14. Solution Design and Invention

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http://st.inf.tu-dresden.de/teaching/asics

1) Complete Solution Processes
2) POPP and Hierarchical POPP
3) nABC
4) Canvases
5) GAP Analysis (Generation, Assessment, Prioritization)
6) Assessment and Prioritization Methods
   1) Qualitative and Quantitative Analysis for Olympic and Efficiency Criteria
7) Writing POS papers

References

► [VanGundy-ProblemSolving] Arthur B. Van Grundy. Techniques of structured problem solving. Van Nostrand Reinhold Company, 2nd edition, 1988. The bible of problem solving techniques, presenting the solution process PARGESI.

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► [Hill] Bernd Hill. Der Methodenbaukasten - Ein Kompendium von Methoden zur Erkennung und Lösung technischer Probleme. 2. erw. u. überarb. Aufl. [Taschenbuch bei amazon]

► Rohrbach, Bernd: Kreativ nach Regeln – Methode 635, eine neue Technik zum Lösen von Problemen. Absatzwirtschaft 12 (1969) 73-76, Heft 19, 1. Oktober 1969.

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► Ziel-orientierte Projektplanung (ZOPP) from GTZ (Gesellschaft für technische Zusammenarbeit) www.gtz.de:

    – http://portals.wi.wur.nl/files/docs/ppme/ZOPP_project_planning.pdf

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

►

► A. Albers, N. Burkardt, M. Meboldt, M. Saak. Spalten Problem Solving Methodology. In: The Product Development. International Conference On Engineering Design (Iced 05), Melbourne, August 15-18, 2005

- http://www.researchgate.net/profile/Albert_Albers/publication/36451 022_Spalten_Problem_Solving_Methodology_in_the_Product_Develo pment/links/0deec52660dc066c9b000000.pdf

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► Mark Sh. Lewin's web page on problem analysis and solving: http://www.mslevin.iitp.ru/

► Ritchey's book on Wicked Problems and GMA: Tom Ritchey. Wicked Problems – Social Messes. Decision Support Modelling with Morphological Analysis. Series: Risk, Governance and Society, Vol. 17. 1st Edition., 2011, Springer.

  – http://www.springer.com/business+%26+management/technology+management/book/978-3-642-19652-2

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/

6 ▶ After problem analysis and literature analysis, solutions must be invented, designed, and selected.

Use systematic methods to
speed up finding a solution

| Problem Analysis | Literature Analysis | Solution Design/ Invention |

# 14.1 Complete Problem Solving Processes (PAD-SAD-RAD)

- A **problem solving process PSP** is a structured process to solve problems
  - Problem analysis and definition (PAD)
  - Solution design: generation, evaluation and selection (SAD)
  - Realization analysis, Implementation, and Documentation (RAD)
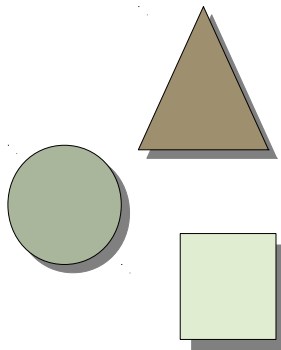
Complete Solution Processes

- **For your research (Master's thesis, paper, etc.), you need a complete solution process**
- Most often, problem-solving processes are driven by a problem analysis
- In general, there are three steps
  - PAD: Problem analysis and definition
  - SAD: Solution analysis and design
  - RAD: Realization Analysis, Implementation, and Documentation
- PARGESI, SPALTEN, and DesignThinking are fantastic solution processes for your Master's thesis
- For a PhD thesis, they have to be iterated several times

PAD–SAD–RAD

PAD: Problem Analysis and Definition	SAD: Solution analysis and definition	RAD: Realization Analysis, Implementation, and Documentation
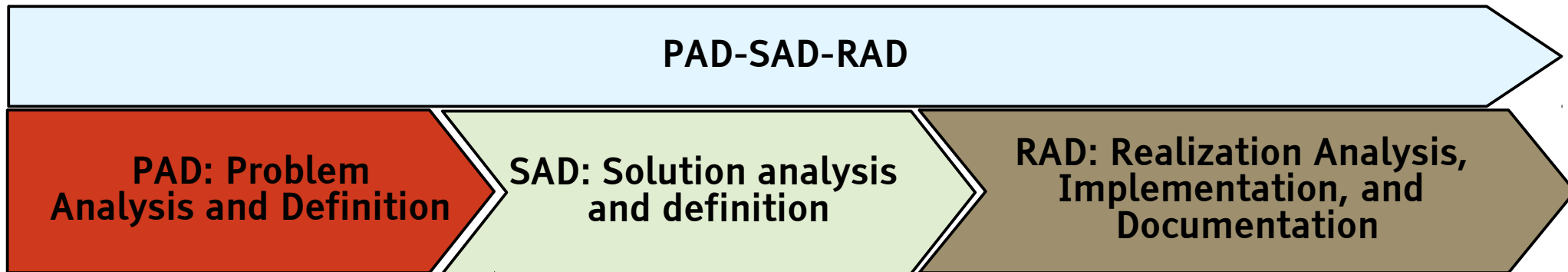
S.P.A.L.T.E.N. is a Solution Process with Assessment of Multiple Solutions

► SPALTEN is a problem solving process

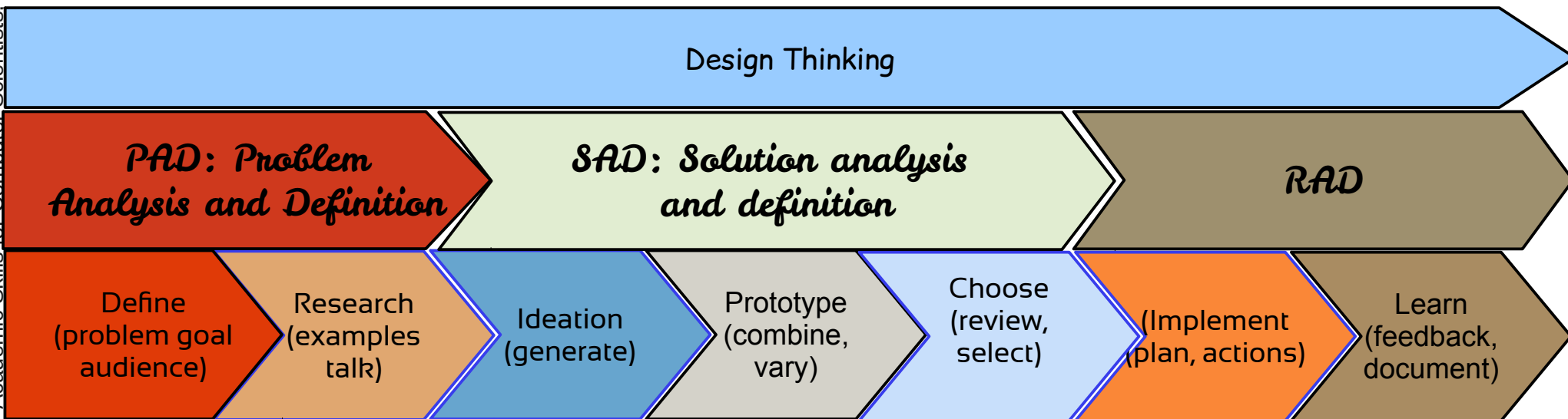Steps: [Wikipedia/Problemlösen, Albers]

- PAD: Problem analysis and definition:
  - Situation analysis (Ist-Analyse, literature analysis)
  - Problem analysis (demarcation, scoping, identification)
- SAD: Solution analysis and design with idea generation, evaluation and selection:
  - Alternative generation (ideation, solution identification and generation)
  - Evaluation (Assessment)
  - Selection (Prioritization)
- RAD: Realization Analysis, Implementation, and Documentation
  - Effect, risk and consequence analysis
  - Introduction (measures and processes)
  - After study and learning, documentation

Academic Skills for Computer Scientists, © Prof. Uwe Aßmann
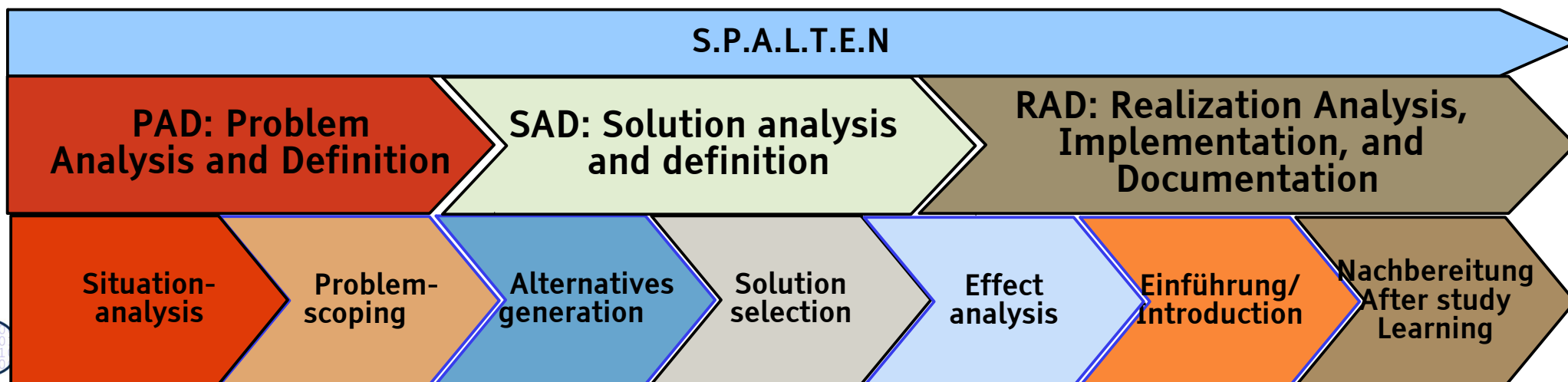
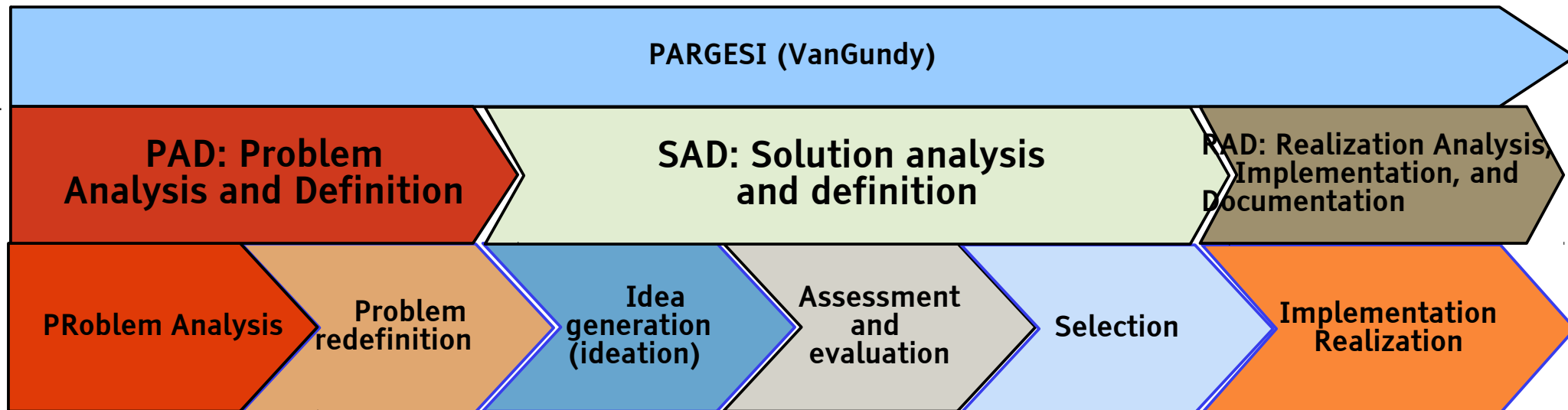# "Design Thinking" is a Solution Process with Prototyping and Assessment of Multiple Solutions

- ▶ http://en.wikipedia.org/wiki/Design_thinking
- ▶ Similar to SPALTEN, but using prototyping to test and select ideas
- ▶ Used by D-School in Stanford and HPI in Potsdam

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Design Thinking						
PAD: Problem Analysis and Definition		SAD: Solution analysis and definition			RAD	
Define (problem goal audience)	Research (examples talk)	Ideation (generate)	Prototype (combine, vary)	Choose (review, select)	(Implement plan, actions)	Learn (feedback, document)

Problem Solving with VanGundy Problem Solving Method PARGESI

▶ [VanGundy-ProblemSolving] contains a structured, very general process to solve structure problems: PARGESI

- – Problem analysis and Redefinition: It is an experience that the first problem definition is not stable, but must be reiterated.

- – Generating Ideas

- – Assessment and Evaluation of Ideas

- – Selection of ideas

- – Implementation and Realization

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PARGESI (VanGundy)

PAD: Problem Analysis and Definition

SAD: Solution analysis and definition

PAD: Realization Analysis, Implementation, and Documentation

PRoblem Analysis

Problem redefinition

Idea generation (ideation)

Assessment and evaluation

Selection

Implementation Realization

Write a Project Plan (GANTT) for the Solution Process of Your Next Project

► PARGESI, SPALTEN, DesignThinking are fantastic solution processes for your Master's thesis

- Write a project GANTT chart
- Estimate weeks for every phase
- What would you prefer for your Master's thesis?

► For a PhD thesis, they have to be iterated several times

# 14.2 Hierarchical POPP and Others

- POPP/ZOPP and its variants are simple Solution Design Processes

- Hierarchic

- *no* alternative generation

- covering of all problems provable
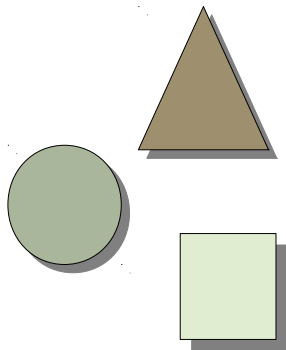
Hierarchical Problem and Goal Analysis ZOPP

▸ POPP is hierarchical, to get traceability between problems, objectives, solutions

▸ **Completeness proofs for covering all problems are easy**

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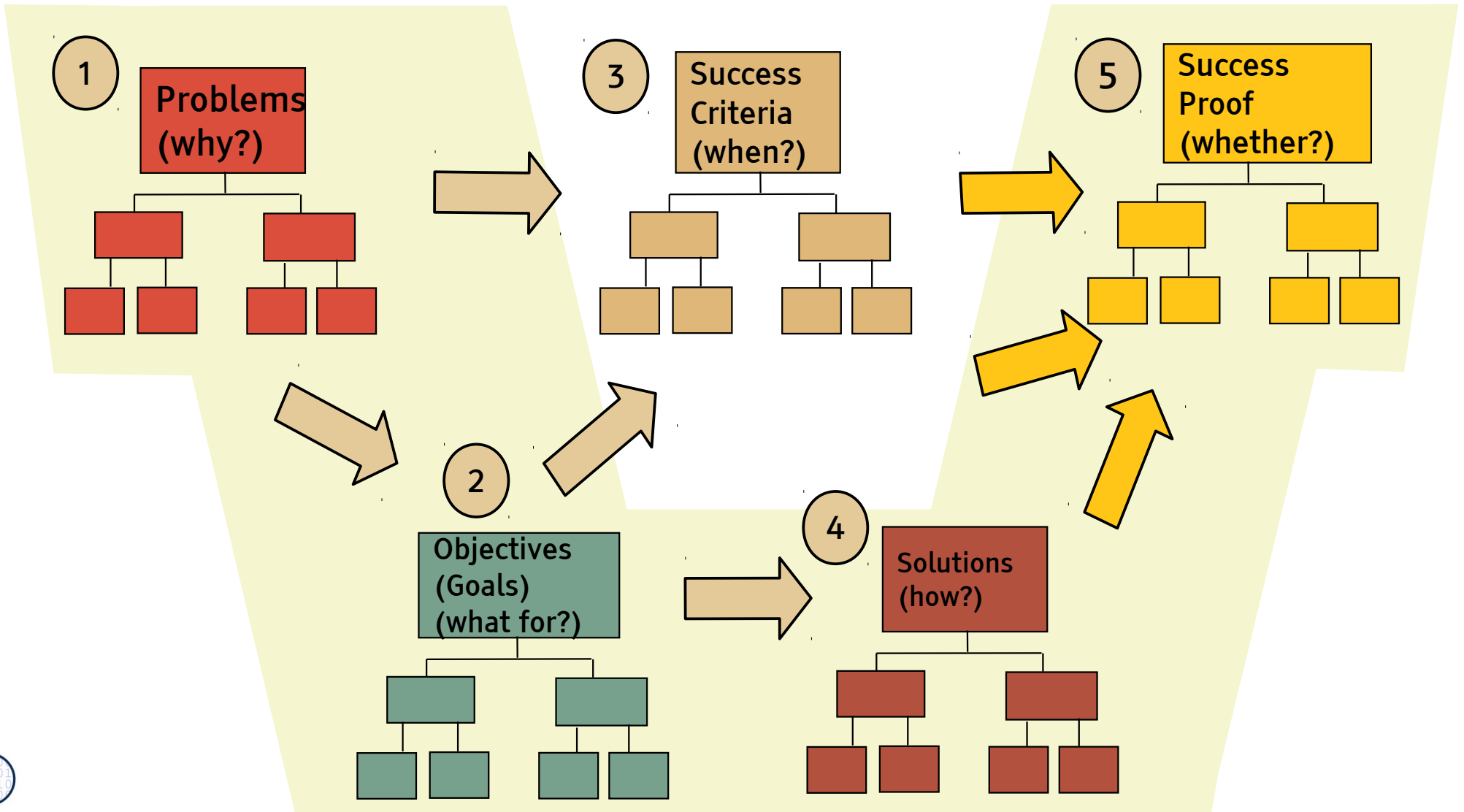
Hierarchical Problem and Goal Analysis with Blocking Factors (B-POPP)

- ▶ Sometimes, it is possible to determine **blocking factors** preventing that the objectives are reached.

- ▶ B-POPP is a ZOPP-like problem and efficiency analysis that checks blocking factors preventing that objectives are reached.

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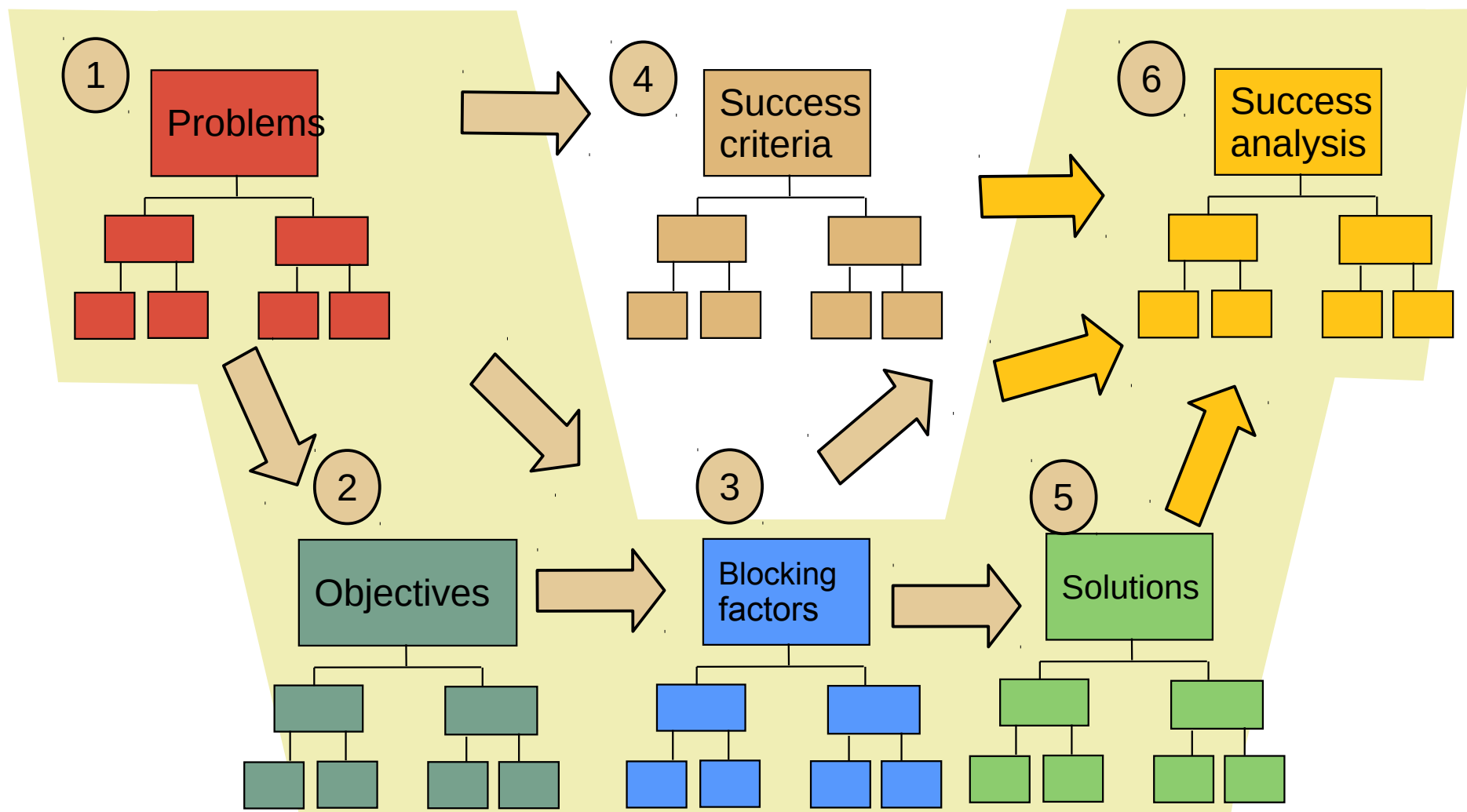
ReLOMTA-POPP

▶ Combining B-POPP with ReLOMTA gives us a wonderful hierarchic solution process with problem coverability.

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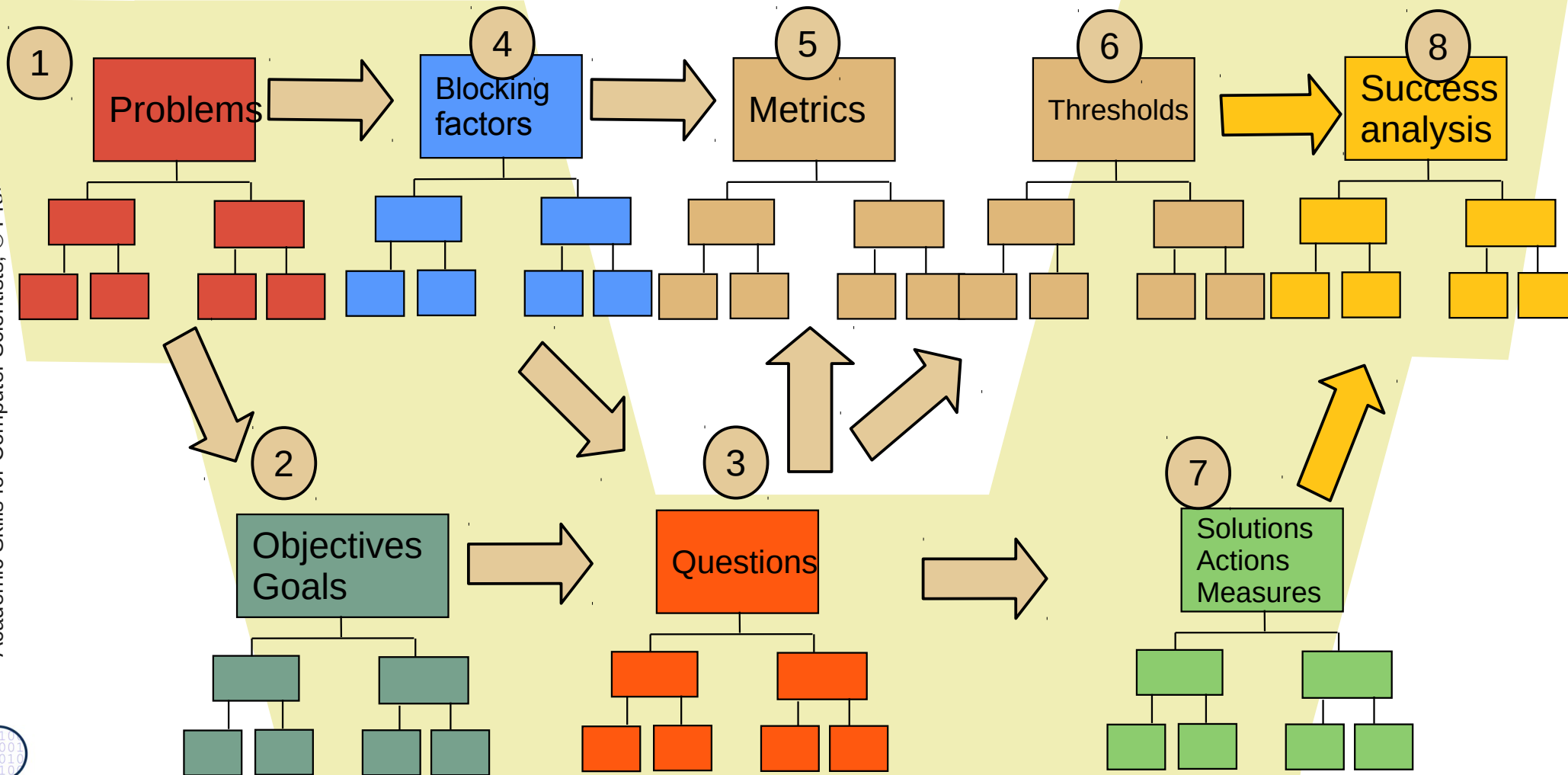
14.2.1 BATE-POPP for Papers
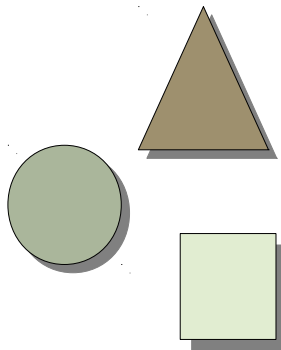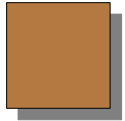
POPP For Your Research

▶ **For all kinds of research:** Bachelor, Master, PhD thesis, Research paper, Essay, Analysis study

▶ **Do a GQM, ZOPP, OMTA-POPP, ReLOMTA-POPP,** or a variant of **B-POPP** and refine it over all the duration of the research

▶ Benefits:

  – If you do not solve a real problem, your research is not relevant

  – Goal analysis helps to think

  – Hierarchical goal analysis helps to focus on the more important issues

  – If your decomposition of the problem is good, you may say something about the *solution's coverage of the problem:*

    • Did I forget to solve a subproblem or are all problems solved? How complete is the solution?

• Benefits for your reports

  – Usually a good ZOPP or B-POPP gives you an introduction for free: just write a paragraph or a section on each of the steps

  – In particular, the *research contributions (research results)* become very clear.

  – An entire report can be structured like ZOPP or B-POPP

Exercise:

- Repeat the paper "Zähmt den Kapitalismus" of Schmidt, and look at his arguments again.

- Do a B-POPP with his article.

- Did Schmidt really treat all problems?

- Which of his problems are blocking factors?

- Did he distinguish problems and goals?

- Did he mention success factors?

- Rewrite the paper starting from your own B-POPP.

- Write an introduction by writing a sequence of apragraphs:
  - background problem → technical problems
  - goals
  - blocking factors
  - success factors
  - solution, approach
  - success validation

Exercise with LaTeX

▶ a) Put B-POPP into a LaTeX template with comments marking up the parts

```
% problems
% objectives
….
% success analysis
```

▶ b) Put B-POPP into a LaTeX style file, defining commands for your documents:

```
\def\problem#1{#1}
\def\objective#1{#1}
\def\blockingFactor#1{#1}
….
\def\successAnalysis#1{#1}
```
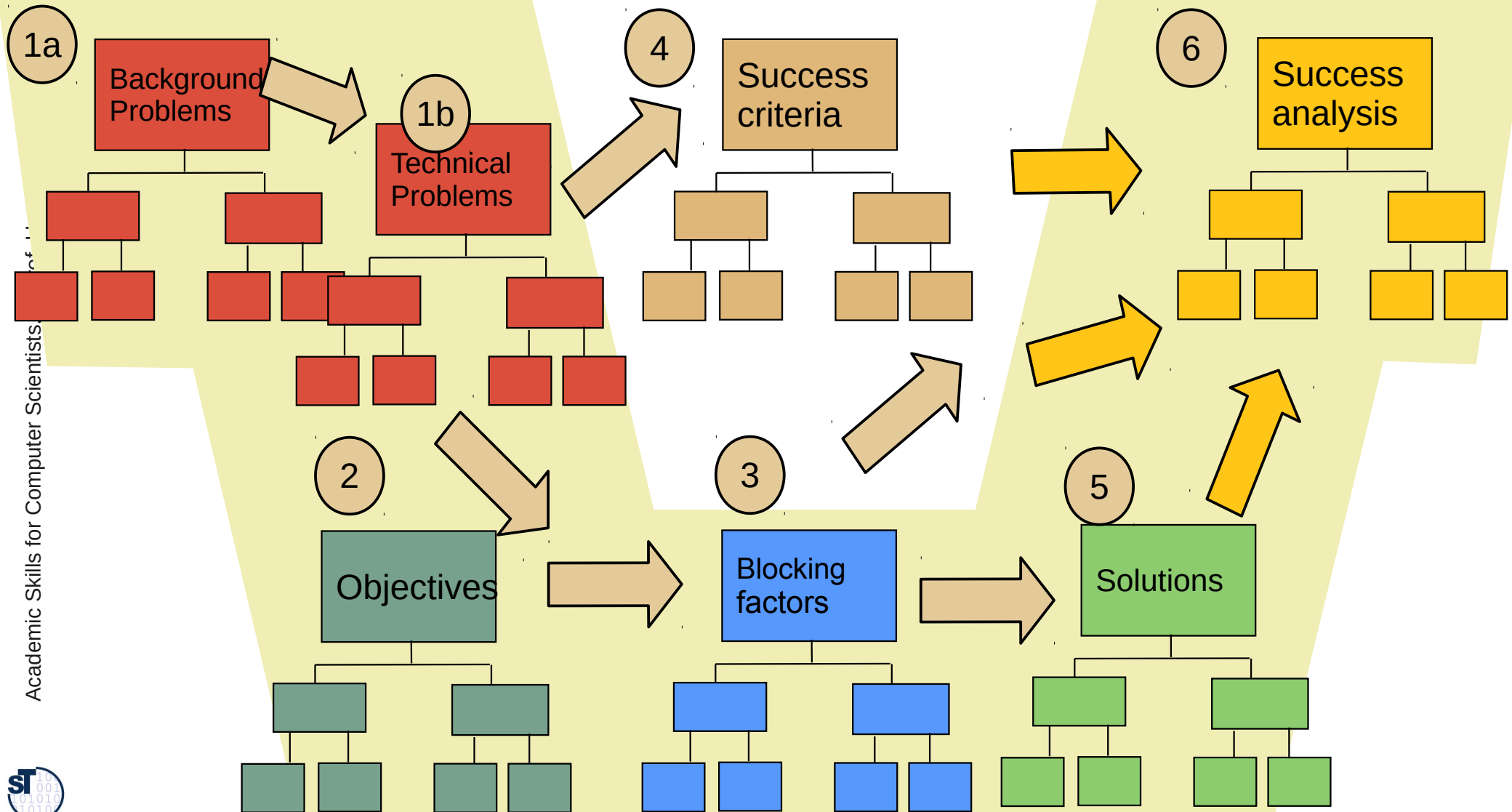
▶ c) do the same defining LaTeX environments

```
\newenvironment\problemEnv{}{}
```

Improved BATE-POPP

- For technology research, it is useful to split problems into **background** and **technical problems**
- Background problems show economic, societal, ethical importance
- Good for research project proposals!

▶ a) Reanalyze Churchill's "Finest hour" speech, in particular the last concluding paragraph, with BATE-POPP.

- – Which goals does Churchill have?
- – Which questions does he derive from the goals?
- – What's the background, what's the technical problems?
- – What is the success factor? Is he giving a metrics?

▶ b) Write a exposé for a Bachelor oder Master's or PhD Thesis with BATE-B-POPP.

Improved BATEID-POPP for Theorem Papers

▶ For idealized research, it is useful to split problems into **background** and **technically practical,** and **idealized (model) problems**

▶ Split also success factors and success analysis: This is called **funnelling**
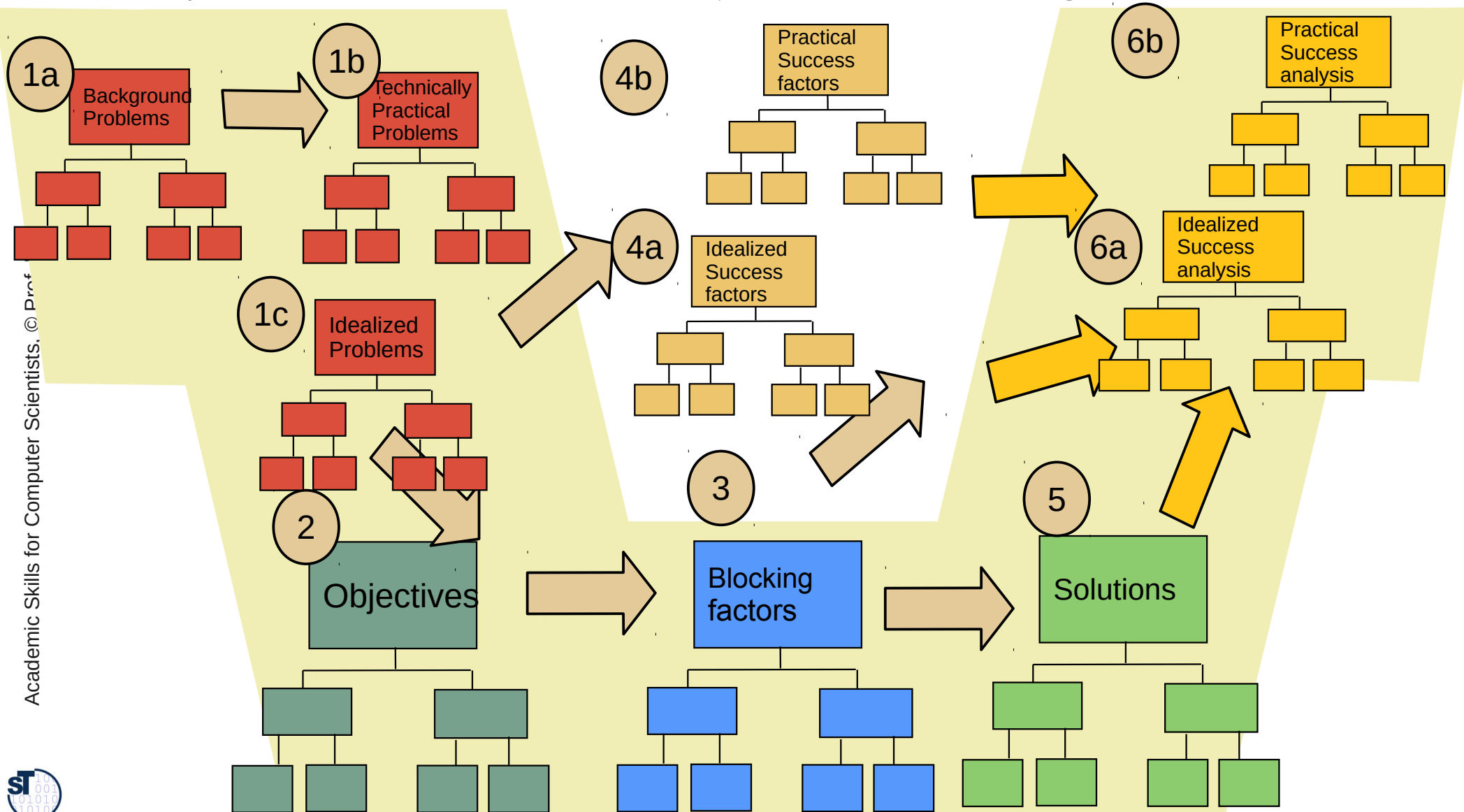
Theorem Paper Outline of [AßmannOO] – How I Would Write It Today – with BATEID-POPP

- [Uwe Aßmann. Graph rewrite systems for program optimization. ACM Transactions on Programming Languages and Systems (TOPLAS), 22(4):583-637, June 2000.]

- **General Background:** Inefficient software is costly for society.

- **IT Background:** Construction of program optimizers is hard and costly, at least 1-3 person years are necessary. (economic problem)

- **Technical problem:** Optimizers cannot be generated, there are diverse theories for single steps, but none is used for generation

- **Goal:** generate optimizers from specifications to speed up development

- **Blocking factors:** no uniform theory for model-driven development of program analyzers and transformers is available.
    - No theory can make it possible to shift analyses into transformations and vice versa

- **Solution:** Use graph rewriting to specify optimizers
    - Definition: Use *edge-addition rewrite systems* to specify program analysis for reachability
    - Definition: Use *exhaustive graph rewrite systems* to specify transformation
    - Uniformity because everything is graph rewriting
    - Theorem: Use stratification to order complex rewrite systems, based on a rule dependency graph which allows for moving rules to other rule systems
    - Theorem on implementation: show that a specific algorithm avoids inefficient redex search (order algorithm)

- **Success factors**: show the specification of several analyses and transformations
    - show the uniformity; show how the optimizer works; show how fast it is running; show optimization effectiveness

- **Success proof:**
    - Mathematical proof of the theorems
    - Case studies of the implementation of the optimizer generator OPTIMIX

PainGain-POPP for Customer Analysis and Practical Research Papers

- ▶ Distinguish special hurting problems (**pains**) and special desired objectives (**gains**)
- ▶ Disginguish objectives in **pain killers** and **gains (added values)**
- ▶ Can be used for Value Proposition Analysis (VPA)
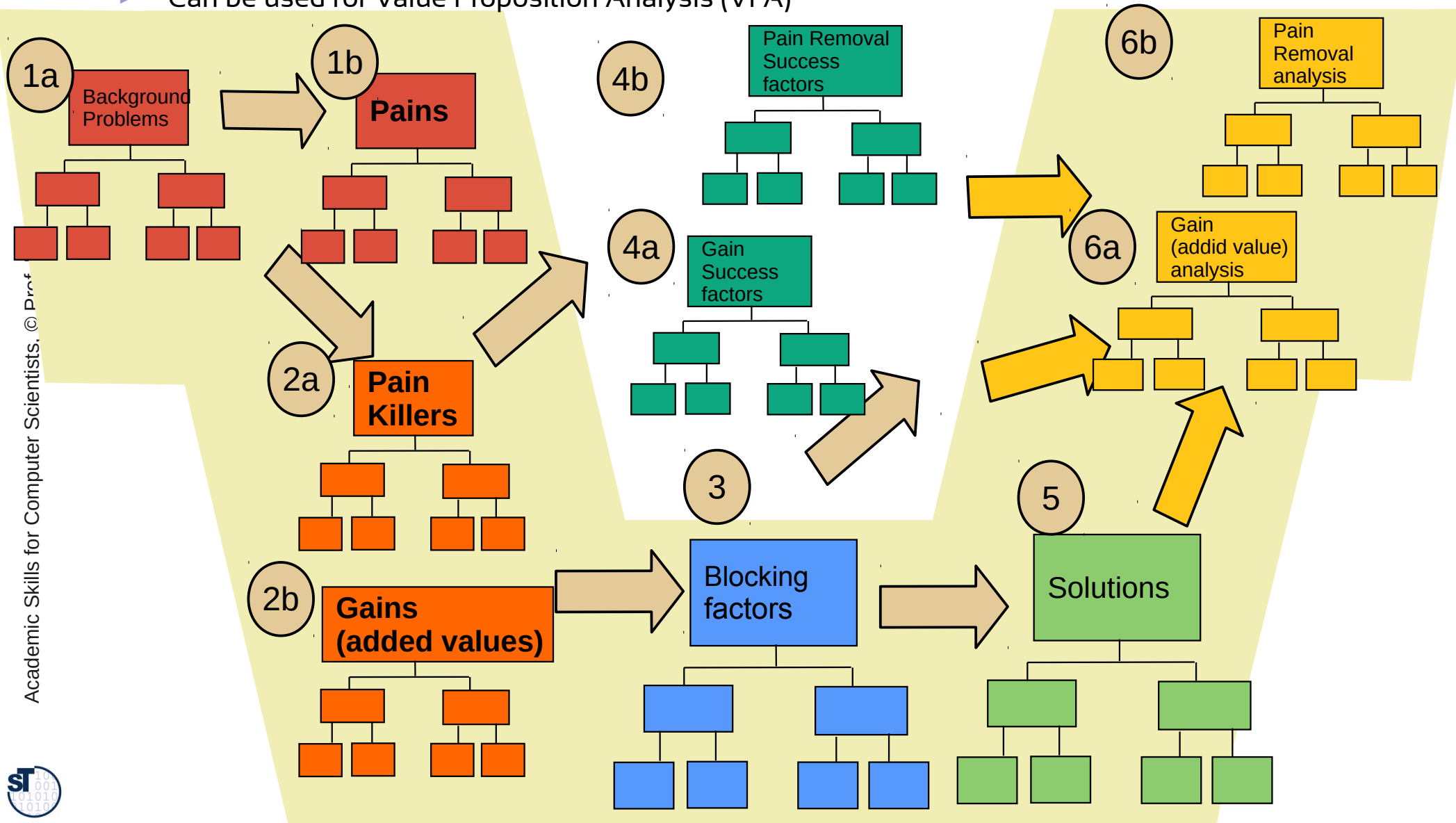
More Exercises

- ▶ 1) Write the introduction section of a
  - – "Why adaptive software architecture can help to solve the German SmartGrid problem"
  - – Use BATE-POPP
- ▶ 2) Write the introduction section of a theorem paper on
  - – "Composition of finite real-time automata for driving trains in time"
  - – see www.railcab.de and the research of Prof. Schäfer's group in Paderborn as inspirement
  - – Use BATEID-B-POPP for idealized research
- ▶ 3) Write the outline of a research project proposal for a funding agency, such as EU or DFG, with BATE-POPP
  - – "Service robots for helping elderly people in their home"

14.3 nABC Value Proposition of Carlson/Wilmot

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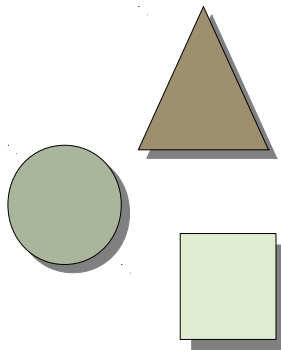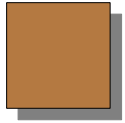
- What does the customer really need?
- What is of value for her?
- What is a *pain* for the customer?

- How does your company solve the needs of the customer?
- How does it create value for her?

Carlson-Wilmot NABC

Need **Approach** **Benefit for Cost (quantitative)** **Competition**
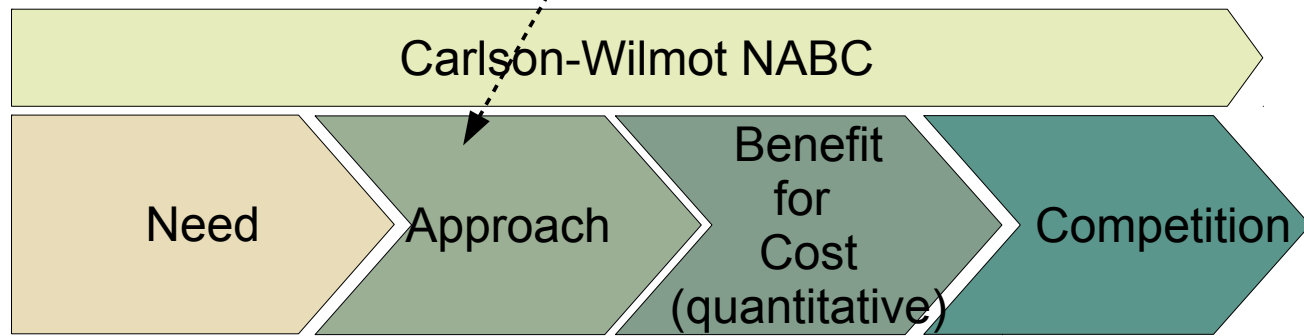
- Who is in the market already?

- How efficient is the solution?
- How large is the benefit?
- How large are the costs?
- If possible, measured quantitatively

For preparing your next application for a job,
Analyze the future employer with NABC
What are his needs?
What is your approach?
What is your benefits for his costs?
Who are your competitors?
Learn the answers for these questions by heart, to be able to present them in the interview!

nAbc Nabc

NABC Value Proposition

▶ After doing a ZOPP, you also should do an NABC Value Proposition [Carlson/Wilmot] and an *elevator pitch*

▶ The Value proposition is more directed to *customers of your PhD thesis* than to other scientists

▶ It explains ordinary people what your research is about, which *need* it solves

► An **elevator pitch** is a 2-minute speech about the nABC of your project

► You should be able to tell it

  ▪ an important investor in an elevator (2 min)

  ▪ your professor

  ▪ your grandmother

► It combines a problem solving scheme with a *hook,* a gripping introductory remark.

► Very good: use nABC with a *hook* and *quantitative benefit-for-cost.*
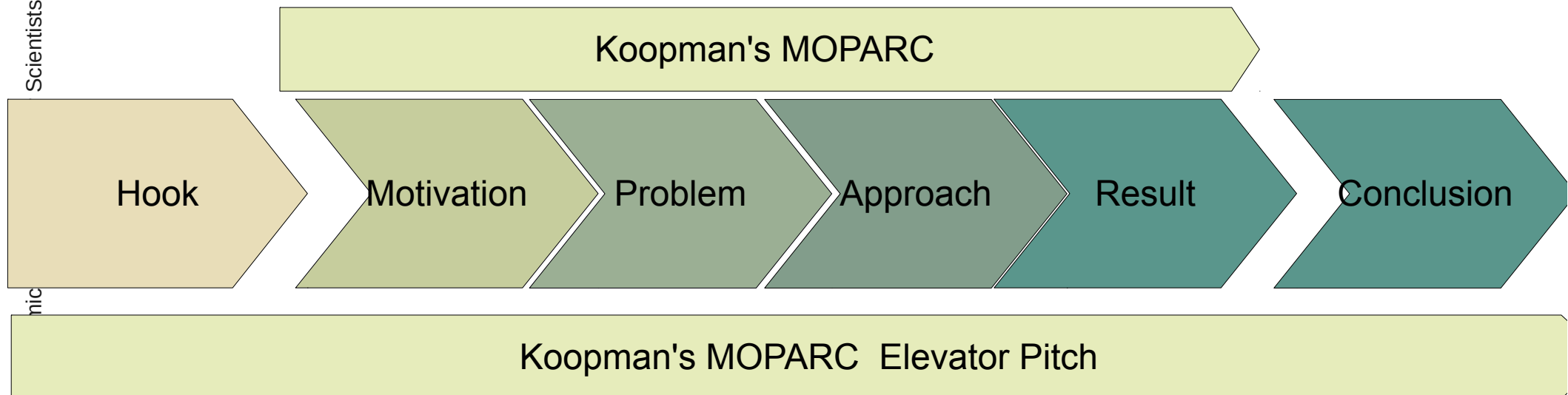
► my solution is 30% better than the competitors'

Carlson-Wilmot NABC

Hook → Need → Approach → Benefit for Cost (quantitative) → Competition → Conclusion

Carlson-Wilmot Elevator Pitch
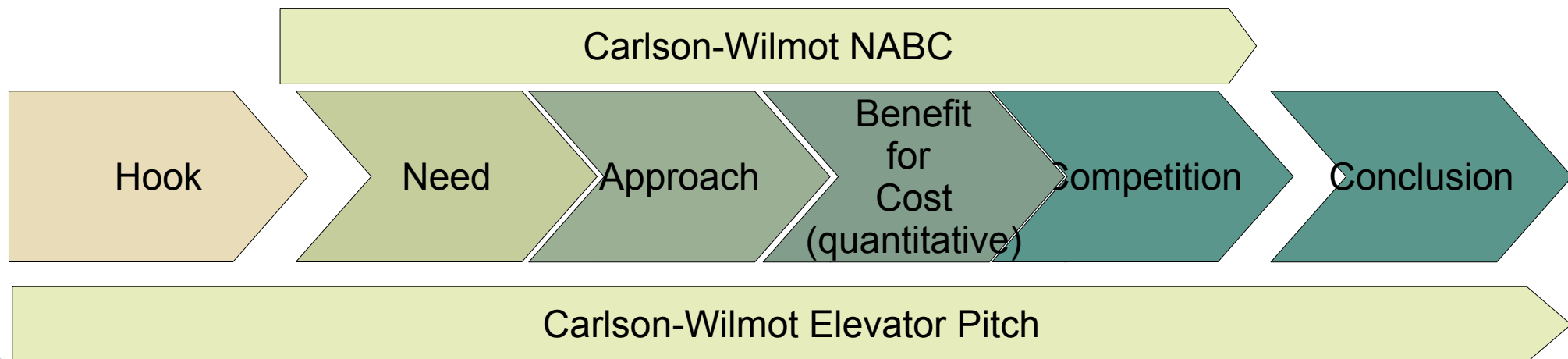
Elevator Pitches

▶ Philip Koopman has a scheme for abstract writing which is also good for Elevator Pitches

Scientists, © Prof. Uwe Aßmann

Koopman's MOPARC

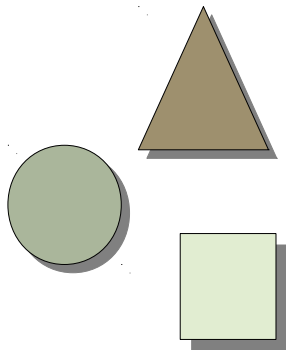| Hook | Motivation | Problem | Approach | Result | Conclusion |

Koopman's MOPARC Elevator Pitch

Other Elevator Pitches

▶ The 4-quarter cake of Vigenshow can also be used (uses honest serving men)

4-quarter-cake

Hook | Why? | What? | How? | What else?

4-quarter cake Elevator Pitch
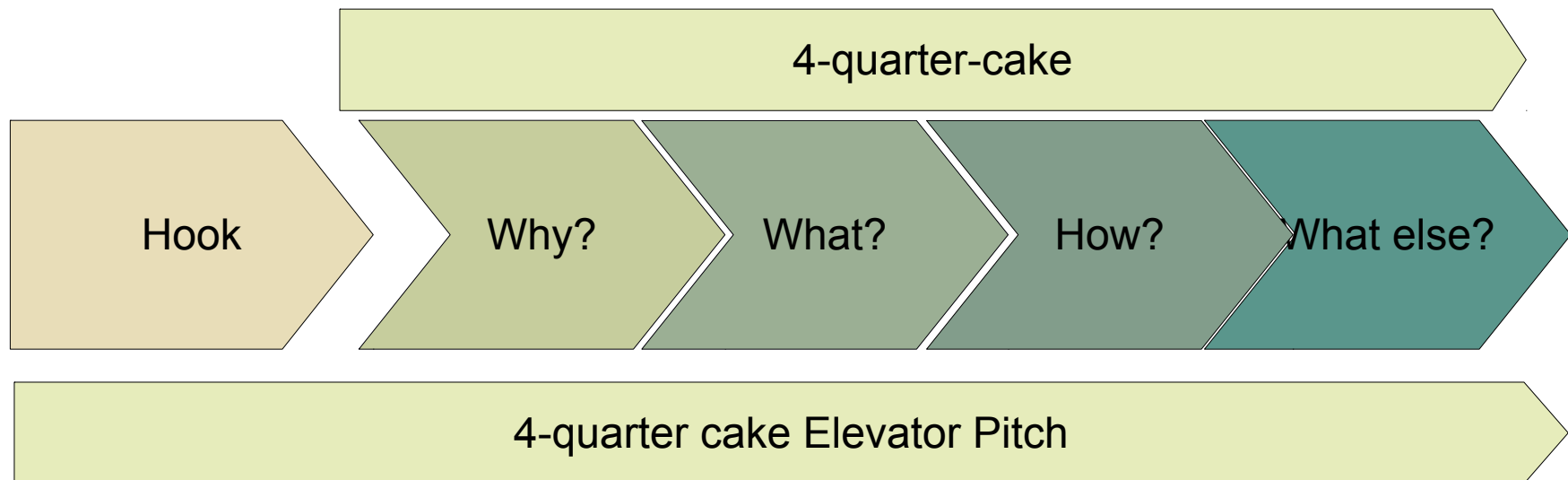
14.4 Canvases

- A Canvas is a structured form, to be printed on a BIG poster
  - It has a **fill order**, in which the fields should be filled
  - Every field has standardized questions
  - Fields are filled by sticky notes
- Canvases are very structured – Mindmaps and Concept Maps are unstructured
- Canvases are **mind maps with normalized discriminators**

SMARTPM **BLUESHEET**

PROJEKTNAME: DATUM:

① HINTERGRUND

② ANSTOSS

③ LIEFERANTEN

④ VORGABEN

⑤ RISIKEN

⑥ AUFTRAG-GEBER | **⑦ PM**

⑧ SCOPE

⑨ RESSOURCEN

⑩ BENUTZER

⑪ ENDPRODUKT(E)

⑫ ZIEL

⑬ NUTZEN

Sidebar text (rotated):
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https://www.openpm.info/download/attachments/12222711/openPM-Canvas_v.1.0.jpg?version=1&modificationDate=1360611776000&api=v2
https://www.openpm.info/display/openPM/Canvas

Develop a Canvas for Yourself

▶ For ZOPP, B-POPP

▶ For nABC

▶ For 7W-POPP Matrix

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14.5 Solution Design (SAD) with GAP: Generation of Ideas, Alternative Analysis, and Prioritization

- When there is not only one solution idea, but many, ideas have to be compared and prioritized
- [VanGundy-ProblemSolving]
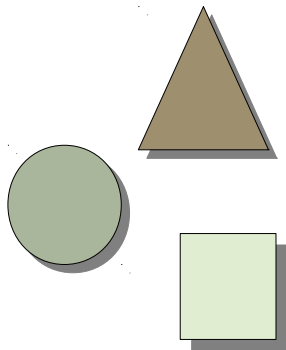
Academic Skills for Computer Scientists, © Prof. Uwe Aßmann

► So far, all solution processes have the disadvantage that they are happy if they find *one* solution

► In a **design phase** of a thesis, not only one design should be investigated, but several alternatives

   – They should be compared, assessed and documented in the report (alternative analysis)

► Technical science motivates the selection of a best technology according to assessment criteria

► Your work is not scientific if you just choose the first solution and do it

Design task ⟩ **Alternative generation (ideation)** ⟩ **Alternative analysis: comparison and prioritization** ⟩ **Alternative selection**
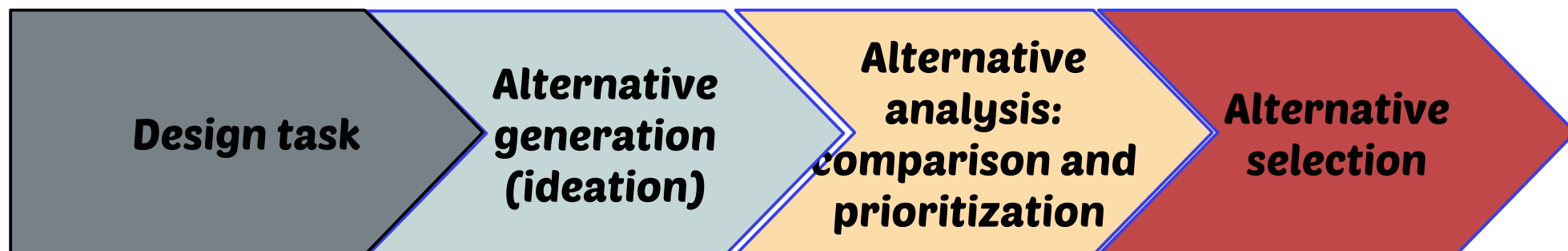
Generation of Prioritized Lists with GAP

▶ GAP is a fine-grained SAD process separating assessment and prioritzation

- For assessments and prioritzations of ideas, problems, solutions, risks, etc
- For alternatives if difficult decisions have to be taken

Generation (Identification, Elicitation, Ideation)	Assessment (Rating, Scoring, Grading)	Prioritization (Ordering, Selection)
Thinking Clustering 7-W questions Structure Trees Brainwriting Brainstorming Delphi-Studies Checklists	**Isolated Assessment** and **Grading** Metrics (on scales) onedimensional multidimensional	**Comparative Assessment and Selection** single-criteria analysis multi-criteria analysis and optimization

Scientific Aspect of GAP for Design Chapters of Final Theses

- ► For a problem of technical science, usually, several designs exist (tool and software architectures, etc)
- ► Though one design must be selected, the alternatives should be
  - G: generated (invented, developed, documented)
  - A: assessed (evaluated individually)
  - P: prioritized (evaluated individually), ordered and selected
- ► A good design chapter discusses several alternatives and why the chosen design is the best!

Embedding of GAP in the VanGundy Problem-Solving Process

- ► [VanGundy, Kap.2] uses GAP, but combines Assessment and Selection
  - ▪ This book has *many* techniques, both for individual and group processes
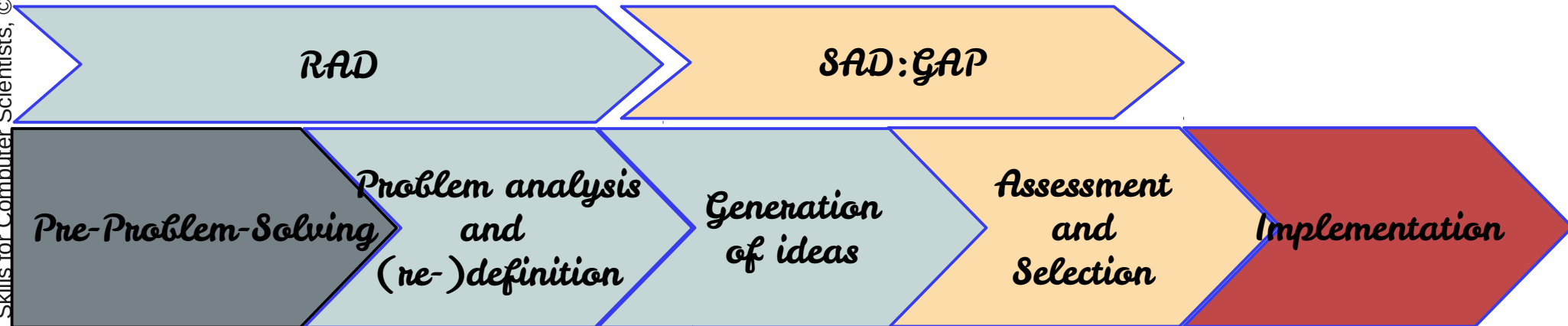
Variation and Extension Method for Ideation

- ▶ **Variation Method about Variability Analysis** [Hill, Zwicky]
  - – In a basic solution, try to ***find variables (variation points)*** which might be changed. In specifications or designs, the variables are called *variation points*
  - – Analyze their range: which values may they take?
  - – Change the variables
  - – Build variant solutions
- ▶ **Extension Method, Extensibility analysis**
  - – In a basic solution, try to find *variables* which might be *extended*. In specifications or designs, the variables are called *extension points*
  - – Analyze their range
  - – Extend the variables
  - – Build variant solutions

14.6 Assessment and Prioritization Methods

- Comparative Analysis: how do approaches of the literature compare?

- Advance Analysis: how far advance is my approach?
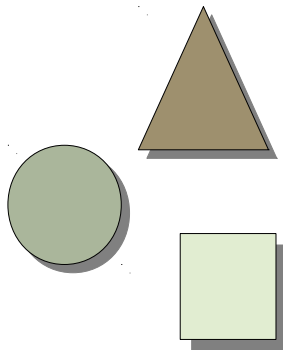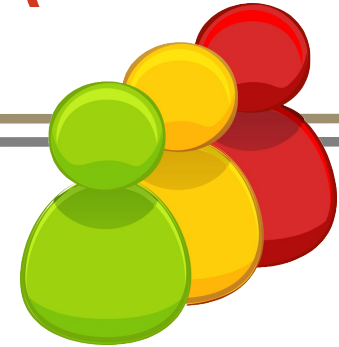
▶ **Traffic lights:** Valuate with red, green, blue

▶ **School grades:** Assessment with 5 points

▶ **"American Women" Method:** Assessment with 10 points

   – Advantage: multiply school grades by 2 => American Women Method

▶ **"Abi-grading":** Assessment with 15 points

   – Advantage: multiply school grades by 3 => Abi-grading

▶ **"Percent grading":** express the adequateness as a quotient of value and whole (20%, 81%, 2/3, ⅓, etc)

▶ **"Factor scaling":** express the adequateness by a real number between 0 and 1 (e.g., stochastic or probabilitic grading)

▶ **"Identify the Champion"** for taking an explicit standpoint and forcing of decisions (Oscar Nierstrasz)

   – A: I fill fight for it

   – B: I am in favor, but I will not fight for it

   – C: I am against, but I will not fight against it

   – D: I will fight against it

[Hill]

A Simple Form of Assessment and Binary Prioritization: de Bono's PMI (Plus-Minus-Interesting)

Plus	Minus	Interesting

- ▶ [DeBono] introduced a very simple 3-step for thinking about decisions
- ▶ Do this really sequentially, i.e., do not add Plusses if you are working on Minusses or Interesting
- ▶ The third category "interesting" helps to find out whether the arguments on Plus or Minus are really important
- ▶ PMI can be used for Discussion parts, Idea, topic, argument generation

Multi-Criteria Attribute Analysis with Kiviat-Graphs

▶ A **Kiviat-Graph** draws a vector from an n-dimensional space into the plane.

▶ It visualizes a multi-criteria analysis

Adaptation

Connection

Product quality

Extensibility

Software process

Aspect Separation

Metacomposition

Scalability

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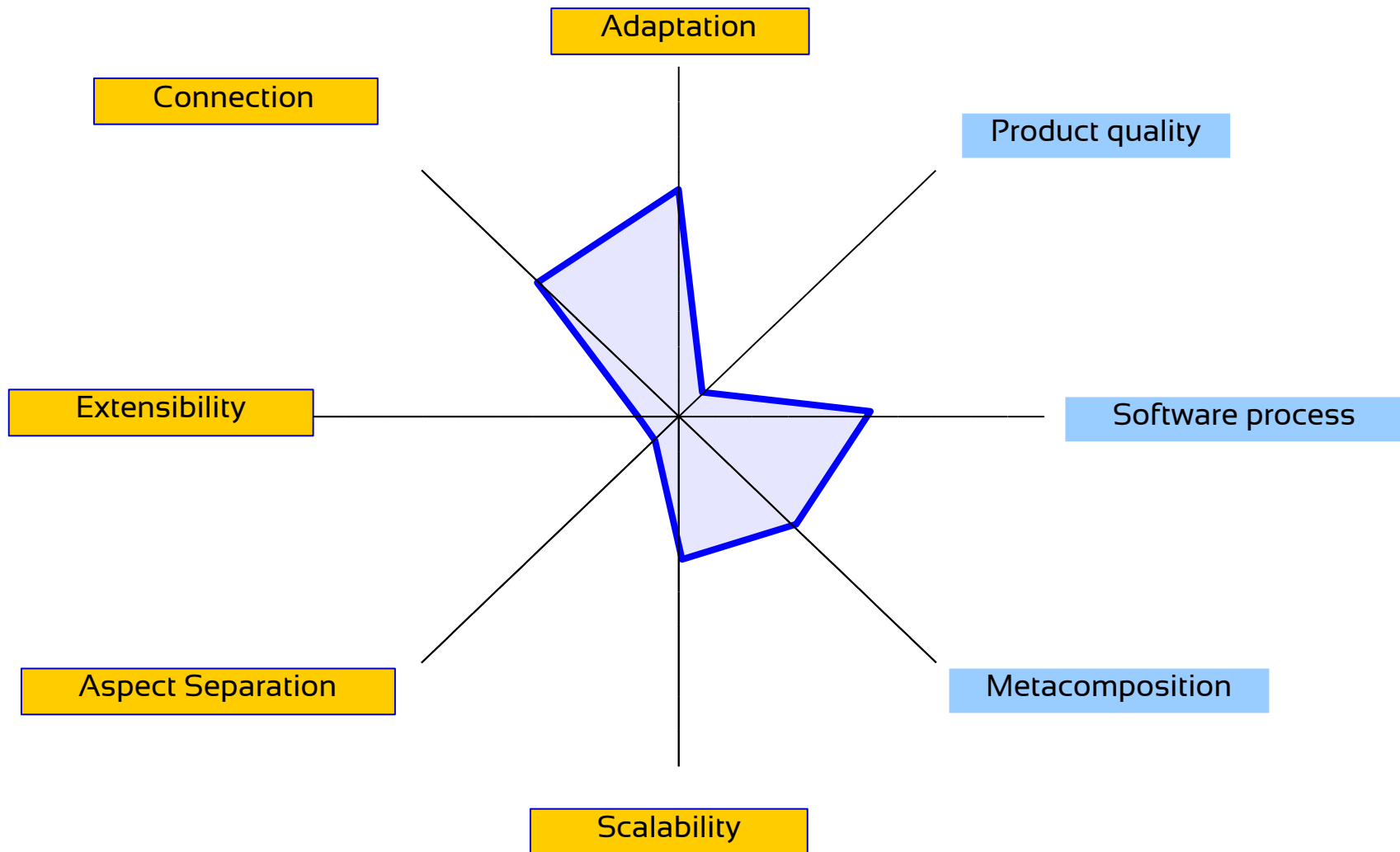
Assesment can be on Olympic Questions or Efficiency Questions

► Approaches, ideas, and solutions can be evaluated with regard to

– Olympic criteria (faster, higher, farer) or

– Efficiency criteria (cost vs utility)

– (see types of questions)

14.6.1 Examples for Multi-Criteria Analyses

Quantitative and Qualitative Comparisons for Olympic and Efficiency Success Criteria

- An **olympic research problem** is about increasing benefit or reducing cost
- A **efficiency research problem** is about doing both
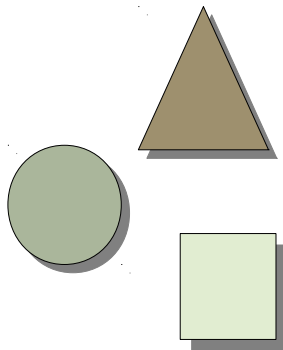
Olympic Assessment with BeNeSiLo – Which Progress are we interested in?

▶ **BeNeSiLo** is a 4-D attribute analysis utility (olympic), measuring progress qualitatively or quantitatively (Better, Nicer, Simpler, LongerLasting)

- Larger rectangles denote greater utility

▶ Enter your own technology and competitors into BeNeSiLo for qualitative or quantitative olympic analysis

▶ **Qualitative comparison:** without scales

▶ **Quantitative comparison:** with scales (e.g., ordinal)
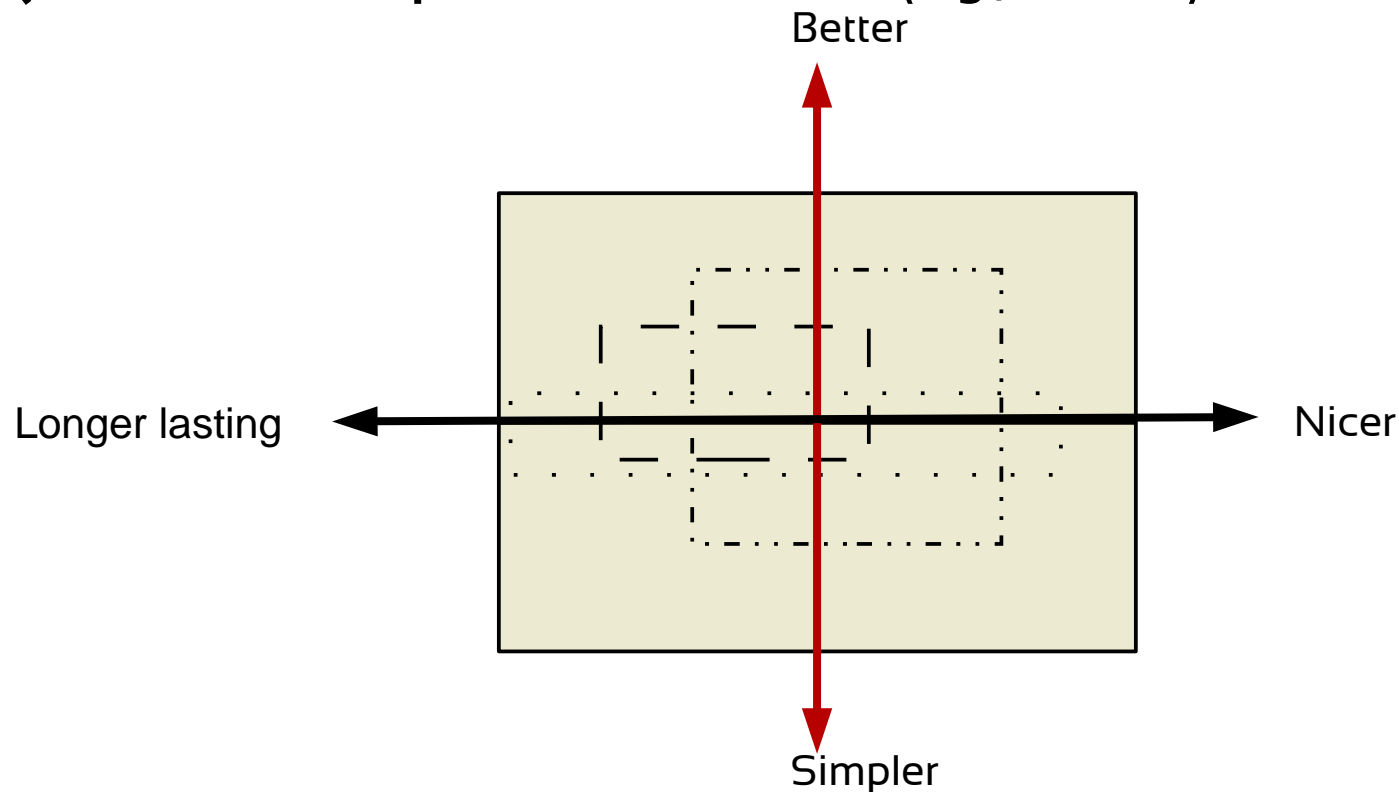
Exercise: Comparing Sort Algorithms

▶ Sorting is a well researched field of algorithmics

▶ Do a BeNeSiLo analysis for comparison of sort algorithms

▶ Look for comparing papers of sort algorithms

▶ Compare according to the criteria:

– Speed (complexity)

– Average speed (average complexity)

– Memory consumption

– Energy consumption

▶ Draw several BeNeSiLo cross diagramm and comment it with a text

▶ 2) Add the dimensions

- Distributability

- Security

▶ and span up a Kiviat graph (6 arms)

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Quantitative BeNeSiLo with Abi Grading for Utility/Benefit Analysis
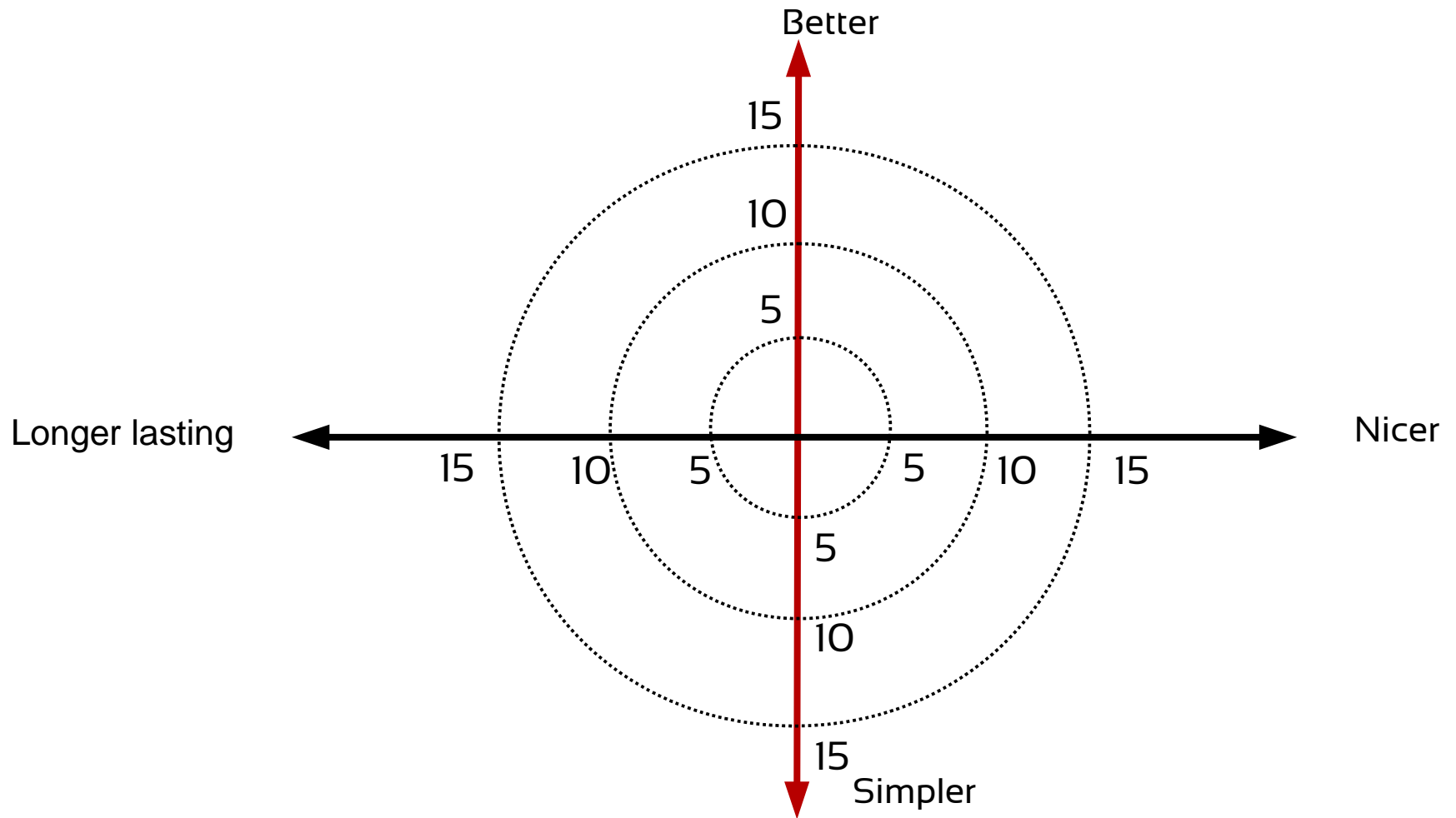
"Magic Rectangle" Efficiency Analysis for Research and Projects

- ▶ Many research problems in technical science deal with **benefit (utility)** or **cost (resource consumption)**
- ▶ These are **efficiency problems:** increase benefit while reducing cost
- ▶ These are related to **efficiency goals**

Cost dimension: Resources and Time

Time:
Deadlines, being early

Cost:
Resource consumption
Money consumption

Quality

Quantity

Benefit (utility) dimension: Quality and Quantity
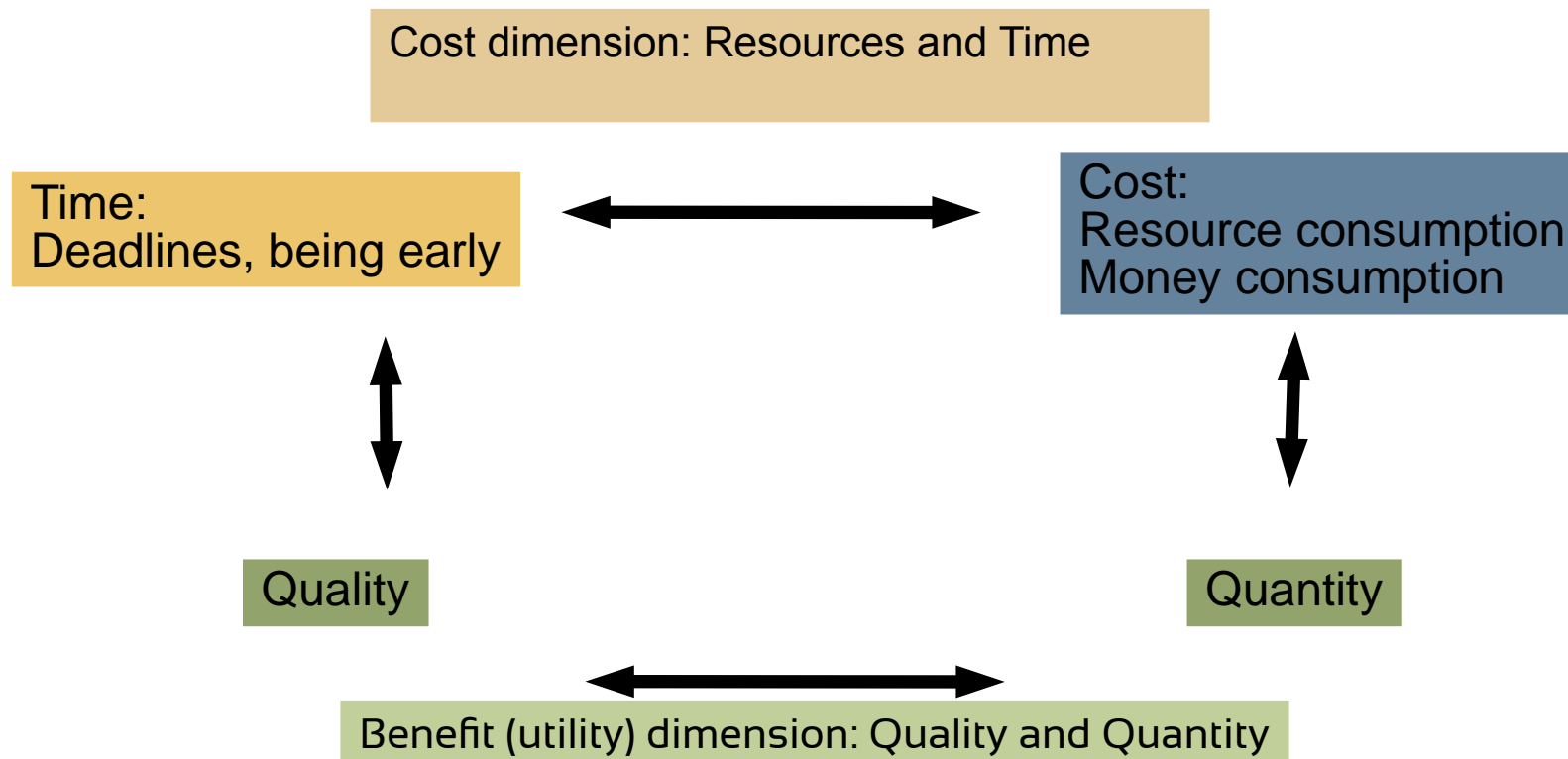
Cost and Utility Interdepend

Cost dimension:
Resources and Time

Time: Dates, Duration

Cost: Money, Resources

Quality

Quantity
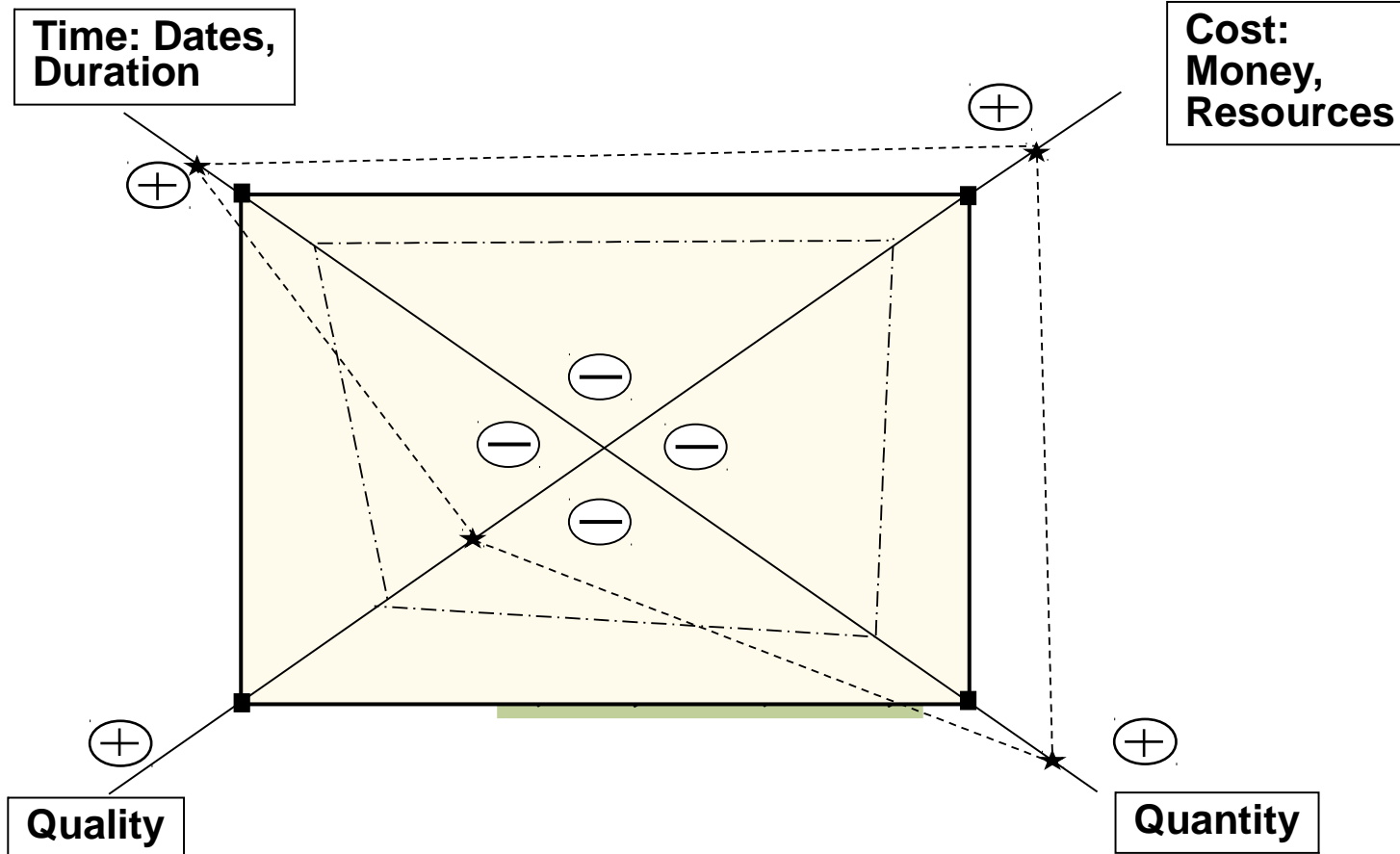
Legende:

(+) = Verbesserung

(—) = Verschlechterung

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Quelle: [Bruno Jenny, Projektmanagement S. 292]

14.6.2 Comparative and Advance Analysis in Tabular Form - Comparisons for Approaches with Regard to Success Criteria

- Advance analysis compares a set of approaches in the literature with regard to some success attributes/criteria/factors.
  - These criteria may stem from a literature analysis or classification.
  - The comparison is usually multi-criteria.
  - Display with tables, kiviat, or portfolios.
  - Qualitative (boolean) or quantitative (scales)

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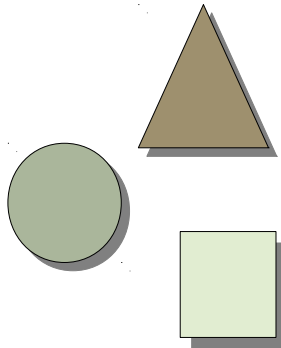
▶ Boolean values in the multi-criteria analysis

	Approach 1	Tool 2	Technology 3	My approach
Criterion 1	no	no	no	yes
Criterion 1.2	may be	yes	no	yes
Criterion 1.3	no	unclear	yes	yes
Criterion 2	yes	yes	no	yes
Criterion 3	yes	no	no	yes

Ex.: Traffic Light Comparative Analysis

▶ Boolean values in the multi-criteria analysis

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	Approach 1	Tool 2	Technology 3	My approach
Criterion 1	no	no	no	yes
Criterion 1.2	may be	yes	no	yes
Criterion 1.3	no	unclear	yes	yes
Criterion 2	yes	yes	no	yes
Criterion 3	yes	no	no	yes

Ex.: American Woman Advance Analysis

► A "American Woman Comparison table" lists several approaches with grades 1-10 in the multi-criteron analysis, indicating the best approach

► For an advance analysis, you have to compare your own approach with all others

► Ex. Scientific evaluation of Papers: Papers are often evaluated with American Woman Analysis according to multiple criteria, e.g., Innovation depth

	Approach 1	Tool 2	Technology 3	My approach
Technical quality	5	3	9	7
Innovation depth	3	3	7	8
Presentation quality	6	4	8	7
Validation quality	7	2	7	9
Practicality	8	3	10	7
Expert level of Reviewer	10	7	8	9

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Ex.: School Grade Analysis for Student's Theses

▶ German Grades 1-5 in the multi-criterion analysis, with 1/3 steps, or equivalently Abi-School grades:

▶ 0.7 (15 – not handed out), 1.0 (best, 14), 1.3 (13), 1.7 (12), 2.0 (11), 2.3 (10), 2.7 (9), 3.0 (8), 3.3 (7), 3.7 (6), 4.0 (5), 5.0 (4, 3, 2, 1, 0)

▶ For theses in Assmann's group, 3 Groups of Criteria exist: technical, presentation, and process quality

  ▪ Grades are handed out on a scale of 1-15 points

|	Approach 1	Tool 2	Technology 3	My approach
Technical quality	12	4	3	12
Presentation quality	14	5	10	12
Process quality	12	8	8	11

Ex.: Weighted School Grade Analysis for Student's Theses

► Weight factors scale the absolute grades in ordinal scale

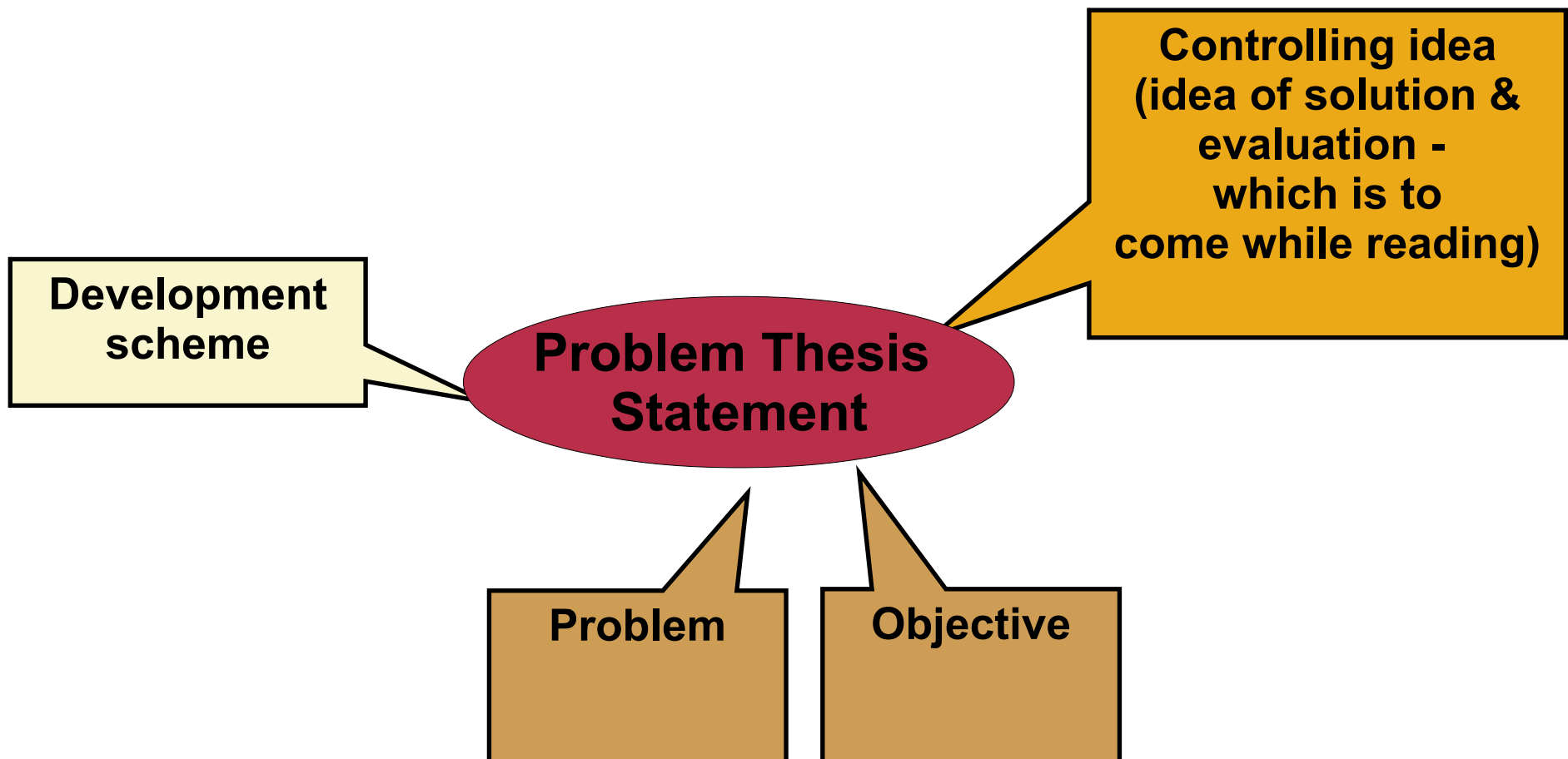|		Approach 1		Tool 2		Technology 3		My approach	
Technical quality	0.45	12	5.5	4	1.8	3	1.4	12	5.5
Presentation quality	0.2	14	2.8	5	1	10	2	12	2.2
Process quality	0.25	12	3	8	2	8	2	11	2.8

14.8 Writing Problem, Objective, Solution-Idea Analysis Papers (POS papers)
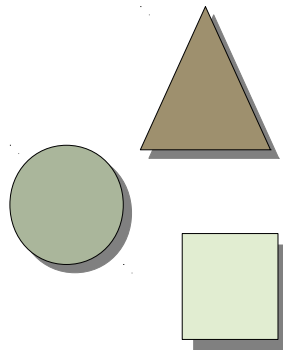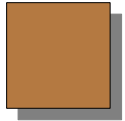
Problem, Objective & Solution (POS) Statements

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▶ A **Problem, Objective & Solution (POS) thesis statement** is a thesis statement showing a problem, an objective and a solution

- ▪ If evaluation is added, it is called **POSE statement**

▶ **Thesis: Problem + Controlling idea (severity) + Development Scheme**

Development scheme

Problem Thesis Statement

Controlling idea (idea of solution & evaluation - which is to come while reading)

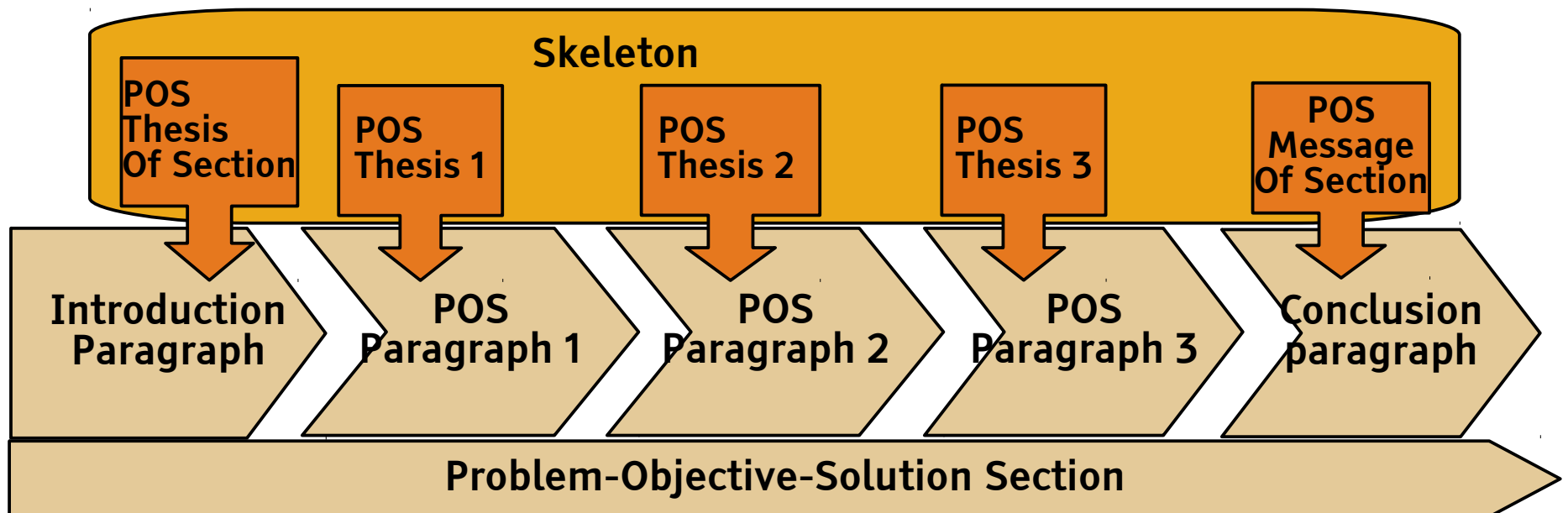**Problem**

Objective

POS Paragraphs in 1-3-1 Structure

▶ We live in interesting times.

▶ Though major global players still believe in the oil economy, we should earn all our energy demands from natural sources in 2030, because the technical progress in harvesting energy is so tremendously fast.

▶ Major global companies are fixed on the oil economy and fight against a methanole economy on the horizon. Also governments support their old-fashioned strategy.

▶ In 2030, however, we should harvest all our energy and store it in methane or methanole, because only the methanole economy can free the world from desastrous C02 pollution.

▶ A technical solution could be to use the political union with countries like Greece to buy their natural energy and transport it by long-distance DC-powerlines to central and northern Europe.

▶ We need to find "champions" who will invest into these golden times of natural energy harvesting.

Introductory Sentence	POS Thesis Statement	Problem*	Objective*	Solution*	Message sentence

1-3-1 Problem-Objective-Solution (POS) Paragraph (5 step)
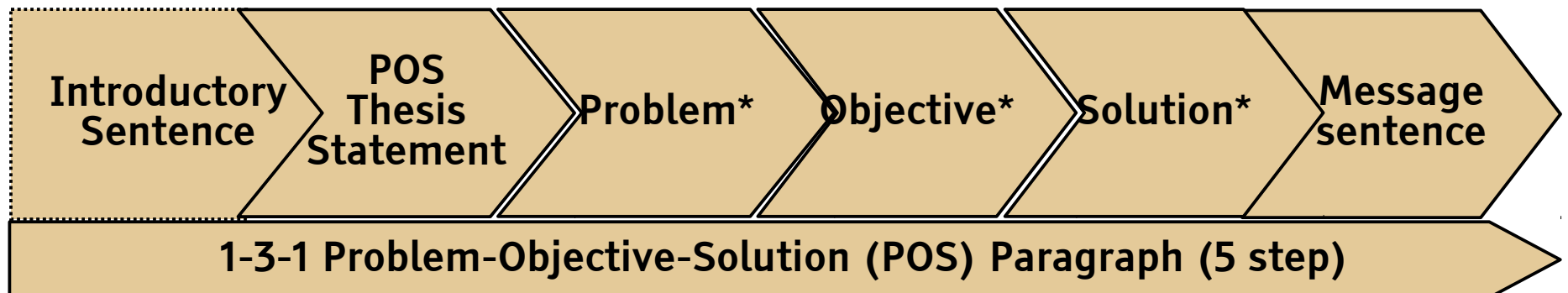
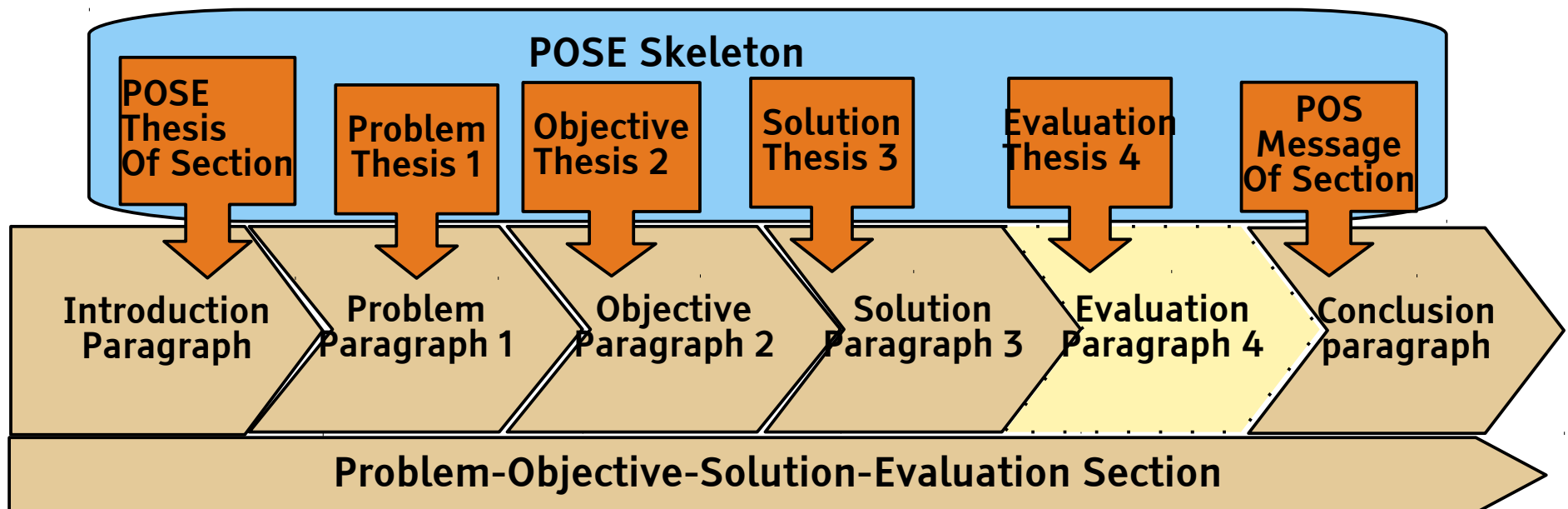# Skeletons of Problem-Objective-Solution Sections

- ► The **skeleton** of a POS section is the sequence of all POS 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

Skeleton

| POS Thesis Of Section | POS Thesis 1 | POS Thesis 2 | POS Thesis 3 | POS Message Of Section |

| Introduction Paragraph | POS Paragraph 1 | POS Paragraph 2 | POS Paragraph 3 | Conclusion paragraph |

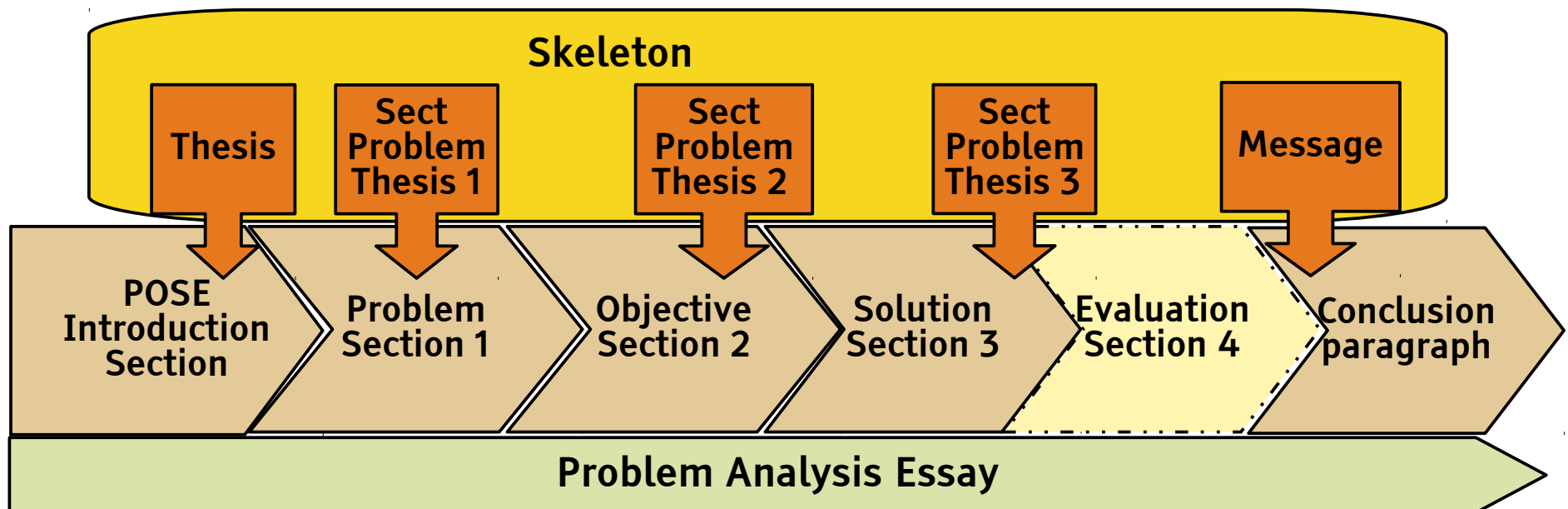**Problem-Objective-Solution Section**

POSE Introduction Sections

▶ A **POSE (problem-objective-solution-evaluation) section** gives an overview over a paper (introduction section)

▶ The POSE section has **unity** if all theses of the POSE paragraphs support the section thesis

▶ Sometimes, evaluation is not available – then it becomes a **POS introduction**

POSE Skeleton

| POSE Thesis Of Section | Problem Thesis 1 | Objective Thesis 2 | Solution Thesis 3 | Evaluation Thesis 4 | POS Message Of Section |

| Introduction Paragraph | Problem Paragraph 1 | Objective Paragraph 2 | Solution Paragraph 3 | Evaluation Paragraph 4 | Conclusion paragraph |

Problem-Objective-Solution-Evaluation Section

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- ► A POSE analysis essay discusses all aspects of a problem, an objective, and a way to a solution (and the evaluation)

- ► A **problem-objective-solution-evaluation analysis research paper (POSE paper)** discusses all aspects of a research problem

- ► A **research exposé** is a **POS paper** (to be written at the beginning of a thesis, usually without evaluation)

- ► Often, Problem and Objective Sections are merged

Skeleton

| Thesis | Sect Problem Thesis 1 | | Sect Problem Thesis 2 | | Sect Problem Thesis 3 | | Message |

| POSE Introduction Section | Problem Section 1 | Objective Section 2 | Solution Section 3 | Evaluation Section 4 | Conclusion paragraph |

Problem Analysis Essay

► **Every thesis needs a structured solution design method**

► **Many students loose time because they don't know any**

► SPALTEN, DESIGN THINKING, ZOPP and other POPP methods are extremely valuable for YOUR thesis

- to organize your thoughts
- to write research exposés
- to guide a reader through the work, or your defense talk

► Solution design processes organize your work systematically

- make you much faster!
- PAD-SAD-RAD is a 3-step schema for solution processes

► GAP is important for finding alternative and evaluating solution ideas

► Olympic and efficiency comparisons are very important for

- comparing your work to others
- selecting the *best* ideas
- showing other people why they are best

► Knowing and using different classes of questions opens a discussion, an ideation process, or closes it

Exercises

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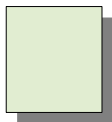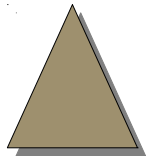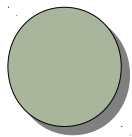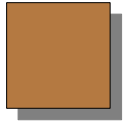
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► Read the essay - **"Innovationen sichern den ökonomischen Erfolg". (1996)**

► 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 POS Papers

▶ Write a POS 1-3-1 essay about the question

▶ "Why should Greece not leave the Euro?"

- Define a skeleton
- Define the POS thesis statements very carefully
- Create unity for your POS essay!