Alfred Holl

**Scientific work and writing**

**Introducing sections**
Title, abstract, preface, structure, introduction, lines of argumentation

**Main part**
Subject, formal requirements, terminology, abbreviations, reader guidance, applied CS, motivation of solutions, documentation, use of literature

**Indexes**
Bibliography

**Technical remarks**
Administrative requirements, pre-correction and supervision, juridical requirements, grading, grading persons
Subject and title

Title and contents of your thesis should fit together
Title understandable for a large public, subtitle in detail
Title should contain important keywords, should not be too comprehensive
Maybe you will have to start with a preliminary title.

Abstract

Should summarize the contents in a well understandable language,
attract attention (“research marketing”)
Introducing sections

Preface 1

No chapter number

Brief background information not belonging to the subject of your thesis.

History and circumstances of the development of your thesis.
Impulse of the thesis, suggestion by whom, how; personal motivation.

Motivation of particularities and limitations
which could otherwise be interpreted as defects.
Preface 2

Previous knowledge of your own, e.g. necessity of getting more familiar with related topics before starting to discuss the central topic.

Duration and type of your search for bibliographical references.

What did you learn by working on your thesis?

Previous knowledge the reader is expected to have.

Requirements by the company where you wrote your thesis.

Acknowledgements (optional)
Table of contents – structure

Decimal section numbers

Clear and detailed fine (not only coarse) structure; give your thesis a good structure, not more than 7 structure entries on one structural level.

Only similar and comparable entries / topics should be put together on one structural level; parallelization should be made recognizable if there are parallel structural entries: therefore, not “apples, computers, desks”, but only “green, yellow, red apples”.

In addition to a linear structure, a two-dimensional structure can be helpful or necessary: table / matrix, network, mind-map, spider net structure.
<table>
<thead>
<tr>
<th>Kernbereiche des PM</th>
<th>Strategie / Planung</th>
<th>Vertragsgestaltung</th>
<th>Finanzierung</th>
<th>Durchführung</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM in ...</td>
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<tr>
<td>Kleinunternehmen</td>
<td>5.1.3</td>
<td>5.1.1</td>
<td>5.1.2</td>
<td>5.2</td>
</tr>
<tr>
<td>Großunternehmen</td>
<td>6.1.3</td>
<td>6.1.1</td>
<td>6.1.2</td>
<td>6.2</td>
</tr>
<tr>
<td>der Wunschvorstellung</td>
<td>4.2.1</td>
<td>4.2.2</td>
<td>4.2.3</td>
<td>4.3</td>
</tr>
</tbody>
</table>
theoretische Grundlagen (Kapitel 4.1)

konfigur. Erzeug. in R/3 (Kap. 4.2)
konfigur. Erzeug. AUT 2 (Kap. 4.3)
konfigur. Erzeug. in FDB (Kap. 4.4)

konf. AUT 2 Erz. in FDB (Kap. 4.5)

Vergleich R/3 und FDB (Kapitel 4.6)

Diskussion verschiedener Aspekte des Konzepts (Kapitel 5.1)

betriebsw. Daten konfigur. Erzeug. (Kapitel 5.1.1)
Merkmale und Merkmalswerte (Kapitel 5.1.2)
Einstellungen für die Prozesse (Kapitel 5.1.3)

Verwaltungsdaten der FDB (Kapitel 5.1.4)
betriebsw. Daten der Merkmalswerte (Kapitel 5.1.5)

Zusammenfassende Darstellung des Gesamtkonzepts (Kapitel 5.2)

Realisierungsplan (Kapitel 6)
Temporal structure

1. Durchgängiges Beispiel
2. Definition und Ziele
3. Input
4. Datenmodelle
5. Output
6. Snowflakeschema
7. Data Warehouse Architekturen
8. Teilmodell OLAP-Würfel
9. Starschema

Prof. Dr. Alfred Holl, Georg Simon Ohm University of Applied Sciences, Nuremberg, Germany
Introduction 1

Brief introductory information about the subject: scientific context.

Embed the subject into a broader context, use an introductory example, guide from commonly understandable areas to your particular subject.

Description / motivation of the structure (from where? how? where?)
- **Starting point** of your thesis: what do we know? Where are the problems?
  - Clear description of research questions / scientific issues
- Exact definition of the objectives (to answer the research questions), description of your task in detail;
  - motivation: what is the purpose of your thesis? What are you aiming at?
- Objectives: reachable, pragmatic, not too optimistic / high / broad
- Motivation of the way how the methods are applied
  - (how shall the objectives be reached) and motivation of the use of particular methods.
Introduction 2

Distinction of the goals:
- generally desired goals to which your thesis contributes
- goals reached within your thesis (do not wake false expectations!)
- actual results of your thesis, form of the results

Formally structured overview of the entire thesis
for each section: number, title, methods used, partial goals
Motivation of the numeric structure of your thesis
by comparing it to the way how the methods are applied
(reflections about the structure, → already important for exposé).

Related work: explain previous research and the novelty of your ideas

Conventions for the reader:
use of character attributes (italics, underline, bold) and font sizes.
## Introduction 3

<table>
<thead>
<tr>
<th>Where from?</th>
<th>Where?</th>
<th>How?</th>
<th>What?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting point scientific issues</td>
<td>Definition of the objectives</td>
<td>Methods (and their use)</td>
<td>(Form of the) Results</td>
</tr>
<tr>
<td><strong>Entire thesis</strong></td>
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<tr>
<td><strong>Chapter 1</strong></td>
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<td><strong>Chapter 2</strong></td>
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<td><strong>Chapter 3</strong></td>
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<td><strong>etc.</strong></td>
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</tbody>
</table>
### Issues

**Issue 1:** The big jumble of graphical BPM notations
- Frequent, unstructured BP modeling style

**Issue 2:** Unmotivated BP decomposition on several levels of abstraction

**Issue 3:** Demonstration of an approach for a motivated decomposition of BPM models on several levels of abstraction
- Minimization of complexity in decomposed BPM models

### Goals

**Goal of Issue 1:**
- Classification of graphical notations
- Evaluation of graphical notations
- Improvements of graphical notations

**Goal of Issue 2:**
- Demonstration of structured BPM

**Goal of Issue 3:**
- Analysis of the actual BP modeling style
- Introduction and discussion of "feature oriented EPCs"

### Methods

**Method 1 (Issue 1):**
- Genetico-logic comparison
- Comparison using a standardized example

**Method 2 (Issue 2):**
- Analysis of the actual BP modeling style
- Introduction and discussion of SBPM

**Method 3 (Issue 3):**
- Discussion of theory of Gestalt
- Introduction and discussion of "feature oriented EPCs"

### Results

**Result of Issue 1:**
- Genealogical tree of graphical notations
- Proposal for improvements of graphical notations
- Overview of analogies of graphical notations
- Evaluation with strengths and weaknesses profiles

**Result of Issue 2:**
- Proof of the necessity of structured BPM (SBPM) shown on an example
- Requirements to SBPM
- Demonstration of the defects caused by unstructured BPM style

**Result of Issue 3:**
- Proof of logic decomposition on several levels of abstraction (under the aspects of theory of Gestalt)
Design and development methods

Requirements engineering and systems analysis
Reference modeling (analogy)
Business process modeling, algorithm modeling
Business Process Reengineering
Information flow modeling
Data modeling, class modeling
Data mining methods
Programming with special development environments
Customizing, tailoring
Design science
Empiric and rationalistic methods to construct models
Methods in information systems continued

Organization-theoretical methods
Elicitation methods such as questionnaire, interview, workshop
Information and knowledge management methods
Market study on standard software
Function point method (for comparisons)
Project management methods
Case studies
Research methods (according to Wilde / Hess 2007)

Main methods (91%)
Deductive by reasoning (using natural language)
Case study (including ethnography)
Prototyping
Quantitative-empiric
Conceptional-deductive (in semi-formal models)
Formal-deductive (in mathematical models)

Side methods (9%)
Reference modeling
Qualitative-empiric (including grounded theory)
Lab / field experiment
Simulation
Action research
References regarding research methods


Hevner, Alan R.; March, Salvatore T.; Park, Jinsoo; Ram, Sudha: Design science in information systems research. MIS Quarterly 28(2004) 1, 75-105.


Peffers, K; Tuunanen, T; Rothenberger, M A; Chatterjee, S: A design science research methodology for information systems research. Journal of Management Information Systems 24(2007), 3, 45-77.


Main part

Presentation of the subject of your thesis.

The following requirements partly apply already for introduction and preface.

Secondary topics should be avoided as they do not belong to your subject. Broad digressions far from your subject will lead to downgrading.

No statements of common knowledge in order to fill pages.
Formal requirements 1

Good results lose their value when they are presented badly.

Accurate formal presentation: orthography, punctuation, page layout. Use of I/we, my/our

Use of language: simple syntax, clear understandability, fluent readability, precision, transparency for a broad public, for every other information systems expert or computer scientist.

Graphic overviews, outlines, diagrams should have a logical arrangement (train of thought; clockwise, from left to right, diagonal etc.); comments should be consistent with contents and disposition of the graphics; arbitrary, but quickly and easily understandable symbolic / notation. Same set of symbols in all of your graphics
Der gesamte Konflikt der Regierung mit der jetzigen Landesvertretung leitet seinen Ursprung aus dem unnatürlichen Verhältnis ab, daß Preußen der einzige der deutschen Staaten ist, welcher sein Herrschen den Anforderungen der Zeit entsprechend eingerichtet hat, und daß wir dadurch genötigt sind, die Kräfte des Landes so anzupassen, daß sie zur Verteidigung des Territoriums auch aller derjenigen deutschen Stäaten dienen, welche mit uns dieselbe Verteidigung verbunden, ohne verhältnismäßig zu den Lasten der Verteidigung beizutragen."

(Aus einem Brief Bismarcks an Molle.)


(Aus dem ersten Band der „Erinnerungen“ von Konrad Adenauer.)

Um den scheinbaren Widerspruch zwischen Naturmechanismus und Freiheit in ein und derselben Handlung an dem vorgelegten Fall aufzulösen, muß man sich an die ändern, was in der Kritik der reinen Vernunft getan war oder daraus folgt, daß die Naturmechanik eine, welche mit der Freiheit des Subjekts nicht zusammen besteht kann, der den Besitzungen derjenigen Dinge anhängt, was der Zeitbedingungen gewachsen. Folglich nur denken des handelnden Subjekts als Erscheinung, daß also sofern die Bestimmungsgründe einer jeden Handlung desselben in derjenigen liegen, was zur vergangenen Zeiten gehört und nicht mehr in seiner Gewalt ist."

(Aus der „Kritik der praktischen Vernunft“ von Kant.)


(Aus „Der philosophische Glaube“ von Jaspers.)

Ein schwerer Wind trieb den Regen seitwärts herunter, und die alten Krögen krochen in die Petzminütler gewickelt, festigt in ihre majestätische Euphoch, die schon lange warzte. Das gelbe Licht der Lampe, die vorm Haus vor Stangen brannte, und weiter unten an dicken über die Straße gespannten Ketten hingen, fackerte anruhig. Fire und da sprangen die Häuser mit Vorbauten in die Straße hinein, die abschüssig zur Fläche hinunterführte, und einige waren mit Beschlägen oder Bänken versehen. Feuchtes Gras schött zwischen dem schlechten Pfahl eroder."

(Aus „Die Dudenbrooks“ von Thomas Mann.)

Die Fähigkeit, mit einer Kinderblechtrummel zwischen mir und den Erwachsenen eine notwendige Distanz herzustellen, zeigte sich kurz nach dem Sturm von der Kellertreppe fast gleichzeitig mit dem Lautwerken eines Stimmen, die es mir ermögliche, in derart hoher Lage anhaltend und verbreitend zu singen, daß niemand es wogerte, ans Trommel, die die Sonne gleich würden geben. Die Schreiendes, wenn nur die Trommel genommen würde, war ich in der Lage, das zu versagen."

(Aus „Die Blechtrummel“ von Grass.)
Formal requirements 2

Punctuation
Formal requirements 3

Headlines (if helpful, put them in the form of questions) should fit the contents of the text.

Section headers (one / two digit sections) in page header.

Structure of the text: frequent headlines (no four pages in a row without any headlines), structure in numerous paragraphs, visible underlines and bold types, comfortable font size (e.g. Word 12 pt), line spacing 20 pt.

No unstructured enumerations (“another”, “a further”, bullet points) Give rise to questions such as: Why just these aspects? Is the list complete?

Literal quotations and inserts similar to footnotes: other character attributes, less line space.
Formal requirements 4 – English

Correct English (good native proof reader)

Vocabulary (simple, no literary English, no dictionary translations and bulky expressions); use Merriam-Webster and the web
Try to find better expressions using paraphrases and synonyms

Morphology

Syntax: simple, short sentences; verb language

Punctuation
**Terminology and abbreviations 1**

**Definition** of the terminology used (complete, correct, clear) in the place of first occurrence (except for standard IS / CS) or reference to *glossary*; highlighting with bold type (no italics as they are not well visible!)

**Preliminary definitions** of your own if definitions in literature are not clear.

Use only a few, well-defined, really necessary *abbreviations*, not mixed with full expressions.

**Homonymy / polysemy**: constant terminology attention with regard to identical terms with different meaning when used by different authors, IT systems, companies (idiolects)
## Terminology and abbreviations 2

<table>
<thead>
<tr>
<th>natural language</th>
<th>formal language</th>
</tr>
</thead>
<tbody>
<tr>
<td>one meaning</td>
<td>one meaning</td>
</tr>
<tr>
<td>many meanings</td>
<td>many meanings</td>
</tr>
<tr>
<td>many forms</td>
<td>one form</td>
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<td></td>
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<tr>
<td>synonymy</td>
<td>homonymy</td>
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<tr>
<td>polysemy</td>
<td>non-ambiguity</td>
</tr>
<tr>
<td>e.g.</td>
<td></td>
</tr>
<tr>
<td>glasses</td>
<td>floor, earth, tree, root</td>
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<tr>
<td>spectacles</td>
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</tbody>
</table>
Reducing the use of company-internal language

Write for a broader scientific community

Avoid a project-internal tunnel view

Step back, have a look at your project from a distance

Describe your ideas and your project experience on a more general level

Explain background knowledge
Reader guidance 1: A didactic task

The reader must be able to follow your thoughts, must be guided: top-down presentation (move details to lower levels) oriented towards the hierarchic memory structure of humans

Help the reader with graphics, illustrations and good examples

At the beginning of larger chapters: put overviews / summaries there, briefly explain the current state of your reasoning, refer to the structural concept, to the context, describe the next step / objective; comment and motivate the fine structure of the chapter and the methods to reach the next objective.

Describe your lines of argumentation in detail and make them transparent. You have to make your ideas discussible to a larger public.
Reader guidance 2

Use references within your thesis only directly related to chapter / section numbers (or page numbers), not unclearly ("earlier", "later"); "see above" or "see below" only recommended with reference to the same page.

Use "To be improved" hints in those places where you yourself are not yet content with your text.

Help one another mutually as proofreaders. Your thesis should be understandable for every other master’s student with the same major; do not read on the monitor, use print-outs! If helpful, contact former master students.

Read the text of your thesis aloud to yourself.
General remarks regarding the contents

Be aware of the methods you use

Do not write only on a detailed level

Problem of NDAs

No internal project report, no insider text, no esoteric text which does not go beyond the horizon of some company or some small research area but a well readable scientific report, e.g. a readable developer (and user) documentation.

At the latest on the master’s level: A mere case study is not sufficient, produce general knowledge which is transferable to other companies
Master theses in applied computer science and information systems

Explain the purpose of the IT application: starting point is some course of events in a company (business process) where the IT application has to be embedded; a business task which it has to support. A system manual (that is, starting point is your IT application) can therefore be at the most a part of your thesis.

Do not forget about the responsibility of computer scientists / information systems experts (e.g. data privacy)! Are you allowed to model / program everything which can be modeled / programmed?

<table>
<thead>
<tr>
<th>Information systems (or socio-technical IS): organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational information systems (or social IS)</td>
</tr>
<tr>
<td>Business IS, applications (or technical IS)</td>
</tr>
</tbody>
</table>
A complete business concept is mandatory.

Distinguish your partial models clearly according to the three dimensions of multi-perspectivity:

**horizontal**: information flow, function/process, data/object models  
**vertical**: partial models on different abstraction levels  
**diaphasic**: business concept, user surface, reports, IT concept

All modeling approaches have to fit together (be consistent).

Business concepts have to be active, they have to include new aspects which do not show up before IT concept design or programming!
1. **Horizontal multi-perspectivity / decomposition:** static and dynamic data and function models

2. **Vertical multi-perspectivity / decomposition:** levels of abstraction

Using design methods (top-down, bottom-up, inside-out), models have to be decomposed into small and transparent partial models on different levels of abstraction (hierarchical levels with different degrees of abstraction).

3. **Diaphasic multi-perspectivity:** phase concepts / software process models

On its way through a systematic software (development) process model, a model of a technical IS has to be transferred in several steps via different models, each of which in turn is split vertically and horizontally, from an organization / enterprise model on the information level to a technical model on the implementation level.
Motivation of solutions: documentation of all of your reasoning

Do not write just a mere protocol of results, but a documentation of your ideas:
Do not apodictically (without motivation) present finished results and solutions, but render account in detail and motivate, why you choose just this method and technique and not other ones!

It has to be possible to follow your reasoning, the way how you found your solution. What gave you just this idea? Which other possible solutions, which other considerations had to be excluded and why (documentation of dead ends)?

It is important that you reflect on and render account of your reasoning and your methods.
This is the only way which allows your advisors to recognize your intellectual work!
Motivation of solutions: documentation of all of your reasoning 2

It is not only important what you did, but also all which you did not do, what you omitted, what you excluded consciously and intentionally. Where could the reader go beyond your thoughts? Do not give rise to considerations such as: “Why does the author not mention this aspect? In my opinion, it would be a logical consequence, an obvious solution!” Of course, there is no need to document trivialities which are of no importance: do not give long-winded explanations where a single sentence is sufficient. It is also intellectual work to distinguish between essential and non-essential, between important and unimportant (opinions about this point can, of course, differ in detail). Deal consciously with norms for diagrams (charts) and methods: do not blindly follow them, but adapt them to the particular requirements of your project if necessary.
Use of literature 1

Think independently: Simplistic copying from literature without understanding, comments and reflections of your own is entirely worthless.

Consider precisely which quotations you choose! Quoting without any accurate reflection will put your work in an unfavorable light (nonsense can be found in books, too; the fact that a word is printed is no guarantee for its absolute quality).

Clearly distinguish your own opinion from literally quoted opinions (quotation marks) and non-literal, reported / mentioned opinions (reported speech) of other authors. You are allowed to use the word “I”!

Quotations should serve as a reference or support your opinion or clearly serve as contrast to your opinion.
Use of literature 2

Put notes and bibliographical references at the best in the text (after the quotation, before period), footnotes do not make a paper more scientific. Abbreviated bibliographical reference: (author’s last name, year: page) or (author’s last name, shortened title, [year,] page)

Non-literal quotations in your own words also require a bibliographical reference.

Essential hints – particularly from your advisors – are sources which have to be quoted.

Overall quotations (adapted from …) for encyclopedic basics

Quoting a quotation is done by double bibliographical reference.
Bibliographic search

Independent literature: books

BVB Bayerischer Bibliotheksverbund
KVK Karlsruher virtueller Katalog (world wide)
scholar.google.com
e-books

Dependent literature: papers in journals and collections

electronic journals (EZB)

Paper databases (DBIS): searching them is mandatory!
Indexes

Glossary
(with reference to page / chapter of the first occurrence of a term)
if necessary

Abbreviation index
(with reference to page / chapter of the first occurrence of an abbreviation)
Figure index
Table index
Key word index

The granularity of glossary and abbreviation index should be adapted to the expected previous knowledge of the reader.
Bibliography 1

Sort your references alphabetically according to the authors’ last names, corporative / institutional authors as well.

Distinguish between used and unused literature. The latter is necessary if the number of possible sources is so big that you have to make a choice or if some sources are not available via internet or libraries.

Give a brief comment (max. 5 lines) to each of the sources mentioned in your bibliography: do you consider it as good, usable or bad, do you use it often, rarely or not at all and why? Although it is not common practice, some books already use this sort of comments which is very helpful for bibliographical research.
Bibliography 2

Monograph:
Author / editor last name, first name: title. place[: publisher] edition year.
Mark editor(s) with following (ed.).
Example for edition and year: 2nd ed. 2005 or ²2005

Paper in a journal:
Author last name, first name: title.
Journal title volume (year) pages from - to.

Paper in a collection (e.g. festschrift, proceedings, anthology):
Author: title. In: Monograph, pages from - to.

As a rule, “grey” literature (e.g. web sites, system manuals) has only short duration. Therefore, print-outs or a CD of the parts used of such sources with the date of access have to be included into the appendix of your thesis. References of web sources require author and title.
Oral presentation – talk

You should have a structure with a decimal classification (also in detail); show it to your audience and recur to it when arriving at a new section.

Overview: Relation of the sections of your presentation to the goals of your presentation and the subject of your presentation.

References with pages, also for figures

You should not read PowerPoint notes.
Technical remarks

Administrative requirements

Entire size: about 100 pages, double line spacing. You can use single line spacing for the final version, but double line spacing is required for all of the pre-corrections.

A thesis for two is possible, but has to be formally separable in the end (e.g. 1st / 2nd part) to meet administrative requirements by some authorities. The actual contributions of the two authors can differ from the formal separation and have to be discussed in the introduction.

A thesis (with reduced size) can have the form of a journal paper or a contribution to a congress.
Pre-correction and supervision

It is your duty to regularly inform your advisors about the progress of your thesis and to submit finished chapters for pre-correction.

These documents have to be on paper. Students from abroad can send pdf-files via e-mail.

The formal requirements have to be accurately met already for pre-correction.

I am available for pre-correction of the final wording only once per chapter. Of course, you can discuss contents and structure of your thesis several times with me before you submit texts for pre-correction.

Pre-corrections have to be submitted together with the final version.
**Juridical requirements**

Always meet the deadlines you agreed upon with your advisors and the university administration.

Include a confirmation of working independently at the beginning of your thesis.
**Information relevant for grading**

A master’s thesis shall prove that a student is able to independently discuss a problem from his / her degree program on a scientific basis.

All of the information which shall be taken into consideration for grading (intellectual work, temporal effort, external requirements by a company etc.) has to be made evident in the text of your thesis.

Additional oral information, side agreements, interpretations, implicit consequences, hints between the lines, no matter of what type and no matter by, with and for whom cannot be considered for grading.
Grading persons

Each grading person is completely autonomous in his / her judgment of your thesis, that is, completely independent of the advisor’s or any other grading person’s opinion.

In Germany, there are two grading persons, in other countries, there may be only one. Sometimes your advisor is also a grading person.

Contact grading persons at the latest when you have accomplished one half of structure and text of your thesis.

Problems with the company involved should be explained on a separate page.
**Method report 1**

The focus of a method report in an information systems master’s program are scientific methods relevant in the field of information systems.

What is the purpose of scientific methods? Scientific methods are used in order to find answers and solutions to scientific issues (scientific questions, scientific problems).

Remember a hard requirement: work in teams of two students.
Method report 2

There are different possibilities to choose a subject for a method report in the framework of an information systems master’s thesis:

Describe the scientific issues and the methods you use to arrive at answers and solutions.

Describe a certain scientific issue relevant for information systems and discuss methods to answer / solve it.

Describe a scientific discipline / approach / theory relevant for information systems, its issues and the methods it uses (state of the art).

Describe a scientific method relevant for information systems and possible scientific issues where it can be used.