# 11. The OI*SDR Research Process - From the Idea to the Text of a Paper or Bachelor/Master/PhD Thesis

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

Speak OI*SDR as Oyster

1) The OI*SDR Research Processes
2) Orientation: From the idea to the research question
3) Information Gathering
4) Diffusion
    1) Structuring
    2) Drafting and Revising for Textification, Talkification and Demos

Literature
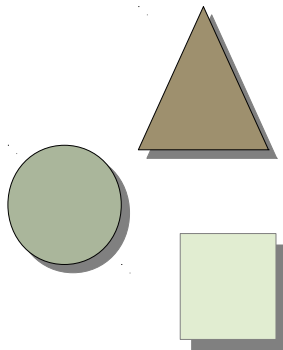
- [Krumbiegel] Helga Esselborn-Krumbiegel. Von der Idee zum Text. Eine Anleitung zum Know-howschaftlichen Schreiben:
    - 3. überarbeitetete Auflage, 2008
    - Leiterin des Schreibzentrums in Köln http://schreibzentrum-koeln.de/
    - Angegliedert am Studentenwerk Köln
- [Rico] Gabriele L. Rico. Garantiert Schreiben Lernen. Rowohlt-Verlag, 1984
    - http://de.wikipedia.org/wiki/Cluster_(Kreatives_Schreiben)
- Joseph Novak, The Theory Underlying Concept Maps and How To Construct Them. IHMC, Techreport, 2002,
    - http://cmap.ihmc.us/docs/theory-of-concept-maps
- Matti Tedre. Know your discipline: Teaching the philosophy of computer science. Journal of Information Technology Education (JITE), 6:105-122, 2007.
- Prof. Mary Shaw from CMU has a lot of good material on Software Engineering Research. http://spoke.compose.cs.cmu.edu/ser04/
- The English portal for students http://www.studentastic.co.uk/
- http://www.studentastic.co.uk/ten-steps-for-better-research-university.html

Other Literature

- [Ashby] Mark Ashby. How to Write a Paper. Engineering Department, University of Cambridge, Cambridge 6rd Edition, April 2005 http://www-mech.eng.cam.ac.uk/mmd/ashby-paper.pdf

- [deBono] Edward de Bono. de Bono's neue Denkschule. Kreativer denken, effektiver arbeiten, mehr erreichen. mvg-Verlag, München.

- [Heimes] Silke Heimes. Schreiben im Studium: Das PiiP-Prinzip. Vandenhoek und Ruprecht. UTB 3457

- Tony Buzan, Barry Buzan: Das Mind-Map-Buch. Die beste Methode zur Steigerung ihres geistigen Potentials. Moderne Verlagsgesellschaft Mvg, 2002.
  - http://de.wikipedia.org/wiki/Mind-Map

- Reich, K. (Hg.): Methodenpool. In: url: http://methodenpool.uni-koeln.de, Abt. Mindmaps

- Marc E. Tischler. Scientific Writing Booklet. Dept. of Biochemistry and Molecular Biophysics. University of Arizona. http://www.biochem.arizona.edu/marc/Sci-Writing.pdf
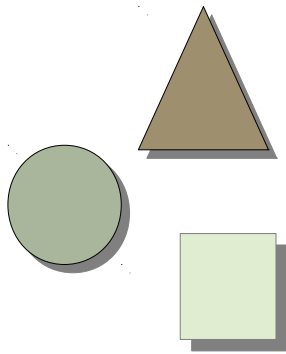
Goals of this Chapter

4

- ▶ Give you an overview of the research process, e.g., of research paper or a Bachelor, Master's thesis, or PhD thesis
- ▶ Illustrate the process with some example methods.
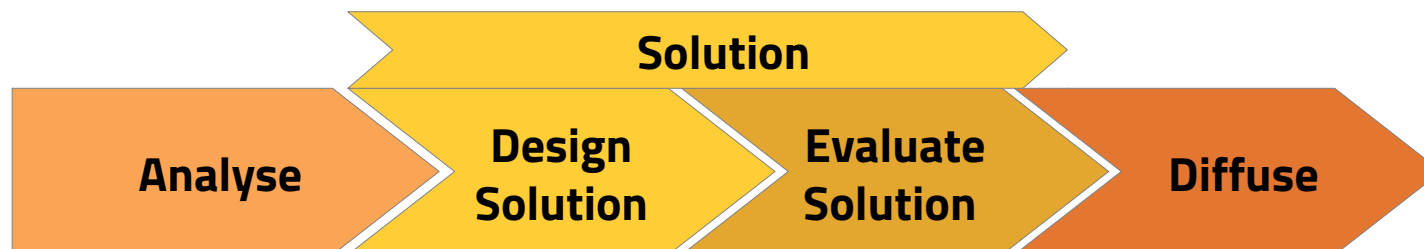
11.1. The OI*SDR Research Processes

Inspired from [Esselborn-Krummbiegel]

Standard Research Process ADED [Österle/Otto]

► [Hubert Österle, Boris Otto. A Method For Consortial Research. Report No. BE HSG/ CC CDQ/ 6, University of St. Gallen http://works.bepress.com/hubert_oesterle/196/]

► **Analyse** existing technologies, literature, background, problems

► **Design** new technologies (new solution)
  – Think, brainstorm, generate ideas
  – Research and develop

► **Evaluate** technologies (new solution)
  – Show why the new technology is superior; use success criteria

► **Diffuse (publish and demonstrate)**
  – Demonstration for creating vision
  – Popularize (position) your research results
  – „visible scientist"

Solution

Analyse | Design Solution | Evaluate Solution | Diffuse

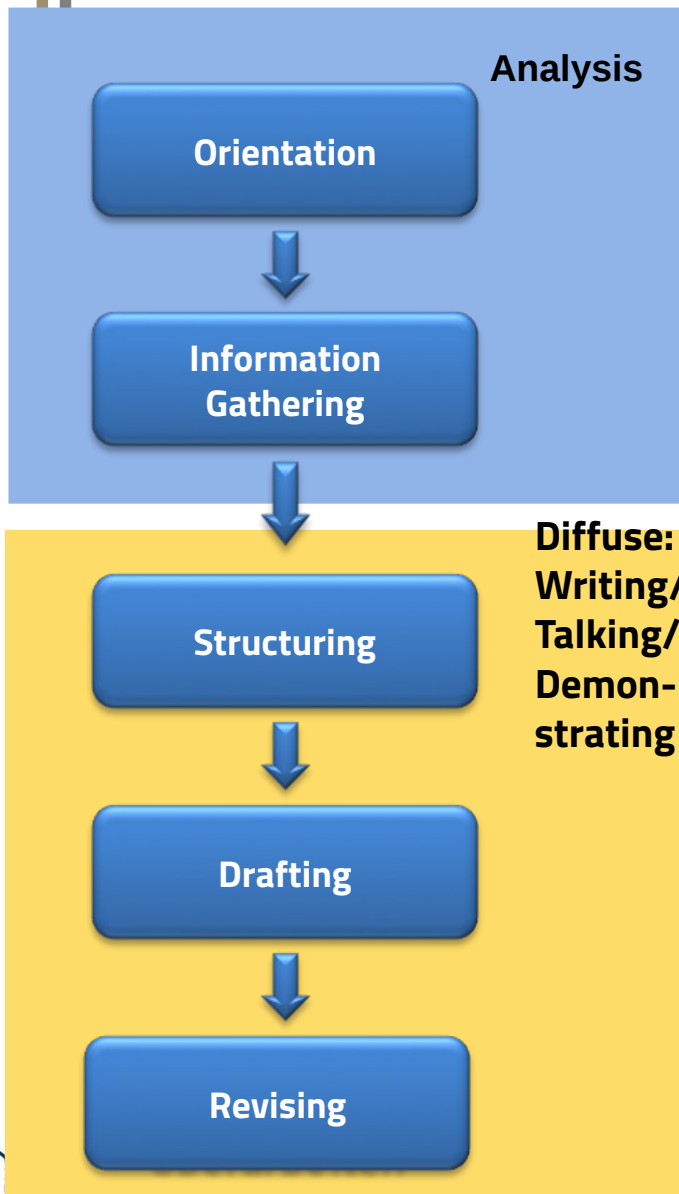Academic Skills in Computer Science, © Prof. Uwe Aßmann

The OI-SDR Research Process
for General Scientific Topics and Overviews (without Evaluation)

Here, we look at a simple variant of ADED, OI-SDR [Esselborn-Krummbiegel].

Phases of scientific text production, e.g., for overview papers on a subject or essays

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Analysis

- Orientation
- Information Gathering

Diffuse: Writing/ Talking/ Demon-strating

- Structuring
- Drafting
- Revising

- Collect ideas, generate ideas
- Find the scope (limits) of the topic
- analyze problems
- Orientation in literature: First overview on literature
- Planning: Expose + project plan
- Market need, relevance analysis: identify your readers and stakeh[...] [Ashby]
- Informing: Information Gathering: Primary texts, evaluate sources. Check relevance of Literature
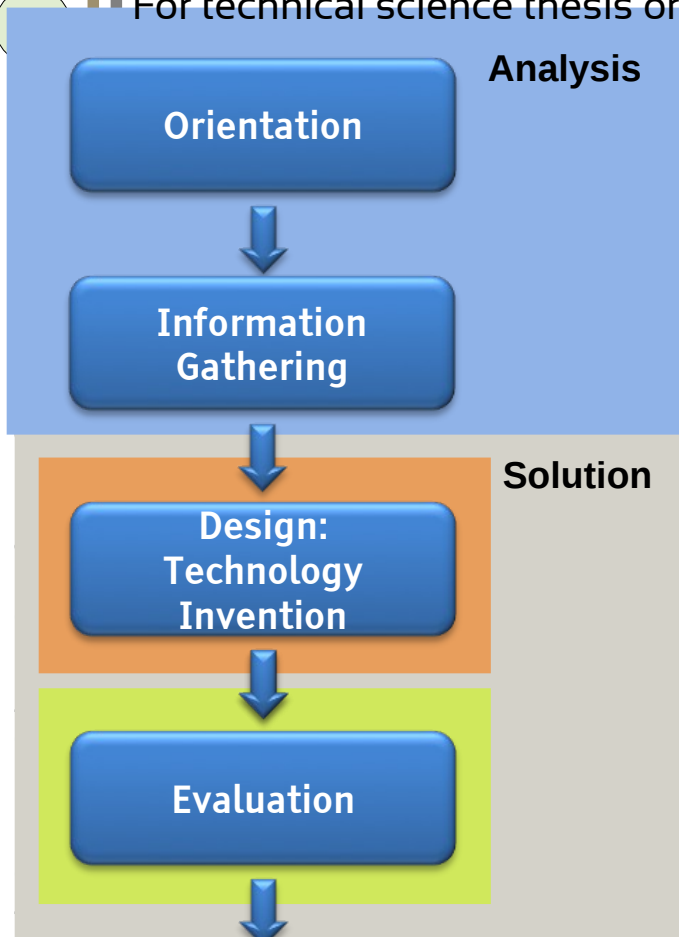
- Order Material
- Find Hypotheses by applying problem and solution analysis
- Outlining
- Design Controlling Ideas, Points, Skeletons
- Issues entwerfen und abgleichen

- Write main part of work
- Write Introduction and Conclusion

- Mature controlling ideas
- Mature skeleton
- Produce yellow draft
- Mature to green document

The OI-DE-SDR Research Process as a Refinement of ADED for Technical Science Thesis

For technical science thesis or for technical papers, an evaluation phase as in ADED is necessary.

Analysis

Orientation

Information Gathering

- **Problem analysis**
- **Automation or optimization hypothesis**
- **Success factor analysis**

In the technical sciences (engineering science, IngenieursKnow-howschaft), a thesis must be technical, i.e., achieve and demonstrate a technical result.

Success factors have to be analyzed to know whether a result is really needed

Solution

Design: Technology Invention

- **Requirements of the solution**
- **Solution design, invention**
- **Design alternatives, assessment and selection**
- **Architecture development**

Evaluation

- **Testing the research hypothesis by experiments**
- **Benchmarking**
- **Interpretation of the experiments**
- **Documenting the limits of the technology**

Academic Skil

Structuring

Diffuse

Diffusion of the technology by writing: a design pattern, a report by demonstrating a software prototype

Drafting

Revision

Demonstrate

The Variant OI-PP-SDR Research Process for Mathematical/Structural Science Thesis

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Analysis

- Orientation
- Information Gathering

Solution

- Proposition Design
- Evaluation: Proof

Diffuse
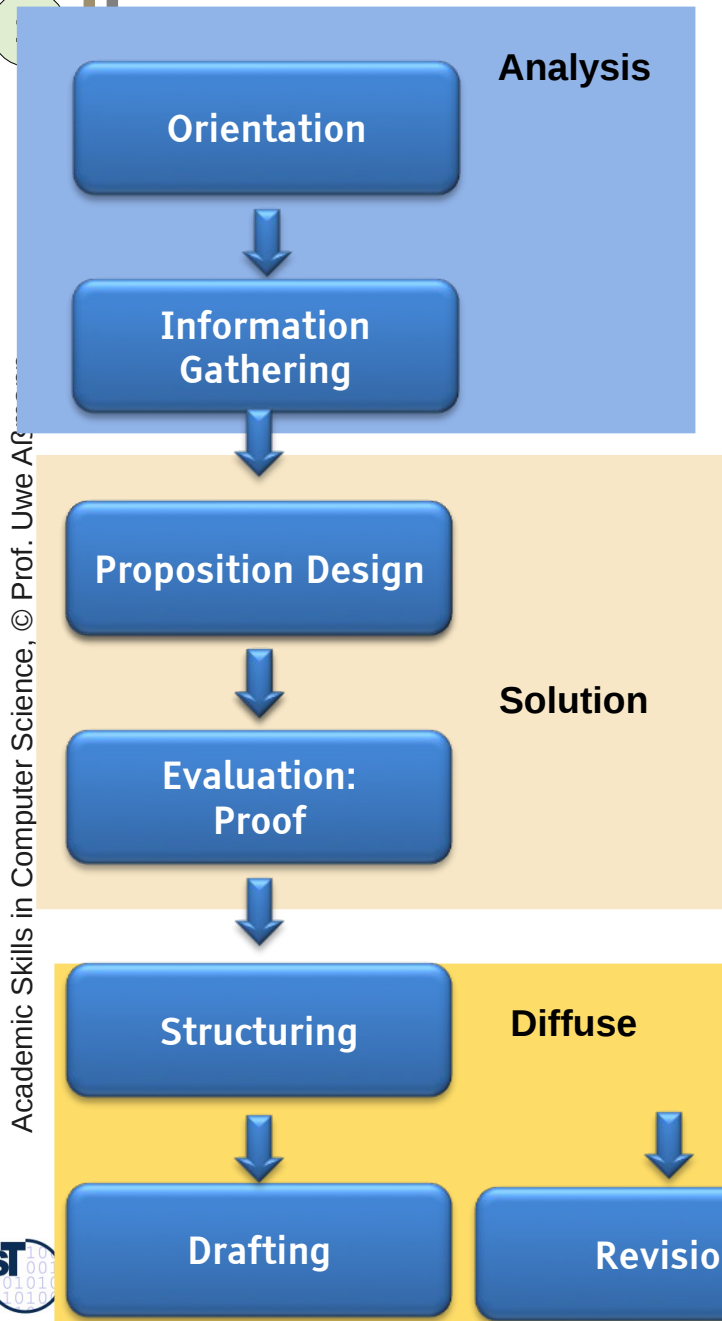
- Structuring
- Drafting
- Revision

Phases of scientific text production, e.g., for mathematical papers or papers in theoretical computer science.

- **Problem analysis**
- **Informal hypothesis**

- **Write up background work**
- **Formalize the proposition**
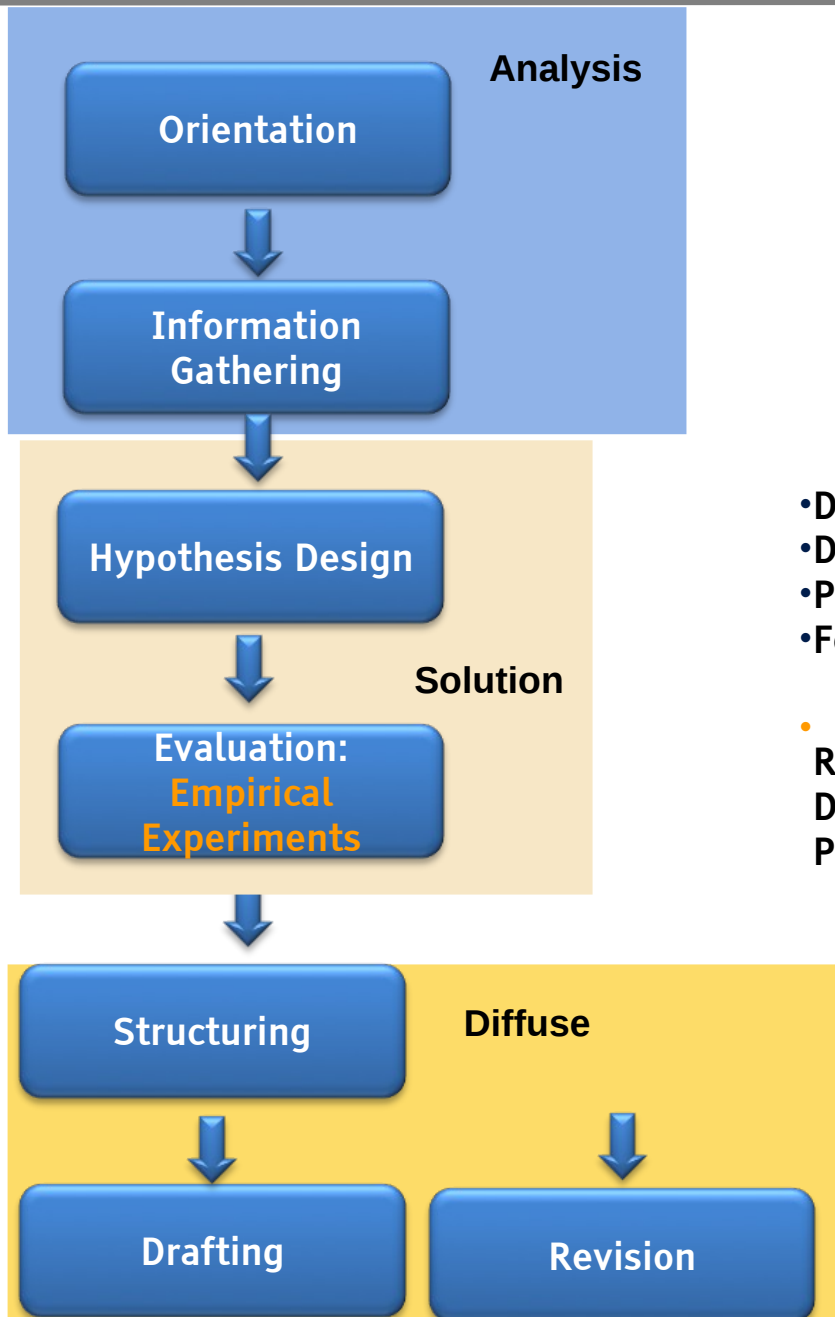- **Decompose into lemmata**

- **Proof the lemmata**

In the structural sciences (mathematics, theoretical computer science), a thesis must prove a **proposition** (thesis), i.e., demonstrate a result in mathematical language and logic.

The Variant OI-HE-SDR Research Process for Empirical Science Thesis

Analysis

- Orientation
- Information Gathering

Solution

- Hypothesis Design
- Evaluation: Empirical Experiments

Diffuse

- Structuring
- Drafting
- Revision

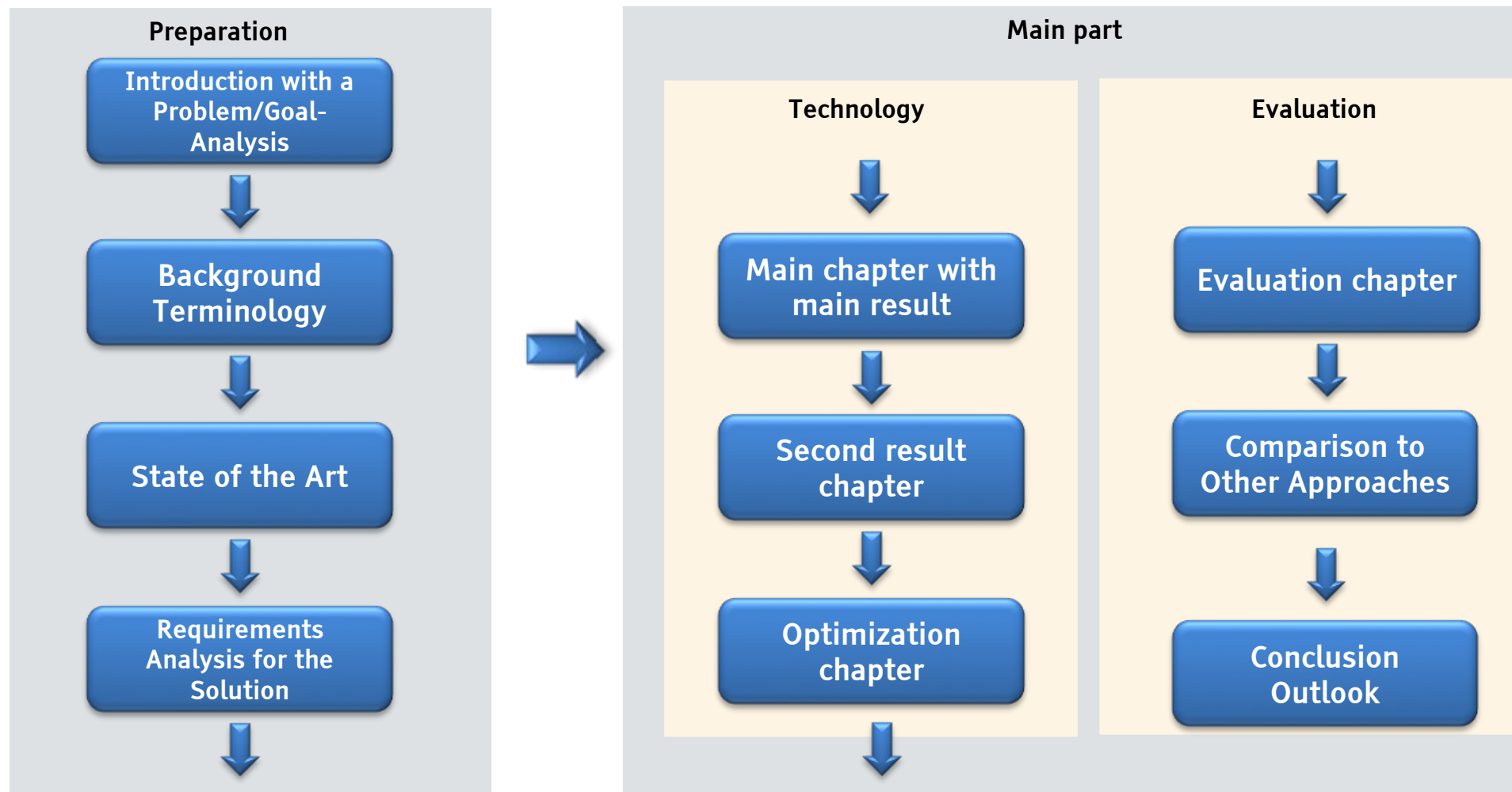Phases of scientific text production for empirical papers e.g., in usability engineering.

- Design of Experiment
- Definition of test gropus (Probanden)
- Planning of date
- Formulation of research hypotheses

-
  Run experiment
  Data recording
  Protocol

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Standard Structure of a Technical Science Thesis

▸ A scientific thesis work should clear demarcate the part that is from you from the part that is not from you (background).

▸ The main part is divided in technology and evaluation part.

  – Some chapters can be folded or distributed.

Preparation

- Introduction with a Problem/Goal-Analysis
- Background Terminology
- State of the Art
- Requirements Analysis for the Solution

Main part

Technology

- Main chapter with main result
- Second result chapter
- Optimization chapter

Evaluation

- Evaluation chapter
- Comparison to Other Approaches
- Conclusion Outlook

The Standard Structure of a Master Thesis in Technical Science is Related to the OIS-SDR Research Process

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Chapters and Process
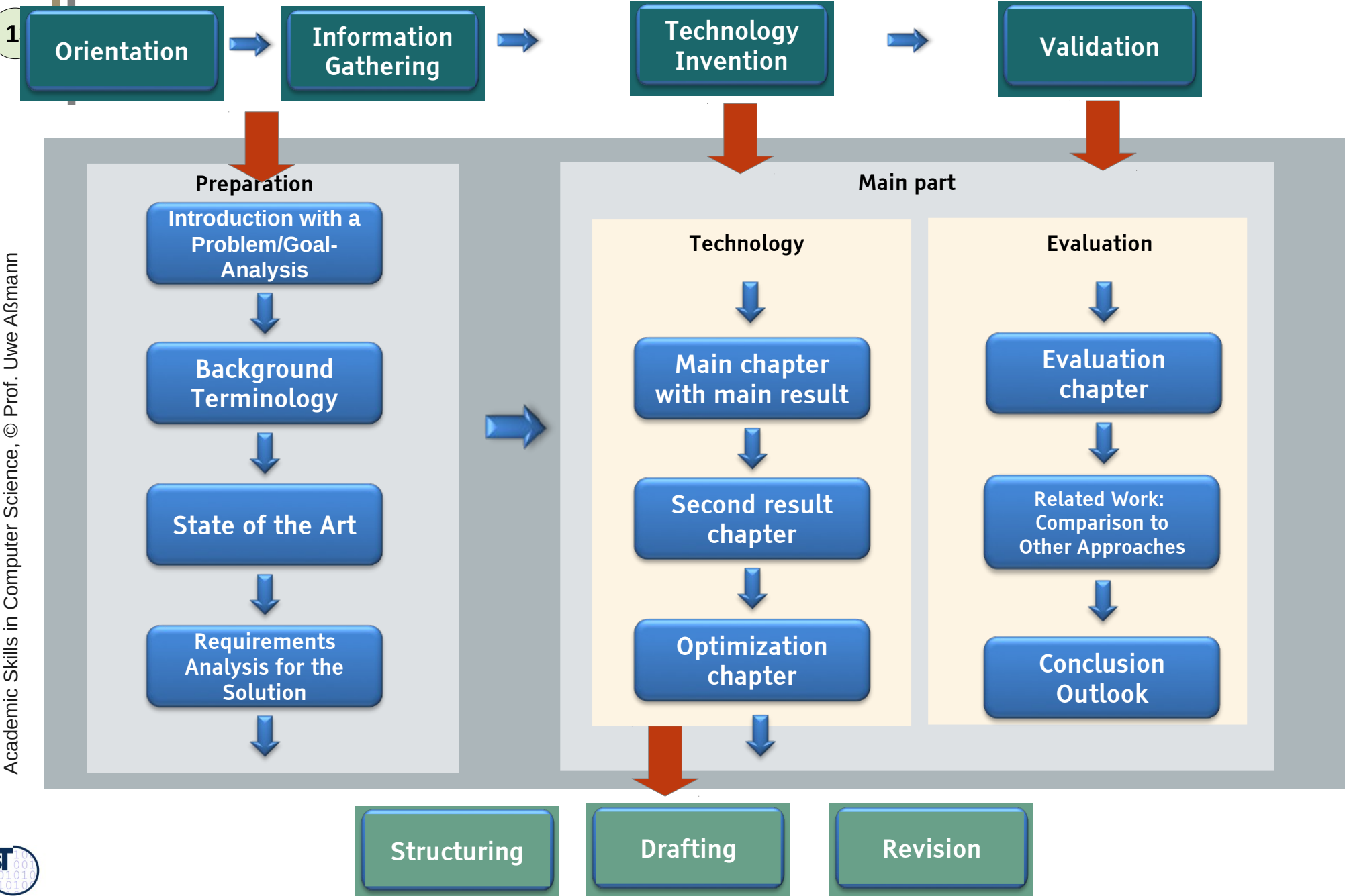
▶ Because the structure of a scientific thesis is related to the chapters, write chapter by chapter

- Start with (a draft of) the "background" and "literature state of the art" chapters from the orientation phase

- Then develop the technical solution and write it up in a main technical contribution chapter

- Validate with an evaluation (experimental, proof, empiric) in parallel.

- Draft, revise, revise,...

▶ If you clearly put your technical contributions into 3-4 main chapters, your main slide at your defense will be:

> **Scientific Results / Contributions:**
>
> **1. Result of Main Chapter 1**
> **2. Result of Main Chapter 2**
> **3. Result of Main Chapter 3**

▶ And this will also form your introduction of your thesis.

Practical Hints

▶ Meet your supervisor biweekly or weekly.

  – Produce protocols of the meetings

▶ Write up everything in scratchpads. Material can be used in the end, and you don't forget important discussions or decisions

  – Starting to write after 2/3 of the time is a fatal error

▶ Reserve 1/3 of your time for writing

  – 3 months Bachelor → 1 month writing

  – 6 months Masters → 8 weeks, at least 7 weeks, writing

  – 4 years PhD thesis → 1 year writing PhD thesis, 0.5 year writing papers

▶ If your writing is not so good, do this course much more intensively than others. Read the original literature.

  – Become a "dressed writer" or "question-based writer" and it will go much better for you

▶ In a Bachelor thesis, reading of English research papers is not yet required, however, in a Master's thesis, it is.

▶ PhD thesis and Master's thesis may be written in English or German.

  – English gets a broader, world-wide audience.

Training Unit

▶ Analyze the following tables of contents from the web site of the course how they fit into this generic outline.

  – Why did the author follow or deviate from the outline?

▶ Diplomarbeiten:

  – [Seidel-DA] Christoph Seidl. Evolution in Feature-Oriented Model-Based Software Product Line Engineering. Diplomarbeit 2011. TU Dresden. http://nbn-resolving.de/urn:nbn:de:bsz:14-qucosa-81200

  – [Wilke-DA] Claas Wilke. Model-Based Run-time Verification of Software Components by Integrating OCL into Treaty. Diplomarbeit. TU Dresden. http://nbn-resolving.de/urn:nbn:de:bsz:14-qucosa-27365

▶ Doktorarbeiten:

  – [Röttger-Diss] Simone Röttger. Systematische Prozessunterstützung für die Entwicklung laufzeitkritischer Softwaresysteme - PROKRIS-Methodik und -Framework. PhD thesis, Dresden University of Technology, 2009. http://nbn-resolving.de/urn:nbn:de:bsz:14-qucosa-25206

  – [Johannes-Diss] Jendrik Johannes. Component-Based Model-Driven Software Development. PhD thesis, Dresden University of Technology, December 2011. http://nbn-resolving.de/urn:nbn:de:bsz:14-qucosa-63986

  – [Seifert-Diss] Mirko Seifert. Designing Round-Trip Systems by Model Partitioning and Change Propagation. PhD thesis, Dresden University of Technology, June 2011. http://nbn-resolving.de/urn:nbn:de:bsz:14-qucosa-71098

  – [Hartmann-Diss] Falk Hartmann. Safe Template Processing of XML Documents. PhD thesis, Dresden University of Technology, July 2011. http://nbn-resolving.de/urn:nbn:de:bsz:14-qucosa-75342

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Homework

▶ Take the outline of Seidl and Wilke and produce one slide each for the defense – as if you had to defend their master's thesis.

▶ Look for *research results (research contributions)*

- – What is the main result?
- – What are secondary results?
- – How did the author

▶ Look for *demarcation to other related work*

- – How is the progress over the state of the art shown?

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11.2. Orientation – From the Problem to the Research Question

- When I don't know what to do yet (Overview)
- This orientation process is from [Esselborn-Krummbiegel]
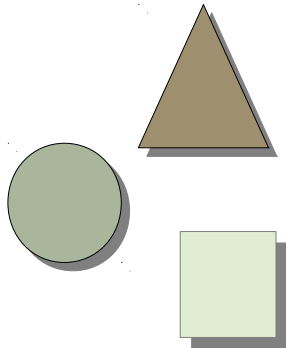
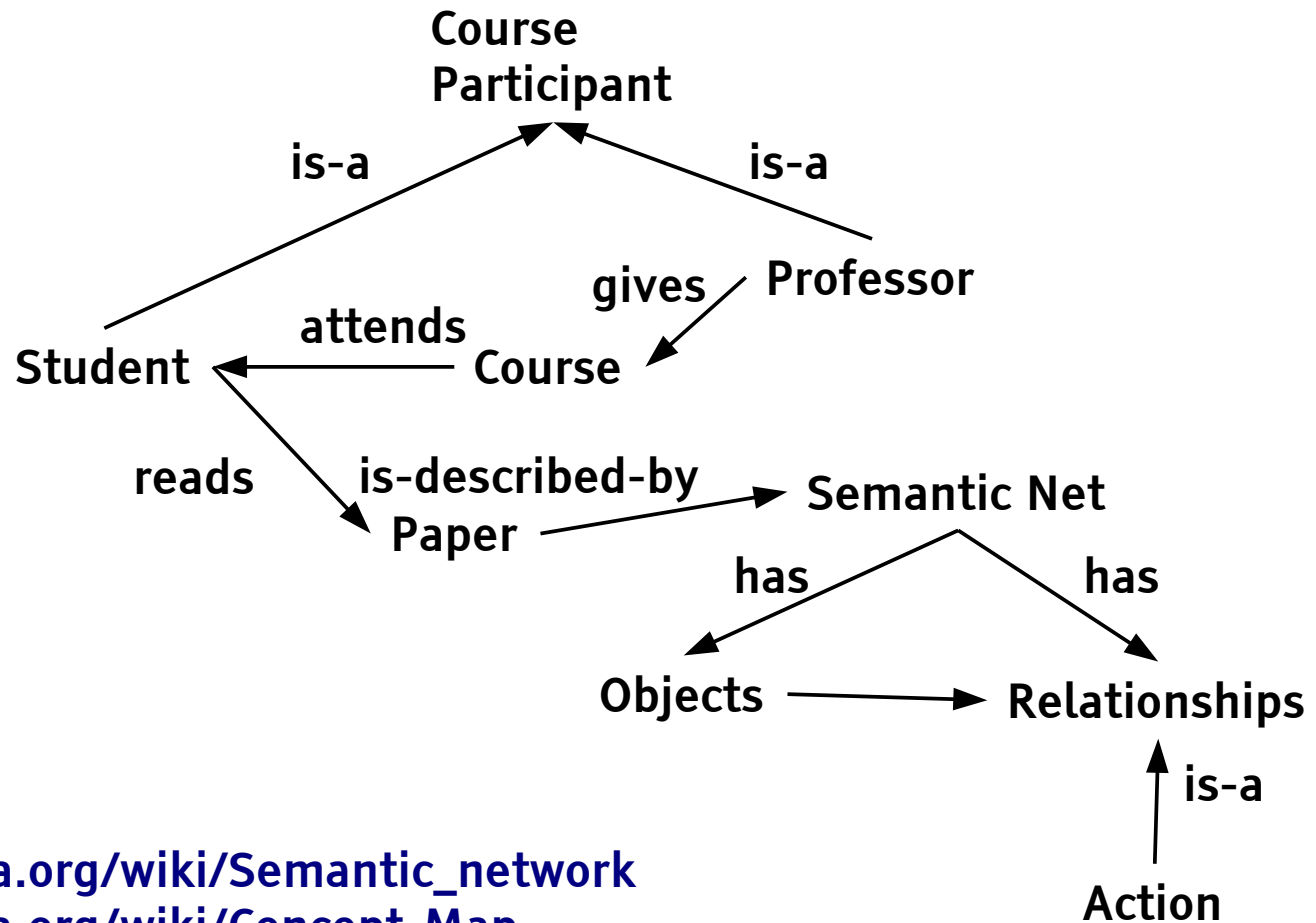# 11.2.1 Idea Generation: Concept Maps, Clusters, Mindmaps and other Techniques

- Concept maps by [Novak]
- Clustering was invented by [Rico] [Esselborn-Krummbiegel]
- Mindmaps by [Buzan]
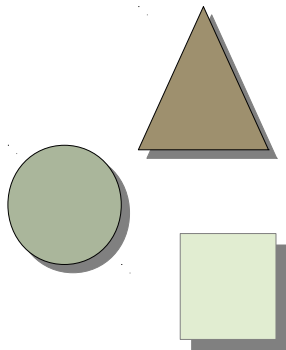
Semantic Nets (Simple Concept Maps)

► To record what you understand, draw a **semantic net (simple concept map)** while reading

► A **semantic net** draws objects and their relationships and actions into a graph

  ▪ Distinguised relationships: is-a, has-a, owns-a, ...

http://en.wikipedia.org/wiki/Semantic_network
http://de.wikipedia.org/wiki/Concept-Map

Concept Maps

▶ http://de.wikipedia.org/wiki/Concept-Map

▶ A **concept map (Begriffslandkarte)** shows several concepts and their relations

- usually, one starts with several central concepts in the middle of a page and collects associations

▶ Concept mapping is a method for analysis, idea generation and structuring. Other forms:

- Clustering, Mindmpping [Buzan], Structure Trees, Cause-Effect diagrams

▶ Depending on the purpose, a concept map is a **model** of problems, knowledge, goals, solution ideas
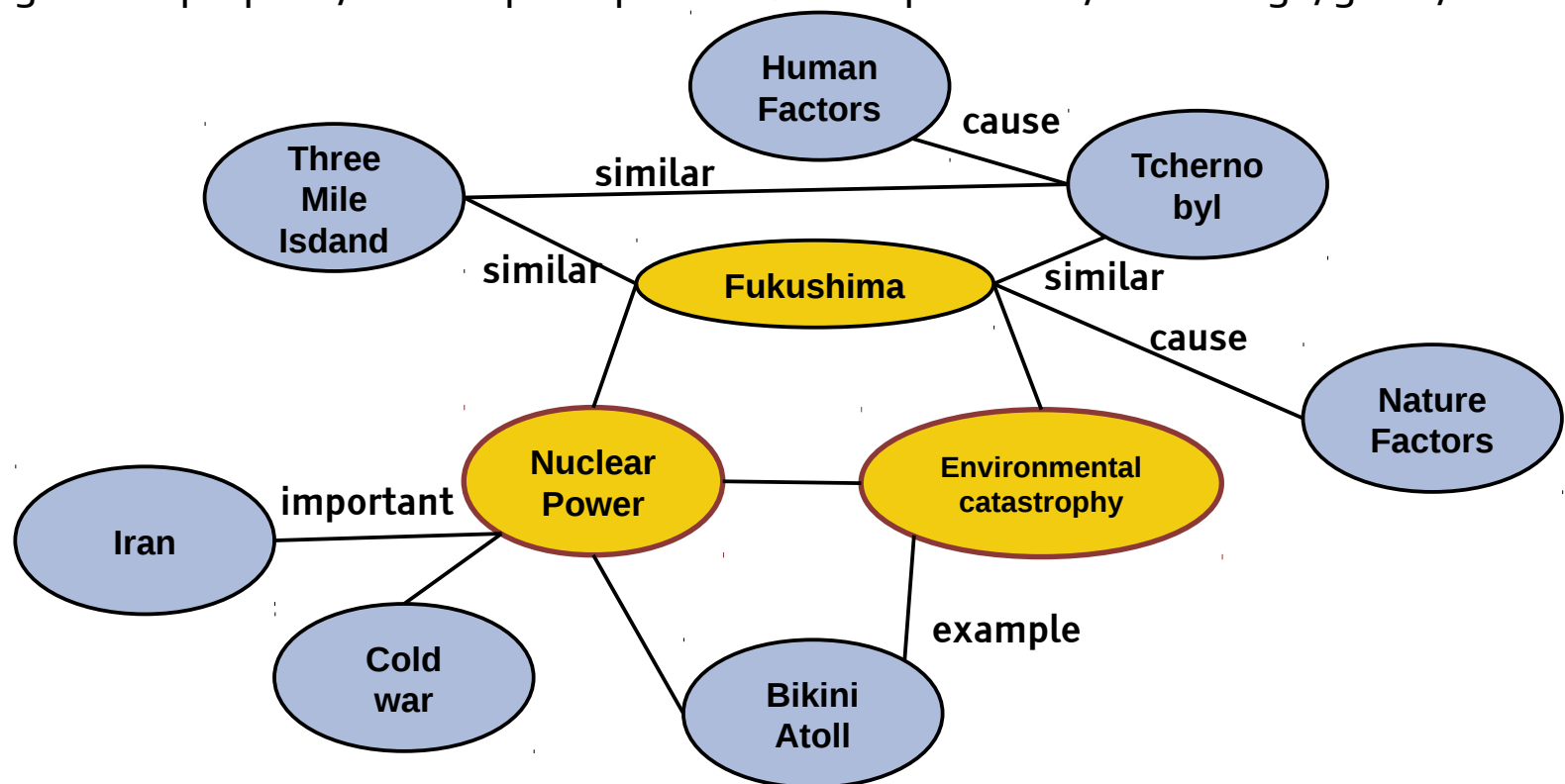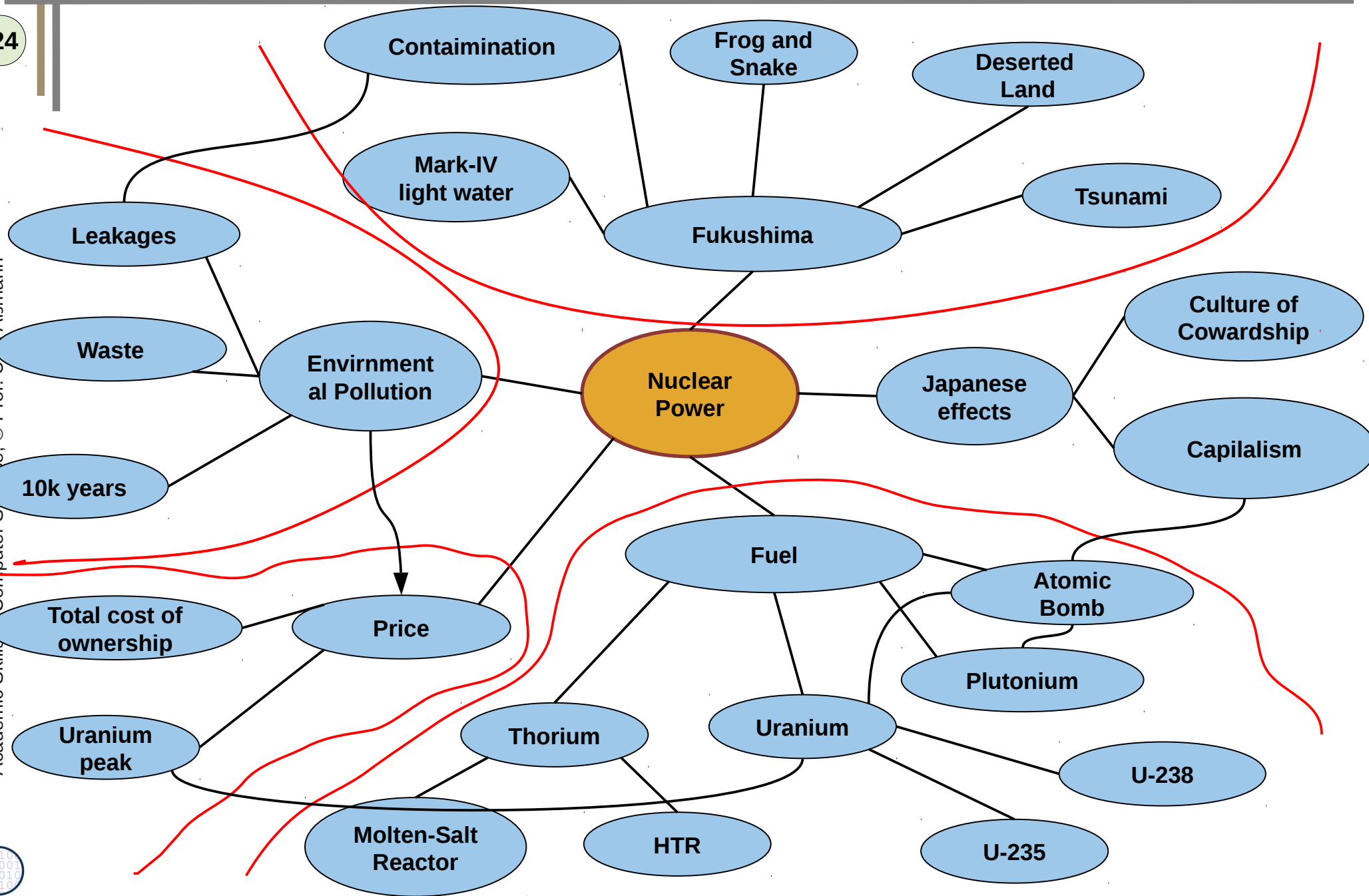
Concept Maps (Strukturbilder, Textbilder)

▶ The **concept map** enriches a Semantic Net with pictures and figures (Strukturbilder) [Novak]

- ▪ http://www.teachsam.de/arb/visua/visua_3_2_6.htm
- ▪ Always start the development with a **focus question** (use the Honest Men)
- ▪ **Grouping** is important: group into phases, layers, regions, skeleton trees
- ▪ Specific relations such as <implies>, <causes>, <abstracts>

▶ Software: http://cmap.ihmc.us/documentation-support/

▶ Alberto J. Cañas, Greg Hill, James Lott. Support for Constructing Knowledge Models in CmapTools. Introduction. Technical Report IHMC CmapTools 93-02. Institute for Human and Machine Cognition (IHMC)

▶ http://cmap.ihmc.us/Publications/WhitePapers/Support%20for%20Constructing%20Knowledge%20Models%20in%20CmapTools.pdf

http://commons.wikimedia.org/wiki/Category:Concept_maps?uselang=de

Clustering Helps to Develop Hierarchic, Logical Structures of Your Work

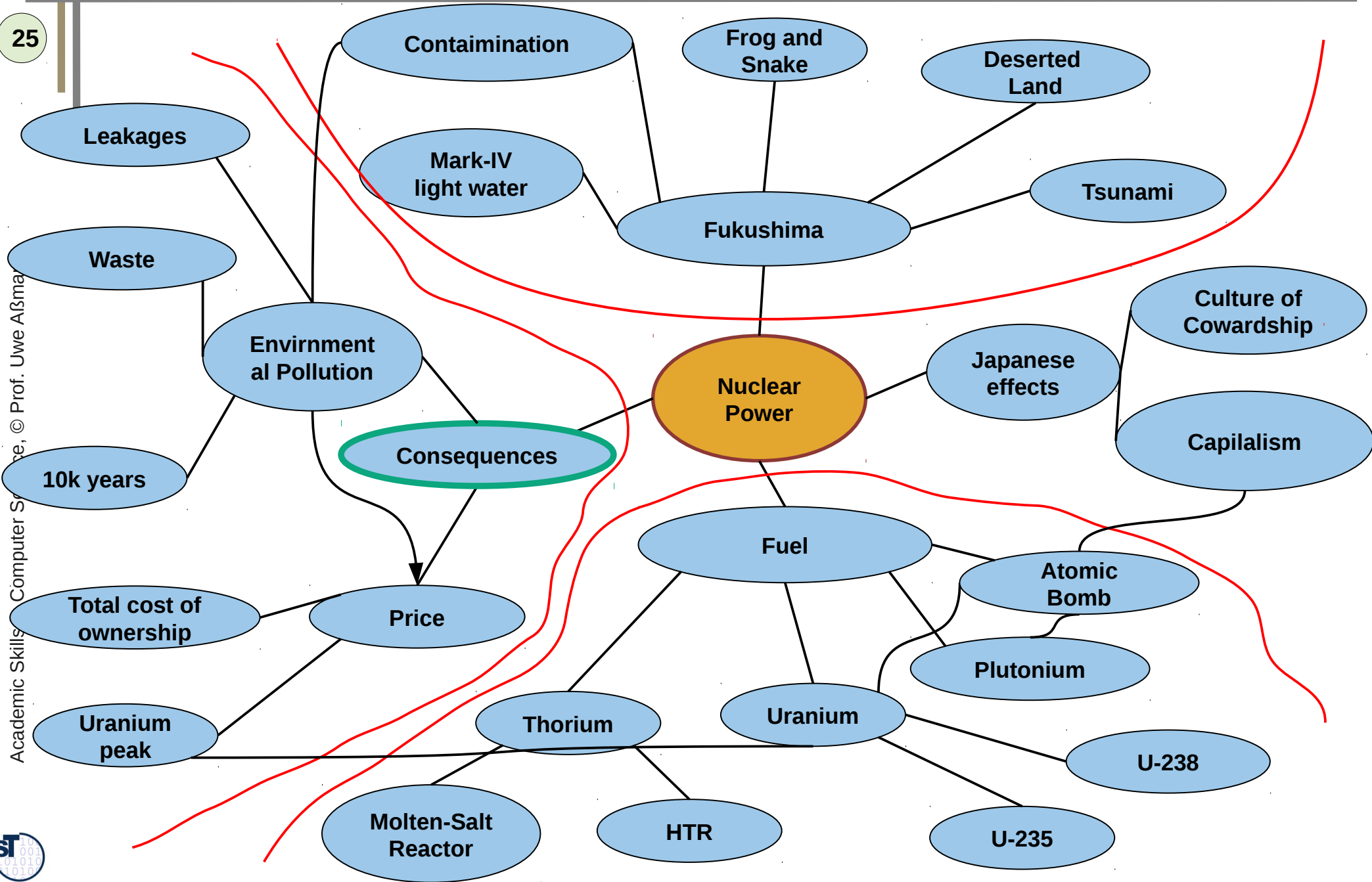Academic Skills in Computer Science, © Prof. Uwe Aßmann

▶ A **Cluster** is a node-labeled concept map with *one* root in the middle of the page

- ▪ If the cluster is a tree, it is called a *mindmap*
- ▪ http://de.wikipedia.org/wiki/Cluster_(Kreatives_Schreiben)

▶ Clustering finds associations to one central term:

- – Develop, structure, find ideas by association
- – Start from a **central term**, concept, or idea (a **spider-map**)
- – Use the blackboard's space to find association
- – Use landscape to get a broader view and more space in breadth

▶ Develop: Note the **central concept** in the middle

- – Start to note associated terms or relations
- – Note **relations** or **discriminators** on the edges (optional)
- – Iterate

▶ Restructure: Redraw on new sheet

- – Find relations between the branches; Group

Cluster of Associations to "Nuclear Power"

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Nuclear Power

- Contaimination
- Frog and Snake
- Deserted Land
- Mark-IV light water
- Tsunami
- Leakages
- Fukushima
- Waste
- Envirnmental Pollution
- 10k years
- Culture of Cowardship
- Japanese effects
- Capilalism
- Fuel
- Atomic Bomb
- Total cost of ownership
- Price
- Plutonium
- Uranium peak
- Thorium
- Uranium
- U-238
- Molten-Salt Reactor
- HTR
- U-235

Revised Bush-Cluster of Associations to "Nuclear Power", now Depth 3 and Tree-Shaped

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- **Nuclear Power**
  - **Fukushima**
    - Contaimination
    - Frog and Snake
    - Deserted Land
    - Mark-IV light water
    - Tsunami
  - **Japanese effects**
    - Culture of Cowardship
    - Capilalism
  - **Consequences**
    - Leakages
    - Waste
    - Total cost of ownership
    - Uranium peak
  - **Fuel**
    - Plutonium
    - U-235
    - U-238
    - Thorium Molten-Salt Reactor
    - Thorium HTR
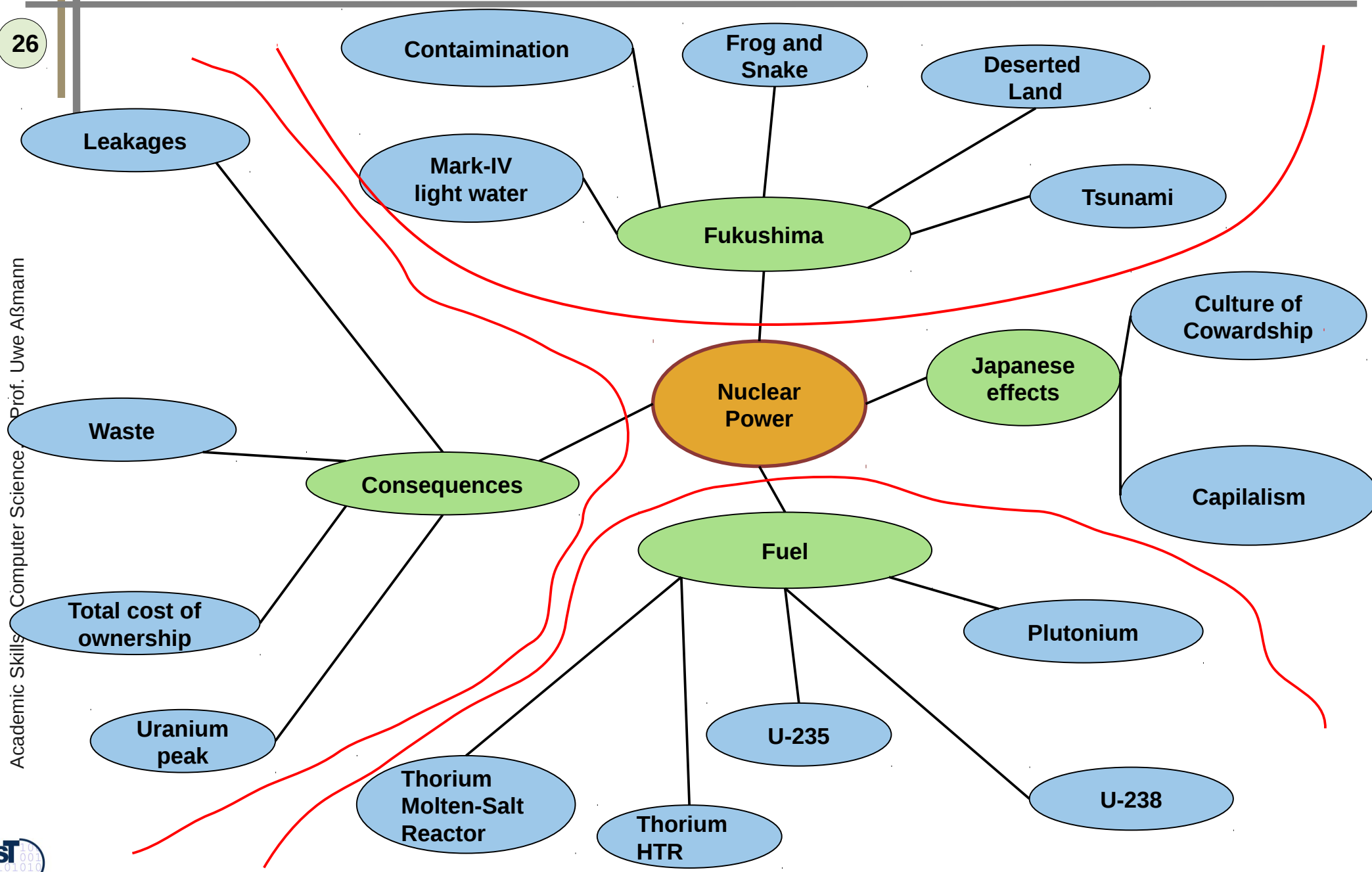
Normalized Clusters lead to Text Blocks with 3 Levels

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▶ Once a cluster has 3 normalized levels, it can directly be textified (put into a text)

- primary tree becomes paragraph structure
- cross-relationships have to be encoded into references

▶ A **comb text (Kammtext)** is a text block stemming from a comb (2-level cluster).

▶ A **bush text (Buschtext)** is a text block stemming from a bush cluster.

▶ An **Xmas text (Weihnachtstext)** is a text block stemming from an Xmas tree cluster.

▶ If more than 3 levels are used, paragraphs become hard to read.

**The fourth level of an Xmas treecluster must be folded away into a bush text.**

Homework

► Which technique does Schmidt use? Combs? Bushes?

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11.2.1.1 Mindmaps (Gehirnkarten)

▶ Mindmaps are similar to structure trees

▶ A **Mindmap** is an node- or edge-labled association tree

▶ Exercise: Transform the Cluster "Nuclear Power" to a mindmap

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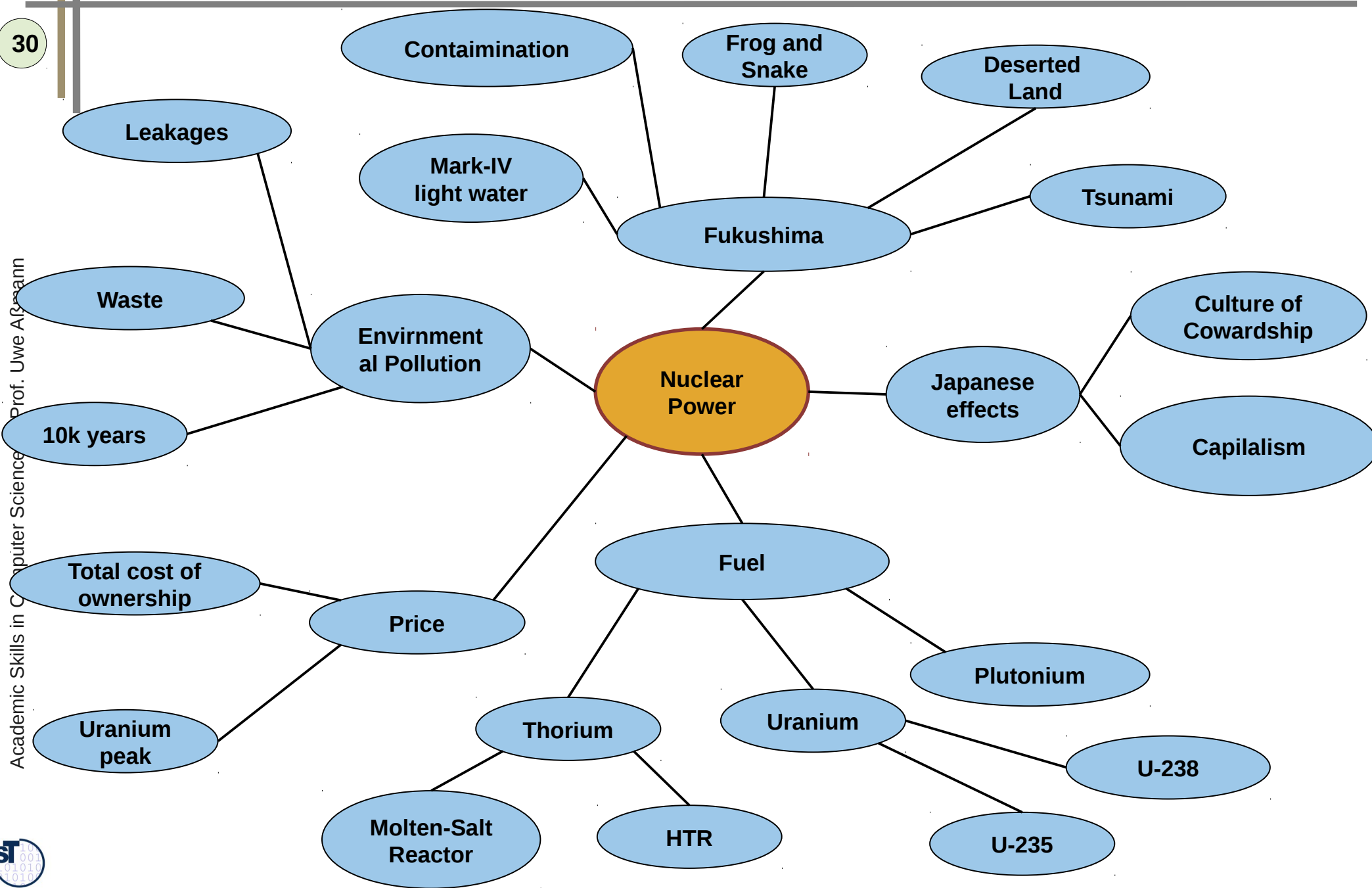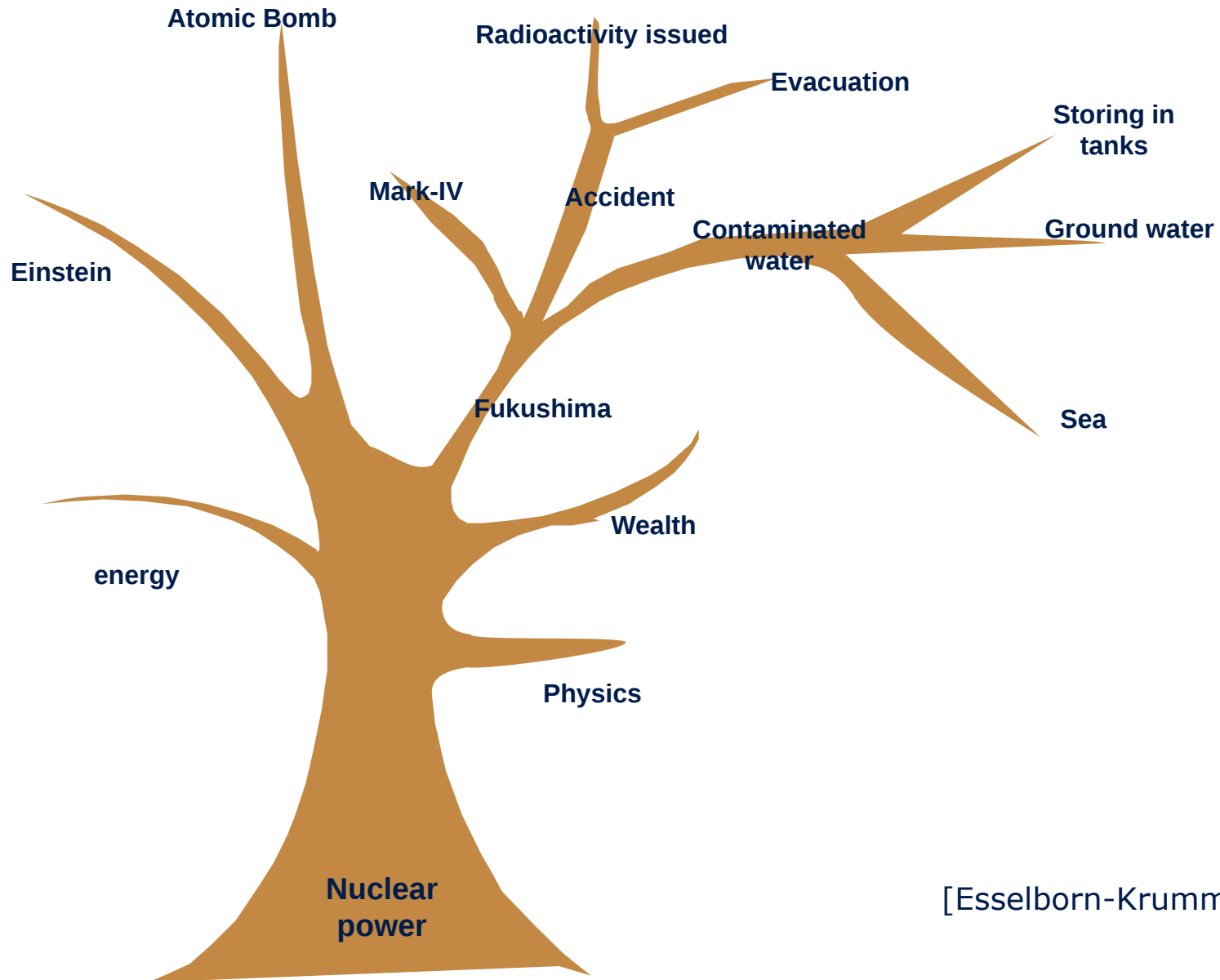
11.2.1.2 Structure Trees

▶ Mindmaps are similar to structure trees

▶ A **Structure Tree (Association Tree)** is a tree with differently deep branches.

  – Structure trees can be drawn as trees (bottom-up tree, top-down tree)

  – Line hierarchies

  – Widget trees

▶ Structure Trees serve to decompose a concept in *one dimension (no-aspects)*

  – Association Trees → hierarchical decomposition of associated concepts

  – Functions → function trees

  – Actions → action trees

  – Concepts → taxonomies, classifications

  – Concepts → part-of hierarchies (mereologies)

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Ex.: Bottom-Up Association Tree "Nuclear power"; Decomposition with Associated Terms

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Atomic Bomb

Radioactivity issued

Evacuation

Storing in tanks

Mark-IV

Accident

Ground water

Contaminated water

Einstein

Fukushima

Sea

Wealth

energy

Physics

Nuclear power

[Esselborn-Krummbiegel]

The 6 honest serving men (R. Kipling, Just So Stories)

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!

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- ▶ For finding topics of research, a text or talk, the 6 honest men (7-W-Questions) should be attempted to expand into a checklist.
- ▶ This checklist can be used to create alternatives for the topic (idea generation for topic).

	Ideas for Topic; Limits and Implications	Aspects
Who?	Who is interested in the topic? Who benefits?	
What?	What do I want to find out? What may change in my topic, problem or question? What is fix?	Results, Solutions
How?	How similar is my topic to another work? How different is it? What is its research advance? research contribution?	Implementation, Realization
Where?	Where is my research located in the research landscape?	
When?	When did somebody else research on something similar?	
Why?	causal; Why do we need the topic?	Motivation; Problem
For what? To which end?	final; What will happen if we don't solve the problem?	Goal

11.2.2 Problem Analysis as Activity in Orientation

- Problem Analysis asks the questions:
- Why?
- To which end?
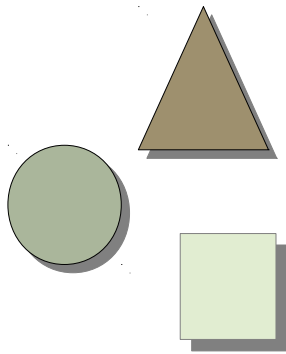
The Law of Questions for Problem Analysis and Problem Solving

▶ From a semantic net (concept map, cluster, mindmap, structure tree), derive a list of questions

- for focussing your work (**focus questions**)
- for the thesis statement of an essay (**thesis question**)
- for the research questions of a research paper or your thesis (**research question)**

http://de.wikipedia.org/wiki/Sesamstra%C3%9Fe

Musik: Ingfried Hoffmann, Text: Volker Ludwig, 1. Version gesungen vom Hamburger Kinderchor Vineta unter der Leitung von Dietrich Czirniok. Ab Oktober 2012 wird das Lied von Lena Meyer-Landrut interpretiert.

Law of Questioning for Problem Solving:

Der, die, das - wer, wie, was – wieso, weshalb, warum – wer nicht fragt, bleibt dumm!

Problem Analysis

- ▶ Most idea generation techniques (concept maps, clusters, mindmaps, Honest Men) can be used to analyze problems
  - ▪ Ask the questions "why" and "to which end"?
- ▶ But they can also be used to generate solution ideas
  - ▪ Ask the question "how to achieve"?
- ▶ and to structure the available knowledge and literature:
  - ▪ Ask the question "What do we know?"

11.2.2 Information Gathering (Recherche) as Activity in Orientation

- Literature must be analyzed to find out what other people have been doing to solve the problem.

Lazy Reading Process RIK

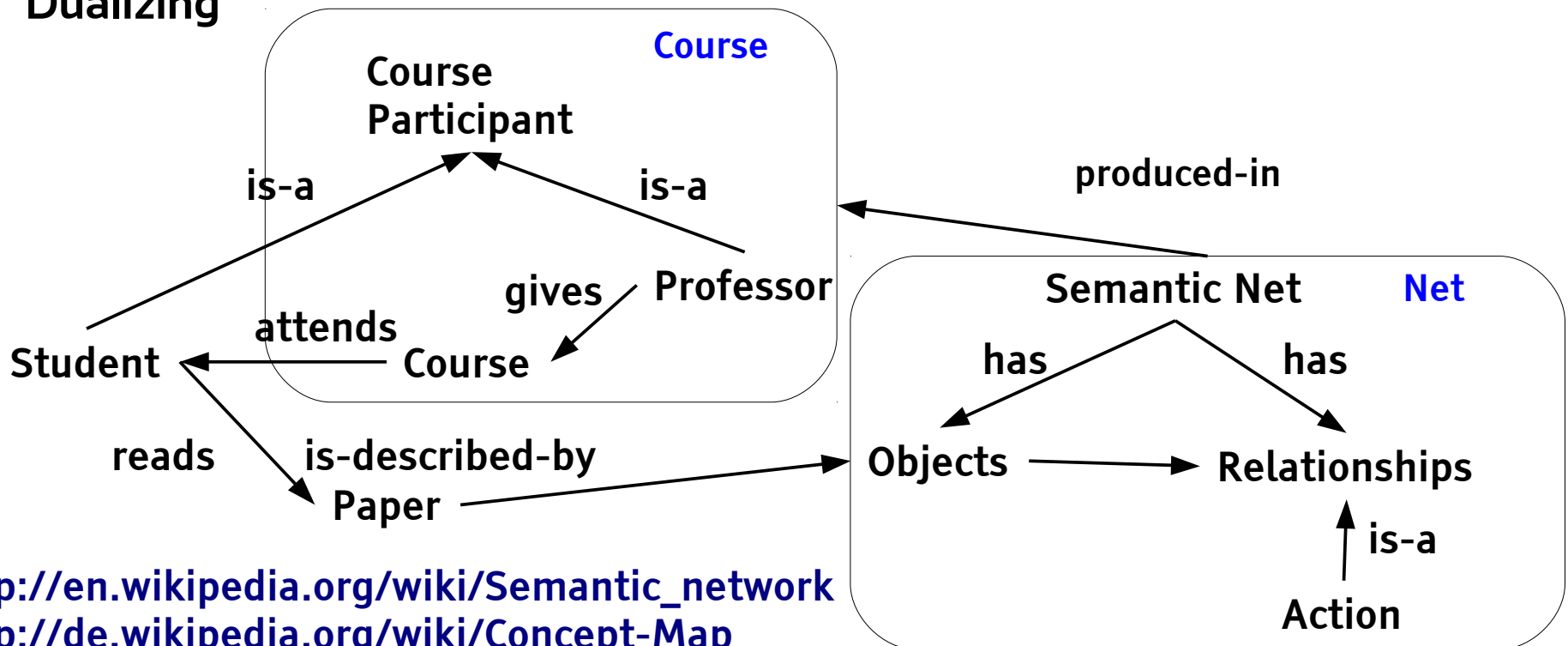| Relevance Check | ➤ | Information Aquisition | ➤ | Knowledge Acquisition |

- ▶ Relevance Check:
  - ▪ Time can be lost when reading too many things
- ▶ Information Aquisition
  - ▪ Try to extract what is important (drawing semantic nets)
- ▶ Knowledge Aquisition
  - ▪ Try to understand what you read
  - ▪ Rearrangements of the semantic nets

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# Rearrangements in Semantic Nets and Concept Maps Structures Information

► An important operation in semantic nets to create *knowledge* is **grouping**, by which larger units of the net can be abstracted (groups, phases, layers, venn intersections, star-diagrams)

  ▪ A group gets a new name (structured names). Groups can have new relations

► **Re-grouping, re-drawing**

► **Hierarchy-Forming (Clustering)**

► **Re-Hierarchising**

► **Dualizing**

http://en.wikipedia.org/wiki/Semantic_network
http://de.wikipedia.org/wiki/Concept-Map

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11.3. Solution Invention – How Do I Find a Solution for my Problem?

Please, consult the lectures of "Software mangement (SWM)" to improve your knowledge on management. Runs in Summer.
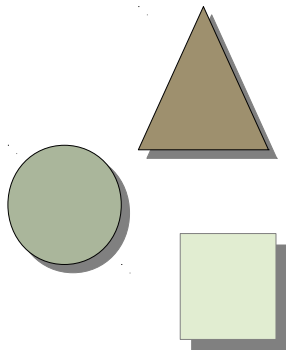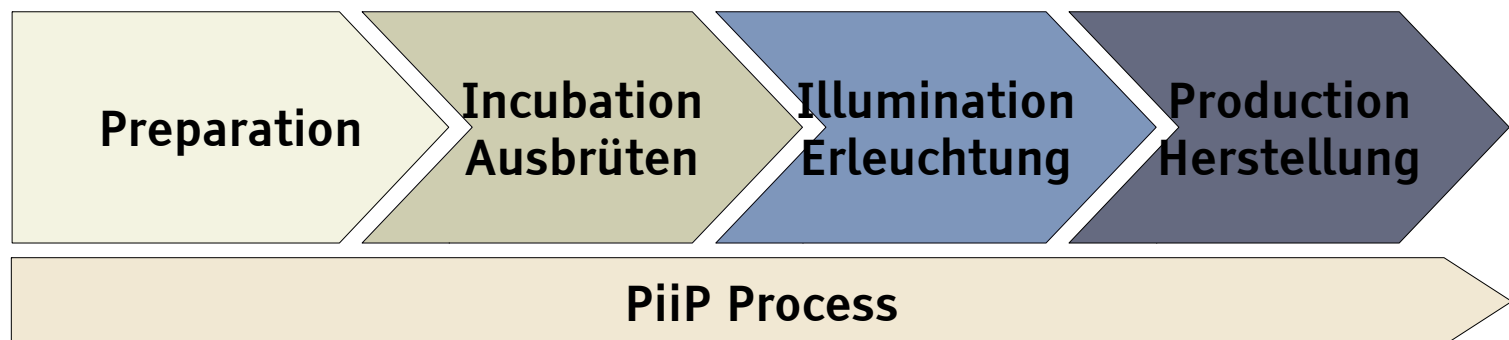
Solution Invention with the PiiP Process

▶ If we want to solve a research problem, we must be enduring and patient. A lot of thinking ("incubation") is needed. [Heimes]

▶ The PiiP process is a very general solution invention process

  ▪ It is always applicable, no matter from where we start

▶ **Don't give up** if the incubation takes some time, and the illumination does not want to appear:

  – Consider, that this is always like this. Edison made more than 10000 experiments before the lightbulb worked.

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| Preparation | Incubation Ausbrüten | Illumination Erleuchtung | Production Herstellung |

PiiP Process

Solution Invention with the Process InECT

The Rational Unified Process (RUP) contains a phase-structured microprocess INECT for general structuring the invention of solutions:

► **Inception:** Fix the problem. Fix all project requirements and conditions. Fix environment.

► **Elaboration:** Analysis, fix use cases, fix interfaces and fix preliminary structural architecture (skeleton)

► **Construction:** Realize the interfaces and the architecture with an implementation

► **Transition**: Prepare next phases; deploy solution; after-math study (Nachstudie); Process improvement for future projects

Inception	Elaboration	Construction	Transition

INECT Process
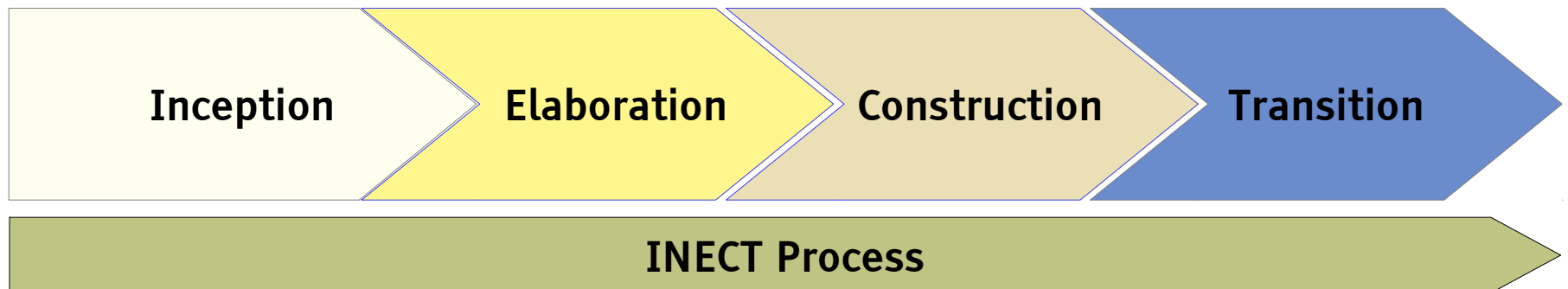
► The advantage of INECT over PIIP is that it can be used as discriminator in a concept map
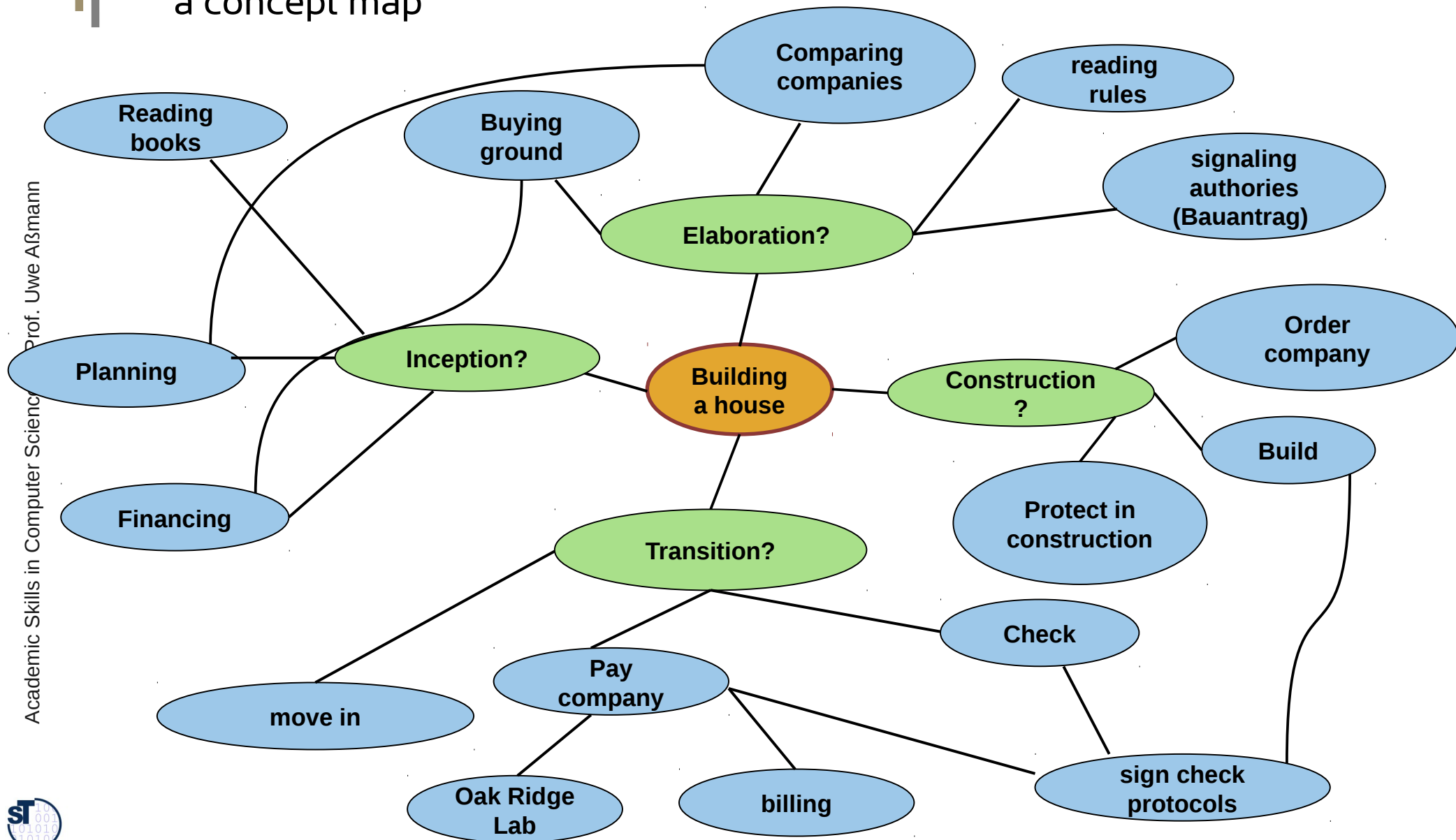
Motivation: How to Develop Your Chapter on "Design" or "Architecture" in your Bachelor/Master Thesis

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

  – Do PiiP or INECT as a start

  – Use the GAP process for incubation and elaboration: The solution ideas 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 G → A Alternative analysis: comparison and assessment → P Alternative Prioritization and selection

Generation of Design Alternatives with GAP

▶ For assessments and analyses of *several designs*

▶ For alternatives if difficult decisions have to be taken

▶ For the design phase of your Bachelor/Master work

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Generation (Identification, Elicitation)	**Assessment, (Rating, Scoring, Grading)**	**Prioritization, Ordering, Selection**
Thinking Clustering Structure Trees Brainwriting Brainstorming Delphi-Studies Checklists de Bono – APC Variation with SIT	**Isolated Assessment** and **Grading** Metrics (on scales) onedimensional multidimensional	**Comparative Assessment and Selection** single-criteria analysis multi-criteria analysis and optimization

Alternatives	Possibilities	Choices

► [DeBono] introduced a very simple 3-step for thinking about alternatives. Process:

► Find an alternative.

► Once you fixed this, think about other "possibilities". Is this alternative the only one?

► The third category "Choices" should fix remarks and reasons for the final choice.

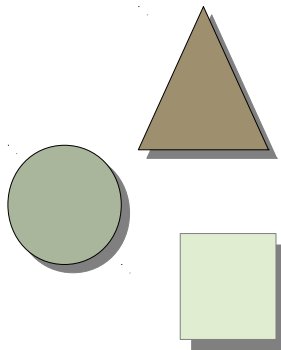► APC can be used for variant generation of problems, solutions, ideas, topics, arguments

11.4.3. Evaluation

- by group experiment

  - by software experiment
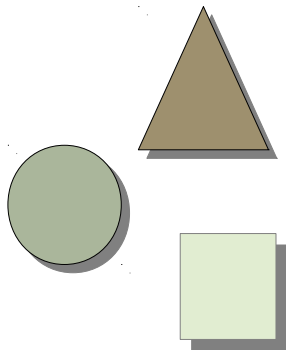
11.5. Diffusion of Research
11.5.1. Structuring

Structuring of Ideas, Problems, Solutions into an Argumentation

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▶ Use concept mapping, 7-W, aspect-oriented concept mapping, and other techniques for idea generation

- Clusters and Structure Trees are the main instruments to bring wild the unsorted ideas into structured, hierarchical form.

Decomposition of structures is along different criteria:

▶ Categorise into taxonomies

– Find super and subconcepts

– Find similarities, differences, relations

▶ Segmenting and partitioning

– Validate superconcepts by identification of separating/segmenting features

– Partition a superconcept into subconcepts

▶ Part-of Hierarchies

▶ Argumentation hierarchies for Claims
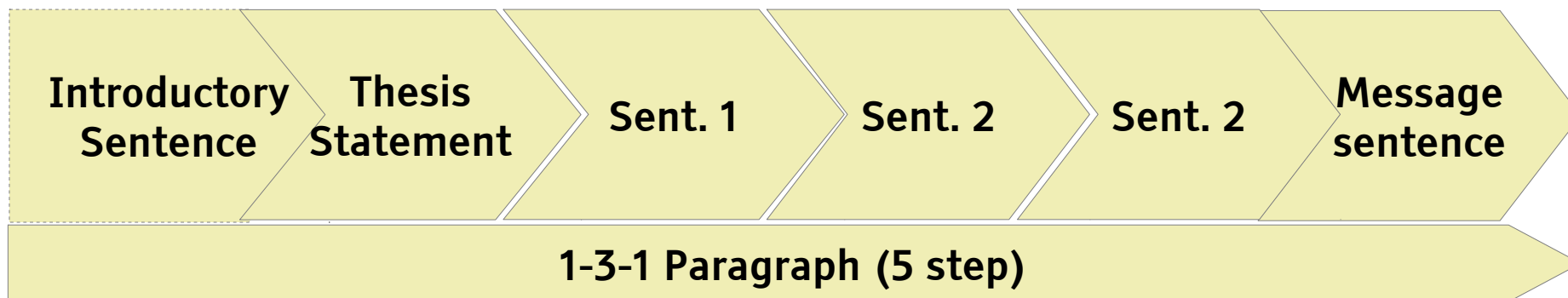
▶ There are special chapters on structuring

▶ This course has several special chapters on how to organize logical clusters with *Thesis statements*

▶ For all texts and talks, thesis statements are **structural contracts** between the author and the reader/listener

▶ **Thesis: Topic + Controlling idea + Development Scheme**

Controlling idea (benefit)

Development scheme

Thesis, Point
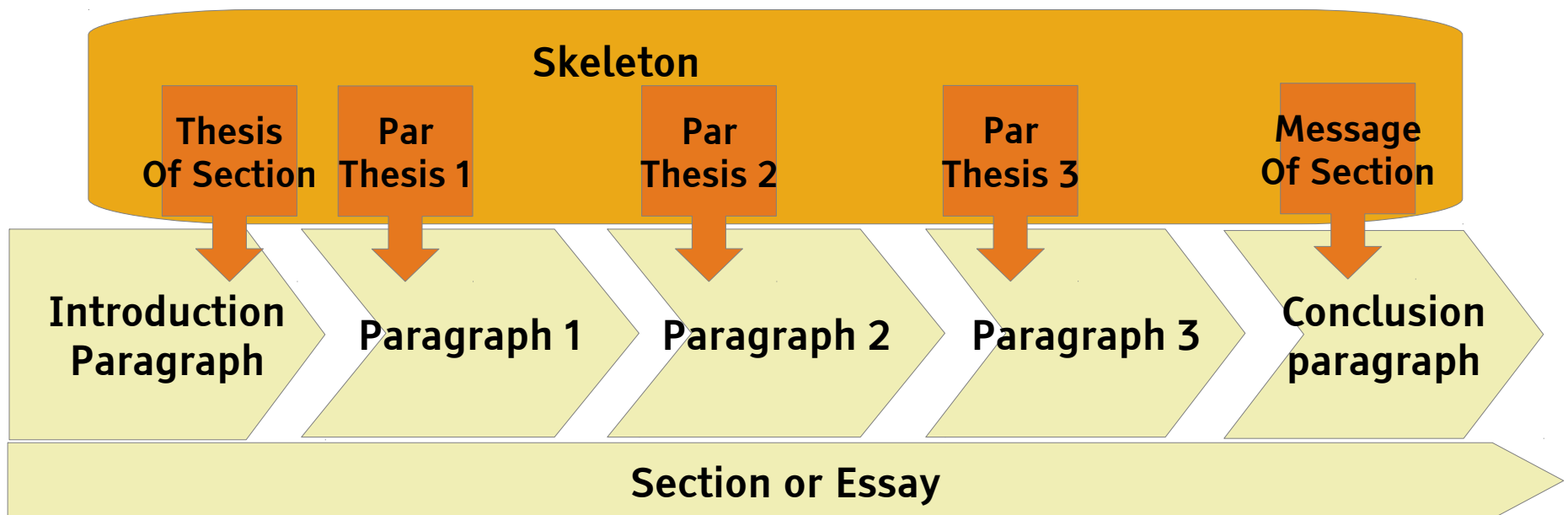
Topic
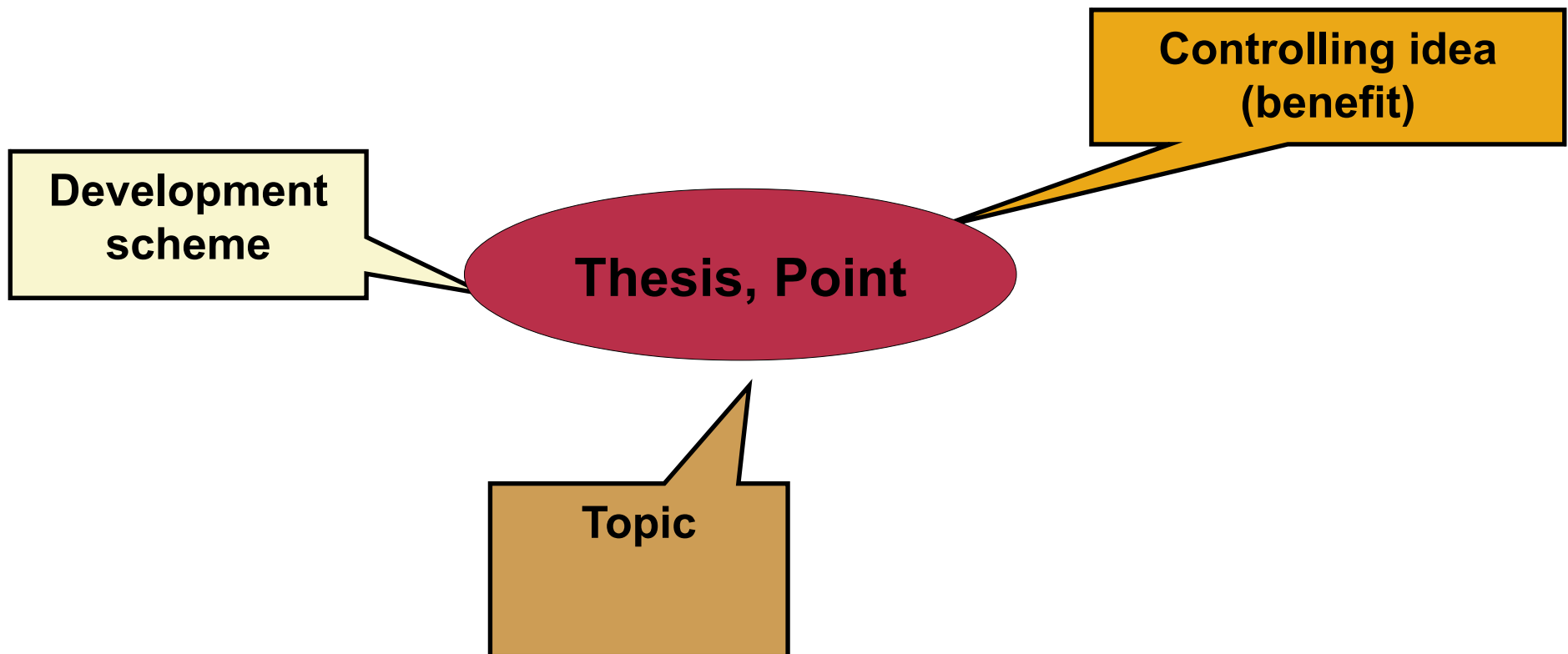
Directed Paragraphs in 1-3-1 Structure

▶ We live in interesting times.

▶ Technical progress in harvesting energy is so fast that we will earn all our energy demands from natural sources in 2030.

▶ We are learning at the moment how to store wind energy in methane gas and methanole (methanole economy)

▶ We have a political union with the South-European countries who have enough natural energy that can be transported by long-distance DC-powerlines to central and northern Europe almost without loss.

▶ We will soon be able to build cheap and efficient multi-stage heat pumps to produce heat of 80° celsius taking only 3° celsius from our environment.

▶ It is time that we find young "champions" who will become entrepreneurs in these golden times of natural energy harvesting.

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| Introductory Sentence | Thesis Statement | Sent. 1 | Sent. 2 | Sent. 2 | Message sentence |

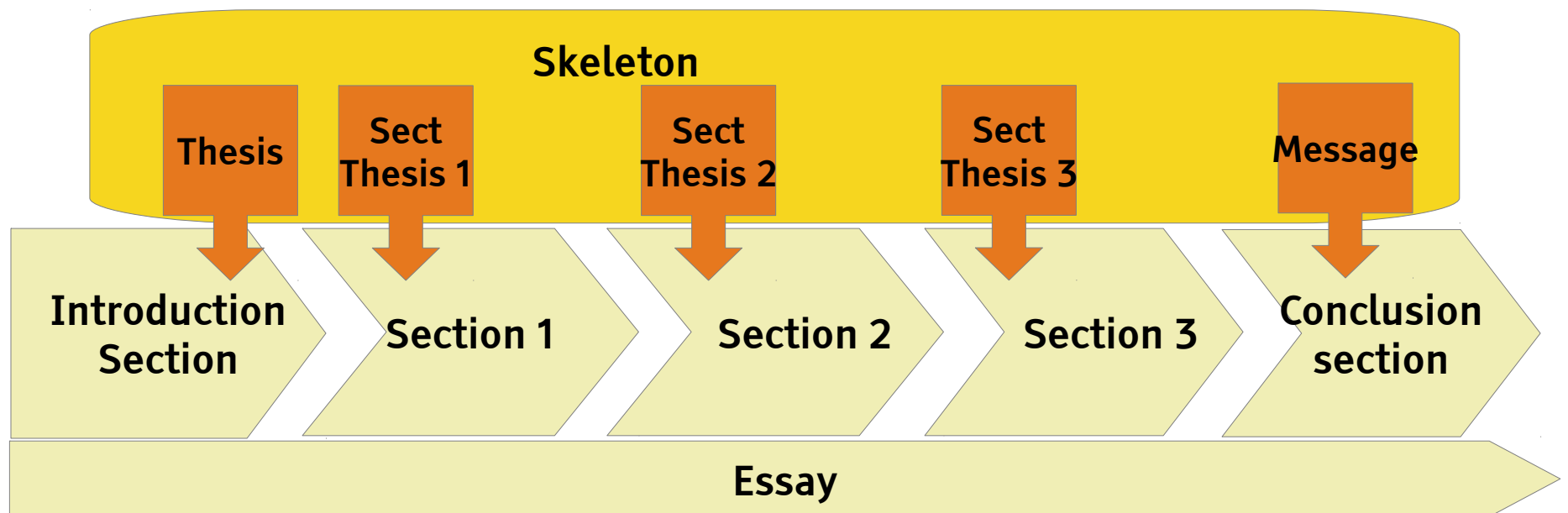**1-3-1 Paragraph (5 step)**

Skeletons (of Sections or Essays)

- The **skeleton** of a section (or essay) is the sequence of all thesis statements of all paragraphs.
  - The skeleton is an abstraction of the text
- The skeleton results from Point maturization, Support analysis, and Skeleton maturization
- A section (or essay) has **unity** if all points of the paragraphs support its thesis.

Skeleton

Thesis Of Section	Par Thesis 1	Par Thesis 2	Par Thesis 3	Message Of Section

Introduction Paragraph	Paragraph 1	Paragraph 2	Paragraph 3	Conclusion paragraph

Section or Essay

1-3-1-Essay

▶ The traditonal structure of an English essay

Skeleton

Thesis	Sect Thesis 1	Sect Thesis 2	Sect Thesis 3	Message

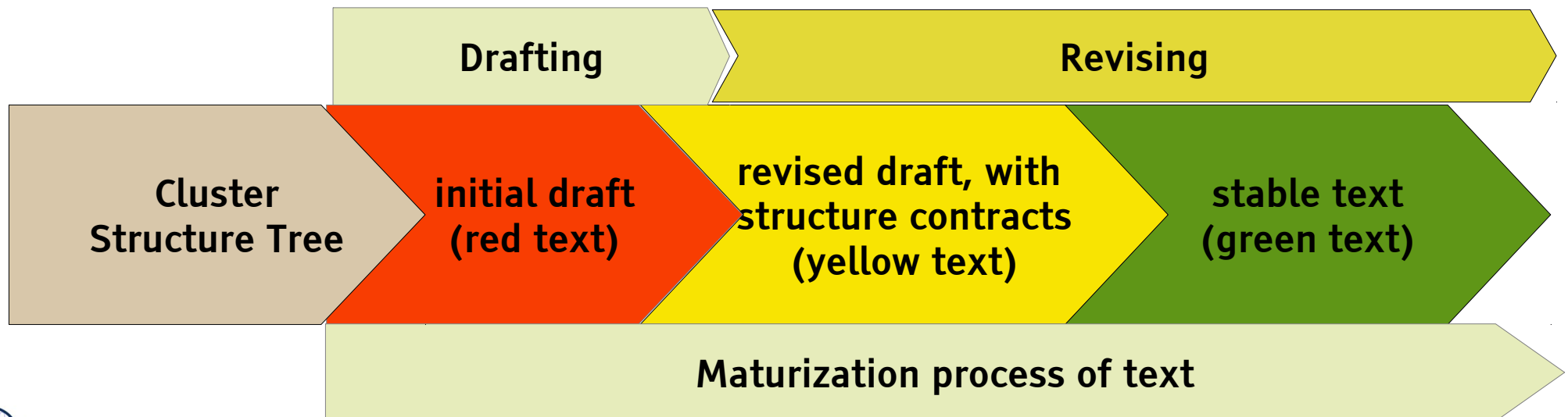| Introduction Section	Section 1	Section 2	Section 3	Conclusion section

Essay

11.5.2. Drafting and Revising for Diffusion: Textification, Talkification and Demonstrating
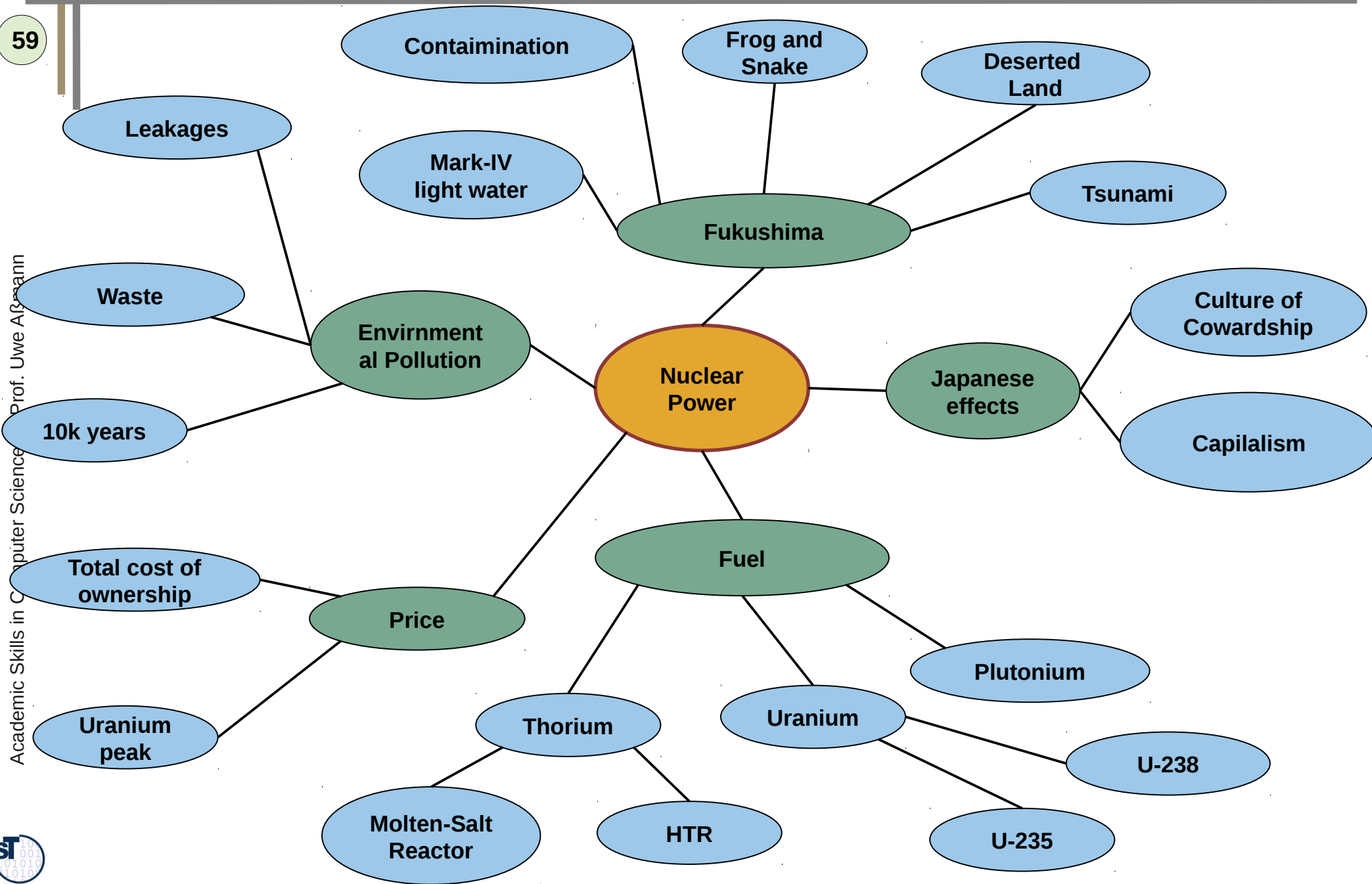
Textification and Talkification of Clusters

▶ **Textification** is the process of putting Clusters, Structure Trees, Points and Development Schemes into beautiful texts, like Fishbones, Whalebones, Pivot paragraphs a.m.m.

  ▪ Once you got a hierarchical base structure, you can start to write

▶ **Talkification** is the similar process of producing talks, and it is very similar.

▶ Both processes start with a **draft (red version),** revise it twice into a **yellow** and a **green version**, the final text or document.

  – Unter three versions, don't believe a text is mature.

Drafting	Revising

| Cluster Structure Tree | initial draft (red text) | revised draft, with structure contracts (yellow text) | stable text (green text) |

Maturization process of text
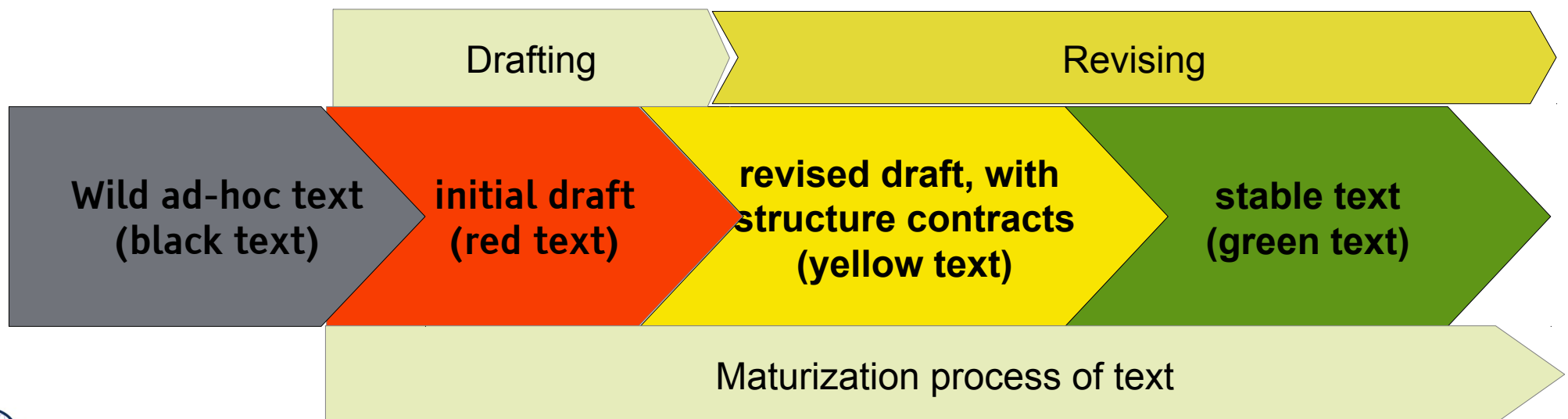
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Revision for ... Unity and Coherence with Controlling Ideas

▶ Most people start to write ad-hoc text (black text). Then, the texts wander around, more and more associated ideas disturb unity and coherence.

▶ **Unity**: a sentence contributes, reminds on or supports the central idea of the text (the controlling idea)

▶ **Coherence**: all sentences relate to each other, being threaded by common words, subjects, thematic strings.

▶ Do not start with black text! Always start with a controlling idea and try to write red text, drafts which are already roughly unity and coherence.

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Drafting	Revising

Wild ad-hoc text (black text)	initial draft (red text)	revised draft, with structure contracts (yellow text)	stable text (green text)

Maturization process of text

Demonstrating

▶ In technical science, experiments and demonstrations are very important.

▶ Scientists and PhD students need to *sell their results,* because results should be *relevant*

▶ On the way to a thesis the student has to *demonstrate* or *sell* his ideas in many ways:

  – A paper, report, and talk should contain an experiment or demo.

  – Screen films and lab videos (labcasts) can be made to illustrate and document

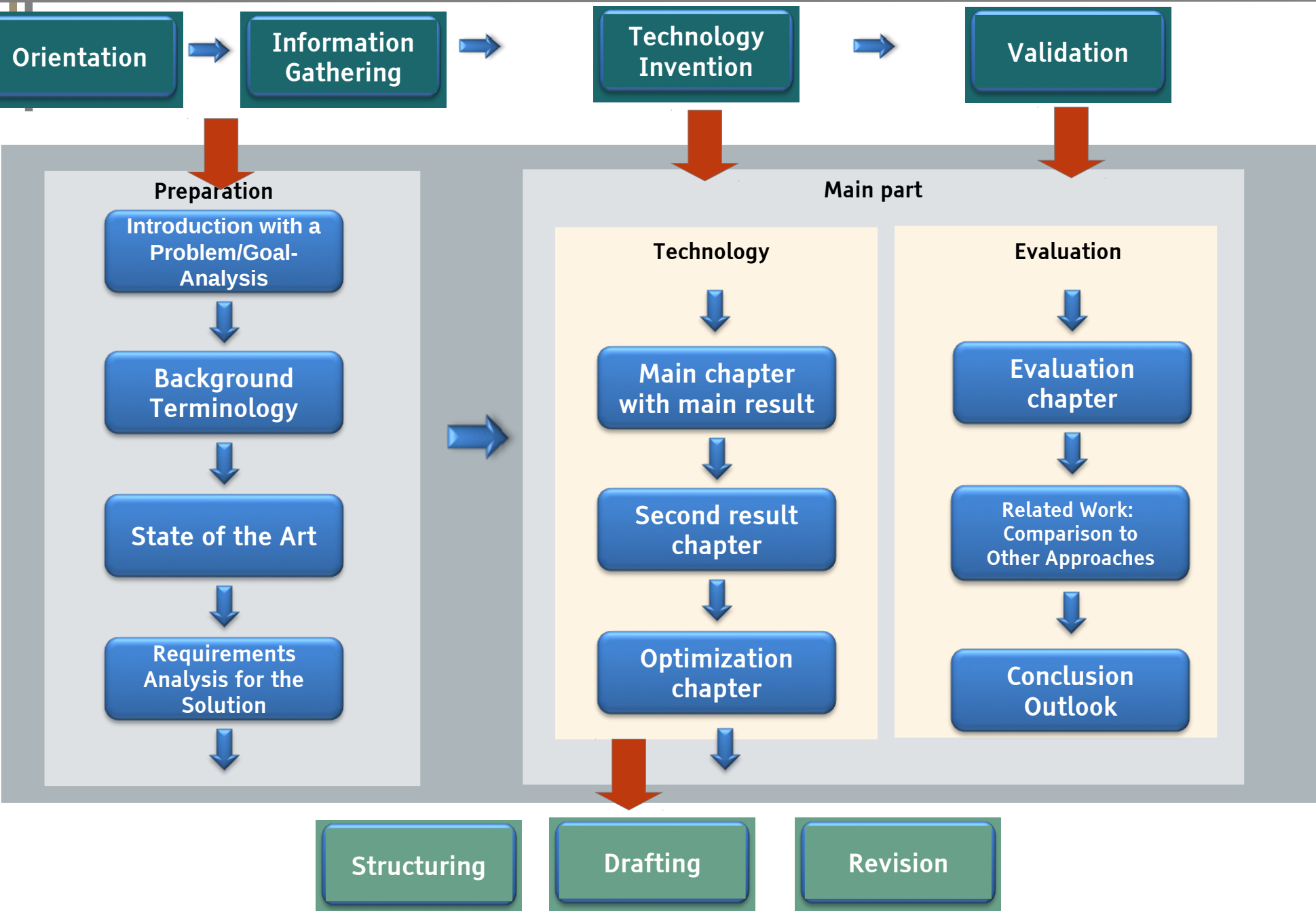Academic Skills in Computer Science, © Prof. Uwe Aßmann

Relevance > **Selling research results** > **Live experiments and demos** > **Screen films Labcasts**

The Standard Structure of a Master Thesis in Technical Science is Related to the OIS-SDR Research Process
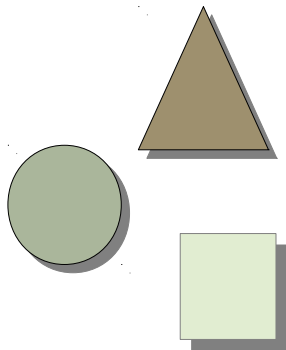
Exercises

63

64

- This week, read:
- **Helmut Schmidt. Zivilisiert den Kapitalismus! (zum 100. Geburtstag von Marion Gräfin Dönhoff), in "Einmischungen", Goldmann-Verlag**
- From the paper, construct a mindmap bush out of the concept "Raubtierkapitalismus"
  - Start with a cluster
  - Trim it to a bush
-
- Use the Metaphor "Raubtier" to develop a structure tree.
  - Develop the metaphor by associations: Meat, Death, Fressen und Gefressen werden, etc.
- Create a new cluster and bush around what you found out about the metaphor.
- Outline a new article around the metaphor "Raubtier" about "Zivilisiert den Raubtierkapitalismus".

Bed-Time Churchill Reading (for English Speakers)

▶ This week, read:

▶ **Winston Churchill. "Their finest hour". Speech in the House of Commons. June 18, 1940. https://www.winstonchurchill.org/learn/speeches/speeches-of-winston-churchill/1940-finest-hour/122-their-finest-hour**

▶ Look at the last paragraph. Construct a mindmap bush out of the concept "Survival of Christian civilization" and another one of the contrasting concept "Sinking into the abyss of a new Dark Age".

  – Start with a cluster
  – Trim it to a bush

▶ Use both concepts "Survival of Christian civilization" and "Sinking into the abyss of a new Dark Age" to develop a structure tree.

  – Develop the metaphor by associations: Abyss, Ocean, Dark, Age, Survival in the Ocean, Civilization, Barbarians, ...

▶ Create a new cluster(s) and bush(es) around what you found out about the metaphor.

▶ Outline a new article around what you clustered.

▶ Why was Churchill's speech so powerful?

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Normalized Clusters should have up to 3, at most 4 Levels

- The logical structure of arguments, blocks, paragraphs, and sections is called a **cluster, flat** or **deep.**

- Usually, clusters fall into the following categories:

  - **Flat**

    - A **comb (Kamm)** is a 2-level cluster with central point and arguments. An **n-comb** has n arguments.
    - A **5-step (5-Schritt)** is a 5-comb with overlayed linear ordering.

  - **Deep**

    - A **bush (Busch)** is a 3-level cluster with central point, first level of arguments (*primary arguments*), and a second level of *secondary arguments*.
    - An **Xmas tree (Weihnachtsbaum)** is a 4-level cluster

- **Clustering (cluster normalization)** starts with wild, unordered clusters, mindmaps, and rearranges them.

- Clusters will also be applied to problems, goals, causes and effects, a.m.m.

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Appendix

▶ Several slides are courtesy to Sebastian Cech

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