



Extensibility and Modularity in Programming Languages

Seminar, WS 2017/18

14.12.2017 | Academic writing



Academic Writing

(based on material by Paolo Giarrusso and
Christian Kästner)



Why write a paper?

- Communicate new findings:
 publication = result of scientific research
- Inform the scientific community (contacts, collaborations)
- Get feedback from peers (external, independent, [anonymous])

...and why summarize papers?

- Summarize existing findings & test your understanding of them
- Prepare for new research (know the state of the art)
- Practice writing
- Get feedback from peers



Other reasons for learning to write papers

- Understand writing from others & learn to judge it
- Learn to argue in a professional way



Basic task when writing a paper

**Encode a complex
web of ideas as a
linear stream of text.**



Basic task when writing a paper

**Encode a complex
web of ideas as a
linear stream of text.
How?**



Steps to writing a (term) paper

Following *Turabian* (2007):

- Ask a question worth answering. (**significance**)
- Find an answer you can support with good reasons. (**correctness**)
- Support these with reliable evidence. (**correctness**)
- Draft a report that makes a good case for your answer.
(**correctness**)
- Revise that draft until readers will think the previous goals are met.
(**clarity**)



Anatomy of a paper

- Title
- Abstract

- Introduction
- (if necessary: Background, Problem Statement)
- Body
- Evaluation
- Discussion
- Related Work
- Conclusion & Future Work

- References



Abstract

- Brief summary of the paper
 - Point out: why important, motivation
 - Main contents/results
 - Contribution
-
- Typically: Write this after you've written the paper
 - Keep in mind: Reader will often decide whether the paper is **relevant** based on the abstract



Introduction

- General problem & its importance
 - Specific problem
 - Difference to prior work
 - Motivation for your work
 - Objectives/contributions (novelty)
 - Main results
 - General approach/outline of the paper
-
- Keep it short



Background (if necessary)

- Necessary background to understand the work
- Know your audience, only really necessary background



Problem statement (if necessary)

- Specific problem & its importance
- If necessary: example
- Sometimes: need to let the reader know there *is* a problem



Body (the contribution)

- Main part
- Describes your approach, the innovation



Evaluation / Proof

- Evaluation criteria
 - Proofs, Examples, Case studies, Empirical Studies
 - Scalability of your innovation, real-world applicability
 - Report experience
-
- Readable, verifiable: can be assessed and replayed
 - Separate data from interpretation (!)



Discussion (if appropriate)

- Interpret results
- Advantages and disadvantages
- Threats to validity



Related work

- Others' work in this direction
- Difference to your work: better? trade-offs? synergies?
(also difference to *your* prior work)
- Context of related work makes your claims of contributions more convincing, e.g.:
 - [Author] did X (which was important), and acknowledged that Y was missing to make it better, and we now provide Y
- Common reviewer comments:
 - „The paper omits important related work“
 - „The authors describe the related work but don't compare their work“



Conclusion & Future work

- Summary
- Results, the achievements
- What is missing, new research questions that arise
- Bigger context, long-term goals

- Link this back to the promises in the abstract and introduction, and to the evaluation, and:
- Clarify the contribution by doing so



References

- Give credits to previous and contextual work
- Reference quotes, claims, previous results

- Only relevant, up-to-date references
- Original source > secondary literature
- Journal > Conference > Workshop > Technical Report
- Don't cite common knowledge (binary tree, propositional formula)



Ok, ...



Ok, ...
..., but how do I start?



First steps

- Make an outline (or make a presentation)
- Write first version, revise later

```
\section{Introduction}

% SPL introduction, develop of many
% variants in parallel

% many variants, testing etc.
% -> novel approaches needed
```



First steps

- Make an outline (or make a presentation)
- Write first version, revise later

```

\section{Introduction}

% SPL introduction, develop of many
% variants in parallel
A \emph{software product line (SPL)} is an
efficient means to create a family of ...

% many variants, testing etc.
% -> novel approaches needed
While the flexibility of SPLs ... it comes
at a price ... millions of variants in
parallel ...

```



Line of thoughts / cohesion („Roter Faden“)

- Maintain **cohesive** line of thoughts
- Split text into **paragraphs** and **connect** them, don't jump between topics
- One thought per paragraph: Write **topic sentence** (first sentence or margin notes)
- **Remove unnecessary** information



Topic sentence: Examples

Software product lines promise several benefits compared to individual development [...]: ...

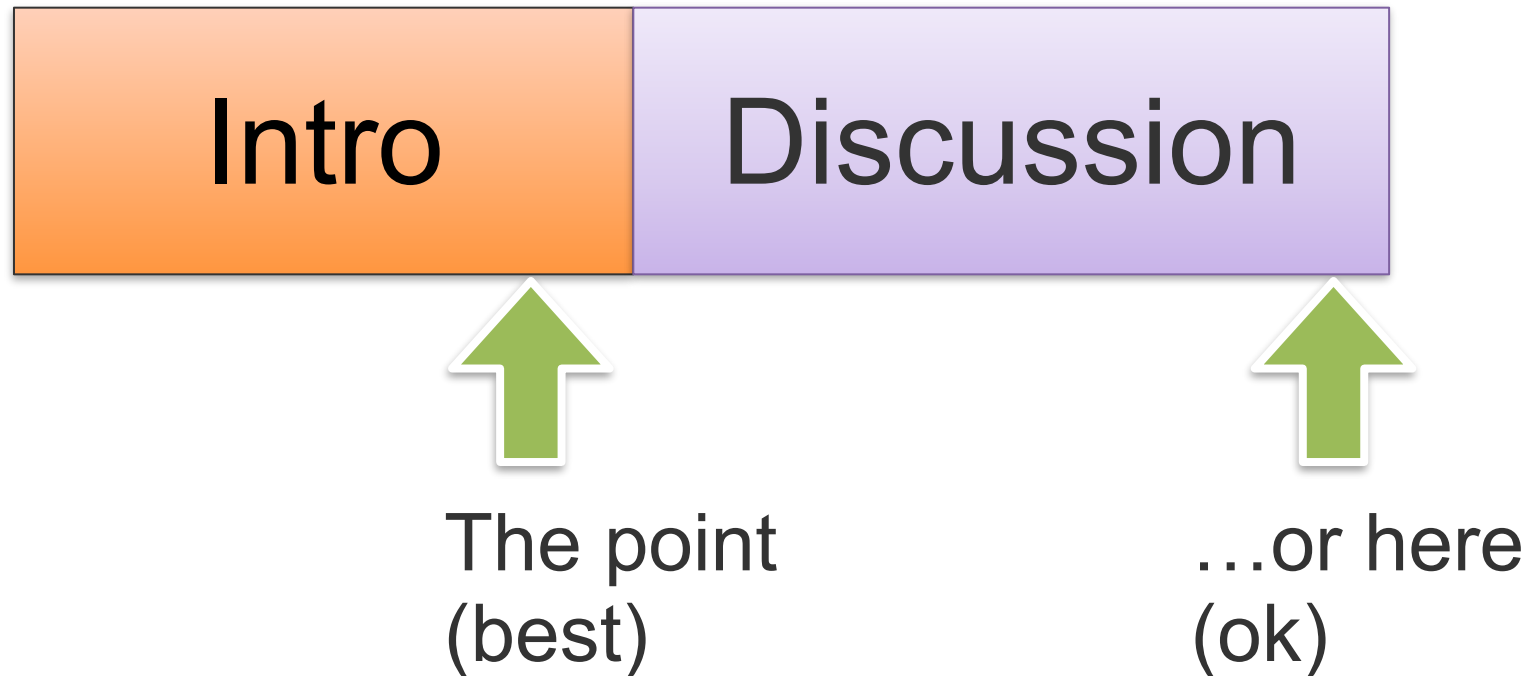
So far, we did not discuss the nature of feature annotations and the feature model. ...

FJ is a minimal functional subset of the Java language for which typing and evaluation are specified formally and proved type-sound with the FJ calculus [8, 40]. ...

We decided to provide a formalization and proof for both properties, after an initial implementation of our type system for Java. ...



Coherence





Coherence on a larger scale

paper

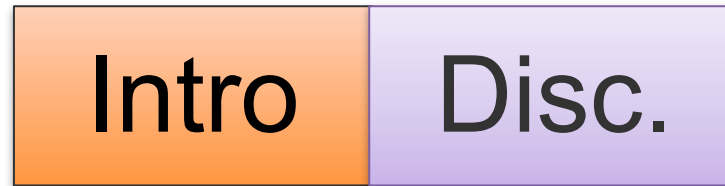


paragraphs



sentences

sections



...

par.s



...



sentences



Say what you say before saying it

- Explain the structure of the text
- Pick up the readers, guide them, prepare them
- Connect chapters (if any) and sections
- Support readers in skimming the paper (dt.: „Querlesen“)

7. IMPLEMENTATION & CASE STUDIES

In the previous section, we have designed and formalized a product-line-aware type system. To demonstrate its practicality, we implemented it in our tool CIDE and performed a series of case studies to evaluate performance and whether we can actually find type errors in existing product lines.

Benefits of AST representation

The AST representation has three main benefits: improved expressiveness, easier use, and opportunities for extensions.

First, we improve expressiveness, since we can classify more



Avoid mere description

- Explain what you are doing and why; example:

„We implemented a type system in our tool CIDE and performed a series of case studies.“
(offers no explanation)

vs.

„To demonstrate practicality, we implemented a type system in our tool CIDE and performed a series of case studies.“



Keep an eye out for...



Typical problems

- Missing motivation (why important?)
- Unclear goal, unclear contribution (*see slide 32*)
- Missing reasoning („that’s the way I did it“)
- Dead-end discussions, unused background
- Unjustified claims (*see slides 33-34*)
- Missing cohesion (*see slides 23-29*)
- Bigger picture missing (*see slide 31*)
- Missing conclusions/results
- Jargon, background missing
- Related work missing



Self contained

- Keep in mind: You are an expert on the topic, while your readers probably aren't (!)
- Thus: Know your audience
and
- Provide all *necessary* background information for understanding your work
 - Be concise
 - Provide references for further details
 - But: a reference does not *replace* explaining necessary background



Stating the contribution

- Make contribution very clear
- Be very specific

The main innovation of this chapter is our revised type system for CFJ. The type system known from literature can be simplified due to redundant premises at the typing rules. A smaller contribution is that we give some new and adapted examples of FJ programs and CFJ product lines.

Perspective, Goals, and Contributions. In this paper, we examine functional aspects in the light of AOR. Function evaluation imposes a



Overclaims

- Be careful with claims you cannot prove
- Narrow it down to your actual contribution, be precise

Our approach provides reliable high-performance data access

VS.

Existing database systems are slow and do not scale



Overclaims

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- Narrow it down to your actual contribution, be precise



Our approach provides reliable high-performance data access

VS.

~~Existing database systems are slow and do not scale~~

overclaim!

(alone because of the imprecise „slow“)



Improving your text:



Revising a sentence for clarity: Example 1

Our lack of knowledge about local conditions precluded determination of committee action effectiveness in fund allocation to those areas in greatest need of assistance.



Revising a sentence for clarity: Example 1

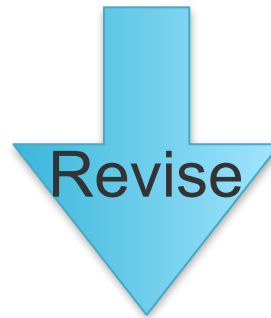
Our lack of **knowledge** about local conditions **precluded**
determination of committee **action effectiveness** in fund **allocation**
to those areas in greatest **need** of assistance.

very problematic w.r.t. clarity



Revising a sentence for clarity: Example 1

Our lack of **knowledge** about local conditions **precluded** **determination** of committee **action effectiveness** in fund **allocation** to those areas in greatest **need** of assistance.



(ad)verbs instead of nouns
paraphrase „precluded“

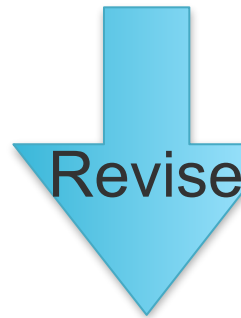
Because we **knew** nothing about local conditions, we **could not** **determine** how **effectively** the committee had **allocated** funds to areas that most **needed** assistance.

from *Williams and Colomb* (1995), p.17



Revising a sentence for clarity: Example 1

Our lack of **knowledge** about local conditions **precluded** **determination** of committee **action effectiveness** in fund **allocation** to those areas in greatest **need** of assistance.



see also:

<http://explorationsofstyle.com/2011/03/02/verbs/>

(ad)verbs instead of nouns

paraphrase „precluded“

Because we **knew** nothing about local conditions, we **could not determine** how **effectively** the committee had **allocated** funds to areas that most **needed** assistance.

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Revising a sentence for clarity: Example 2

Decisions in regard to the administration of medication despite the inability of irrational patients voluntarily appearing in Trauma Centers to provide legal consent rest with a physician alone.



Revising a sentence for clarity: Example 2

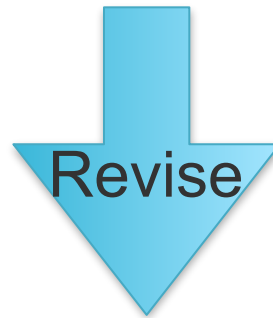
Decisions in regard to the **administration** of medication despite the **inability** of irrational patients voluntarily **appearing** in Trauma Centers to **provide** legal consent **rest** with a physician alone.

very problematic w.r.t. clarity



Revising a sentence for clarity: Example 2

Decisions in regard to the **administration** of medication despite the **inability** of irrational patients voluntarily **appearing** in Trauma Centers to **provide** legal consent **rest** with a physician alone.



finite verbs instead of nouns & gerunds

When a patient voluntarily **appears** at a Trauma Center but **behaves** so irrationally that he cannot legally **consent** to treatment, only a physician can **decide** whether to **administer** medication.

from *Williams and Colomb* (1995), p.17



Revising a sentence for clarity: Key idea

- **Tell a story**
- Figure out **actions** and their **agents**
- Main actions go in the main verbs
- Agents go usually in the subject
- (Agents sometimes might be abstract, if they're familiar to readers or the abstractions are critical)



Revising a sentence for clarity: Consequences

- Try to limit empty verbs; example:
 perform typechecking -> typecheck
- Limit metadiscourse
 - Bad: „It seems to us a plausible conjecture that ...“
 - Don't give it the main verb, move it aside
 - Better: „... in our opinion...“
- Limit passive (*but see next slide*)
- Those aren't fixed rules! Rather, they can guide you to achieve the overall goal of telling a comprehensible story to the reader.



Revising sentences together

- Go from old topics to new, avoid jumping between topics
- This might require using passive:

Some important questions have been raised by scientists studying **black holes**. A **black hole** is created by the collapse of a star into a small volume. Compressing so much matter into so little space affects deeply the surrounding space.

- Replacing the 2nd sentence by

The collapse of a star into a small volume creates a **black hole**.

makes the text less cohesive.



A note on repetition

- „Don't reuse the same word“: common advice **with lots of downsides**
 - **Synonyms for technical terms** can be **confusing**
(readers need to learn more terms than otherwise needed)
 - Pronouns can be used ***if they are not ambiguous (!)***



Bibliography matters...



Referencing publications

- Reference ideas and prior work
- Always reference used or adopted figures; example:
 - „Figure 2: Feature model of Berkeley DB, adopted from [2]“
- (Copyright can be an issue)
- NEVER copy & paste text from papers or websites
 - Paraphrase ideas
 - Also be careful when copying from yourself (more on this later)



Citation style

- Direct quotations are not common, except for definitions
- Typically use quotation at the end of a sentence; examples:
 - „We formally extend Featherweight Java (FJ) – a Java subset proved type-sound using a concise calculus [41].“
 - „Without loss of generality, we focus on FODA-style feature models [12, 43], because ...“
 - „Parnas suggests dividing programs according to concerns instead of purely technical considerations [13].“
- Do not use reference as subject; avoid „see“; examples:
 - bad: „[13] shows additional statistics“
 - bad: „see [13] for additional statistics“
 - borderline: „In [13], Hu et al. show additional statistics“
 - better: „Hu et al. presented additional statistics [13]“



Citing own work

- Make clear when referencing own work

This problem was studied earlier, but in a less general setting [2,3,5].



Citing own work

- Make clear when referencing own work

BAD
~~This problem was studied earlier, but in a less general setting [2,3,5].~~

BETTER

We studied this problem earlier [2,3,5], but in a less general setting.

In prior work, we studied this problem in a less general setting [2,3,5].



Reference style

- In papers
 - Typically: numbered references: [1], [2]
 - Page numbers omitted
- In a thesis
 - Rather use abbreviations: [ATG09]
or better author-year style: [Apel and Saake, 2006]
(LaTeX: package natbib)
 - Provide page numbers for books [S99, pp. 55-59]

- Disclaimers:
Different researchers prefer different styles.
Ask adviser(s) of your thesis.
Check formatting guidelines of publishers.



Formatting bibliographies

- References must include:
 - Name of authors
 - Title
 - Where published
 - Journal Article: Journal & Volume & Edition & Pages
 - Conference Paper: Conference & (Series and volume) & Pages & Publisher
 - Book: Publisher
 - Technical Report: Number & Department & University
 - Year
- Optional and usually not included (if you include them, do so consistently for all references): ISBN, ISSN, DOI, location, date, editors, ...



More bibliography tips

- Keep your bibliography clean, especially:
 - consistent information in all entries,
 - consistent upper/lower case,
 - consistent names for conferences/journals
- Use a tool like BibTeX to help you with that and more
- (Try to familiarize yourselves with e.g. BibTeX (recommended tool for this seminar), and just write me if you have any specific questions/problems.)



Referencing URLs

- (Usually) don't.
- Consider using a footnote instead
- If you really must reference a URL, provide **date of access**, e.g.:
Eclipse Website, <http://eclipse.org>, accessed June 12, 2009
- If possible provide authors, e.g.:
LE BERRE, D., PARRAIN, A., AND SAIS, L., 2006. SAT4J: A satisfiability library for Java. <http://www.sat4j.org>
- Reference specific version of wikis / other pages that keep a history, e.g.:
<http://en.wikipedia.org/w/index.php?title=Bibliography&oldid=351449917>



Further reading

- Paul J. Silvia. 2007. *How to Write a Lot: A Practical Guide to Productive Academic Writing*. American Psychological Association.
- Joseph M. Williams, Gregory G. Colomb. 1995. *Style: Towards Clarity and Grace*. University of Chicago Press.



Thank you.

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