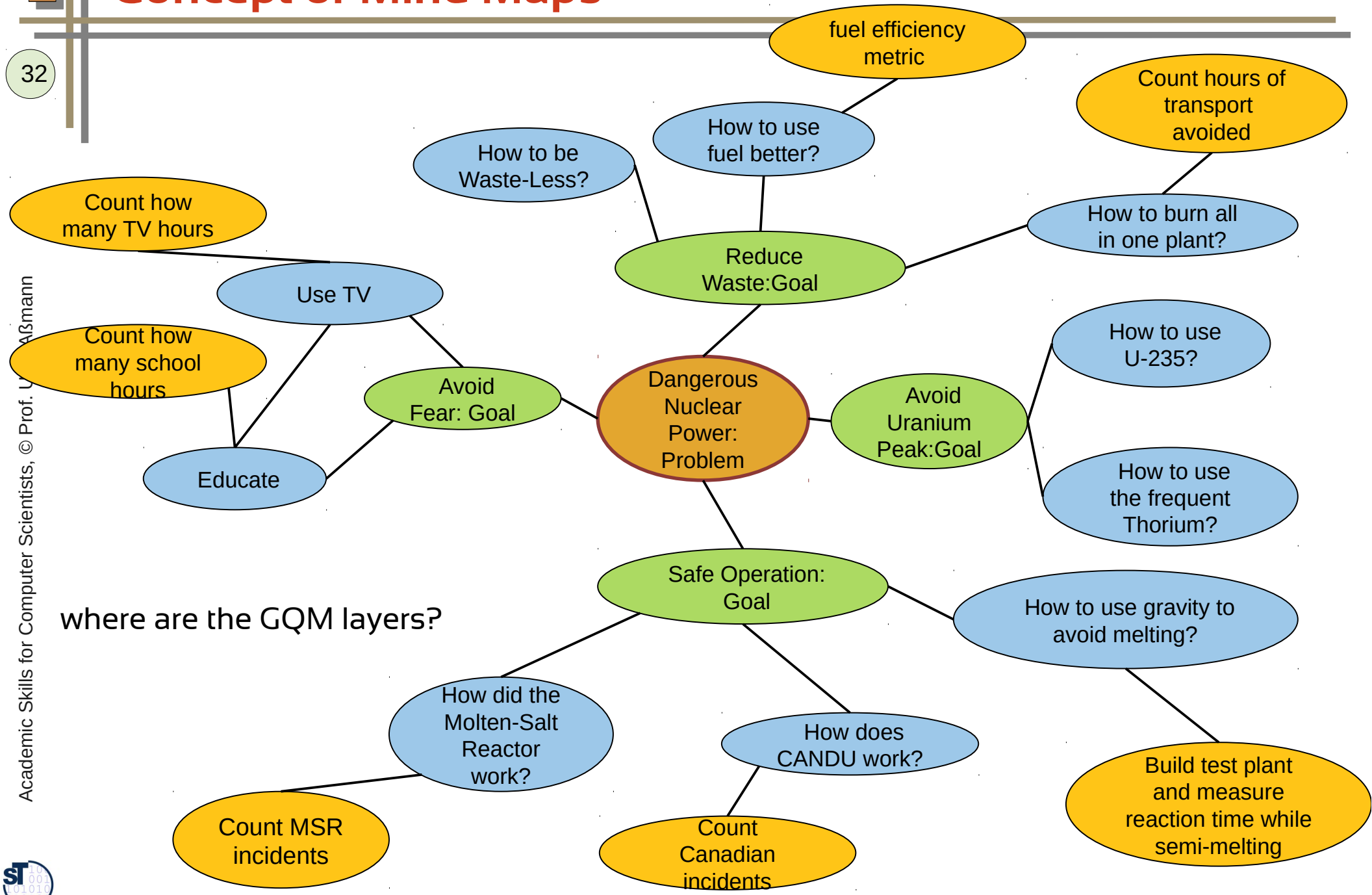
- GQM [BasiliRombach] is a special **layered** PA method, or **phased** PA
  - We start with the topmost layer, add the second layer of questions, then the third layer of metrics
- The original GQM approach uses a **layer cake** (multi-bush, 3-level multi-hierarchy) of goal level, question level and metric level.
  - Questions can be related to several goals
  - Metrics can be related to several questions
- Idea: Achieve the goals by answering questions with metrics
- Use the honest serving men to generate questions



Exc.: Solving Some Practical Problems with GQM

- "I am so lonely"
  - Different goals may solve this problem, "have a beer in the evening", "marry in 12 months", "move into a Wohngemeinschaft"
  - Correspondingly, questions and metrics are different
- "I am so hungry"
- "Germany has too many unemployed people"
- "Neonazis are a danger for democracy"

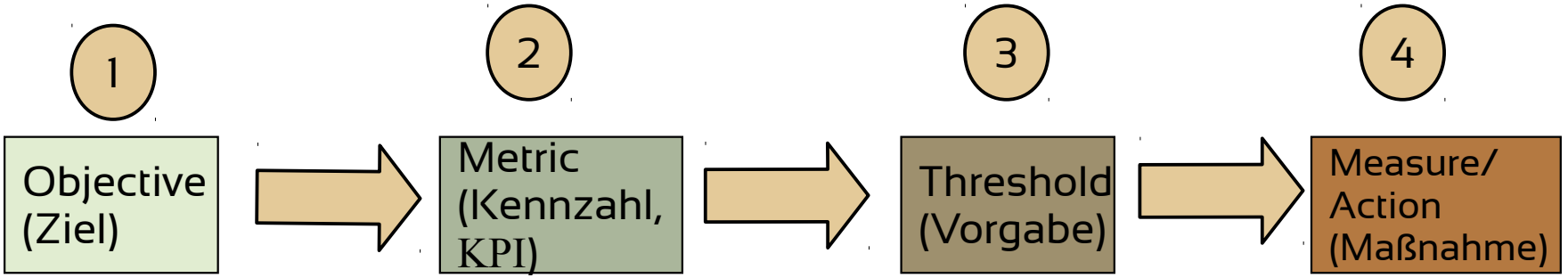
Layered PA Methods can be Arranged in Rings of Concept or Mind Maps



where are the GQM layers?

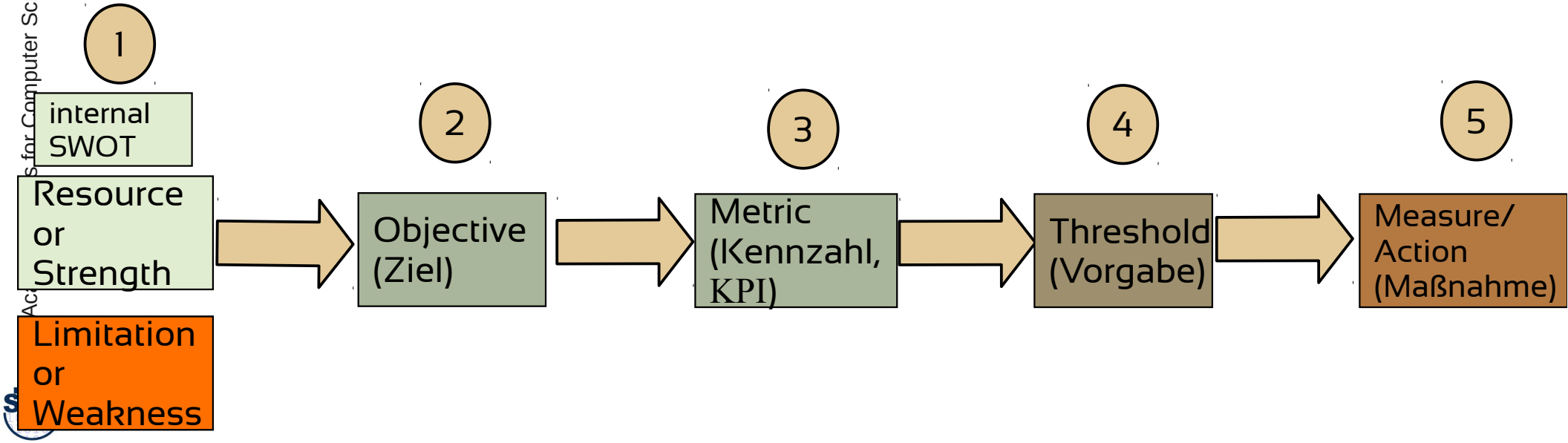
OMTA-POPP: Objective-Metric-Threshold-Action Analysis with KPI (Kaplan/Norton)

- OMTA-POPP is a refinement of GQM and uses metric values (key performance indicators) to measure the quality of a solution
  - and tests with a threshold whether the goal is reached
- OMTA-POPP automatically fulfils the SMART-criterion "Measurable"
- According to Kaplan/Norton it consists of 4 steps **OMTA**:
  [**Objective** → **Metric** (KPI, Kennzahl) → **Threshold** (Vorgabe) → Action (Measure/Maßnahme)]
  - The steps can be hierarcally structured
- Hierarchical OMTA
  - Create a hierarchical process from the simple OMTA scheme



ReLOMTA-POPP: Resource-Limitation-Objective-Action Analysis

- ReLOMTA-POPP extends OMTA-POPP with a phased **situation-goal-action analysis**
  - starts from an *internal problem/condition* of the stakeholder, customer, the patient, the project, the organisation, self (the internal dimension of SWOT)
  - either a resource or strength
  - or a limination, constraint, or weakness
- Immediately, from this a goal is defined
- and an action to reach the goal
- Can be done hierarchic
- Create a hierarchical process from the simple ReLOMTA scheme



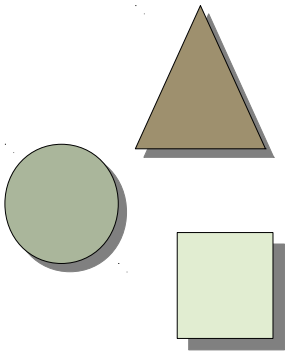
Excercise “Finding a new Product”

- You are MZ, a web browser company. Another company brings out a free browser and diminishs your market share.
- Put up a ReLOMTA-POPP for find a new product for your company.
  - Put it up as layered structure (layer cake)
  - Reorganize it as phase structure (from left to right)
  - Reorganize it as concept map with rings (concentric)

12.3 Non-Hierarchical Problem Analysis vs Hierarchical
12.3.1. Simple POPP Schemes

Without problem-goal analysis no way to invention, to technology nor to a scientific result.

POPP is a problem analysis with problem coverability



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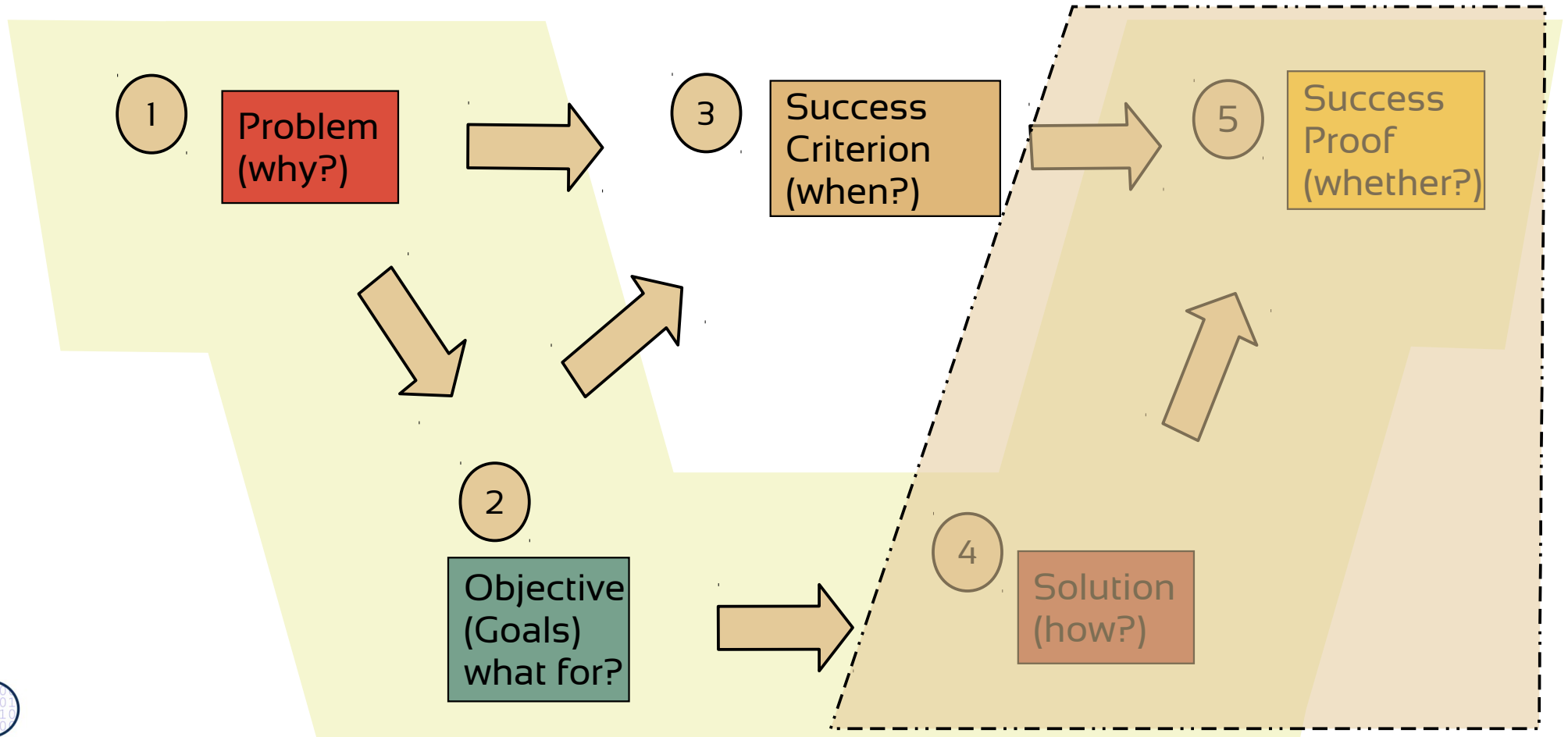
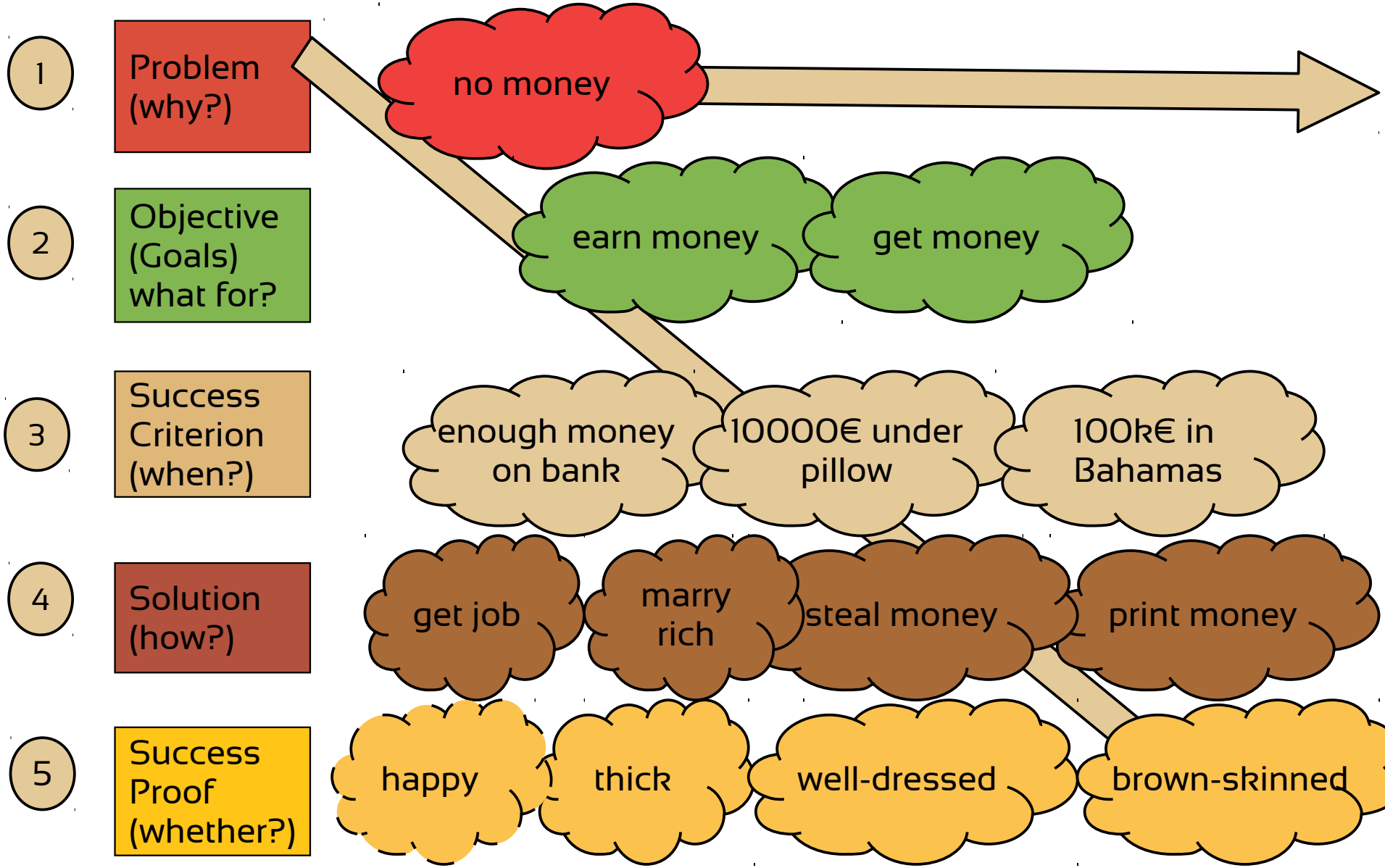
Rept.: The Swiss Knife of Solving Problems: Problem and Objective Analysis POA for POPP

- POA/POPP is a **goal-oriented problem-solving analysis and planning method** with success proof:
  - With a set of success criteria, it is checked whether the solution solves the problem
- POPP provides **problem coverability: did all problems find solutions? are all objectives reached?**
- Scientific variants of POPP are KAOS, i* [Siegemund]



ZOPP in a Layer Cake

- Layer cakes can grasp phase processes like ZOPP



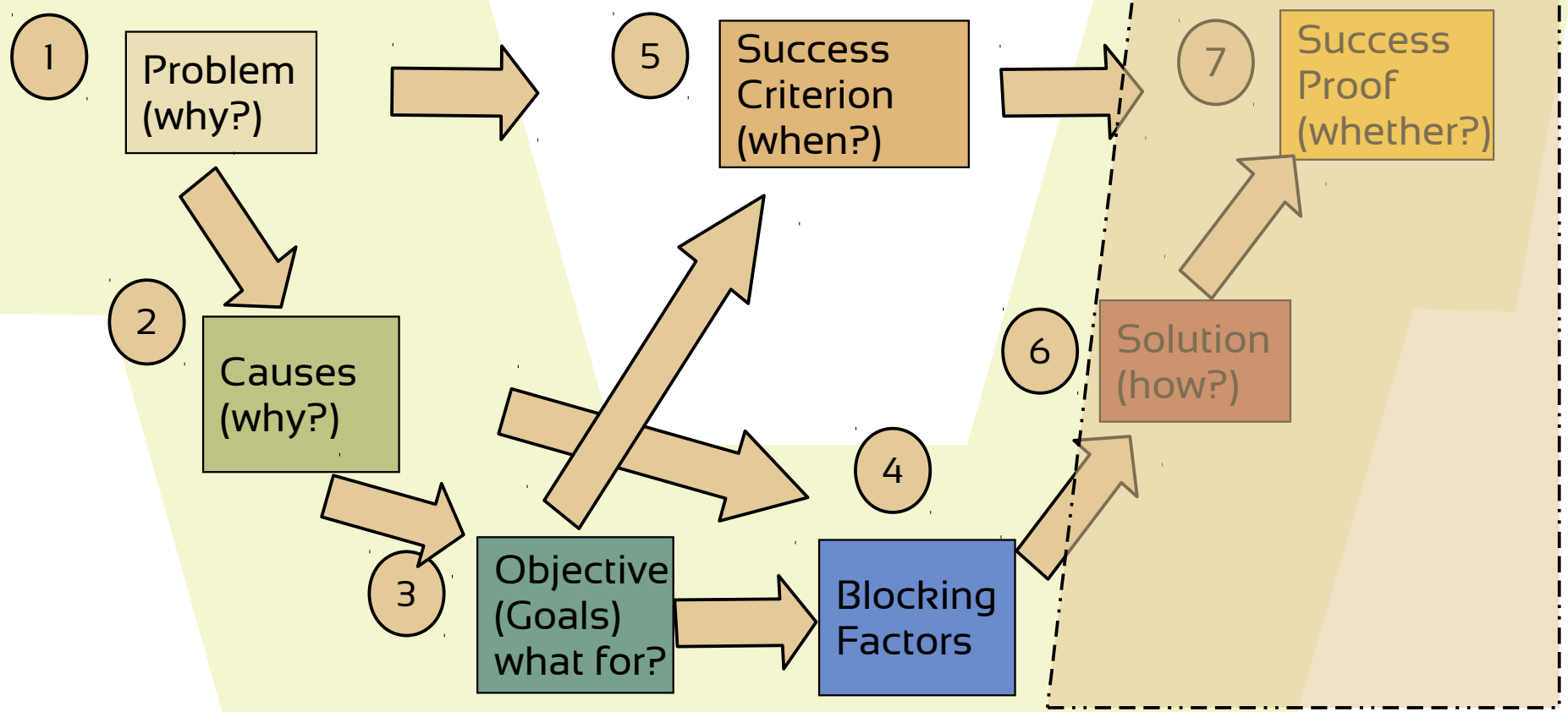
The Honest Serving Men are Linked to POPP (7W-POPP-Matrix)

- The 7-W-Questions can be attributed to a phase of a POPP.
- Problem Problems of Context, Development, Change
  - Problems of Stakeholder (Society, Users, Companies..)
- Objectives / Goals: Technical, Buiness, Benefits (Benefit Goals)

Concern of POPP		Benefit	Success factors
Agens, Object, Stakeholder	Who?	Who will benefit from solving this problem?	Who has defined this success factor?
Action, Requirement	What?	What is the real benefit of this solution? What is the cost?	What are the success factors to measure the achievement of this benefit?
Success Factors	When?	When will we know that we have succeeded?	
	Where?	Where did the problem occur?	Where will we measure the success of this?
Problem	Why?	Why do we need the benefit? Why do we have this problem?	
Objective/Goal	For what? To which end?	Why do we need the benefit? What will happen if we don't solve the problem?	
Solution, Realization	How?	How do we increase the benefit of this solution? How is this benefit achieved?	How will we do it? How will we measure the success of this?

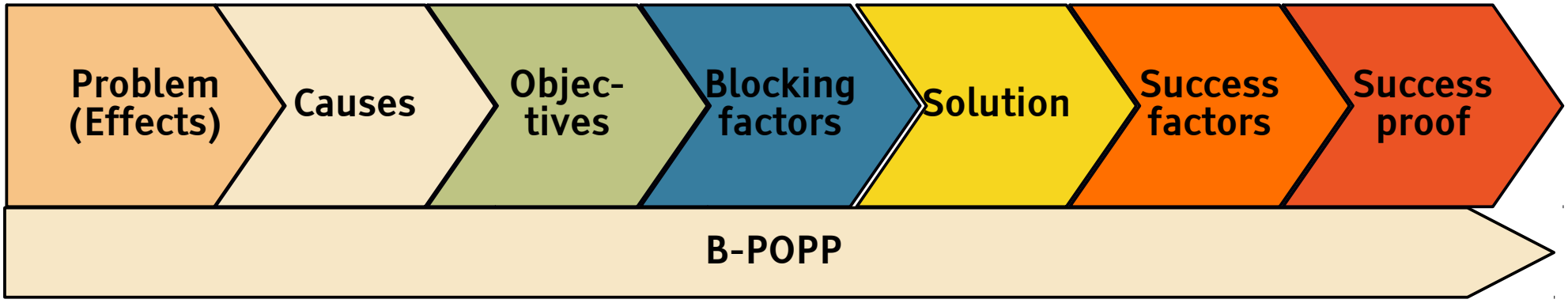
Problem Analysis with Blocking-Factor POPP (BOPP)

- B-POPP/BOPP asks for Causes and Blocking Factors hindering Goals to be realized
- **Causes** should be distinguished from Effects
- **Blocking factors** are specific problems that *hinder* the achievement of goals.They are particularly important because they *block*
- Solutions are derived directly from blocking factors



Flat Problem Analysis (Flat PA)

- When PA is done **flat,** problems are not decomposed, but transformed into solutions in a **flat way.**

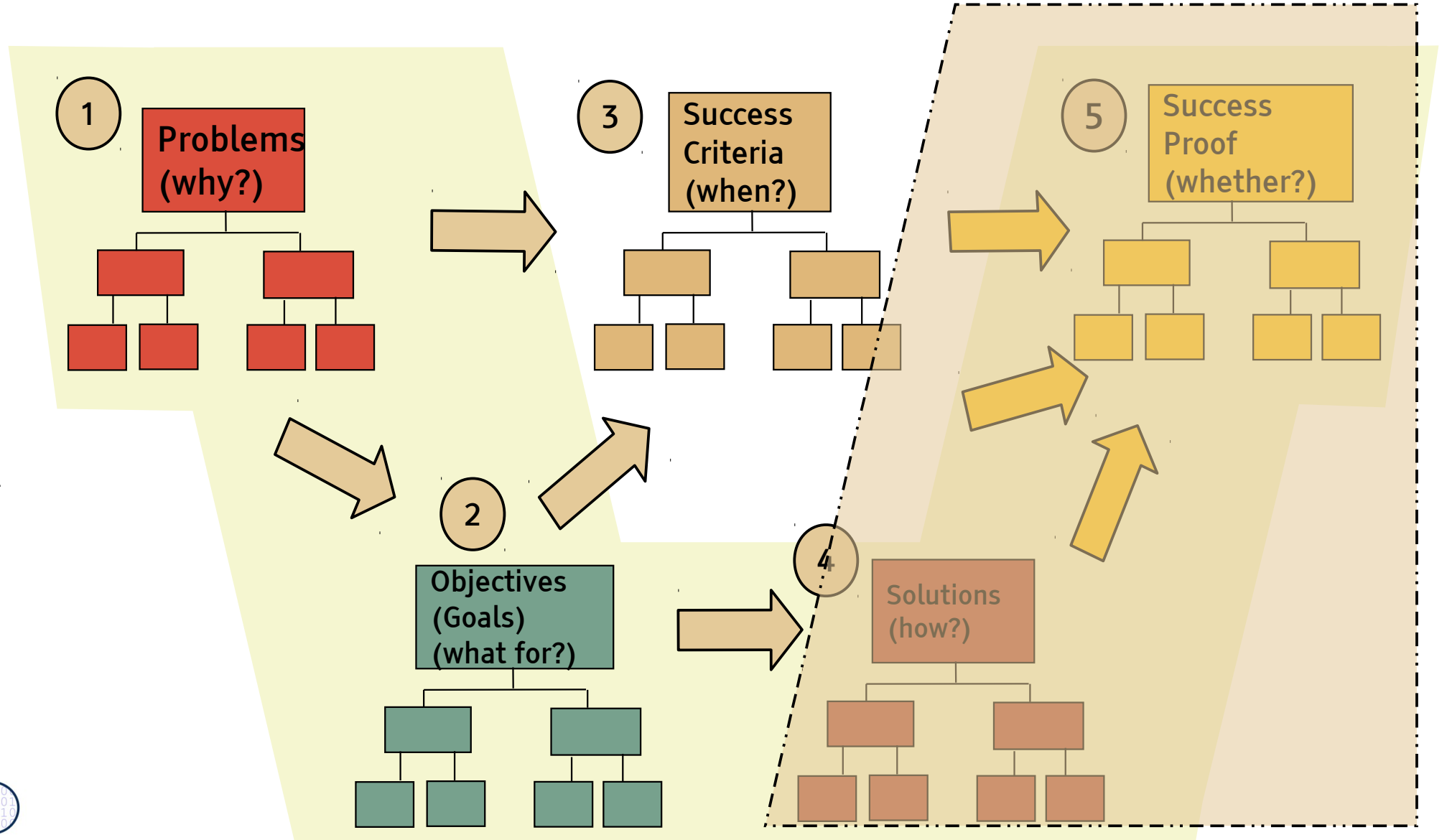


Exc.: Solving Some Practical Problems

- Do a B-POPP in a layer cake on one of the following problems.
  - "I am so lonely"
  - "I am so hungry"
  - "Germany has too many unemployed people"
  - "Neonazis are a danger for democracy"
- Transform the B-POPP into a mind map with rings

12.4.2. Hierarchical Problem Analysis

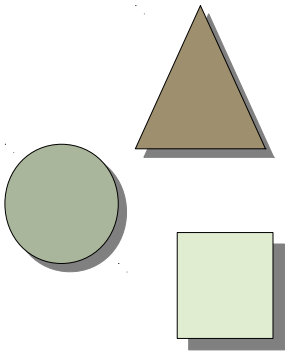
- ZOPP ("Ziel-orientierte Projektplanung") is a hierarchical PA
  - How to decompose problems, objectives, success criteria, solutions?



- Transform a hierarchical, phased ZOPP into a sequence of mindmaps

12.4 Aspect-Oriented Question Matrices

- Problem analysis can be based on **aspect-oriented** questions
- [Thiele, Leicher, Scherer]



Aspect-Oriented Instantiation of the The Honest Serving Men for Specific Aspects or Problem Fields

[Thiele] shows that the 7-W questions must be instantiated for different purposes in form of checklists. E.g., for problem & goal analysis different **matrix question lists (aspect-oriented question lists)** result

	Problems	Goals	Solutions	Success Criteria
Who?	Who is responsible to treat the problem?	Who has defined this Goal? Who benefits from achieving this goal?	Who will provide it?	Who will check it?
What?	What is the real problem? What are the subproblems of the problem?	What are the subgoals of this goal?	What will be produced by the solution?	what will be the success criteria?
How?	How does this problem affect us? How can we solve this problem? How can we delay the handling of the problem?	How will we achieve this goal?	How do we solve the problem?	How will the success be checked?
Where?	Where did the problem occur?			where will the problem disappear?
When?	In which situation did the problem arise?	When will we achieve this goal?	When will the problem be solved?	How long will we have to wait to know the success?
Why?	Why did the problem occur?	Why is it important?		
What for? To which end?	What would a solution for the problem help us to achieve? What will happen if we don't solve the problem?	What will the achieved goal further enable?	To which end will we solve the problem?	

The Honest Serving Men (7 W-Questions) Instantiated for Benefit Questions

- For finding a controlling idea of a text or talk, the 7-W-Questions should be tried to expand into a checklist. This checklist can be used to create alternatives for a technical science hypothesis or a controlling idea.

Concern		Benefit	Success factors
Agens, Object	Who?	Who will benefit from solving this problem?	Who has defined this success factor?
	What?	What is the real benefit of this solution? What is the cost?	What are the success factors to measure the achievement of this benefit?
Space and Time	When?		
	Where?	Where did the problem occur?	Where will we measure the success of this?
Problem	Why?	Why do we need the benefit? Why do we have this problem?	
Objective/Goal	For what? To which end? (Wozu?)	Why do we need the benefit? What will happen if we don't solve the problem?	
Solution, Realization	How?	How do we increase the benefit of this solution? How is this benefit achieved?	How will we do it? How will we measure the success of this?

Excercise: Instantiate the Honest Serving Men for Aspect-Oriented Question Matrices by

- Summary questions
- Problem questions
- Blocking factor questions
- Olympic questions
- Efficiency questions
- Put up a matrix to assemble the questions

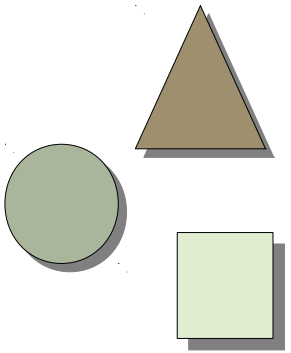
The Law of Paragraph Question and the Classes of Questions

- Remember the Law of Paragraph Question
- Which class of question fits to your paragraph?
  - open? probably closed is hard to write about
  - Problem questions lead to problem description paragraphs
  - Summarizing questions to summaries
  - Alternative questions lead to a development scheme called comparison and contrast" (dialectic development)
  - Benefit questions are always nice
  - Effect questions lead to cause-effect development scheme
- Put up an aspect-oriented question matrix on your problem area!

Law of Paragraph Question:
Never write a paragraph without an invisible question you answer in the paragraph.

12.5 Aspect-Oriented Concept Mapping with Normalized Discriminators

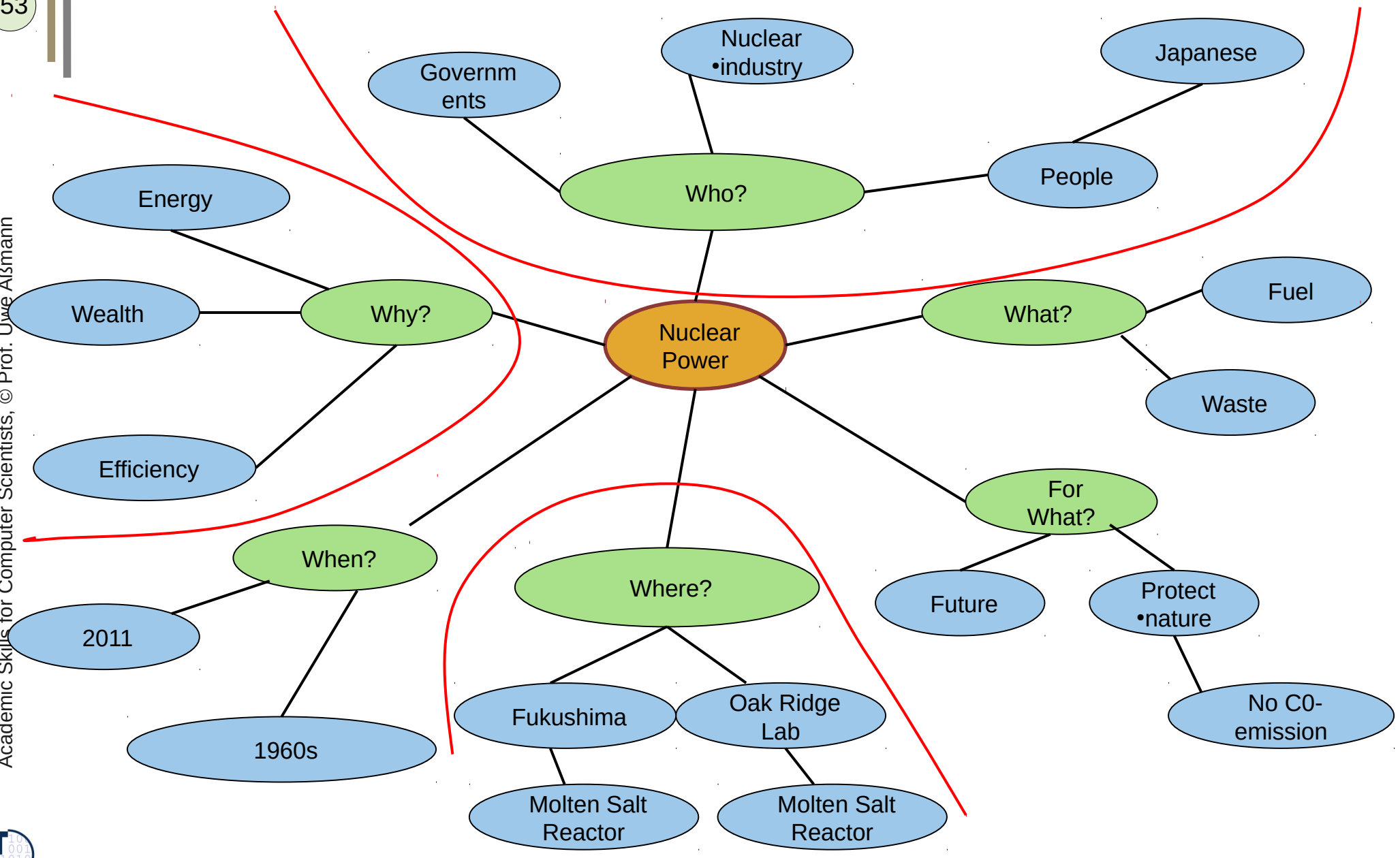
- Concept maps and Mindmaps can be decomposed by a standardized/normalised first level
- Many of the schemes of this chapter can be used as discriminator (7W, POPP, GQM, etc.)



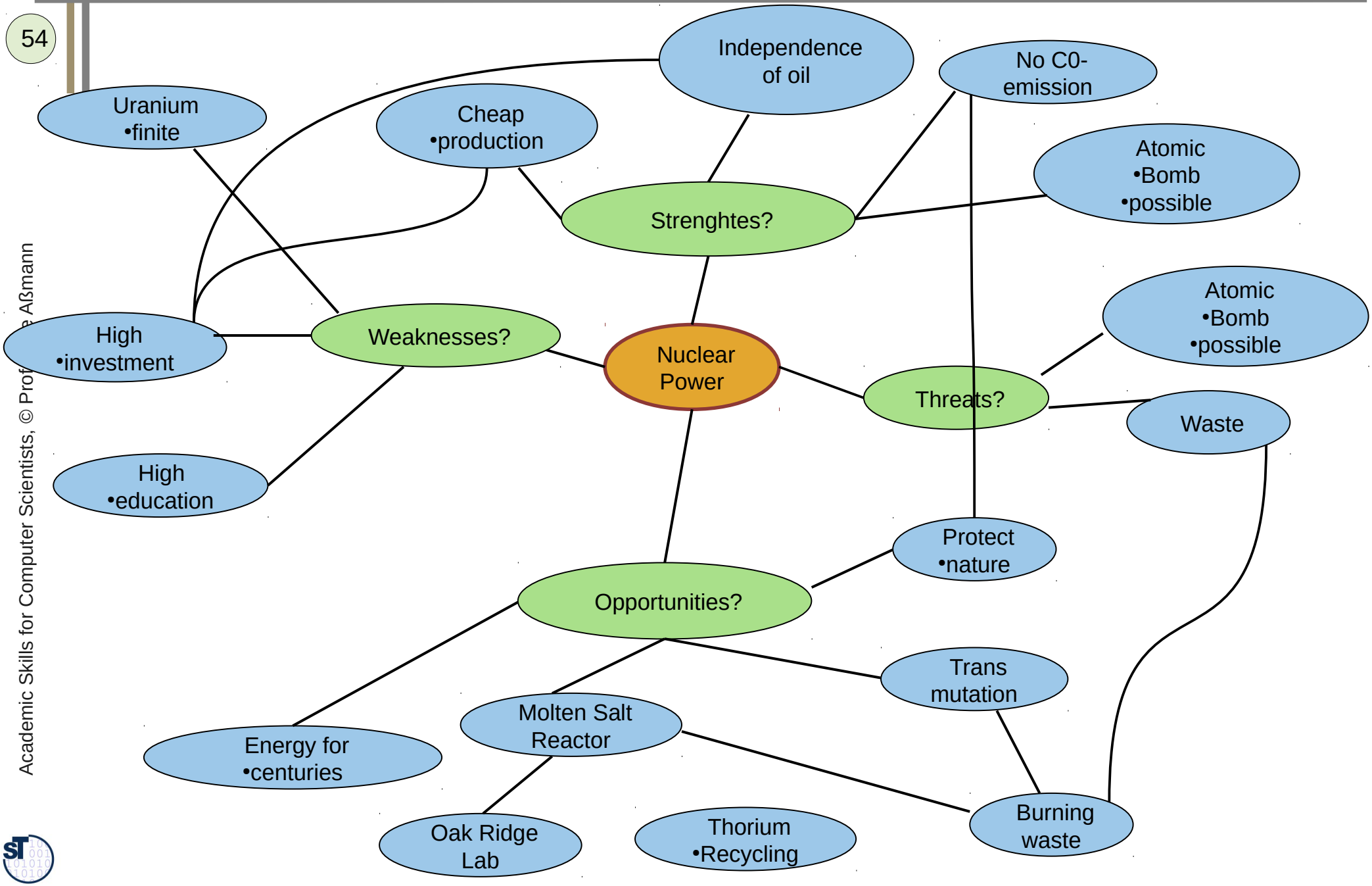
Aspect-Oriented Concept Maps

- An **aspect-oriented concept map (cluster, mindmap, structure tree)** is a spidermap with a standardized discriminator on the first level
  - 7-W-questions
  - North – South – West – East
  - CoTiQQ: Cost – time – Quantity – Quality
  - SWOT: Strengthes – Weaknesses – Opportunities - Threads
- The standardized discriminator helps to find decompositions

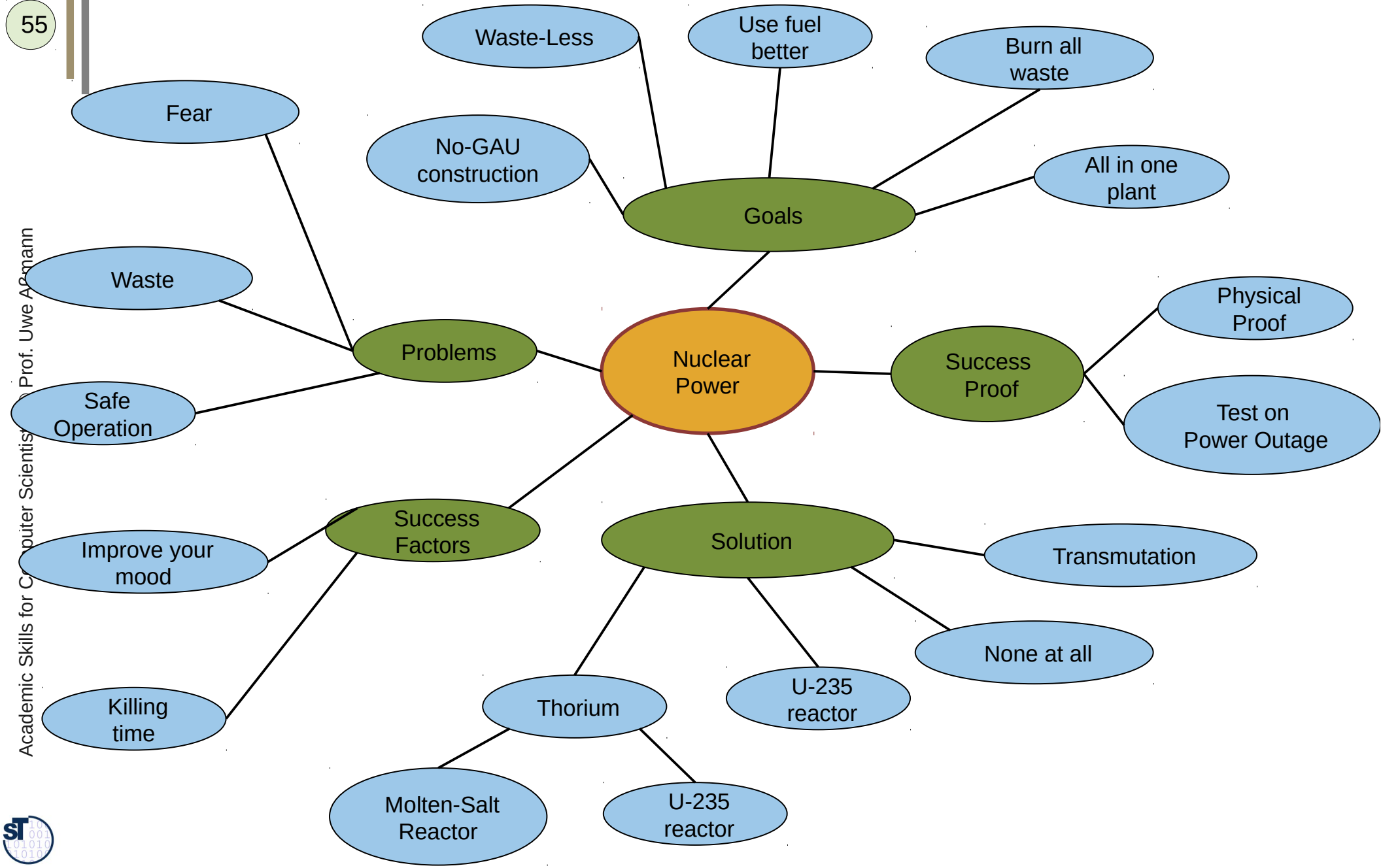
Aspect-Oriented Mindmap with 7-Serving Men as Discriminators



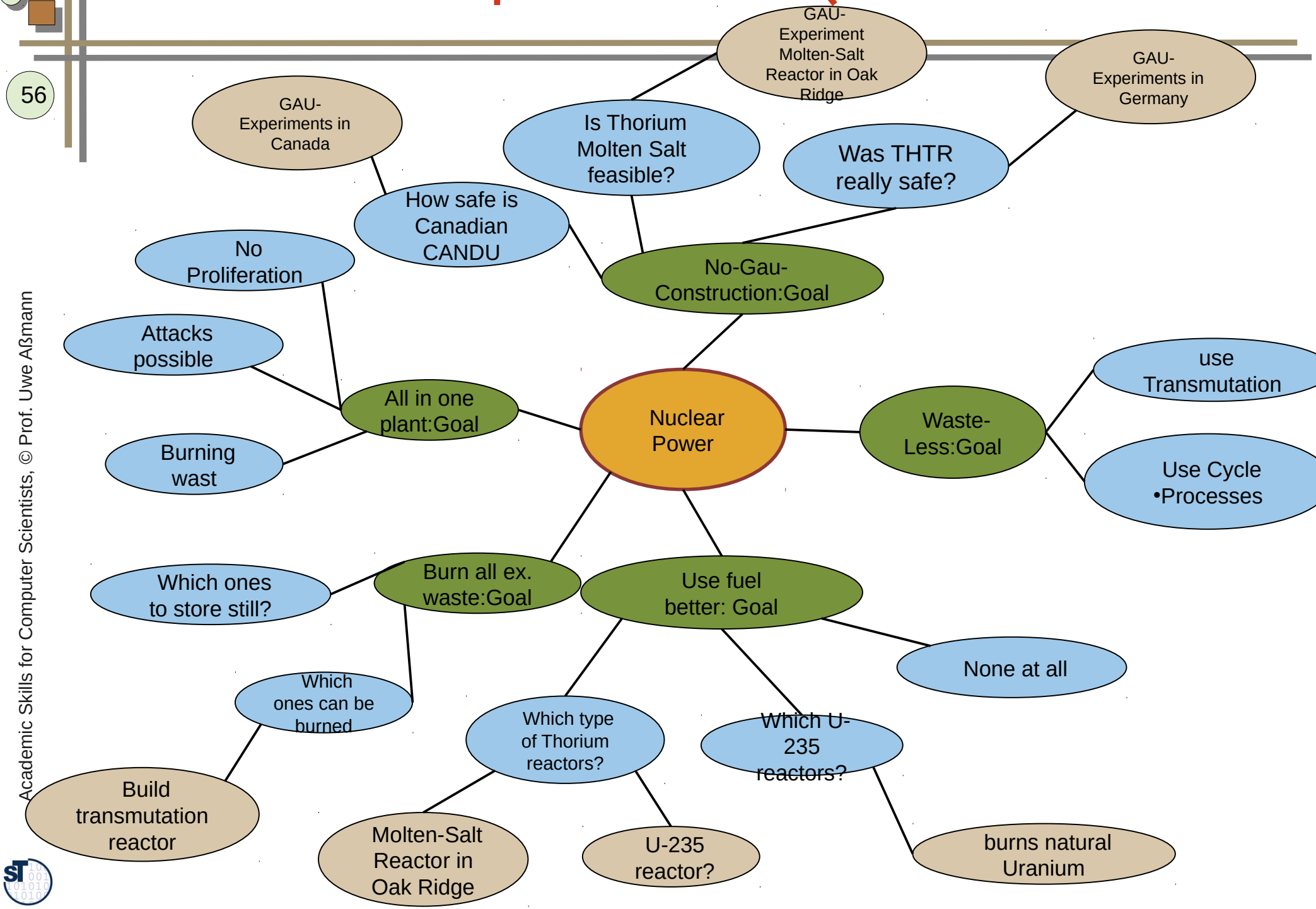
Aspect-Oriented Cluster with SWOT as Discriminators



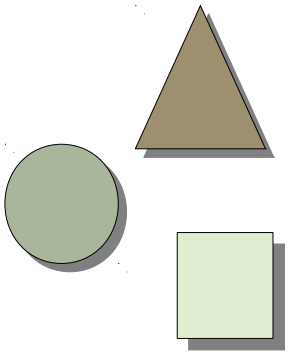
First-Level Decomposition with POPP



First-Level Decomposition with GQM



12.6 Writing Problem Analysis Papers



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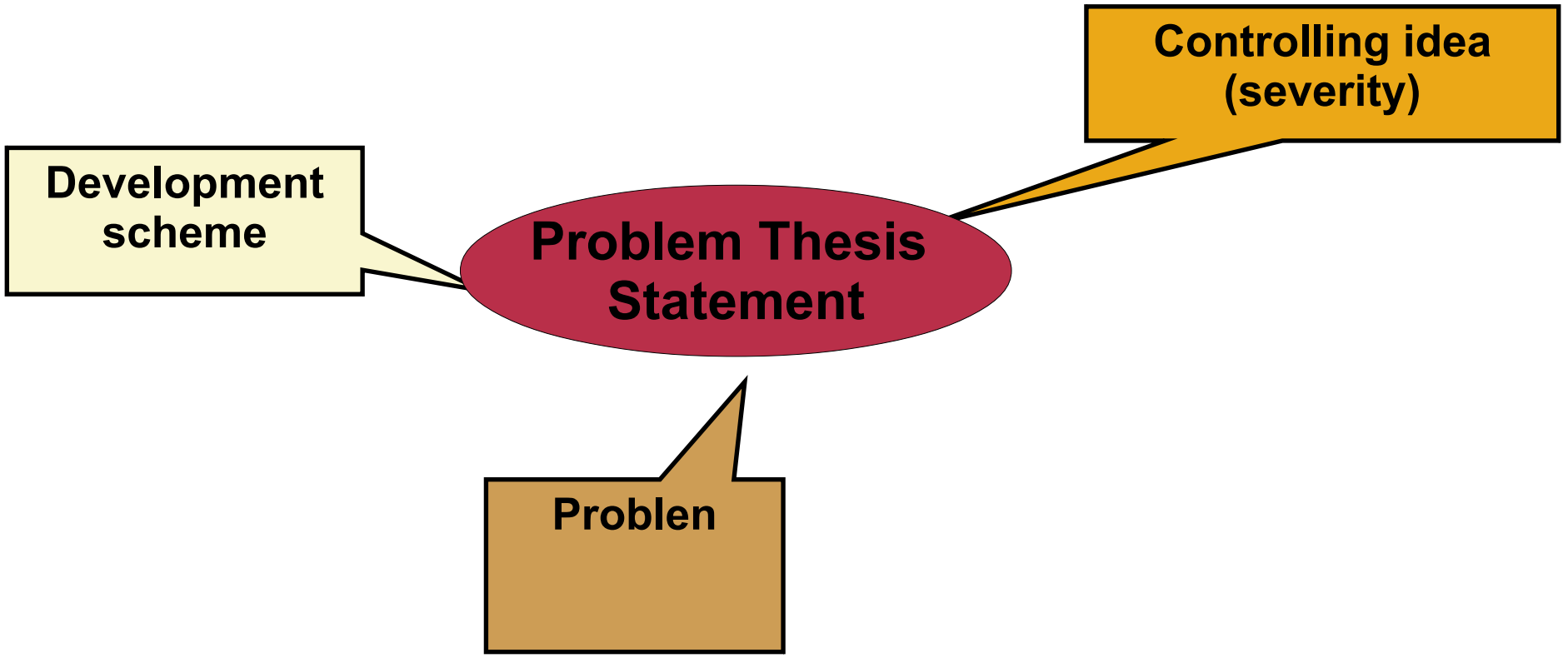
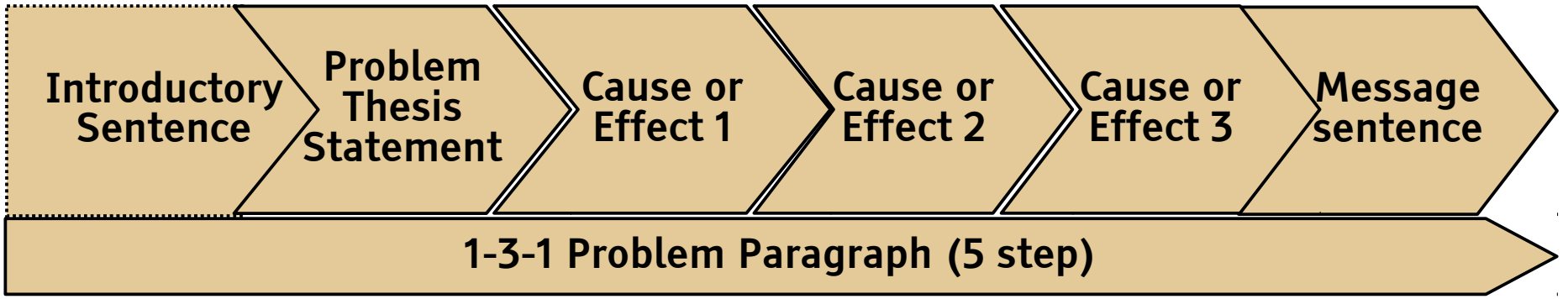
Problem Statements

- A **problem thesis statement** is a thesis statement showing a problem.
- **Thesis: Problem + Controlling idea (severity) + Development Scheme**



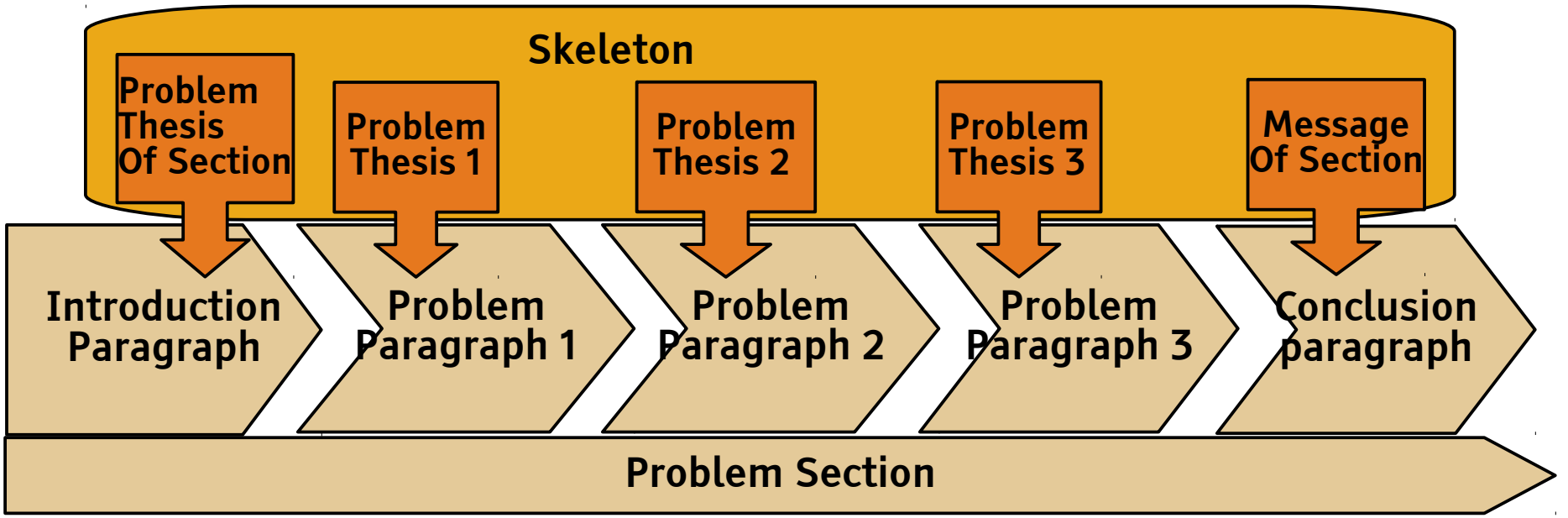
Problem Paragraphs in 1-3-1 Structure

- We live in interesting times.
- Though technical progress in harvesting energy is so fast that we might be able to earn all our energy demands from natural sources in 2030, none of the global players seems to take action in this innovation wave.
- Though we are learning at the moment how to store wind energy in methane gas and methanole, major companies are fixed on the oil economy and fight against a methanole economy on the horizon.
- While we have a political union with countries like Greece who do not have a stable economy, nobody is interested to buy their natural energy and transport it by long-distance DC-powerlines to central and northern Europe.
- Although we can build cheap and efficient multi-stage heat pumps, these techniques are rarely known.
- We need to find “champions” who will become entrepreneurs in these golden times of natural energy harvesting, but very few are taking on this grand challenge.



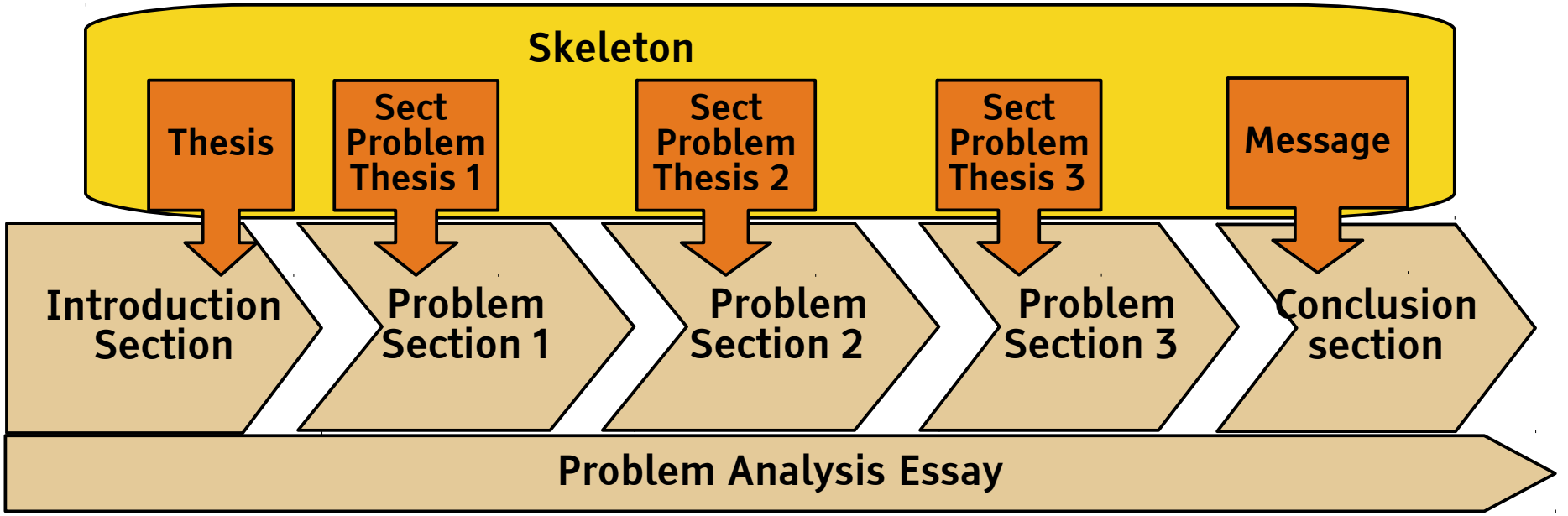
Skeletons of Problem Sections or Essays

- The **skeleton** of a problem section is the sequence of all problem thesis statements of all paragraphs
- A problem section has **unity** if all problem theses of the paragraphs support its section problem thesis
- Problem sections may be positioned as section 2 or 3 of a paper



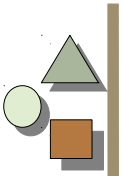
1-3-1-Problem Essay

- A Problem analysis essay discusses all aspects of a problem.
- A **problem analysis research paper** discusses all aspects of a research problem.



Why Do We Need Problem Analysis

- Layered Problem Analysis uses structured ways to analyze problems
  - Visualization as layers or as layered concept map
- Aspect-Oriented Problem analysis uses a matrix organization
  - Visualization as matrix or concept map with discriminator layer
- ZOPP and other POPP methods are extremely valuable for PA
  - to organize your thoughts
  - to write introductions
  - to guide a reader the work, or your defense talk
- Writing problem analysis essays or papers should rely on a PA method



Exercises

- What is a metric-based PA method?
- What is a layer cake?
- How do you rearrange a layer cake into a layered concept map?
- How to hierarchizise ReLOMTA?
- What is an aspect-oriented question matrix?

Homework – The Weekly Schmidt

- Read the essay - "Innovationen sichern den ökonomischen Erfolg". (1996)
- Analyze the problem-goal analysis of Schmidt by trying to relate all points to a BATE-POPP.
  - Which problems does Schmidt identify? Which super-, which subproblems?
  - Which problems are background problems? Which ones are technical problems (problems economical politics can influence)?
- Write from the BATE-POPP an outline of a new essay, your own analysis.

Homework – The Weekly Churchill

- Read first Winston Churchill's speech “Never despair”.
  - https://www.winstonchurchill.org/learn/speeches/speeches-of-winston-churchill/1946-1963-elder-statesman/102-never-despair
- Analyze the problem-goal analysis Churchil presents to the house of commons about the atomic and the hydrogen bomb.
- Do a BATE-POPP yourself, ordering the problems and goals by decomposition and subordination. Find out blocking factors and success factors.

Writing PA Papers

- Write a problem analysis 1-3-1 essay about the question
- "Why should African refugees not be encamped in camps on the North African coast, if they want to escape to Europe?"
  - Define a skeleton
  - Define the problem thesis statements very carefully
  - Create unity for your problem essay!