universität wien

Business Analytics

Scientific Writing

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Agenda – Scientific Writing

- Style of Scientific Writing
- Formal Design
- Content
- Working with Literature

Style of Scientific Writing

- Goal of the thesis:
  - Demonstrate that you can use your professional knowledge to prepare a specific thesis topic in a way that others can understand and grade it.

- Who is the reader? Assume that…
  - Fundamental knowledge on the topic is available (at least BSc level)
  - General interest in the topic is given

- Reading and understanding the thesis must be easy
  - Do not write down anything you do not understand yourself!

Wording (1/3)

- Fundamental questions
  - Are my arguments comprehensible or unclear?
  - Are my arguments concise or content-free?

- Instructions for style of writing
  - Appropriate and factual
  - Avoid common speech
  - Every sentence needs to make a factual statement and relate to the previous and following sentence
  - Build chains of arguments (1 → 2 → 3)
  - Give reasons for statements (Why?)
  - Avoid “empty” statements (“Everybody knows…”)

Wording (2/3)

- Use precise terminology
  - Do not replace professional terminology with your own word creations
  - Define terms that do not belong to the basic language of the field
  - Carefully think about what you can presuppose
    → Do not explain in detail

- Objectivity
  - Distinguish between subjective, justifiable assessment and personal opinion

Wording (3/3)

- Things to avoid
  - Filler words (e.g. anyhow, anytime, one and only, unfortunately, nice, also, somewhat, …)
  - Pictorial language (“tip of the iceberg”)
  - Common phrases (no jokes, no irony)
  - Do not overdo it with foreign words
- Use language correctly
  - Grammar
  - Spelling

- Focus on content and plot first, focus on wording, grammar and spelling later (→ ask friends!)

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Formal Design

- You can layout the seminar thesis in your way as long as the design is “reasonable”.
- But what could reasonable mean?

Mandatory requirements:

- Sufficient margins (at least 2 cm), line pitch of 1.5 lines, font size 11-12, justified text
- Length: 10-12 pages of actual text
- Group work: demonstrate who is responsible for which part
- No duplex print

Structure of Thesis (Example)

- Title Page
  - Includes title, name, student ID, logo of Universität Wien, name of research group, name of supervisor, submission date
- Summary (1/3 – 1/2 page)
- Table of Contents
  - Maybe: List of Abbreviations / Symbols / Figures / Tables
- Main Text
- Bibliography
- Maybe: Appendix

Table of Contents

- Headings must be informative and concise
- There must be a logical connection with predecessors and successors
- Consistency: at least two subheadings

- Level of Detail: one item should comprise about one to five pages
- Level of Detail: usually no more than three levels required
- Headings must be consistent between table of contents and text → try automated table of contents

Table of Contents: Example

Abbreviations and Symbols

- Abbreviations
  - Long, often-used expressions can be abbreviated
  - Explain in text when used for the first time
  - Do not change well known abbreviations

- Symbols
  - One symbol = one meaning
  - Explain in text when used for the first time

- Formulas
  - Use formula editor

Figures and Tables

- Aggregate information and transform them into a useful format
- Only use them if really required, since they need lots of space
- Consecutive numbering and titles (with references)
- Position close to respective text
- No uncommented figures and tables!
  → Text reference is mandatory!
- Check quality of printing

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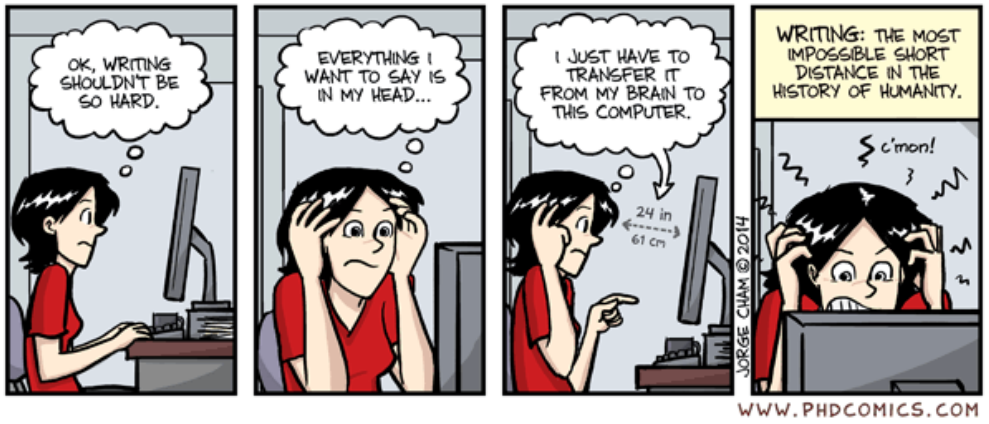
Common Structure of OR-oriented Theses

- Introduction
- Fundamentals, e.g.
  - Problem Description, Definitions
  - Literature Review
- Methods, e.g.
  - Mathematical Model
  - Solution Approach
- Results, e.g.
  - Experimental design
  - Outcomes
  - Discussion
- Conclusion

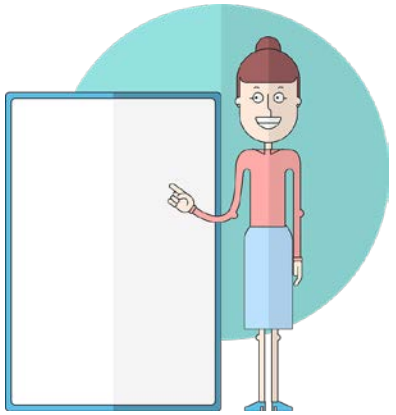
Introduction

- Describe the topic and embed it in a reasonable, topical framework
- Motivation: Why is your topic relevant?

- Research agenda: One or several research questions, hypothesis, goal of thesis
- If applicable: Justification of research method (e.g. literature overview, interview)
- Structure of seminar thesis (overview on chapters)



Main Part



- Content
  - Overview on state of the knowledge
  - Explanation and comparison of several ideas

- Golden plot
  - What is the task of each paragraph and each chapter?
  - New chain of argumentation → new paragraph
  - Goal: Avoid errors or misunderstandings in reasoning and redundancies
  - Many forward and backward references indicate an insufficient logical structure

Concluding Parts

- Summary
  - Summarize the implications of your thesis
  - What are the answers to the research questions discussed in the introduction?
  - Personal opinion, future development

- Appendix
  - Contains material that is not necessarily required for understanding the main text
  - E.g. tables, figures, proofs, questionnaires
  - No “garbage can”
  - No extension of the text

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Working with Literature

- Any idea taken from any source and used in your thesis needs to be referenced!
- Plagiarism is not acceptable in scientific writing → Fail

- Goal of references:
  - Academic integrity
  - Traceability
  - Security of students (in case of flawed sources)
  - Security of original authors (in case of flawed usage)
  - Shows scientific independence
  - Support of own hypotheses
  - Recommendation of sources

Quality of Sources

- Not every source is a credible source!

- Sources that are usually credible are…
  - Scientific monographies (newest edition)
  - Collections (handbooks, proceedings, encyclopedias)
  - Scientific journals

- Usually not suited for scientific referencing are…
  - Lecture notes of classes
  - Bachelor / Master / Seminar theses if not publicly accessible
  - Wikipedia
  - Online sources if content is available from other above mentioned sources

Citations

- Direct quote
  - Rarely used in our field
  - Exact repetition of the original phrase embedded in quotation marks “quote” and reference in the text
  - If the repetition is incomplete, the particular omissions are clarified by “…”: “He said this is a good idea … and finally added another.”

- Analogously: indirect quotes
  - Foreign thoughts and statements in your own words
  - No distortion of statement allowed
  - Reference with author and year of statement in the text
  - If the same source is used for a whole paragraph, a reference at the end of the paragraph is sufficient

Examples for Citations

Increasing importance of city logistics service providers arises from significant changes and developments in the ways in which freight operations are carried out nowadays. Following recent publications by Ruesch and Petz (2008); Crainic et al. (2009a, b), the following trends can be stated:

- Distribution concepts have changed considerably. There is a significant degree of centralization in manufacturing sites, stock keeping points, and retailing, leading to increasing demand for transportation.

Corresponding to an increase of overall traffic volumes, the number of freight vehicles moving into and within cities is expected to grow at a steady rate (Crainic et al. 2009b). In European conurbations, more than 80% of today's road freight trips are of distances below 80 km and can be defined as urban or urban regional transport (Ruesch and Petz 2008). Thus, the generation of efficient and customer-oriented

Bibliography

- Contains every cited source
  (but no sources that are not used!)

- Ordering
  - Alphabetically following name, prename of first author, second author, etc.
  - Several sources of the same author or author teams are ordered by publication year
  - If the publication year is the same, “a”, “b”, “c” have to be added to the publication year (e.g., 2009a)
  - No academic titles
  - Different types of sources are not differentiated

Examples (1/2)

- Monography
  - *Name of author(s)* (*year of publication*) *title*. *edition* (if > 1), *publisher*, *place of publication*.
  - Ehmke, J. F. (2012) Integration of Information and Optimization Models for Routing in City Logistics.
    Springer, New York.

- Journal article
  - *Name of author(s)* (*year of publication*) *title of article. Name of journal volume*(*issue*), *page numbers*.
  - Schmid, V., Ehmke, J. F. (2015) Integrated timetabling and vehicle scheduling with balanced departure times. OR Spectrum 37(4), 903-928.

Examples (2/2)

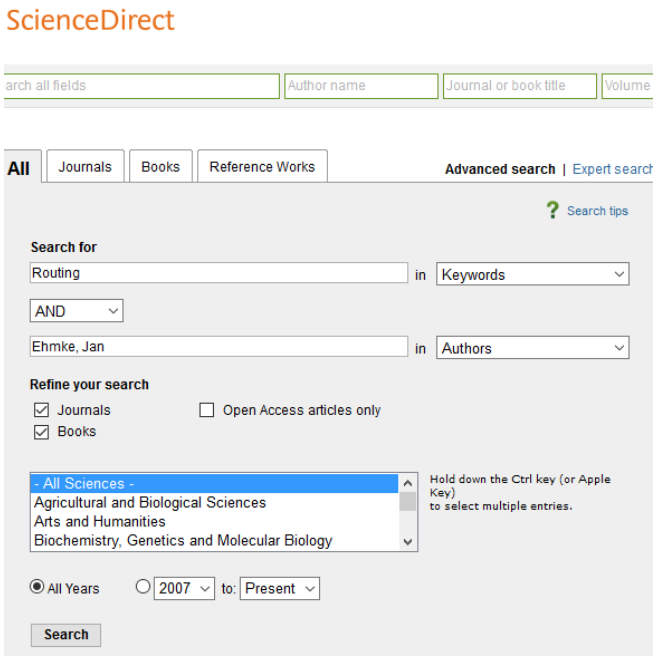
- Proceedings / Handbook chapters
  - *Name of author(s)* (*year of publication*) *title of contribution*. In: *name of editor(s)*, eds., *title of proceedings*, *publisher*, *place of publication*, *page numbers*.
  - Eckert, S., Ehmke, J. F. (2017) Classification of Data Analysis Tasks for Production Environments. In: Abramowicz, W., Alt, R., Franczyk, B., eds., Business Information Systems Workshops BIS 2016, Springer, Heidelberg, 1-12.

- Internet / Online sources
  - *Author name(s)/Publisher/Company* (*year*) *title*. URL: *internet address*, last visited on: *date*.
  - Oanda (2008) Currency Converter for 164 Currencies. URL: www.oanda.com/convert/classic, last visited on: 2017-03-16.

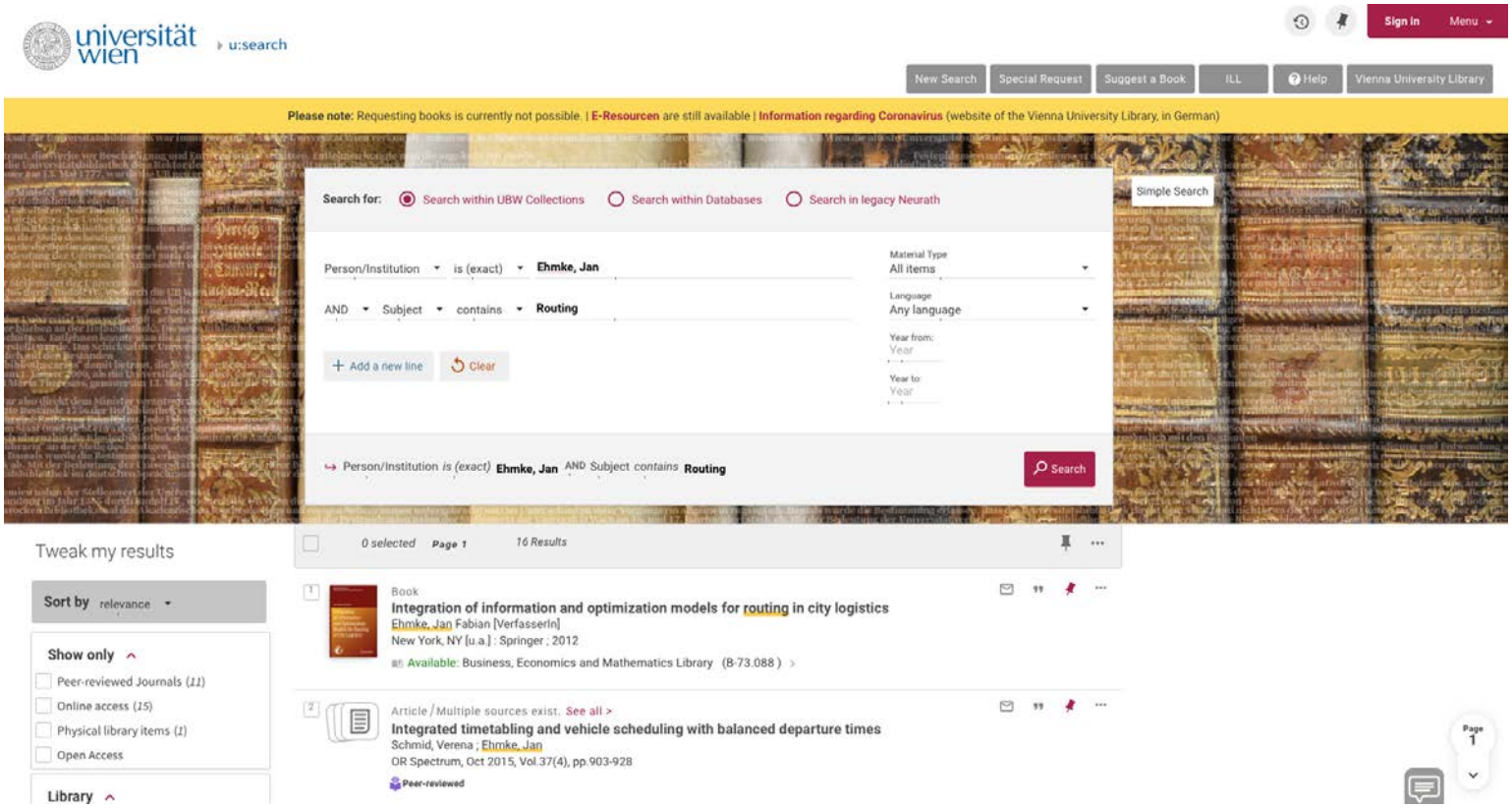
How to Find Literature? (1/4)

- Find literature with the help of literature databases

- Universitätsbibliothek Wien provides access to many scientific databases via u:access
- Business Source Complete
- EconBiz
- Google Scholar
- Scopus
- ScienceDirect
- …



How to Find Literature? (2/4)



How to Find Literature? (3/4)

Vehicle routing to minimize time-dependent emissions in urban areas Original Research Article
European Journal of Operational Research, Volume 251, Issue 2, 1 June 2016, Pages 478-494
Jan Fabian Ehmke, Ann Melissa Campbell, Barrett W. Thomas
Abstract | Research highlights | Purchase PDF - $35.95 | Supplementary content

Interval Travel Times for More Reliable Routing in City Logistics Original Research Article Open Access
Transportation Research Procedia, Volume 12, 2016, Pages 239-251
Patrick-Oliver Groß, Michael Geisinger, Jan Fabian Ehmke, Dirk Christian Mattfeld
Abstract | PDF (806 K)

Ensuring service levels in routing problems with time windows and stochastic travel times Original Research Article
European Journal of Operational Research, Volume 240, Issue 2, 16 January 2015, Pages 539-550
Jan Fabian Ehmke, Ann Melissa Campbell, Timothy L. Urban
Abstract | Research highlights | Purchase PDF - $35.95 | Supplementary content

Exploiting Travel Time Information for Reliable Routing in City Logistics Original Research Article Open Access
Transportation Research Procedia, Volume 10, 2015, Pages 652-661

References

Agatz et al., 2008 Agatz, N., Campbell, A., Fleischmann, M., & Savelsbergh, M. (2008). Challenges and Opportunities in Attended Home Delivery. In B. Golden, R. Raghaven, & E. Wasil (Eds.), The Vehicle Routing Problem: Latest Advances and New Challenges, Springer.

Brockfeld et al., 2007 Brockfeld, E., Lorkowski, S., Mieth, P., & Wagner, P. (2007a). Benefits and limits of recent Floating Car Data Technology – An Evaluation Study. Proceedings of WCTR Conference 2007. Available at http://elib.dlr.de/49618/.

Brockfeld et al., 2007b Brockfeld, E., Passfeld, B., & Wagner, P. (2007b). Validating Travel Times Calculated On The Basis Of Taxi Floating Car Data With Test Drives. Proceedings of 14th ITS Conference. Available at http://elib.dlr.de/50208/.

Citing articles (10)

A capacitated vehicle routing problem with order ...
2017, Engineering Optimization more

The vehicle routing problem with hard time wind...
2016, Expert Systems with Applications more

Vehicle Routing Problems with Fuel Consumption...
2017, Mathematical Problems in Engineering more

How to Find Literature? (4/4)

- Check references (backward search)
- Check citations (forward search)
- Determine keywords
  - Difficult to find the right keywords, but they are important!
  - Think about constraining your search!
  - Use several keywords in combination!
- Example SciDir: 'service' yields 2 million results!
  - "service orchestration" → 483 results
  - Add "service composition" → 8 results

Google Search

- Problematic, since…
  - EVERYBODY can publish information on the internet
  - The author (company/organization) rather rarely vouches for quality of content
  - Traceability not ensured
- Examples
  - Wikipedia: not a scientific source
  - Internet forums: no guarantee for correctness of answers for discussed questions!
- Google Scholar
  - Accessibility to many articles
  - Forward search
  - But always check carefully where you end up!

Quality of Literature

- Generally
  - The considered literature should correspond with the level of a scientific thesis
  - Private encyclopedias are usually not sufficient

- Publication
  - Publisher or Series is an important quality measure (e.g. Springer Publisher)
- Author
  - Reputation, recognition

- Journal Ranking
  - Jourqual 3 (VHB e.V.)
  - Handelsblatt

Quantity of Literature

- There is no general answer to the question on how many sources should be processed!

- The quantity is determined by
  - The type of questions to be considered
  - The available literature
  - The time dedicated to the work on the thesis

- Indicators
  - Expected number of pages of thesis
  - What has been agreed upon with the supervisor

Further Remarks

- Time management: Writing costs much time!
  Several improvement iterations are required.
  - For basics on scientific writing, the "Schreibberatung" provides useful information
    → Before submission: check consistency of sources in bibliography and text
  - Can be done automatically with CITAVI or Microsoft Word

- Check layout of thesis by printing into a PDF file
- Submit thesis electronically
- Attach all online sources
- http://www.wikihow.com/Write-a-Seminar-Paper