

How to Write a Great Master Thesis?

Best (and worst) practices from choosing a topic to handing in

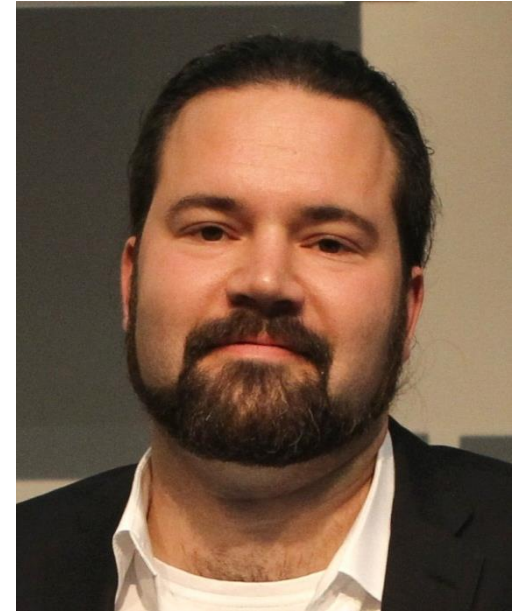
Dr. Elmar Juergens

In close cooperation with Dr. Angelika Reiser & Vivija Simic

2000 - 2006



2006 - now



2009 - now

Agenda

1. Why?
2. What's important?
3. Choosing a topic
4. Doing the work
5. Presentation



thesisguide.org

- Folien
- Video
- Detaillierte Essays
- FAQ

THESIS GUIDE

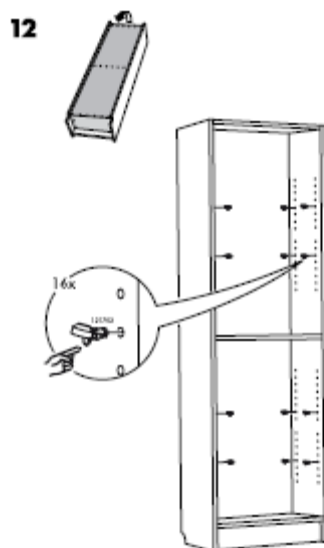
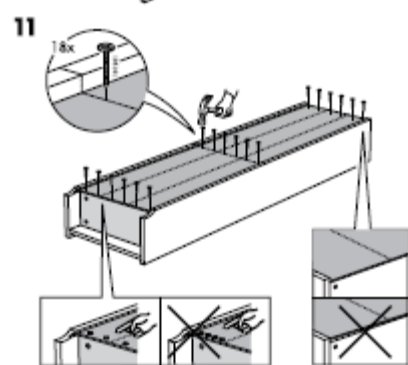
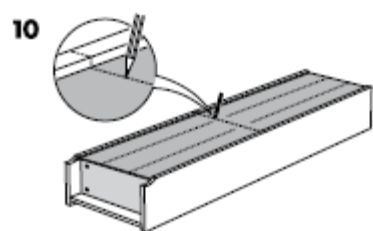
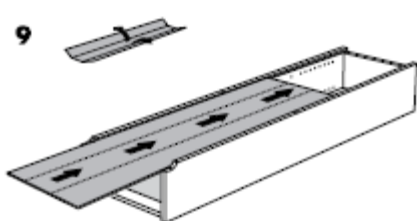
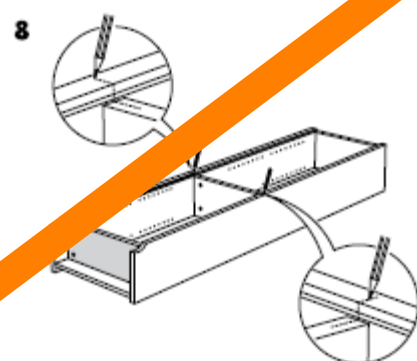
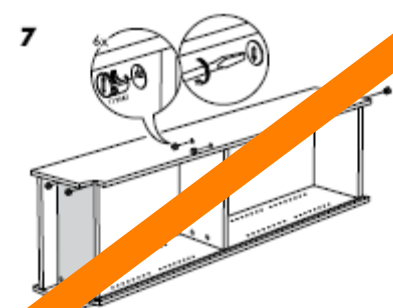
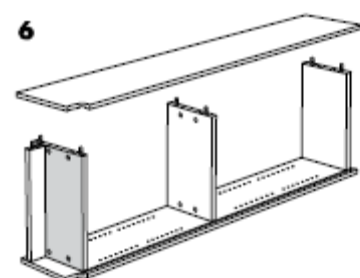
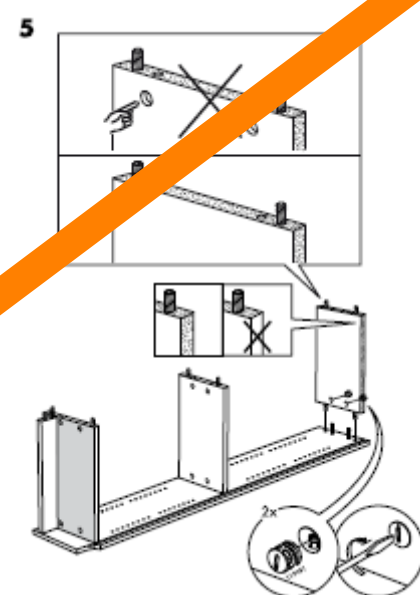
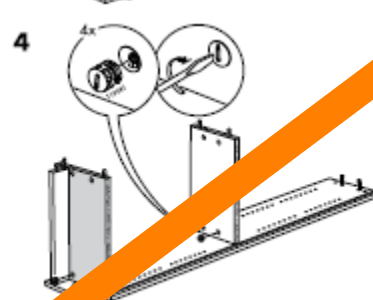
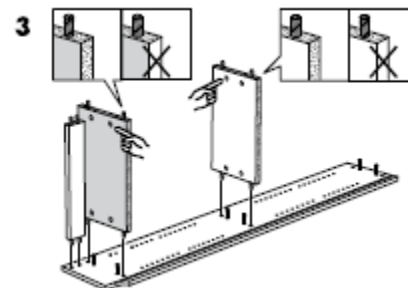
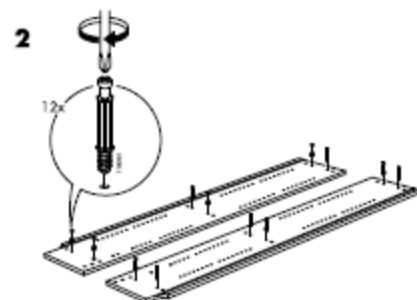
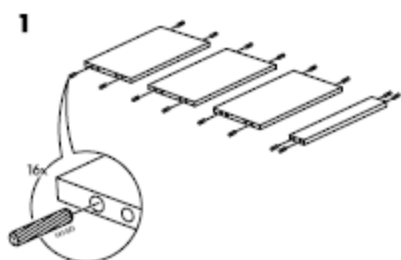
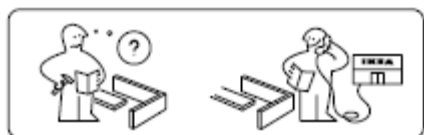
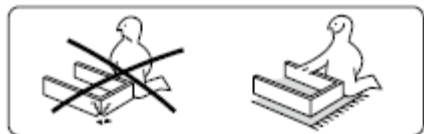
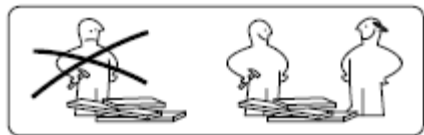
START HERE PREFACE CONTENT CONTRIBUTE ABOUT ME

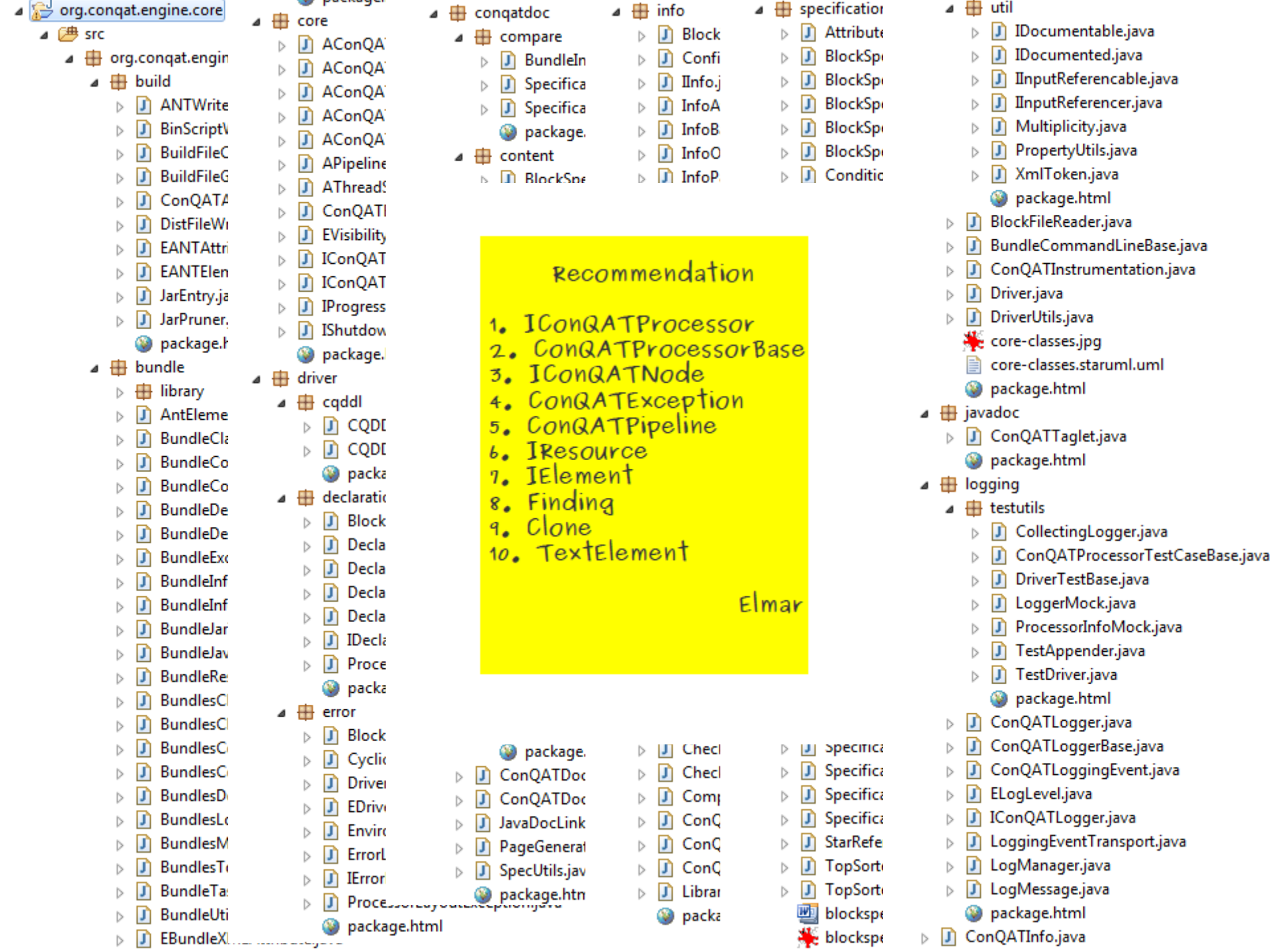


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3. Choosing a topic
4. Doing the work
5. Presentation



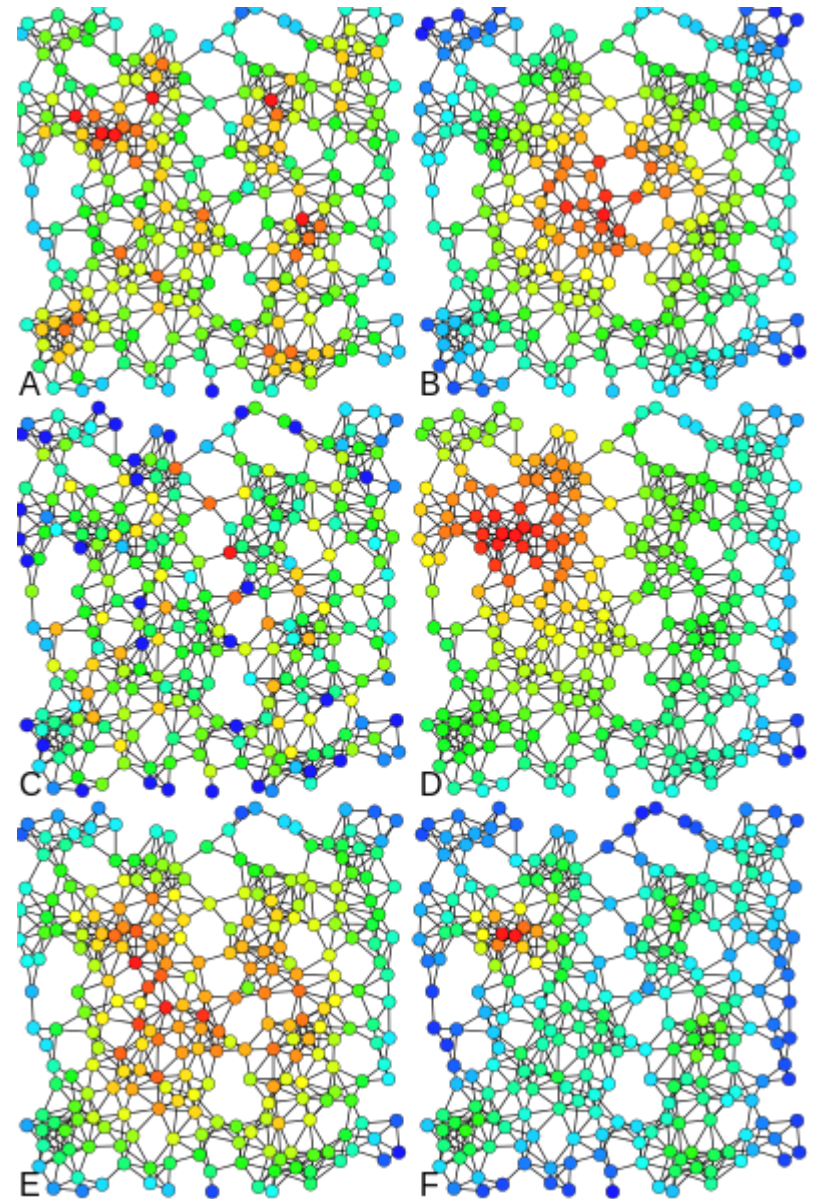
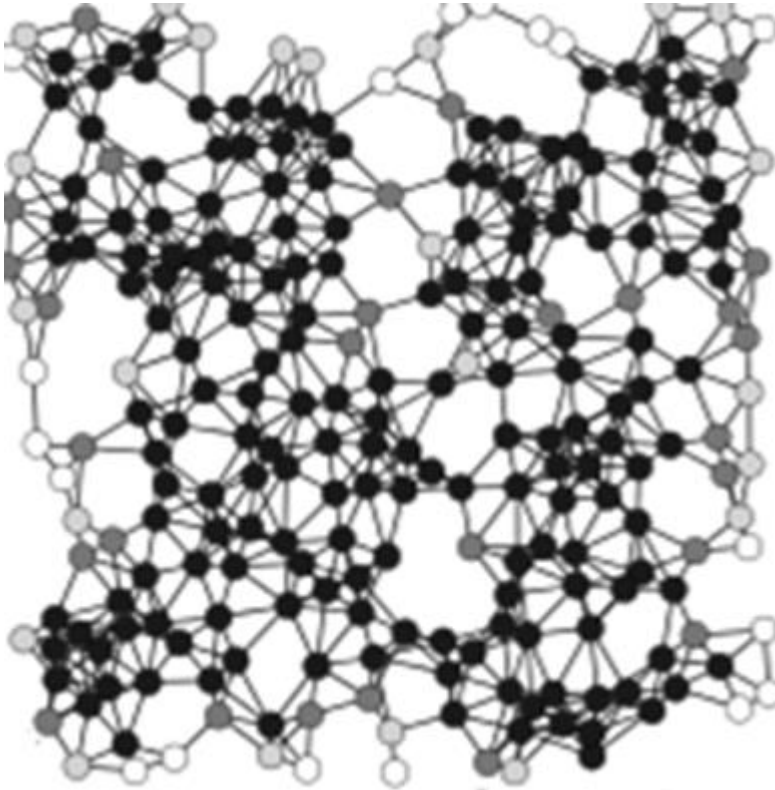


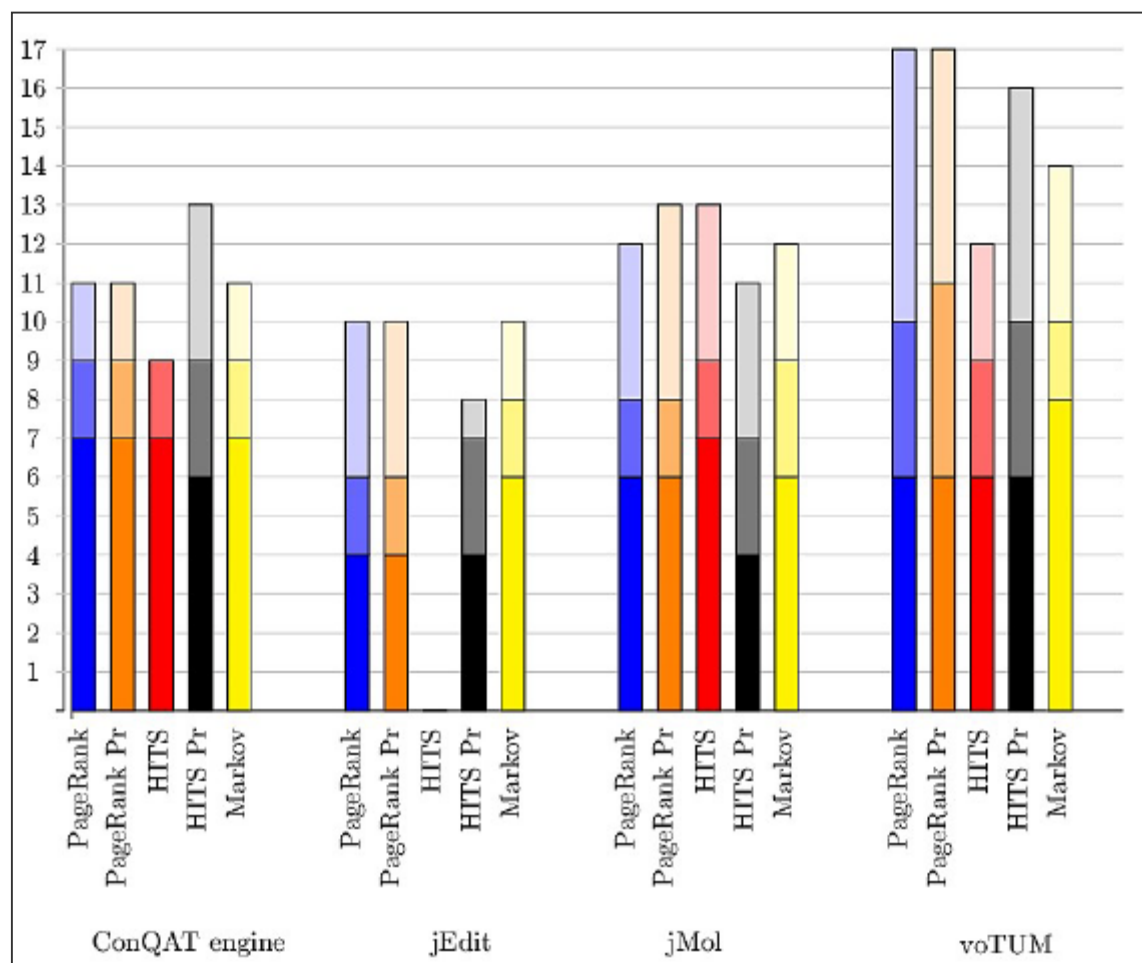


Recommendation

1. IConQATProcessor
2. ConQATProcessorBase
3. IConQATNode
4. ConQATException
5. ConQATPipeline
6. IResource
7. IElement
8. Finding
9. Clone
10. TextElement

Elmar







*Using Network Analysis for Recommendation of
Central Software Classes*

Daniela Steidl, 2012,

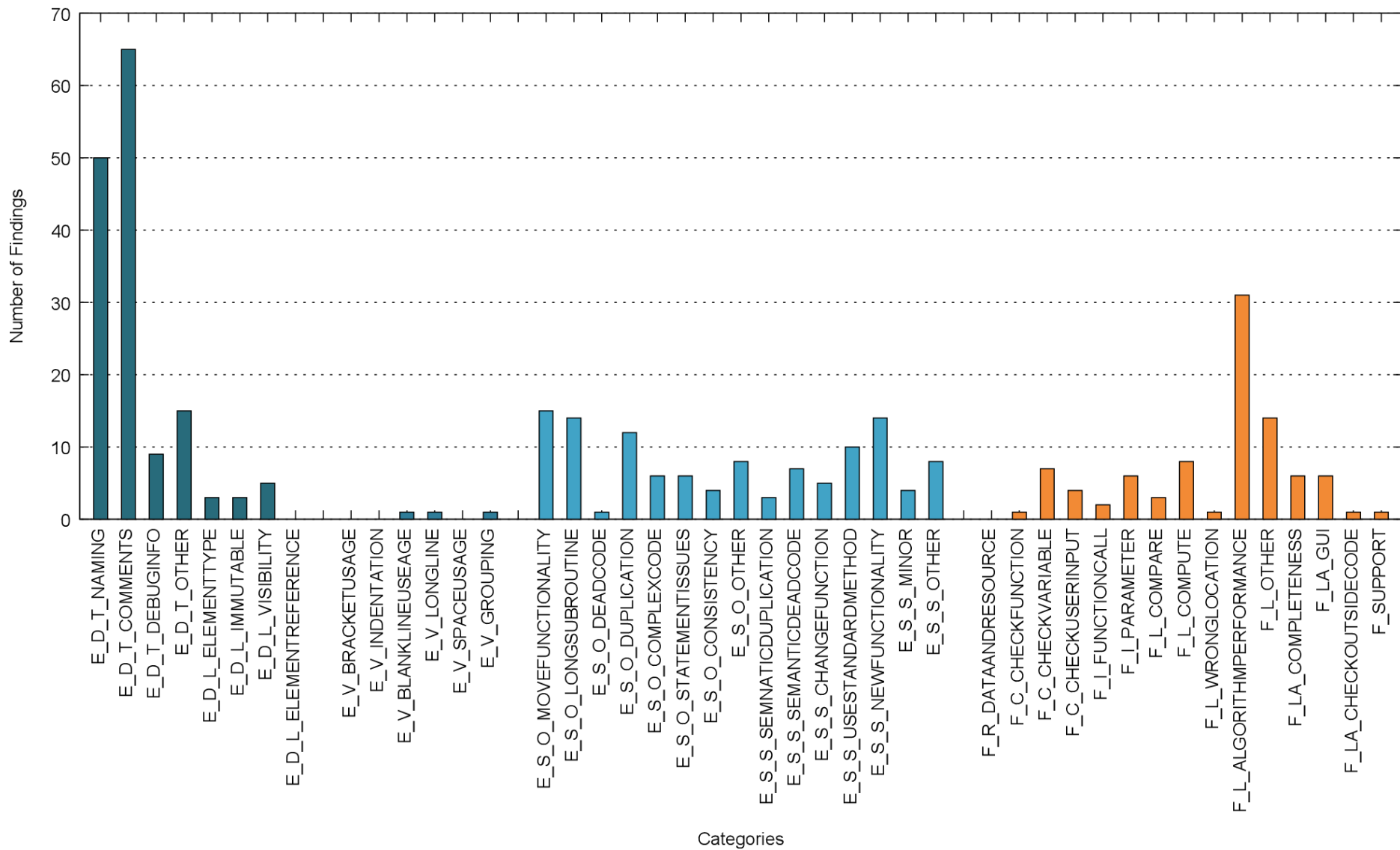
Intl. Working Conference on Reverse Engineering
Kingston, Canada

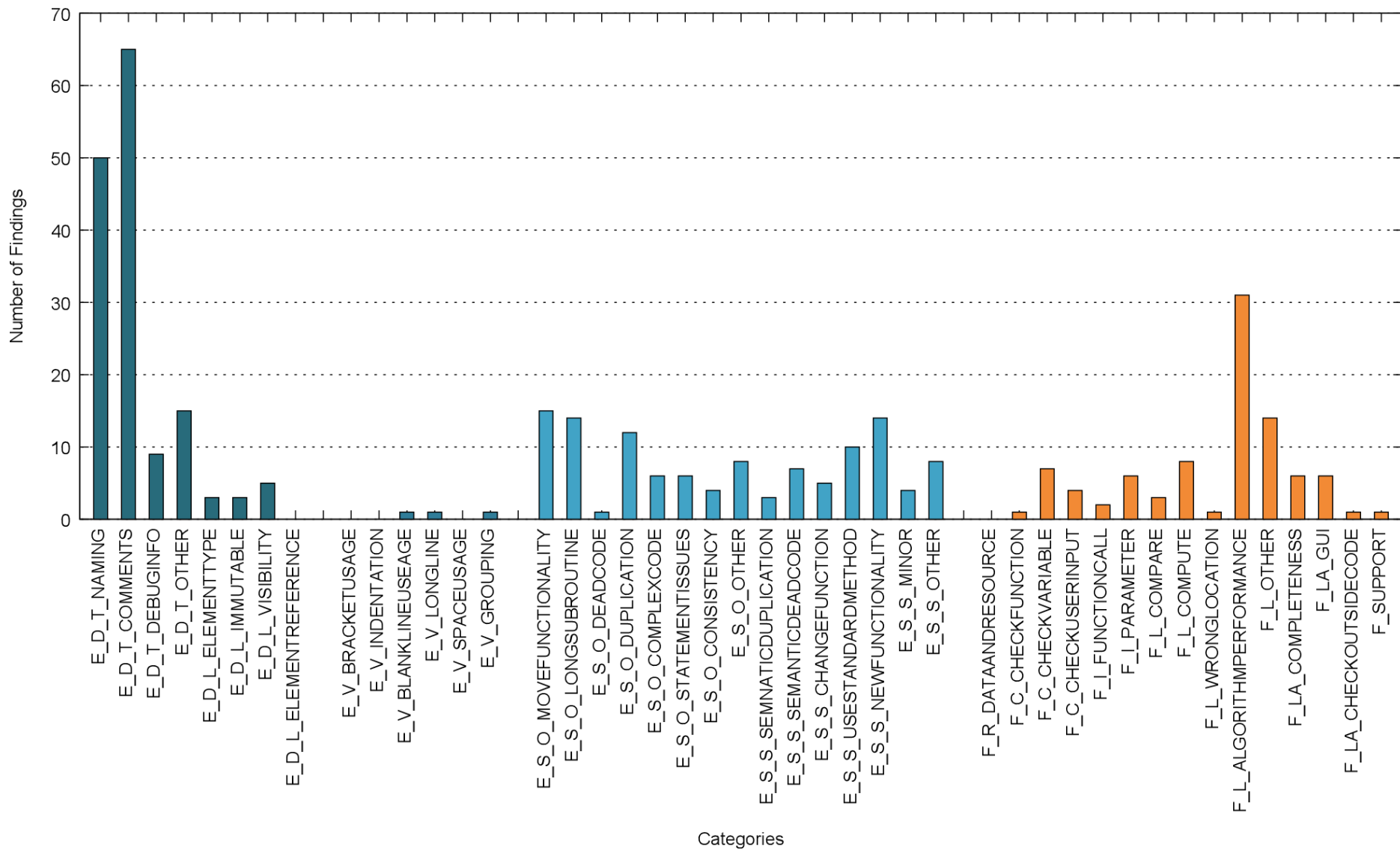


*Revealing Missing Bug-Fixes in Code Clones in Large-Scale
Code Bases*

Martin Pöhlmann, 2013,

Intl. Workshop on Software Quality and Maintainability
Genova, Italien





Refactoring Suggestions for Long Methods



```
public void writeComment(final DatenDownload datenDownload) {
    if (datenDownload.film == null) {
        // kann bei EinmalDownloads nach einem Neuladen der Filmliste/Programmeustart der Fall sein
        return;
    }
    final Path filePath = Paths.get(datenDownload.arr[datenDownload.DOWNLOAD_ZIEL_Pfad_DATEINAME]);
    if (Files.exists(filePath)) {
        final String strFilePath = filePath.toString();
        String strComment = datenDownload.film.arr[datenDownload.FILM_BESCHREIBUNG];
        if (strComment != null) {
            //no need to write spotlight data when there is no description...
            if (strComment.isEmpty()) {
                return;
            }

            //replace quotation marks...
            strComment = strComment.replace("\"", "\\\"");

            final String script = "tell application \"Finder\"\n"
                + "set my_file to POSIX file \"" + strFilePath + "\" as alias\n"
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                + "end tell\n";

            try {
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                builder.command().add(script);
                builder.start();
            } catch (Exception ex) {
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                    SwingUtilities.invokeLater(() -> {
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                            "Sollte dieser häufiger auftreten kontaktieren Sie bitte " +
                            "das Entwicklerteam.</html>",
                            null,
                            null,
                            ex,
                            Level.SEVERE,
                            null);
                        JXErrorPane.showDialog(daten.getMediathekGui(), info);
                    });
                }
                Log.errorLog(915263987, "Fehler beim Spotlight schreiben" + filePath.toString());
                //AppleScript may not be available if user does not use the official MacApp.
                //We need to log that as well if there are error reports.
                try {
                    if (!System.getProperty("OSX_OFFICIAL_APP").equalsIgnoreCase("true")) {
                        logUnofficialMacAppUse();
                    }
                } catch (NullPointerException ignored) {
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                }
            }
        }
    }
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    }
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Using Network Analysis for Recommendation of Central Software Classes
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Revealing Missing Bug-Fixes in Code Clones in Large-Scale Code Bases
Martin Pöhlmann, 2013,
Intl. Workshop on Software Quality and Maintainability
Genova, Italien



Deriving Extract Method Refactoring Suggestions for Long Methods
Roman Haas, 2016,
Software Quality Days
Wien, Österreich

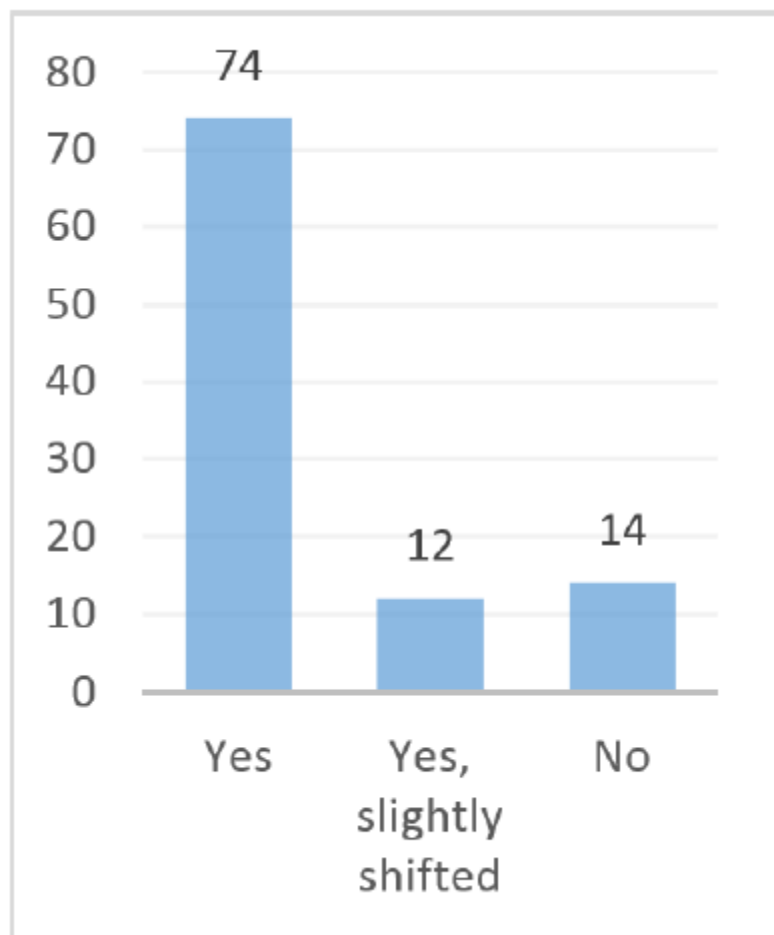
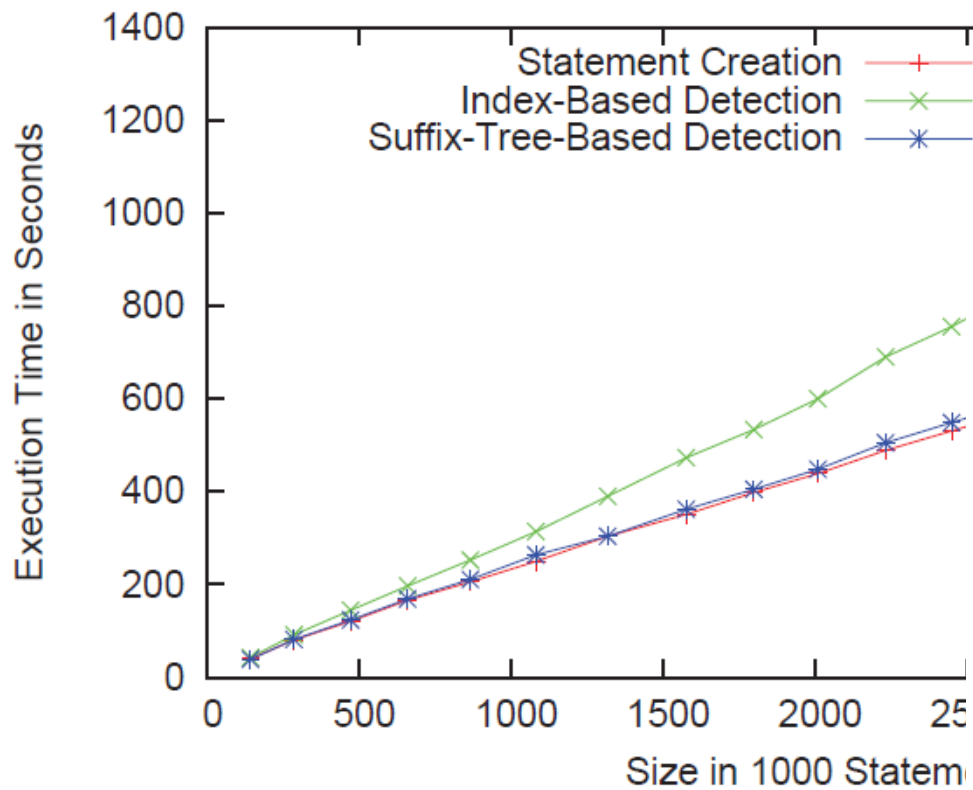


Ticket Coverage: Putting Test Coverage into Context
Jakob Rott, 2017,
Workshop on Emerging Trends in Software Metrics
Buenos Aires, Argentinien

Agenda

1. Why?
2. What's most important?
3. Choosing a topic
4. Doing the work
5. Presentation






FAKULTÄT FÜR INFORMATIK
DER TECHNISCHEN UNIVERSITÄT MÜNCHEN

Bachelor's Thesis in Business

**Automatic Categorization
Open-Source S**

Jonathan Ber




FAKULTÄT FÜR INFORMATIK
DER TECHNISCHEN UNIVERSITÄT MÜNCHEN

Bachelor's Thesis in Computer Science

Discovery of missed reuse opportunities

Tobias Völke



Roles

Author



Supervisor



Professor



Roles

Author

- Creates solution
- Implements code
- Writes text
- Presents work

Supervisor

- Invents topic
- Feedback for work
- Evaluation



Professor

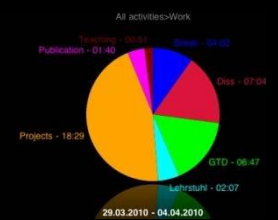
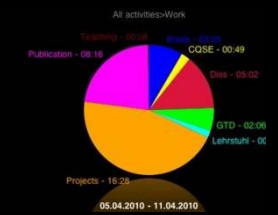
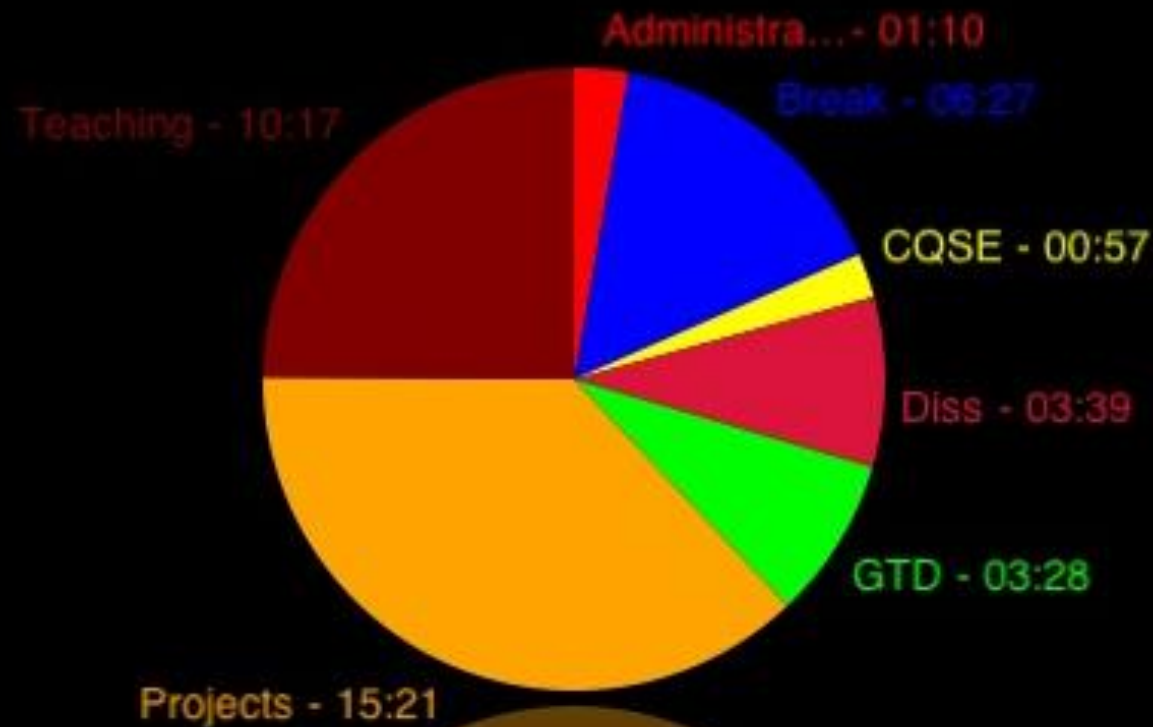
- Feedback topic
- Formal Evaluation

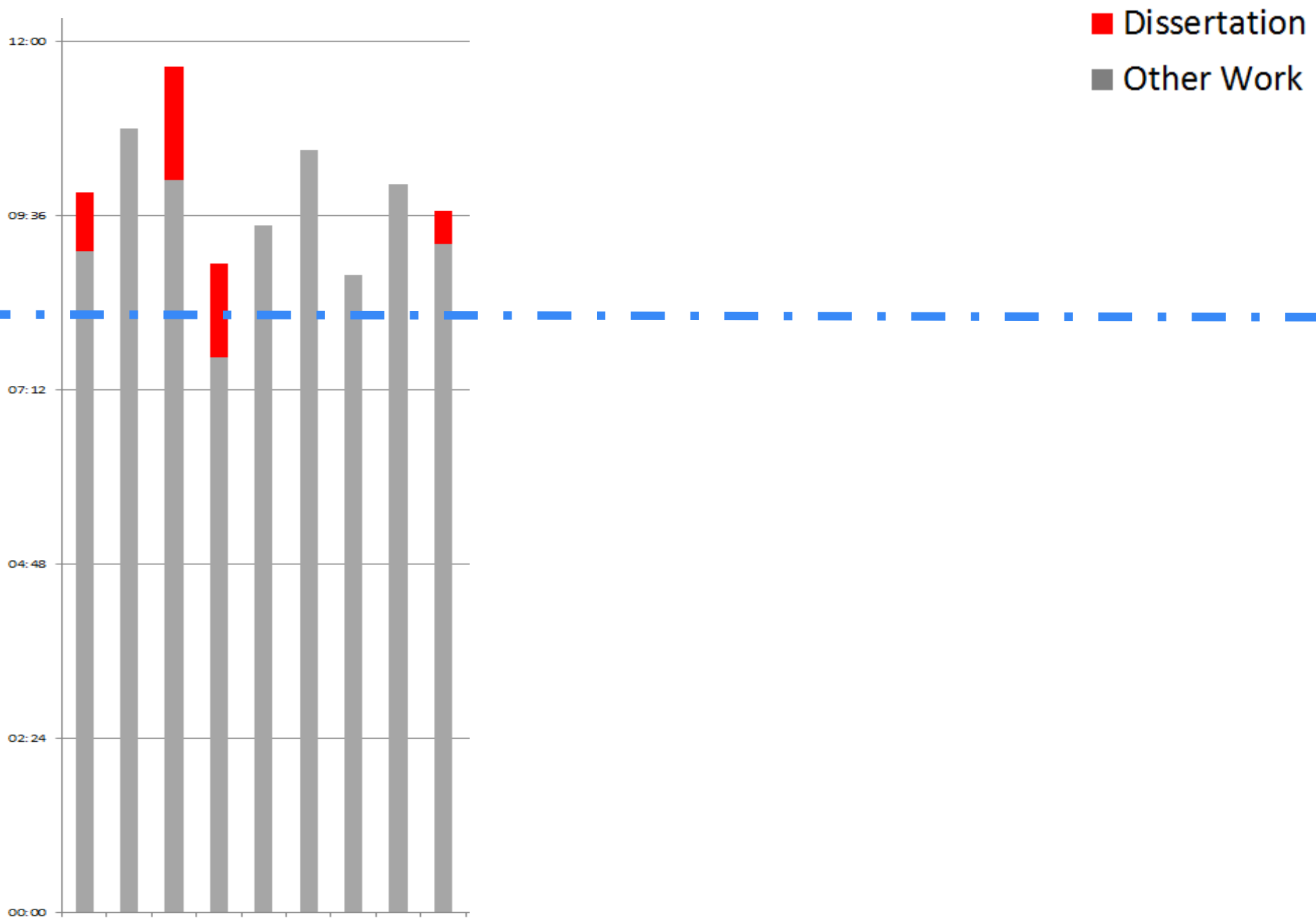


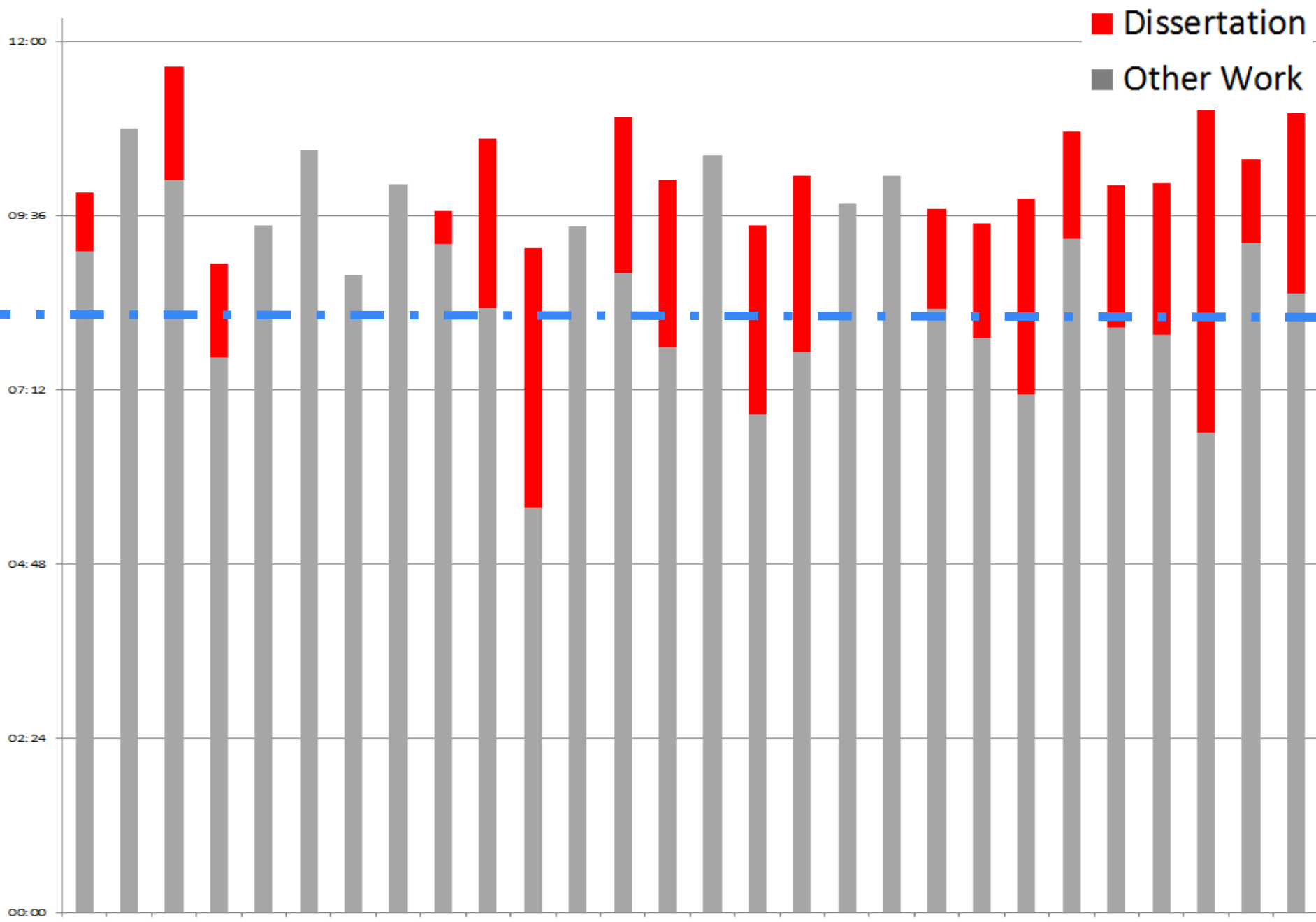
Agenda

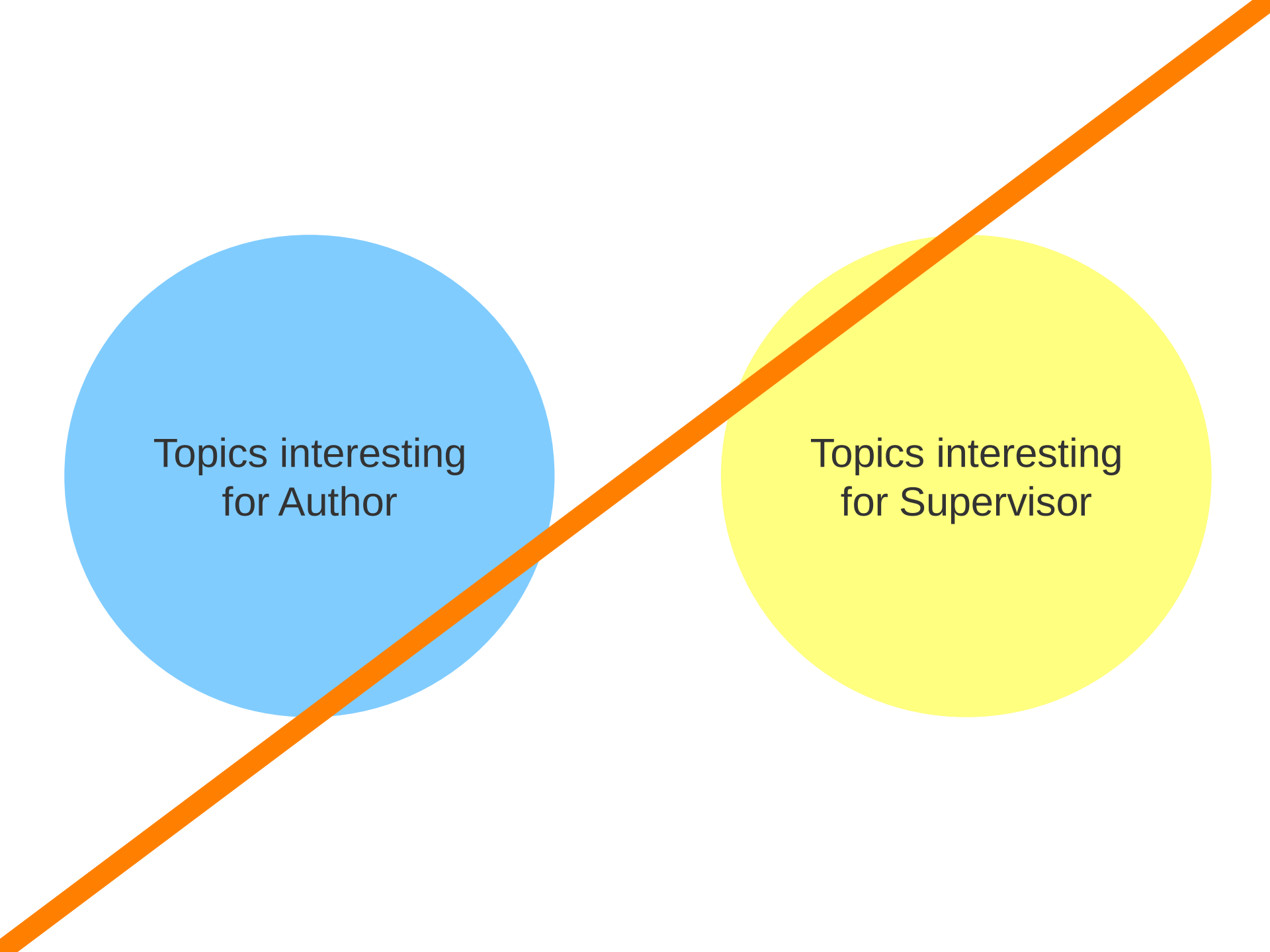
1. Why?
2. What's important?
3. Choosing a topic
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A Venn diagram consisting of two overlapping circles. The left circle is light blue and contains the text 'Topics interesting for Author'. The right circle is light yellow and contains the text 'Topics interesting for Supervisor'. A thick orange diagonal line runs from the bottom-left to the top-right, passing through the intersection of the two circles.

Topics interesting
for Author

Topics interesting
for Supervisor

Sources

- Courses of Studies
- Chair webpages
- (Old) topic descriptions
- List of topics at in.tum.de:

<http://intranet.in.tum.de/pages/14qh3nhl9lznu/Thesisankuendigungen>

Ask potential advisors! They are looking forward to your initial application!

Thesis Application is an Application!

You should address two important points:

- Motivation: why are **you** interested?
- Strengths: why should **you** work on the topic?

Optionally

- CV, motivation letter
- Feedback: TUM Career Center

What if I don't have a Topic in Mind?

- Ask potential advisors for ideas
- As an advisor, I do **not** expect
 - Students to come up with thesis topics
 - Students to apply only for documented topics



From: Roman Haas
To: Elmar Juergens
Date: 10.12.2013

Hallo Herr Juergens,

ich studiere Informatik an der TUM im fünften Semester und möchte im kommenden Sommersemester meine Bachelorarbeit schreiben. Ich interessiere mich für Software Engineering-Themen wie z. B. Tests, Analyse, Softwarequalität und habe im Rahmen meiner Werkstudententätigkeit auch erste Erfahrungen in diesen Bereichen gesammelt. Beispielsweise beschäftige ich mich damit, Tests einer Komponente in einem Flugsimulator zu automatisieren. Außerdem habe ich im Sommer bei der Ferienakademie an einem Kurs zum Thema "Programmanalyse" teilgenommen, der mir viel Spaß gemacht hat.

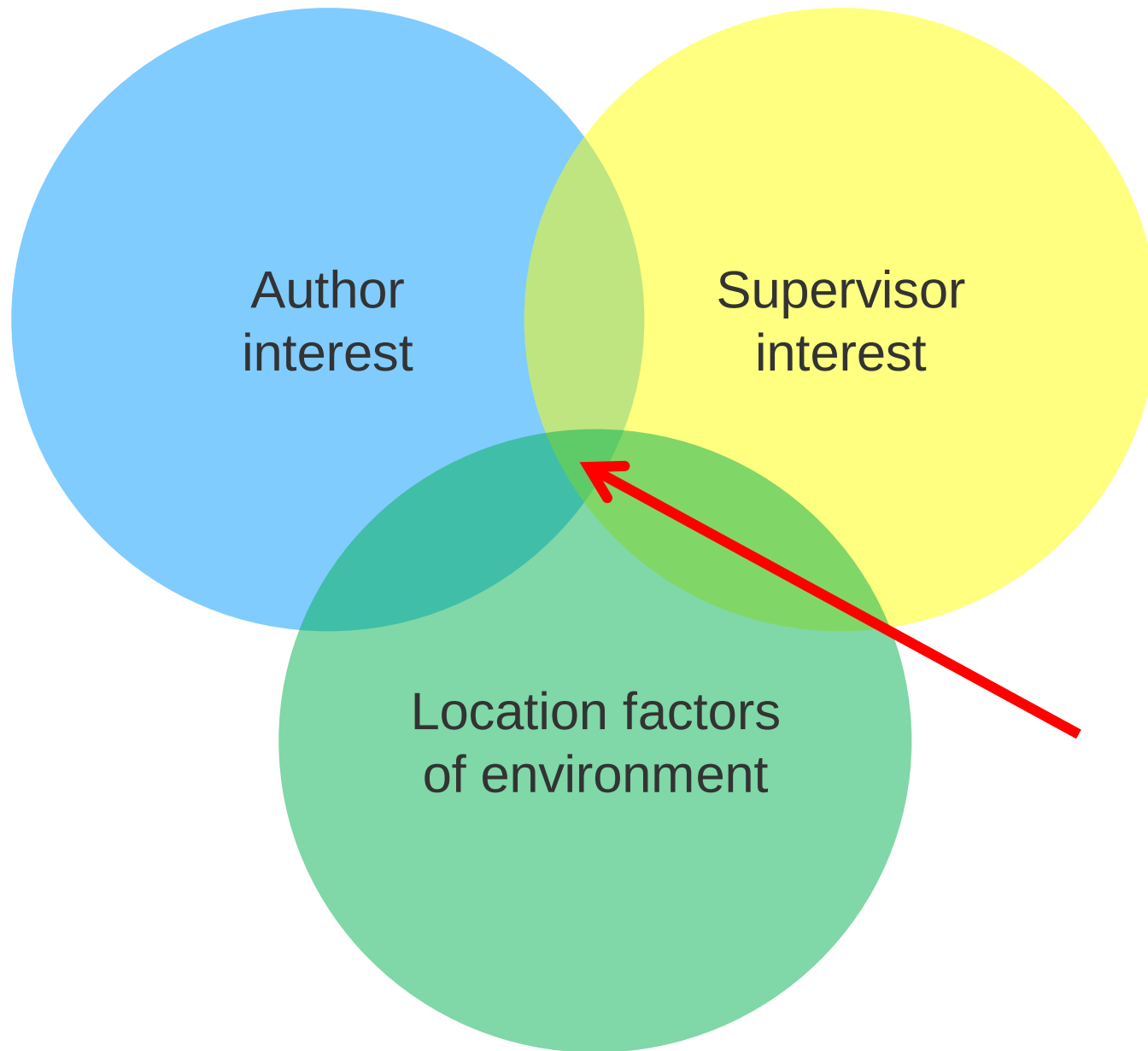
Haben Sie noch Themen für eine Bachelorarbeit aus den Bereichen Software Engineering/ Testing/ Analyse?

Falls ja, könnten wir uns mal auf einen Kaffee treffen, um uns darüber genauer zu unterhalten?

Danke für Ihre Antwort!

Viele Grüße

Roman Haas



TUM

- Contact to research (PhD?)
- Easier to find supervisor
- Scientific publication more probable
- More visionary topics
- Experience in Supervision

⇒ Insight into scientific work

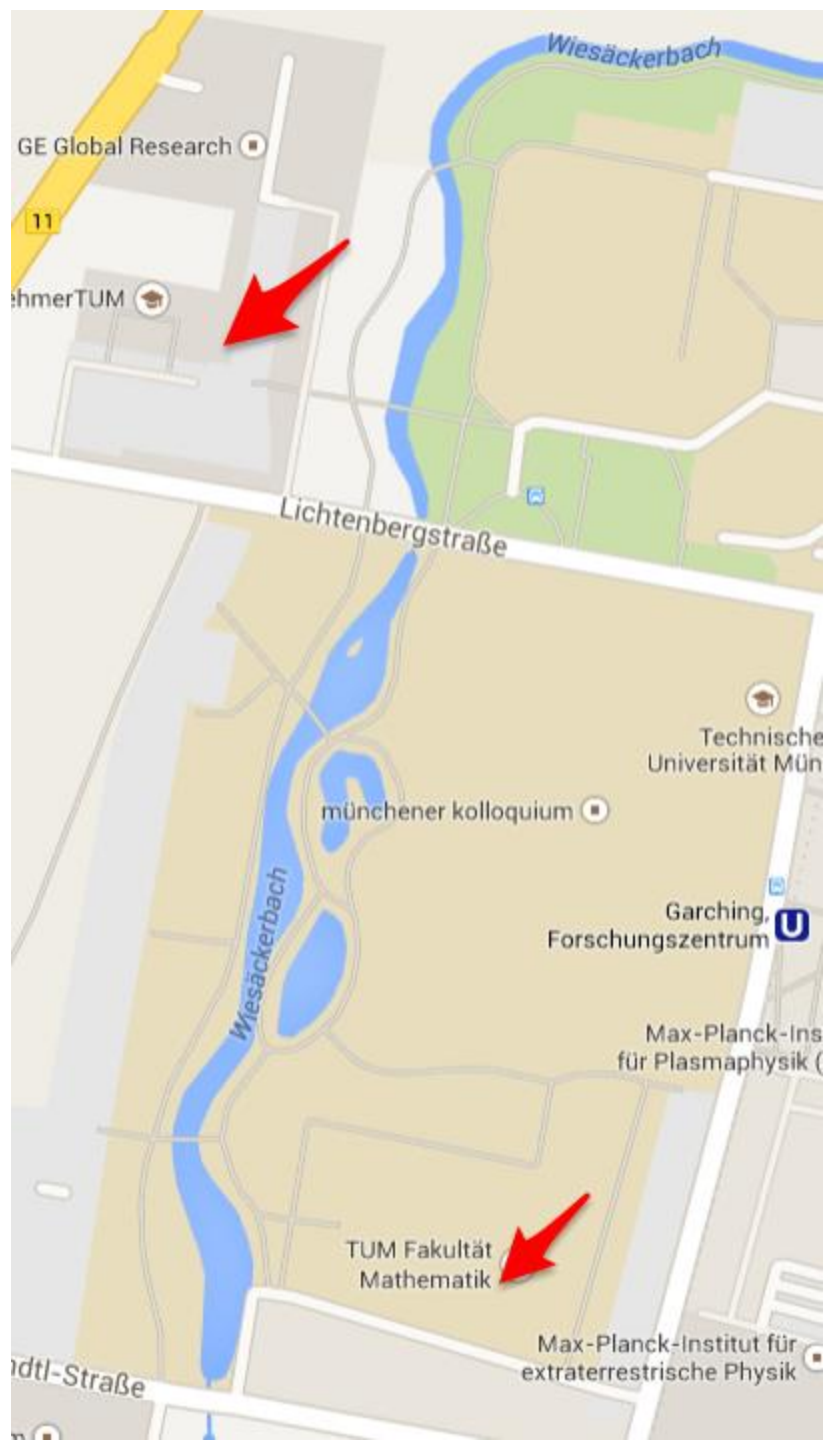
Industry

- Contact to company (Job?)
- Easier to find topic relevant in practice
- You might get paid
- Publication more difficult (Exception: Case study)
- Synchronization of supervisors requires more effort

⇒ Insight into Company

Special Case

Spin-Offs/Research institutes: sometimes best of both worlds



CQSE



Werkstudent/In



Als Werkstudent arbeitest Du mit uns an unserer Software **Teamscale** und bist eigenständig für die Implementierung neuer Features zuständig.

Aufgaben

Als Werkstudent/in arbeitest Du mit unserem Team an **Teamscale**. Deine Aufgaben sind Teil des normalen Entwicklungsprozesses und fließen als solche in den nächsten Release ein.

Du arbeitest an verschiedenen Seiten von Teamscale:

- Weiterentwicklung des Web-Front-Ends
- Weiterentwicklung der Eclipse-IDE-Integration
- Arbeit am Service-Layer und der Analyse-Engine

When does a topic suck?

If you cannot tell, if a solution for it is good, or not.

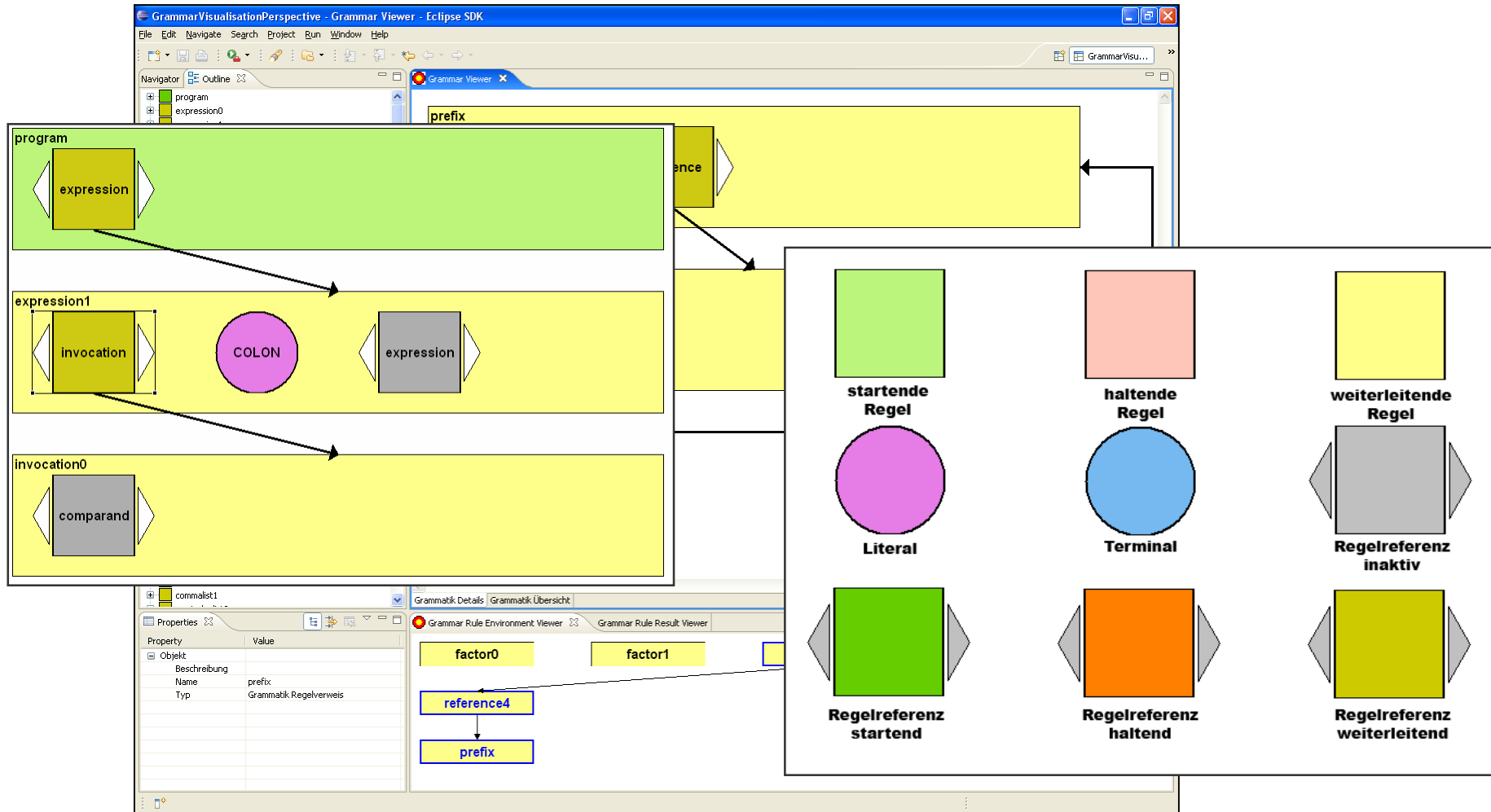
Most important factors:

- Is there a clear problem statement?
- Is there a way to evaluate alternative solutions?

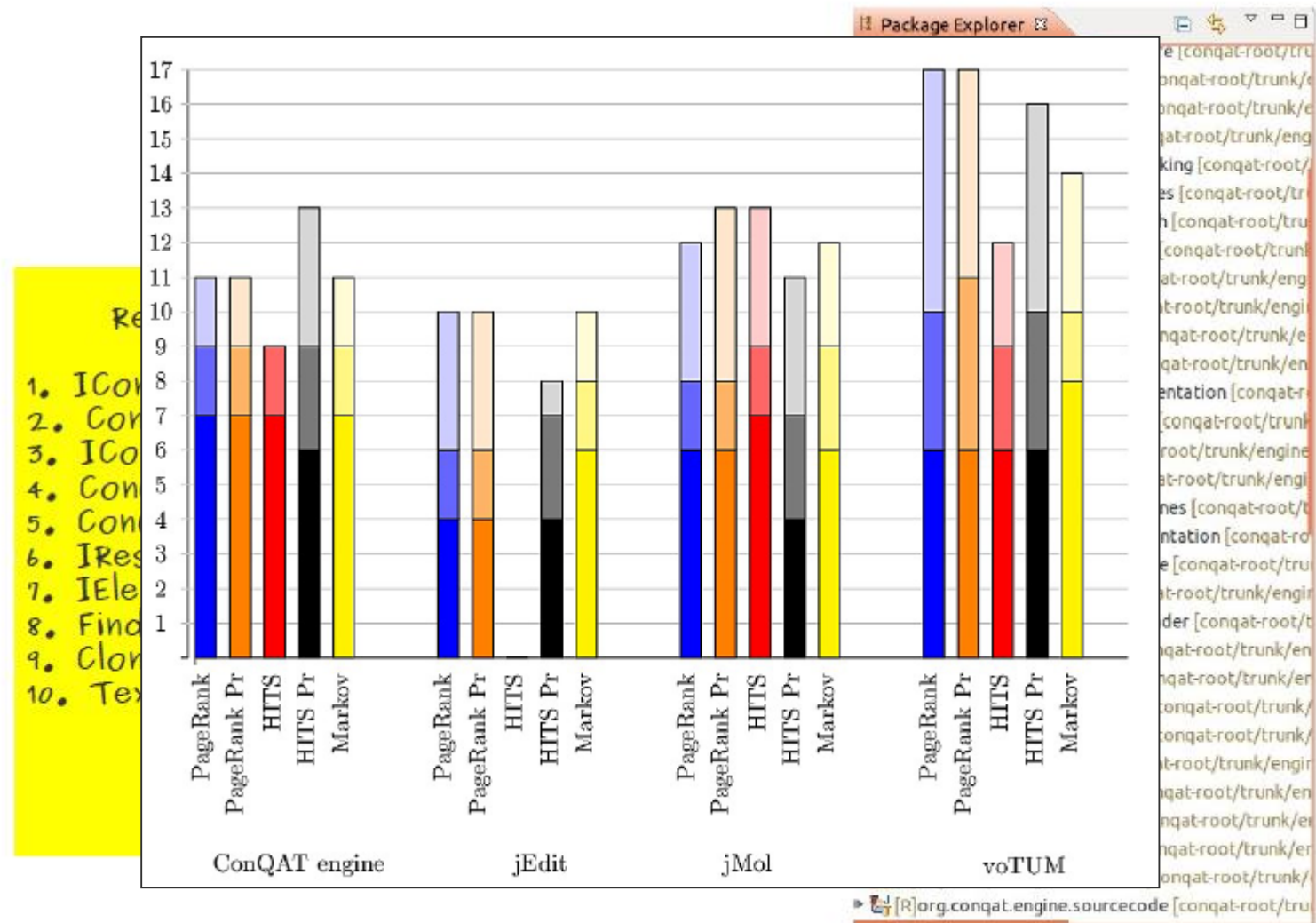
Why important?

- Helps you choose between alternatives
- Helps you convince your supervisor
- Helps your supervisor convince his professor

Unterstützung von Sprachentwicklung durch Visualisierung



Using Network Analysis for Recommendation of Central Software Classes (Daniela Steidl, 2012)

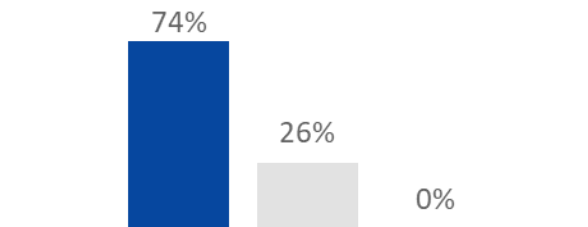


Refactoring Suggestions for Long Methods

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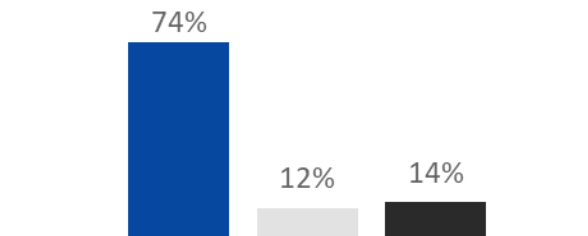
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                    }
                } catch (NullPointerException ignored) {
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}
```



Which candidate would you use more likely for an extract method refactoring?

■ TOP 1 ■ TOP 2/3 ■ Random



Would you use the selected candidate for an extract method refactoring?

■ Yes ■ Yes, with slight modification ■ No

Topic-Antipatterns

- Search my Literature
 - Implementation only
 - Choose my Tool
-
- Lack of objective evaluation criteria
 - Hard to guide your own work
 - Publication difficult

Registering a thesis

- Registration with academic affairs office determines completion deadline
- Registration each 15th day of a month
- Duration: 6 Months

My Advice: Register immediately.

Questions?



- Choosing a topic?
- Topic quality criteria?
- Internal vs. external thesis?
- Registration?

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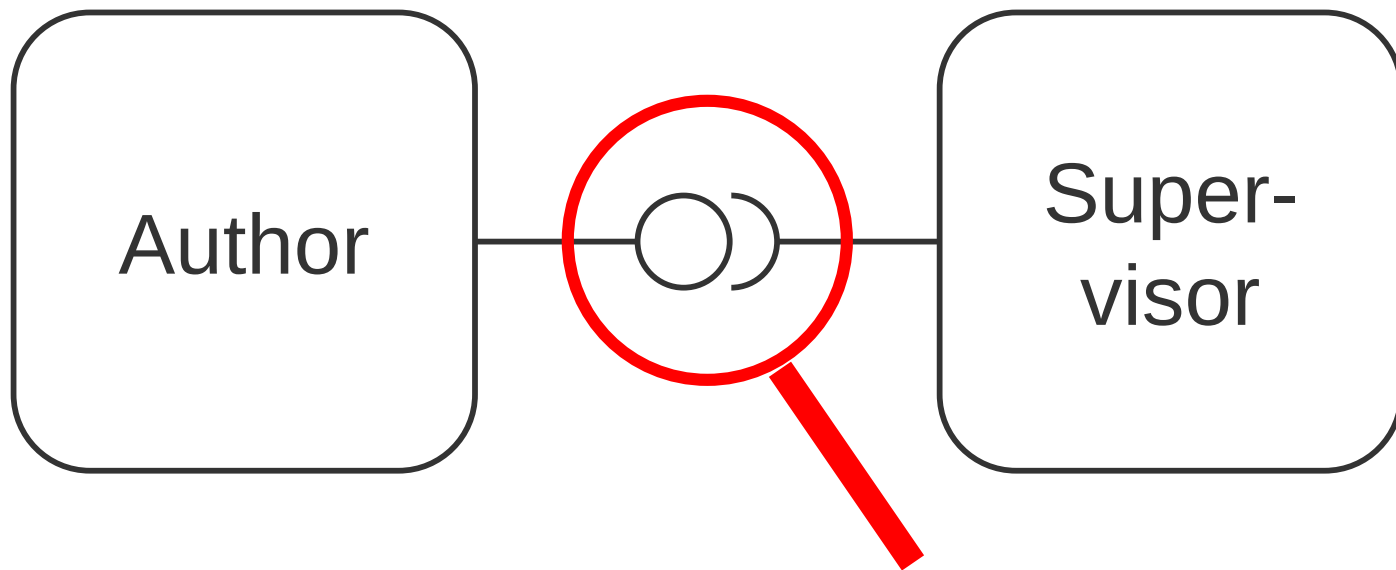
What characterizes scientific work?

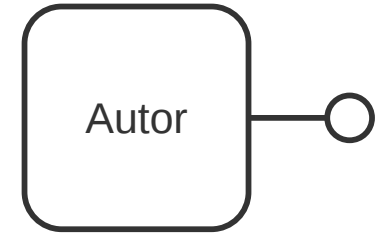
German: Wissenschaftliches Arbeiten: schafft Wissen.

⇒ Scientific work creates knowledge

- Separate opinion / hypothesis from empirical results
- Separate your results from previous work

Goal: Enable reader to trace (or in some cases reproduce) your results.



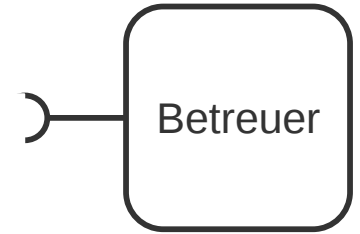


Author Responsibilities

- Time management
- Request feedback
- Communicate problems
- Make decisions

To make supervisor happy, report in each meeting

- Status last meeting
- What happened since then
- What you plan to do next, which problems you see



Supervisor Responsibilities

- Topic definition and –clarification
- Scoping
- Giving Feedback

Not Responsibility

- Micro-Management & Time management
- Take away decisions
- Proof-read complete work

Meet how often?



-  Regular meeting
-  Meeting on demand
-  Feedback for outline

Parts

1. Introduction
2. Fundamentals
3. Related Work
4. Solution Approach
5. Evaluation
6. Future Work
7. Conclusion









Parts

1. Introduction
2. Fundamentals
3. Related Work
- 4. Solution Approach**
- 5. Evaluation**
6. Future Work
7. Conclusion



> 2/3 of thesis

Thesis Architecture

Posted on [October 13, 2014](#) by [ElmarJuergens](#) — [Leave a comment](#)

The outline is the architecture of your thesis. It decomposes your document into components (called chapters) with dependencies between them (called references). As for software, the architecture plays a crucial role for the success of your project.

Since text is hard to refactor (much harder than source code), it is tedious manual work to fix an outline that does not work properly later. Minimize this risk by 1) using a standard architecture and 2) early validation of a prototype (through supervisor feedback).

Standard Architecture

A suitable *software* architecture allows the most important operations to be performed with high performance, even if this increases the cost of other operations. A search engine architecture, for example, is optimized for performance of search queries. Other text operations, say spell checking, are slow or not supported at all.

A suitable *thesis* outline allows a readers to answer the most frequent questions with high performance (i.e. without having to read the whole document). Which problem does the thesis solve? Did the approach work? What are its results and limitations? Which section should I read for details? Less important questions, say in which order the ideas occurred to the author, may not be answerable at all.

Categories

- [Execution](#) (6)
- [FAQ](#) (1)
- [General](#) (3)
- [Initiation](#) (5)
- [Presentation](#) (3)

<http://thesisguide.org/2014/10/13/thesis-architecture/>

Tools

- LaTeX
- Version control system (on server with backup)
- JabRef



Questions?



- Interface Author / Supervisor?
- Supervision?
- Tools?
- Where and how to write?

Agenda

1. Why?
2. What's important?
3. Choosing a topic
4. Doing the work
5. Presentation



Die harte Gefäß-
-schicht
und Bohrer-
von Arbeit-



BA ermöglicht
persönliches
Wachstum

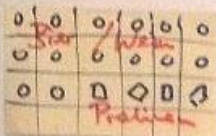
IKEA-Schrank

Arbeit Daniela
Proble- + Ansatz



Transatlantische -
Folie

Welche bis jetzt Folio
für Wohlgeheim
ist. Betruener

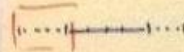
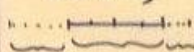


Antler Bitten Thread



Antes (Dob) 76

Chadron

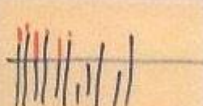


Sucht einen
inbrünstigen
aufrichtigen
Kretzer

Erwartung: Tom

- Univeral defizit
- Je höher unelare

Tomate Arbeitshilfe



Quelle

Deutsche

überprüft die
Eignung des
Themas

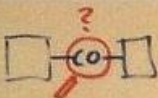


Uni | Eastern

+
Shooting Arbeit
Daisla
→ Fackelbach

Visualisierung, -
seit ~~der~~
→ Evaluation

Klärt Erwartung
an Lebens-
verhältnis



- + Thema $\rightarrow$ $\square \rightarrow$ H
- + Scoping
- + Vortragsanordnung
- + Feedback

- Entscheidungsabstraktion
- Zeitmanagement
- Konstruktive Zusammenarbeit

- Zerstreuung
- Farbreakeile
- Problem lösen
- P. 11

Beurteilt man
entschieden über
Qualität u. Wert
der Angebots



G1	G2	G3	G4
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Versionkontrolle
LaTeX
Job Ref.



Freiburg
ausgegeben
für Abrechnung






















924 Dehner



How to Draft Your Presentation

Posted on [March 4, 2015](#) by [ElmarJuergens](#) — [1 Comment](#)

When I listen to a thesis presentation, I need to understand the problem statement or how its average-case amortized runtime is presented with a nifty visualization.

In other words, if the big picture of a presentation can save it. The first priority

What do I mean by *presentation structure*? parts. How much time you spend on which you shorten, or leave out entirely. Whether an example that comes up again at different points so on.

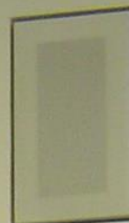
Creating the structure is about making choices. Choices are difficult to change later on. The goal is to deliberately make and evaluate these choices.

When I prepared my first presentations, I had a fundamentally bad idea, as it distracts from

The image shows my final slide mock-ups [3]. Some of the post-its are still unchanged from brainstorming. Others are new. In some cases, I have stuck post-its on top of each other, often to note points for the narrative that I want to tell when I show a certain slide. The fourth row from the top contains three slides that outline the process that this post describes. You can see the small rectangles that depict post-its, their clusters and then the final slides. They are rough, but good enough at this point.

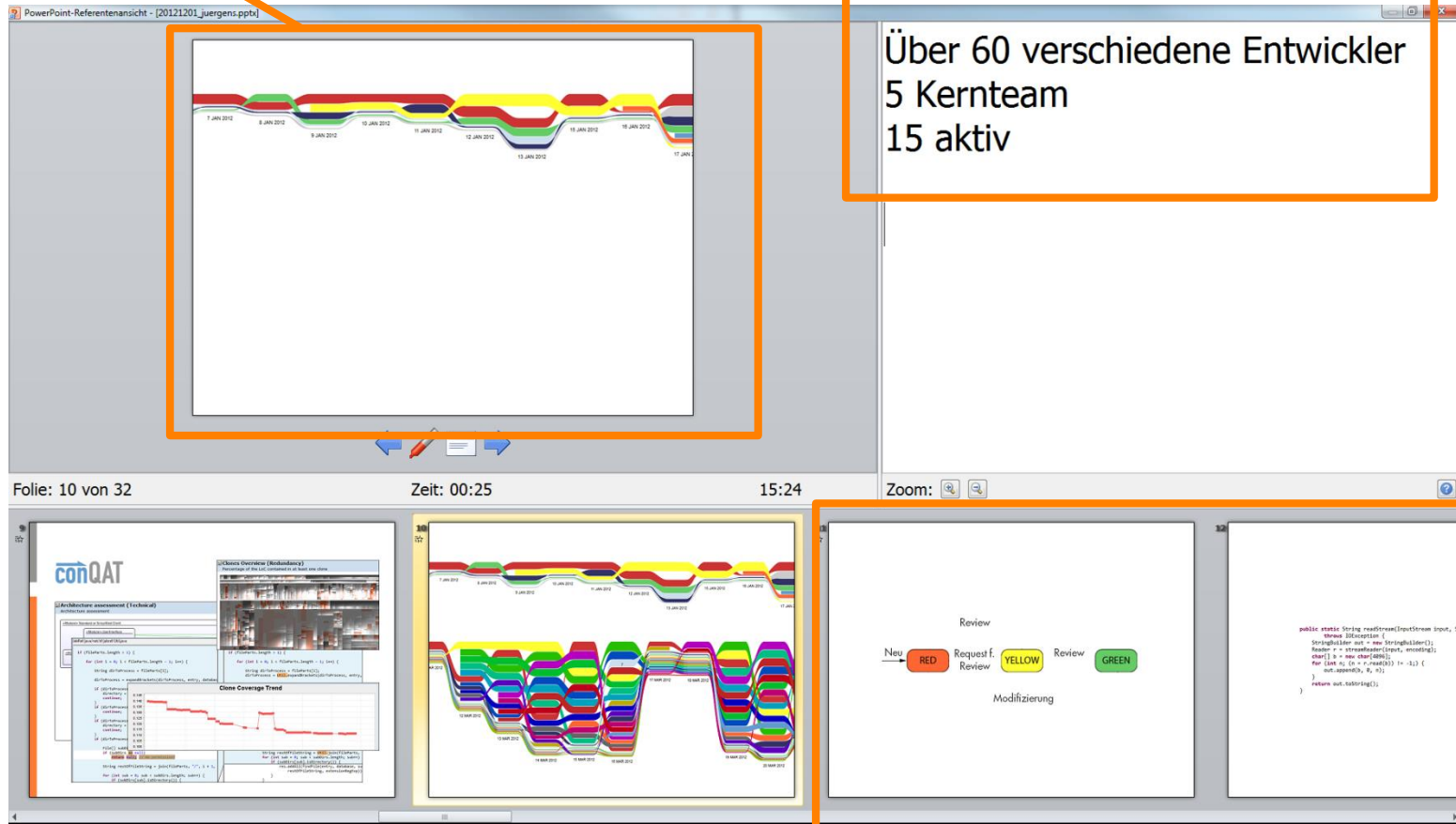


As all processes, this one is a simplification. Creating a real presentation is more messy and contains moving back and forth between steps. If I have visualization ideas early on, I take them down, even if the process tells me to focus on cluster messages at this point. Or I change the slide order 10 minutes before a presentation, if I feel that it works better in that situation. If this happens to you, don't feel bad about violating the process. The goal is a great presentation, not process conformance.



Audience sees this

My notes



Next slides





How to Rehearse Your Thesis Presentation

Posted on [March 4, 2015](#) by [ElmarJuergens](#) — [Leave a comment](#)

A new set of presentation slides is like a new program. It contains bugs. It reduces the pain for all who discover (and fix) its bugs before exposing it to a larger audience.

My test process for presentations has three steps. The first one is alone. The second one is in front of a small group of representative users. The third one is with a larger audience.

Step One: Alone

The first rehearsal step is to give the presentation to a test audience.

Step Two: Test Audience

The second rehearsal step is to give the presentation to a test audience.

Two to four persons make the perfect test audience size. A single person can miss too many problems or be too subjective. More than four add little value but complicate the rehearsal, since everybody wants their say. Personally, I prefer three test audience members.

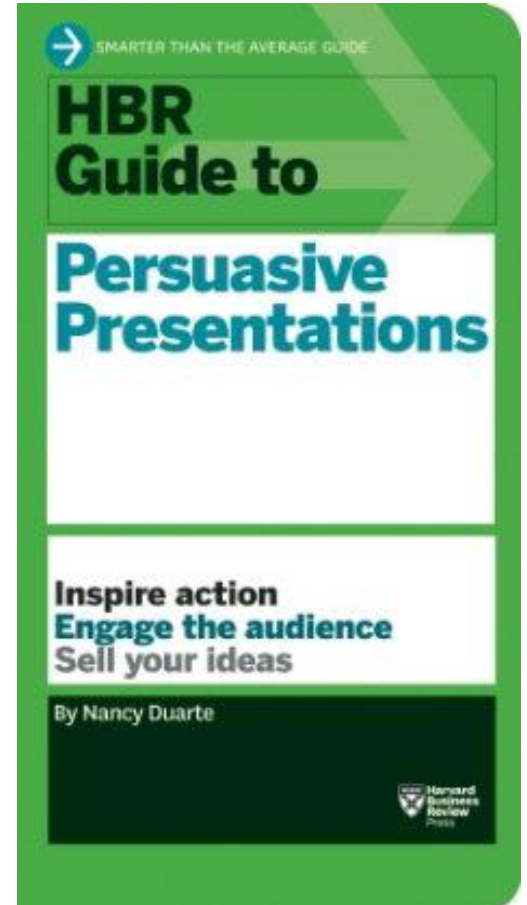
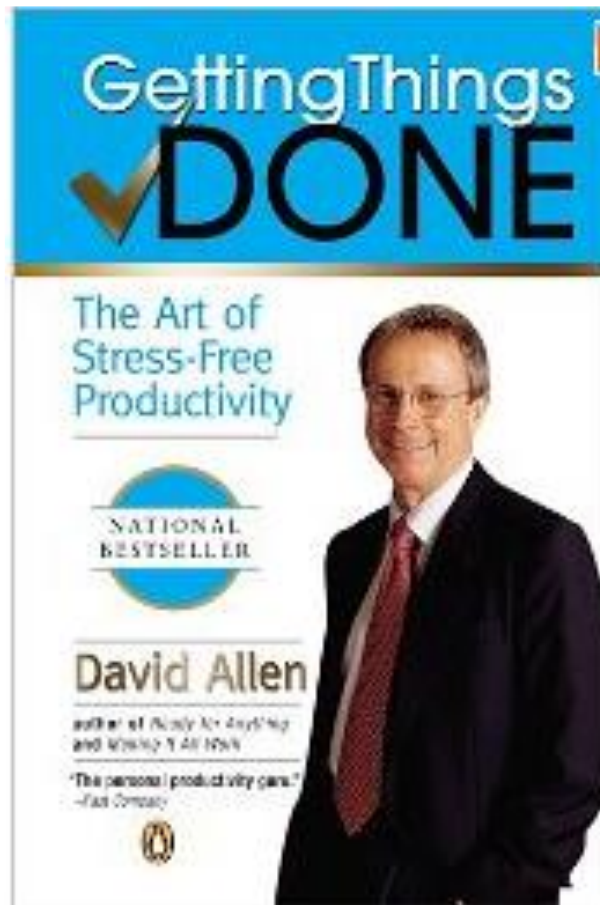
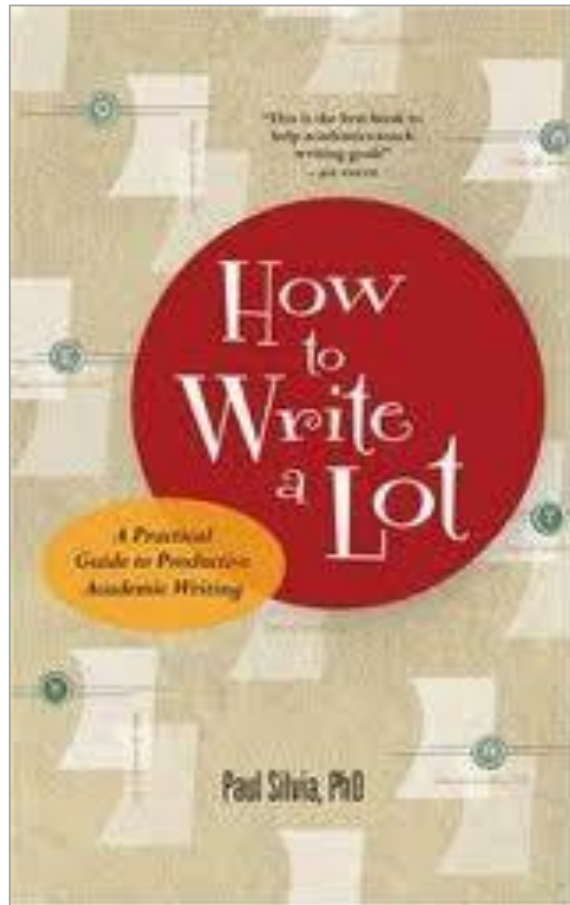
The test audience comments are the more helpful, the more similar the test audience is to the audience of the final presentation. Computer science students are thus preferable over parents over grandparents. However, take what you can get. A rehearsal in front of your grandparents is still far better than no rehearsal in front of an audience.

I use this process for test presentations with an audience:

- Hand out pen and paper, including a printout of the slides. It is easiest to note down visual slide problems on the slides themselves. It also allows you to collect the notes afterwards.
- Plan at least three times the amount of time of the presentation for the entire meeting (e.g. 60min rehearsal meeting to test a 20min presentation).

After handing in

- Celebrate!
- Make presentation appointment early
- Communicate your time constraints early to supervisor



JUNE 10, 2016 | HAAS93 | FAQ, GENERAL | EDIT

Avoiding Typical Pitfalls (not only) at TUM

This post is from Roman Haas (he was advised by Elmar in his Bachelor's Thesis).

It focuses on more or less typical problems that appeared to him and his friends during our theses and how to avoid them. They are described by anti-patterns, i.e. there is always a description of a problem and a possible solution for it. The problems are sorted by the moment when you should pay attention to them: the first ones may appear at the beginning of your work, the latter ones appear during your work or at the end.

Rating Criteria Surprise

Problem: You are not happy with the final grade of your thesis because you spent too much time on things that are not (so) relevant for the grade.

Solution: Ask your supervisor at the beginning of the work which criteria will be used to rate the thesis. Does the code that you wrote for the thesis influence the grade? What about the presentation at the end?

Wasting Time on Thesis Template

Problem: At the end of your writing time you realize that there are formal errors like formatting issues and content of the cover page in your thesis.

Solution: Look for a thesis template at the very beginning of your work, e.g. ask your friends which template they used. Do also check at the beginning whether all formal

Forschungsarbeiten @CQSE

- Thursday, 12.07., 17 Uhr im gate
- Agenda: How to do a BA/GR/MA @CQSE
 - Analysis Implementation
 - Evaluation/ Case Study
 - Advisors
 - Pitch of current topics
- Afterwards, pizza and beer 😊



- Register at

<https://forschungsarbeiten-cqse.eventbrite.de>



TUM provides the platform.

It is your responsibility, to create your environment to write a successful thesis.

Thanks!

Want to share your thesis experiences?

Looking for a student job or thesis topic in Software Engineering?

Please contact us: juergens@cqse.eu, haas@cqse.eu

@ElmarJuergens

www.thesisguide.org