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

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Speak OI*SDR as Oyster

1) The OI*SDR Research Processes
2) Orientation: From the idea to the research question
3) Information Gathering
4) Reading
5) Structuring
6) Writing: Drafting and Revising
7) Demos

Literature

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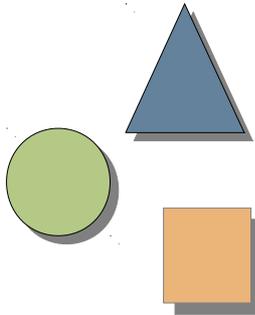
- ▶ [Krumbiegel] Helga Esselborn-Krumbiegel. Von der Idee zum Text. Eine Anleitung zum wissenschaftlichen Schreiben:
  - – 3. überarbeitetete Auflage, 2008
  - – Leiterin des Schreibzentrums in Köln http://schreibzentrum-koeln.de/
  - – Angegliedert am Studentenwerk Köln
- ▶ Matti Tedre. Know your discipline: 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

In this sense, computer scientists are expected to be bricoleurs, sort of academic jacks-of-all-trades. [Tedre]

Other Literature

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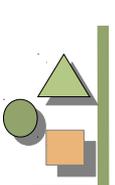
▶ [Heimes] Silke Heimes. Schreiben im Studium: Das PiiP-Prinzip. Vandenhoek und Ruprecht. UTB 3457

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

▶ [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

Bed-Time Schmidt Reading (for German Speakers)

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- Helmut Schmidt is a good read, isn't he? 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 and an analogy spiral.
    - 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)

▶ Winston Churchill is also a good read? 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 and an analogy spiral.

  – 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?

10.1. The OI*SDR Research Processes

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Inspired from [Esselborn-Krummbiegel]

The OI-SDR Research Process
for General Scientific Topics and Overviews

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

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Research

Orientation

Information Gathering

Writing/Talking

Structuring

Drafting

Revising

- **Collect ideas, generate ideas**
- **Find the scope (limits) of the topic**
- **Orientation in literature: First overview on literature**
- **Planning: Expose + project plan**
- **Market need: identify your readers and stakeholders [Ashby]**

- **Informing: Information Gathering: Primary texts, evaluate sources. Check relevance of Literature**

- **Order Material**
- **Find Hypotheses by applying ZOPP**
- **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**

Phases of scientific text production, e.g., for technical papers or theses in a technical science.

Orientation

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

Information Gathering

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

Solution

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

Technology invention

- **Requirements of the solution**
- **Solution design, invention**
- **Architecture development**

Validation

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

Structuring

**Documenting the technology by writing:
a design pattern, a report**

Drafting

Revision

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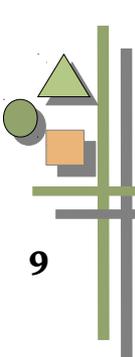
The Course Structure

▶ The course is structured along OIS-SDR:

- Orientation
- Information gathering
- Solution
  - Invention
  - Validation
- Structuring the material and results
- Drafting a text
- Revising a text

# Standard Structure of a Technical Science Thesis

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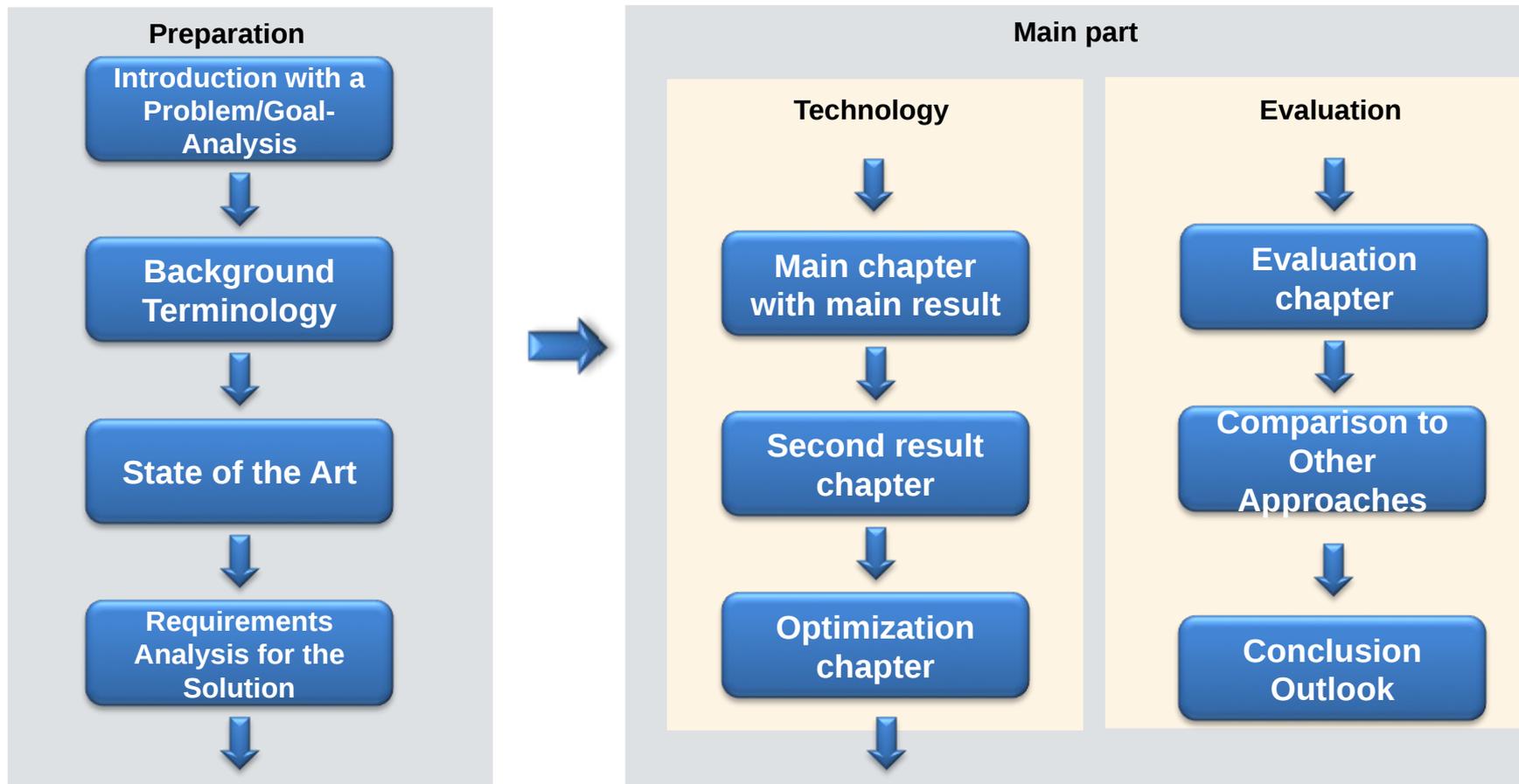
The Standard Structure of a Master Thesis in *Technical Science* is Related to the OIS-SDR Research Process

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Orientation	→	Information Gathering	→	Technology Invention	→	Validation

Preparation

Main part

Introduction with a Problem/Goal-Analysis

↓

Background Terminology

↓

State of the Art

↓

Requirements Analysis for the Solution

↓

Technology

↓

Main chapter with main result

↓

Second result chapter

↓

Optimization chapter

↓

Evaluation

↓

Evaluation chapter

↓

Related Work: Comparison to Other Approaches

↓

Conclusion Outlook

Structuring | Drafting | Revision

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.
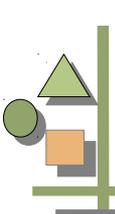
Practical Hints

▶ 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

▶ 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

▶ 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 2010. 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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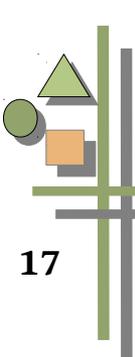
▶ Take the outline of Seidl and Wilke and produce one slide each for the defense – as if you had to defend their master's thesis.

▶ 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?

# 10.2. Orientation Process – From the Idea to the Thesis Question

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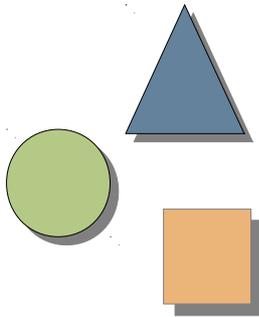
10.2.1 Idea Generation
Clustering with Mindmaps and other Techniques

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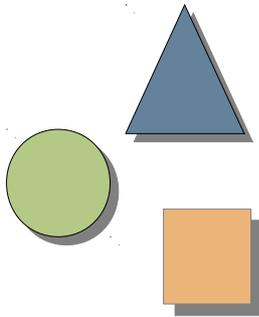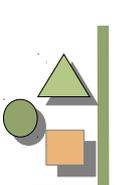
Clustering Helps to Develop Logical Structures of Your Work

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▶ Objective:

– Develop ideas by association

– Use the blackboard's space to find association

▶ Activation of both hemispheres

– Left: analytical thinking

– Right: thinking in images, associations

▶ Procedure:

– Note the central concept in the middle

– Start to note associated terms or relations

– Iterate

▶ Clustering is a method for idea generation and structuring
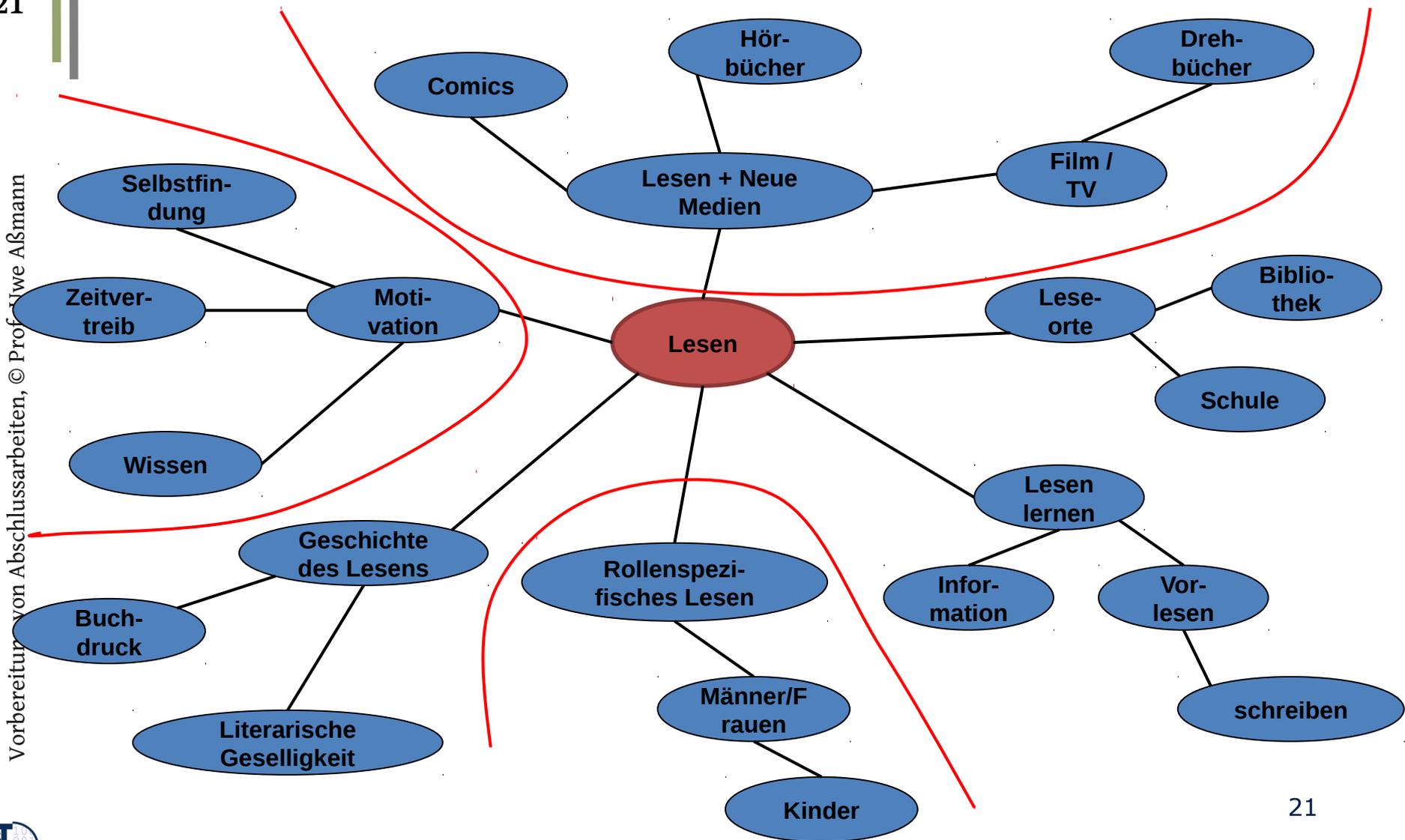
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Ex.: Refined 4-Level-Cluster "Lesen"

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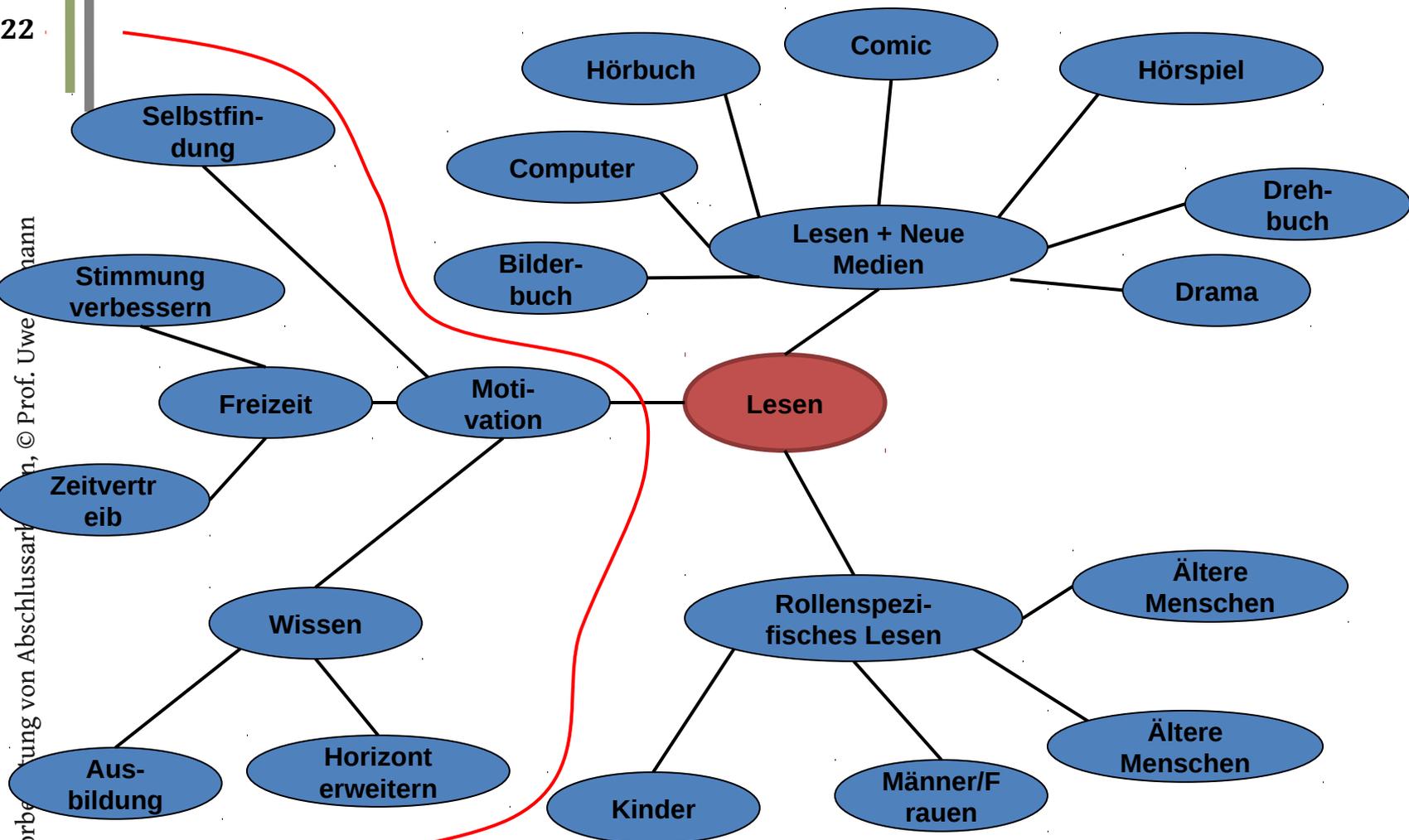
Ex.: Refined 3-Level Cluster "Lesen"

Lesen

Bildung
- Selbstfin-dung
- Horizont erweitern
- Aus-bildung

Lesen + Neue Medien
- Hörbuch
- Comic
- Hörspiel
- Computer
- Dreh-buch
- Bilder-buch
- Drama

Freizeit
- Stimmung verbessern
- Zeitvertr eib

Rollenspezi-fisches Lesen
- Ältere Menschen
- Ältere Menschen
- Kinder
- Männer/F rauen
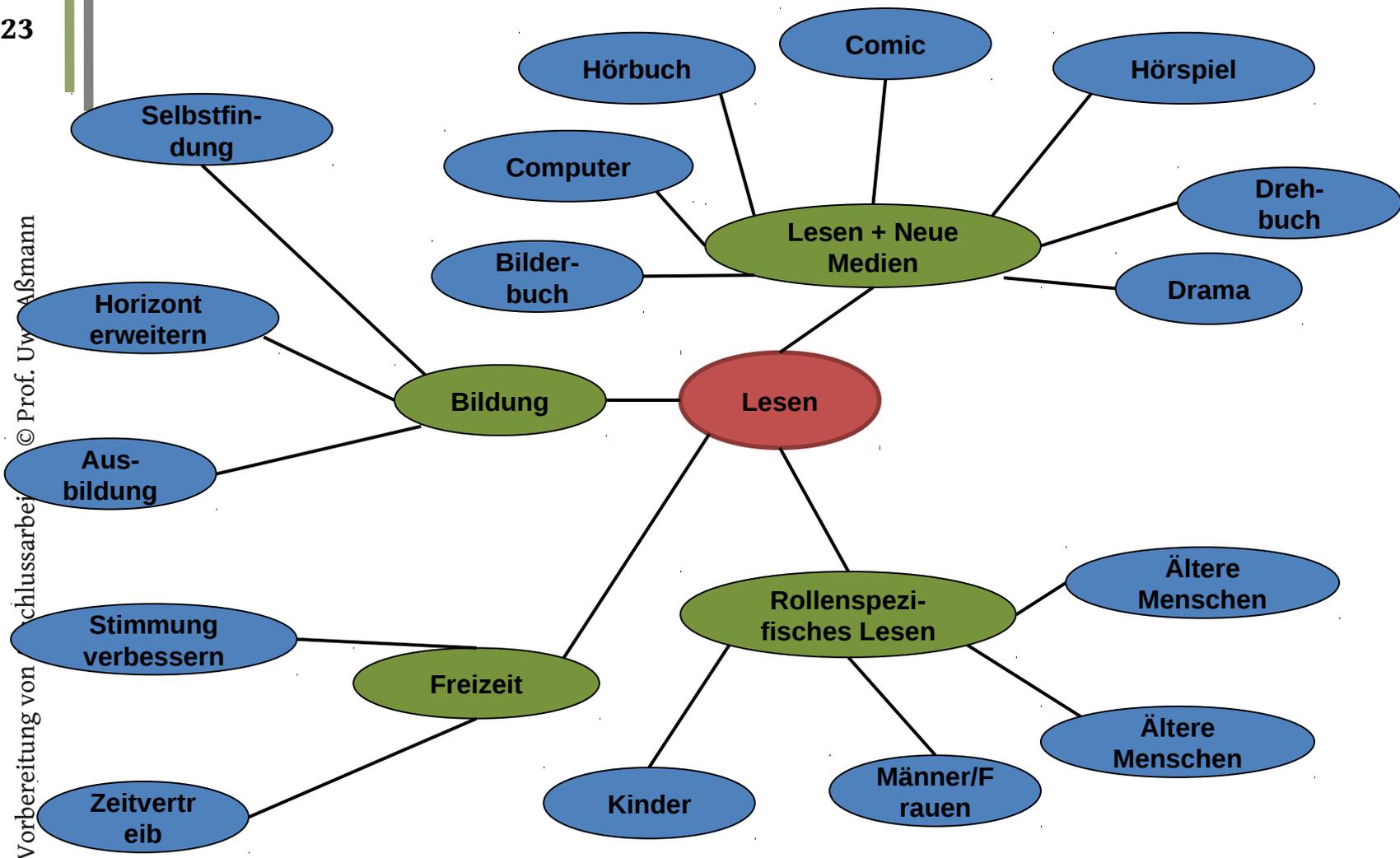
▶ The logical structure of blocks, paragraphs, and sections is called a **cluster**

▶ Usually, the logical structure (cluster) falls into the following categories:

▶ A **comb (Kamm)** is a 2-level cluster with central point and arguments. An **n-comb** has n arguments.

▶ A **5-step** is a 5-comb with overlayed linear ordering.

▶ 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.

Text Blocks should have up to 3 Levels

▶ 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 tr 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.

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Training Block

▶ Turn the 4-level cluster about Lesen into a bush text.

▶ Which technique does Schmidt use? Combs? Bushes?

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10.2.2 Other Idea Finding Techniques

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More Creative Methods to Find Ideas

- ▶ Structure trees
- ▶ Analogy spirals
- ▶ Topic fans
- ▶ The 6 honest serving man

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10.2.1.1 Structure Trees
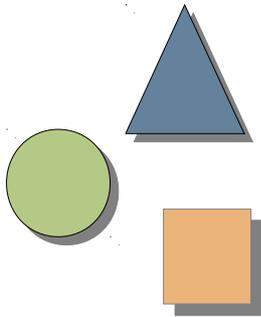
Structure Trees

▶ Objective: find decompositions of a difficult thing

▶ A Structure Tree is a tree with differently deep branches.
  - Structure trees can be drawn as trees
  - Line hierarchies
  - Widget trees

▶ The metaphor of a tree helps some people to brainstorm.

▶ 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)

[Esselborn-Krummbiegel]
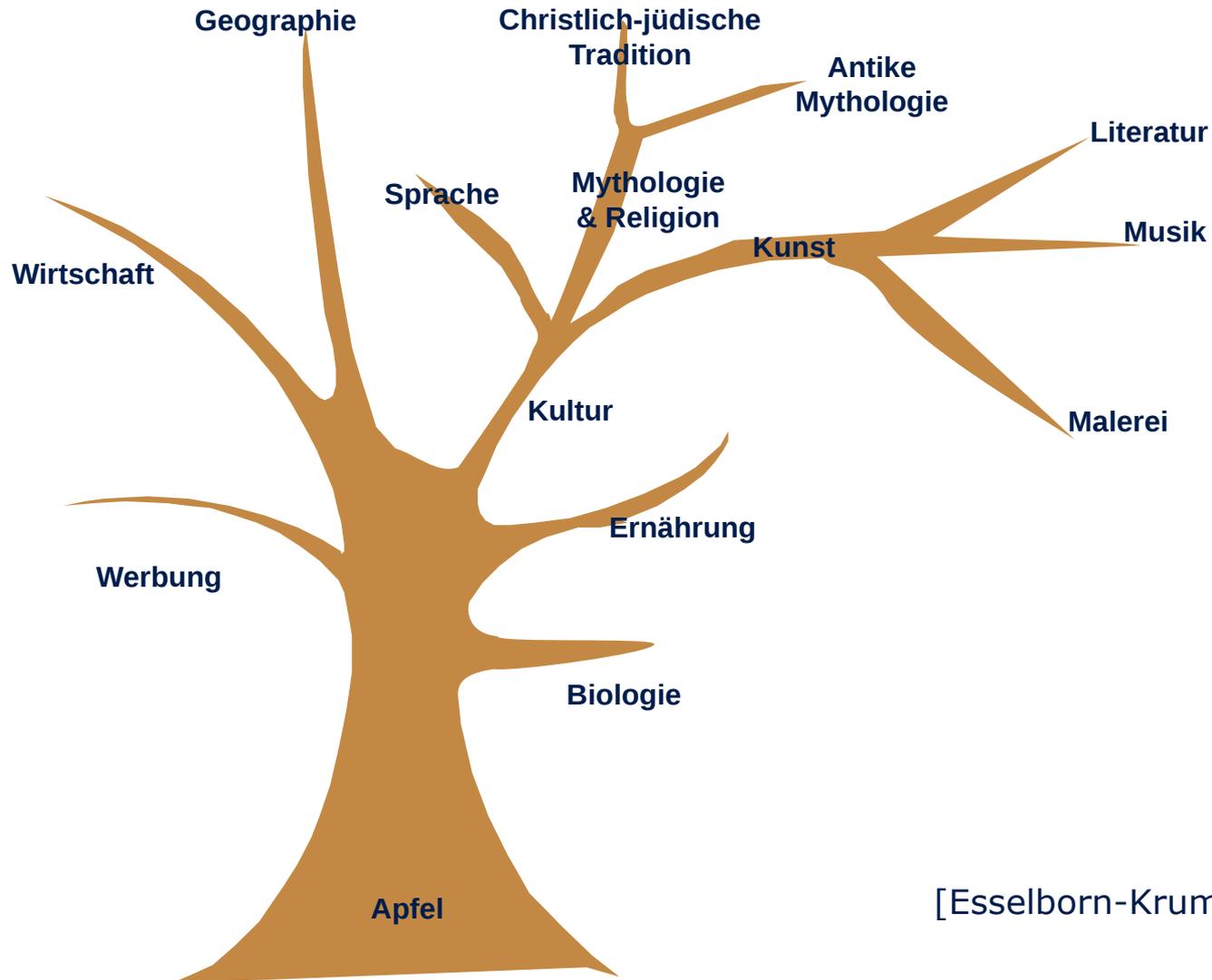
10.2.1.2 Analogy Spiral (Analogierad)

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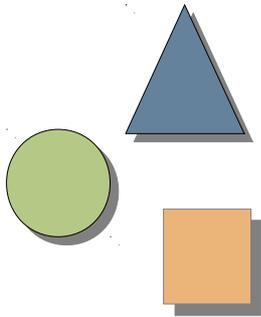
Analogy Spiral (Analogierad)

► **Objective:** Find relations and connections between aspects of a concept

► How To:

   – 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

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► Find out structural features (Merkmale) of film and novel

► Recognize and associate similar and typical features

► Go round in a spiral from inside to outside

► Associate concepts and features more and more concrete and detailed

Point of View

Innerer Monolog

Kamera-perspek-tive

Symbole

Dehnung

Zeit-lupe

Film

Multi-media-lität-

Mon-tage

Collage

Kamera-bewegung

Erzähler
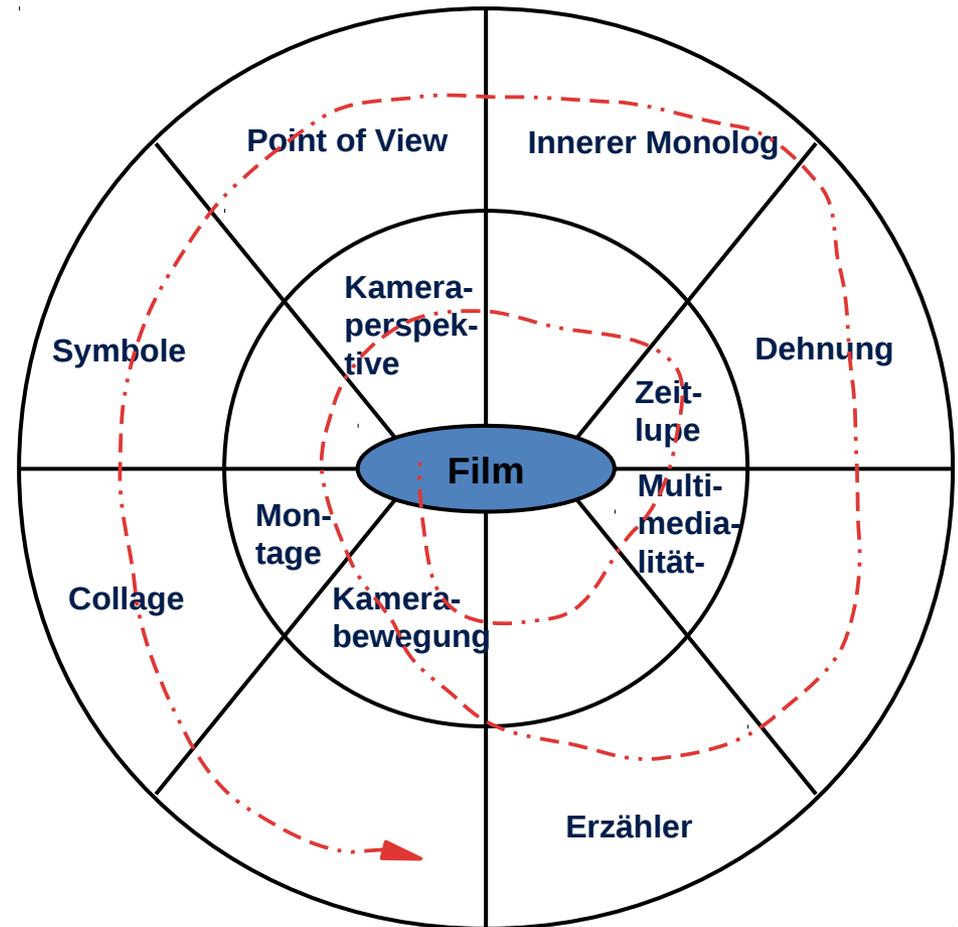
▶ Analyzing features of concept "control flow graph"

▶ Mario Friske. Strukturelle Testabdeckung funktionaler Spezifikationen
subs.emis.de/LNI/Proceedings/Proceedings133/gi-proc-133-036.pdf

Abbildung 3: Übertragung struktureller Merkmale von Kontrollflussgraphen auf funktionale Spezifikationen mithilfe eines Analogierades

10.2.1.3 Topic Fans (Themenfächer)

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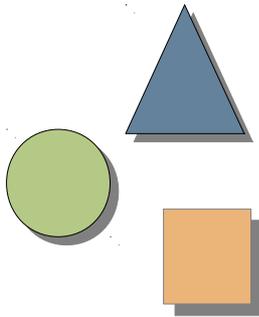
Find and Scope Topics with Topic Fans

▶ The topic fan combines analogy circle and topic tree by giving explicit meaning to the levels (rings).

▶ Objective:

- Problem-oriented analysis of a topic
- Collection of aspects of the problem and related questions

Topic Fans with Levels (PAQO)

- ▶ Problems (P)
  - – related to the topic
- ▶ correlated Aspects (A)
  - – related to the problems
  - – related to the context of the investigation
- ▶ Questions (?)
  - – 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

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Lesen

Medien + Lesen

Motivation

Rollenspezifisches Lesen

Freizeit

Selbstfindung

Wissen

Welche literarischen Zeugnisse?
Gibt es einen Unterschied der Lebensphasen?
Vertieft man Lebensthemen?
Wie bewältigt man Gefühle?
Probiert man Rollen aus?

Tagebücher von Schriftstellern zeugen von Selbstfindung

Lektürebiographien zeigen Entwicklungen

Texte machen Rollenangebote

10.2.1.4 The 7 Basic Questions (7 W-Fragen)

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!

► For finding topics of research, a text or talk, the 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).

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	Ideas for Topic; Limits and Implications
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?
How?	How similar is my topic to another work? How different is it? What is its research advance? research contribution?
Where?	Where is my research located in the research landscape?
When?	When did somebody else research on something similar?
Why?	Why do we need the topic?
For what? To which end?	What will happen if we don't solve the problem?

10.2.2 Strategic Analyses for Research

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- Not all research is *relevant*
- Often, decisions have to be made about which way to go in research. Several general analysis for strategy can be used.
- [more material in course "Software Management (summer)"]
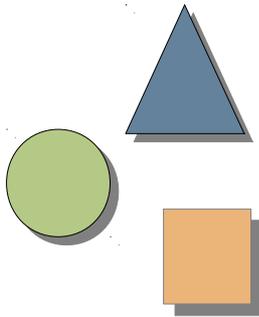
SWOT Analysis

▶ SWOT is a 4-dimensional attribute analysis for the development of a strategy for or project [Albert Humphrey]

▶ For strategic decisions of your thesis and your research

Strengthes

**Unternehmensanalyse (Inweltanalyse)
Internal attributes**

Umweltanalyse
External attributes

Threats

Opportunities

Or: Trends

Weaknesses

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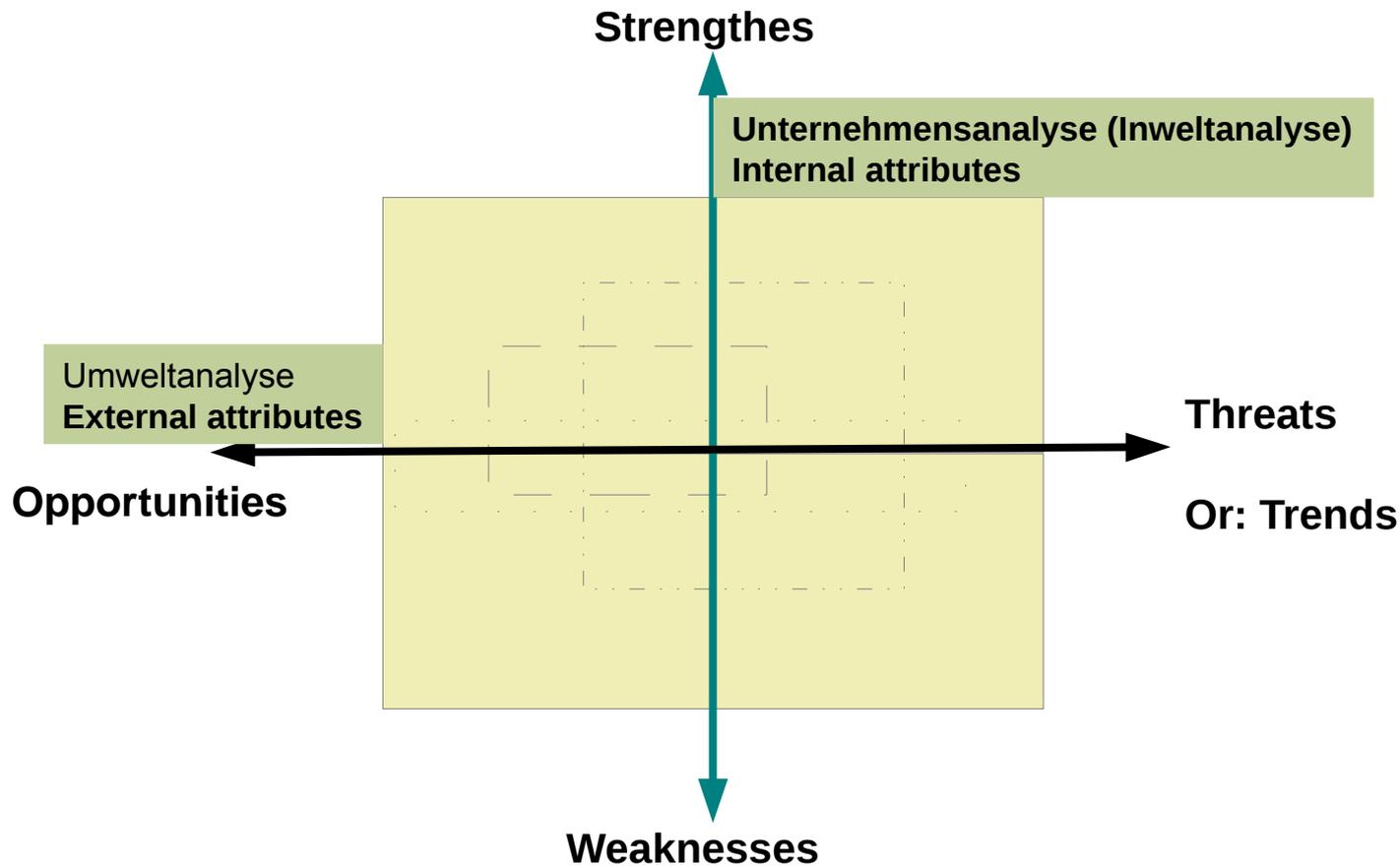
▸ Die **"low hanging fruit"-Analyse (Fruchtbarkeitsanalyse)** analysiert die Menge der möglichen Forschungsfragen und -resultate

- Der **Fruchtbarkeitsfaktor** ist ein Nutzen-Nutzen-Attraktivitätsfaktor:

- **Fruchtbarkeitsfaktor** = Win*Effort

▸ Am attraktivsten sind **"low hanging fruits"**, weil sie mit wenig Aufwand viel Gewinn abwerfen

▸ **Dogs** können durchgeführt werden, um strategische Ziele zu erreichen

▸ **Snakes** kill immediately – never do research on them!

▸ **Elefants** erdrücken die Forschung auf mittelfristige Sicht
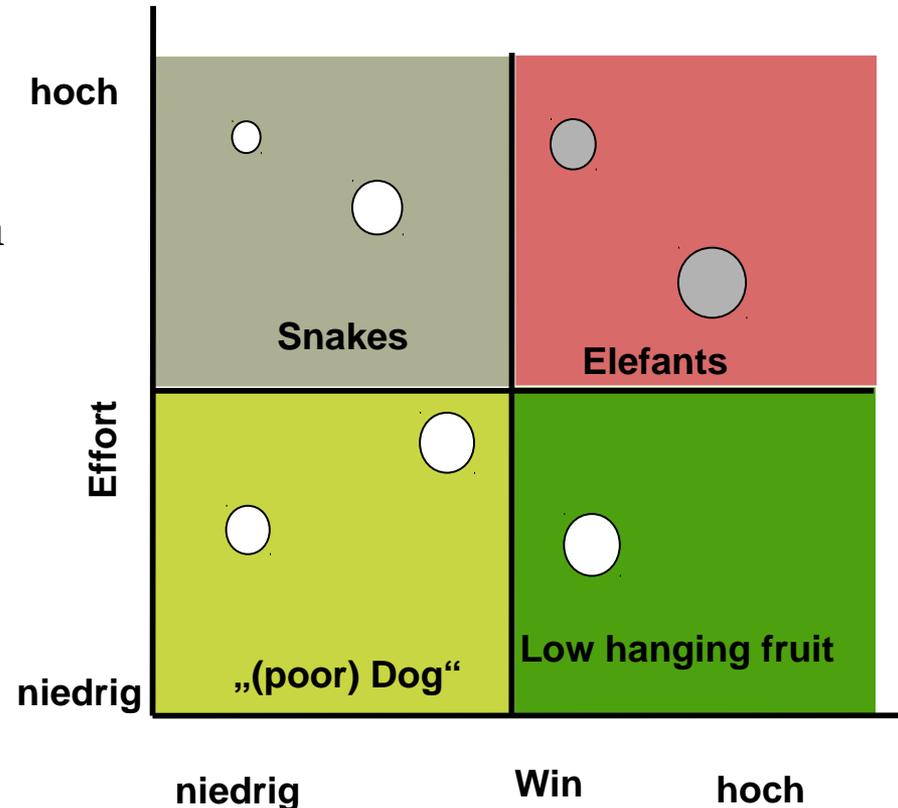
„KillerApp" Analyse (Attraktivitätsfaktor)

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► Die **"KillerApp"-Analyse** analysiert die Menge der möglichen Projekte, Produkte oder Dienstleistungen auf Verstehbarkeit und Bedarf.

  – Der **Bedarfsfaktor** ist ein Nutzen-Nutzen-Attraktivitätsfaktor:

  – **Bedarfsfaktor** = Bedarf * Verstehbarkeit

► Am attraktivsten sind "KillerApps", weil sie leicht verständlich und werden von vielen gebraucht

Bedarf subjekt für den Kunden verständlich?

hoch

niedrig

Good John

KillerApp

Technical Golden App

Mass App

niedrig   **tatsächlicher Bedarf**   hoch
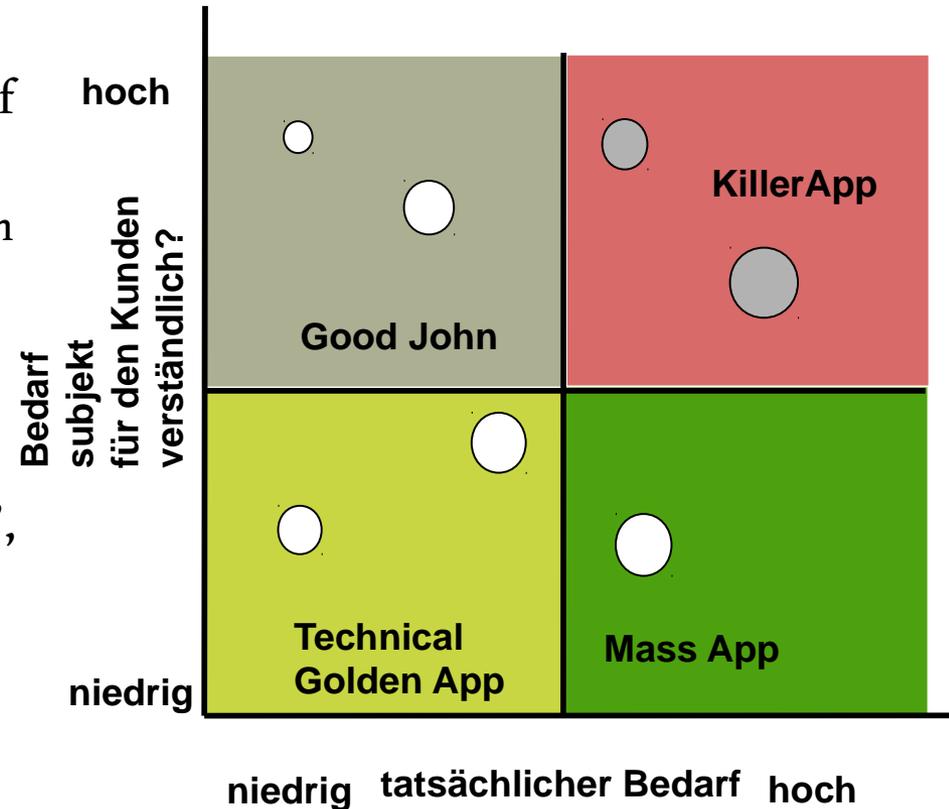
Home Work

▶ Conduct a "low hanging fruit" analysis for the topic "Smart Grid"

▶ Conduct a "killer app analysis" topic Smart Grid

- find a killer ap
- find a golden technical a

10.3. Information Gathering

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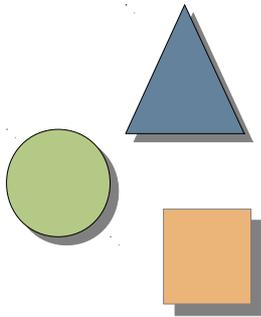
Information Gathering (Recherche)

▶ Most often, literature is found today on the internet.

- – Google scholar
- – Research gate
- – bib-Server in Karlsruhe
- – dblp search engine

▶ Use the SLUB license to find papers with Springer, ACM, IEEE.

▶ For non-licensed papers, use the SLUB search engine

- – http://www.slub-dresden.de/
- – Go and lend a paper copy

▶ Saxony stores most of its Master's thesis and PhD theses on "Quality Content of Saxony", our permanent pdf server

- – http://www.qucosa.de/
- – Here you can find most of the Master's theses of the chair of Software Engineering.

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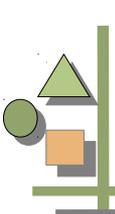
▶ Distinguish primary from secondary sources

  – Read and cite primary sources!

  – If you found a good pedagogic overview article interesting for others, too, you may also cite this secondary source

▶ Important journals in Software Engineering

  – ACM Transactions on Software Engineering and Methodology (TOSEM)

  – ACM Transactions on Programming Languages and System (TOPLAS)

  – IEEE Software

  – Springer Software and Systems Journal (SoSym)

▶ Overview journals or bibliographies for certain topics

  – ACM Computing Surveys
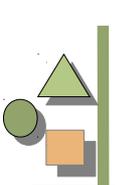
Homework: Look for interesting Journals and Conferences in Software Engineering

- ▶ Surf ACM, IEEE, Elsevier, Wiley, Springer
- ▶ We collect them next time

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10.4. 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.

► **Relevant research**: Somebody, the **research stakeholder,** needs the result.

► **High innovation depth**: research result lies much beyond the state of the art

► **Narrow result:** the research result will not influence many applications, produ
markets, nor other research.

► **Disruptive result:** The research result will change many technologies, product
markets, value chains.

► **Epsilon-result:** The research result is not far away from the state of the art, bu
contains a definite improvement.

► **"low hanging fruit"-result**: the research result is quite easy to achieve or to
document

▶ Most often, such a problem-solution analysis will become part of the introduction of your report.

▶ 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

  – ZOPP (Ziel-orientierte Projektplanung)

  – PROBLOSS (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.

▶ Here comes an introduction.

10.4.2 Generation Processes for Problems, Ideas, Solutions

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- Finding solutions or ideas is important.
- Use some general generation processes
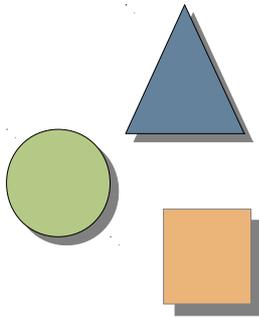
▶ For assessments and analyses of ideas, problems, solutions, risks, etc

▶ For alternatives if difficult decisions have to be taken

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| Generation (Identification, Elicication)	Assessment (Grading)	Prioritization (Ordering)
Elicitation Brainstorming Delphi-Studie Checklisten	Einzel-Bewertung mit Metriken (auf Skalen) eindimensional mehrdimensional	Vergleichende Bewertung Im eindimensionalen Fall ist die Priorisierung einfach mehrdimensional: multikriterielle Analyse multikriterielle Optimierung

10.4.3. General Processes to Achieve Solutions

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Die Phasengliederung des RUP ist als INECT allgemein als DO-Prozess verwendbar (Phasenmodell):

▶ **Inception:** Festlegung aller Projektbedingungen und Einrichtung einer Umgebung zur Durchführung aller folgenden Arbeitsschritte

▶ **Elaboration:** Durchführung der Analyse, Festlegung aller Anwendungsfälle und Entwurf der Architektur

▶ **Construction:** Fortführung des Entwurfs sowie Implementierung der Architektur und Durchführung des Tests

▶ **Transition**: Übergangsphase in der das Softwareprodukt beim Kunden auf der Zielplattform installiert und integriert wird; Nachstudien; Prozessverbesserung

Inception **Elaboration** **Construction** Transition

Main phases
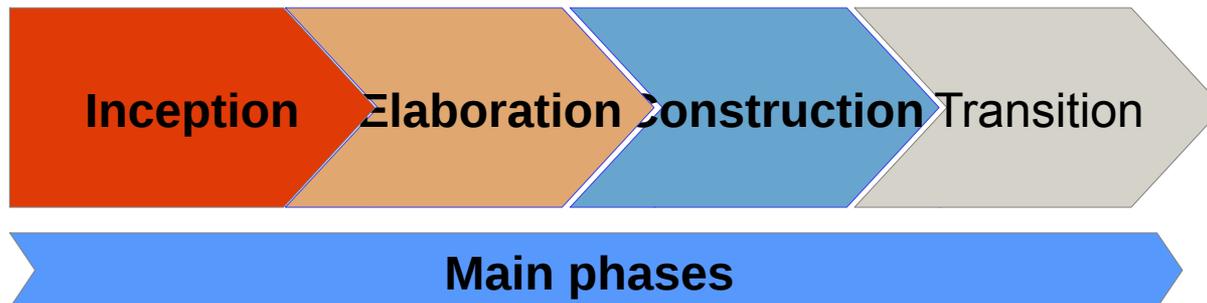
▶ If we want to solve a research problem, a lot of thinking ("incubation") is needed.

▶ Don't give up if the illumination takes some time!

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

▶ [Heimes]

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

PiiP Process
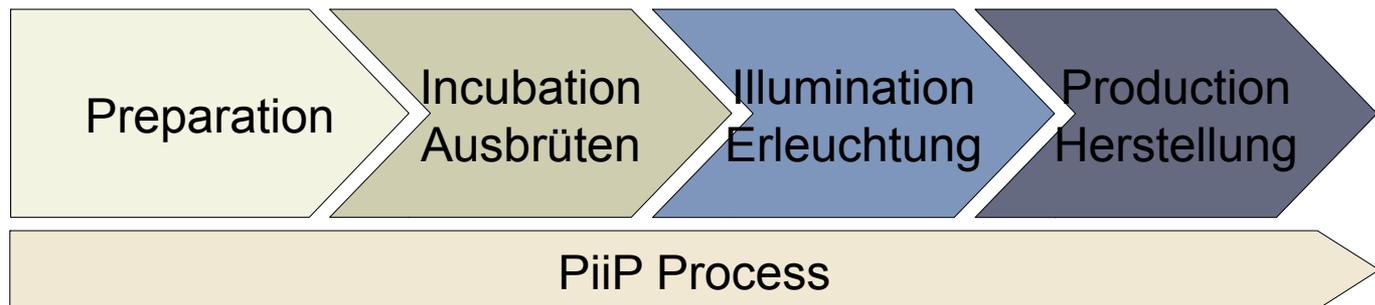
10.5. Structuring

59
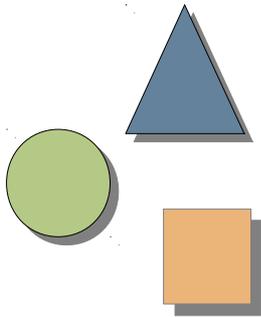
Structuring of Ideas, Problems, Solutions

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

  – They can easily be brought into other hierarchical schemes.

▶ Categorise into taxonomies

  – Oberbegriffe finden

  – Ähnlichkeiten und Zusammenhänge finden

▶ Segmenting and partitioning

  – Validierung von Oberbegriffen durch Aufdeckung trennender Merkmale (z.B. durch Mindmap – ähnlich Clustering)

  – Oberbegriffe liefern gewichtete Teilbäume

▶ Part-of Hierarchies

▶ Argumentation hierarchies for Claims

▶ There is a special chapter on structuring with development schemes (Ch. 12).

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▸ This course has several special chapters on how to organize logical clusters with *development schemes*

▸ For all texts and talks, several **structural contracts** between the author and the reader/listener need to be developed:

- Point
- Thesis
- Controlling idea
- Controller
- Skeleton

▸ They are called the **dress of the naked text or talk**

10.6. Textification: Drafting and Revising

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Textification and Talkification

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

▶ **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.

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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

- 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 id

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

- A text with a **controlling idea** is called a text with **structural contract**

- Do not start with black text! Always start with a **controlling idea** and try to write red text, drafts wh 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)

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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

▶ Unity and coherence (controlling ideas, controllers, and threadings)

    – Pivot structures

    – Concession

▶ Transitional sentences and paragraphs

▶ Grammatical correctness: punctuation, words, commata,..

▶ Removing boredom (metaphors, hook paragraphs, soap boxes,...)

10.7 Demonstrate
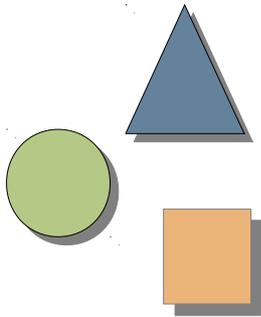
► In technical science, experiments and demonstrations are very important.

► Scientists need to *sell their results,* because results should be *relevant*

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

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

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| Relevance | Selling research results | Live experiments and demos | Screen films Labcasts |
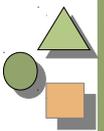
Appendix

▶ Several slides are courtesy to Sebastian Cech

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