Guidelines on writing a Master thesis

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The following guidelines are meant to support both students and supervisors regarding composing and supervising a Master thesis. They are by no means committing.

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1 These Guidelines are based on
- "Scientific Writing", Peer Teaching Paper by Nicole Herzlieb, Dec., 2006 University of Bremen
- "Information about Final Thesis in Computer Science/Digital Media coached by DiMeB (Digital Media in Education)", Prof. Dr. Heidi Schellhawe, University of Bremen
and composed by Prof. Dr. Ulrike Erb, University of Applied Sciences Bremerhaven
I. Objectives

With a master thesis a student should demonstrate:
- The ability of working autonomously on an academic level
- The ability of working with scientific methods on the solution of a problem in a specific academic area of Computer Science/Digital Media.

According to Umberto Eco, a scientific study ...
- treats a distinguishable topic,
- tells something new about this topic,
- is useful for others,
- must contain all the information which is necessary to judge, if the statements are o.k.

In a scientific study you give an answer on a special research question.

The development of software or the adaptation and implementation of software is not mandatory for a Digital Media thesis. But in general, it is advisable and useful.

II. Preparation Process

1. Finding Topic

To find a thesis' topic, there are several possibilities:
- Ideally, the topic is based on former studies in a project or course.
- The topic may also be given by a company, where the student is doing a job or internship.
- Or the student has her/his own concrete ideas and presents them to a Digital Media professor, who may accept it, if it fits to her/his field of research and work.
- Or the student is interested in a topic, which will be elaborated together with the potential supervisor.
- Or a Digital Media professor suggests a topic which is of interest for his research area. This topic may be modified according to the student’s interests.
- The time frame for the Master thesis is 5 months. The extent of the thesis should be adequate to the topic. Thesis should not exceed 80 pages (DIN A4, excluding appendices). This applies if you use a font size of 11 or 12 and a line spacing of 1.5. The text might be formatted left-aligned or justified. The thesis has to be written in English. Two well-bound copies have to be submitted to the examining office.

2. Specifying Problem

- Read up on given or chosen topic, become acquainted on the subject-matter. Find a not yet discussed or solved problem or open topic you want to research or rather study on further.
- Narrow it down to one specific question e.g. to prove a hypothesis (your supervisor might support you in this process). Not every question is a good research question, e.g. “How to develop good software?” is a too general question. It should be possible to develop and prove the answer with scientific methods.
- Refer to the main source that led to your research question as a basic source when describing the purpose of your paper.
- Scientific work always relies on existing knowledge and researches, so there is always a given basis to your problem of research. Use it, quote it (!!!) and do not reinvent the wheel!
- Research thoroughly: Ensure not to work on a problem other scientists solved already.
- Character of your Research:
  e.g. Case Study / Empirical Study / Development of a practical solution, like implementation of a prototype (for proving some hypothesis or showing some functionality etc.) / Analysis and Evaluation of existing solutions, technologies or theories etc.
  (A tutorial on how to use specific technologies is no scientific paper!)

3. Writing a Synopsis (“Exposé”)

- Prior to registering the thesis at the examination office the student writes a synopsis (“exposé”) and discusses it with his/her supervisor. The main purpose of the exposé is to give a precise description of
the subject and its feasibility. The “exposé” and its discussion with the supervisor build an important step to a successful final thesis.

- The “exposé” should cover 1 to 3 pages and contain the following information:
  - Personal dates (name, matriculation number, course of studies and semesters, email, address)
  - Working title for final thesis
  - Objective and leading question: What has to be achieved in the end? Which questions should be answered?
  - Area of Computer Science/Digital Media: Where exactly is the subject placed?
  - Work packages: What has to be done? (This might be its most extensive part)
  - Method: How will it be accomplished? How do you want to proceed?
  - Work- and timetable: Which steps are necessary and when should they be finished (milestones)?
  - First overview of relevant literature
  - Suggestion for the thesis’ outline

4. Registering the thesis
After the agreement on the expose, the thesis should be registered at the “Prüfungsamt”. At least for this step you should know, who will be your second supervisor, because you need the signatures of your supervisors for the enregistration.

III. Prewriting Process
- Outline your ideas the way they come up
- Always consider your target reading group
- Always consider your purpose of writing
- Do not drift off from your actual topic
- Only concentrate on content: Do not consider neatness, spelling, sentence structure
- If planning to present your paper: Write down ideas and figures for a presentation

IV. Writing Process
1. Target Group
To avoid an unnecessarily extensive research and writing effort consider the target readers’ fundamental knowledge in the field with which your paper will deal.
For a Digital Media thesis your target group normally are people with good Digital Media and Computer Science know how.

2. Structure
Structure your thesis regarding the “XI. Sections of a Scientific Paper” below.
Assign your preparation and prewriting notes to the appropriate section of your paper.
At the beginning of each main chapter should be given a short introduction about purpose and outline of this chapter.

3. Research
In order to refer to existing knowledge, it is necessary to study the “state of the arts” of your topic, that means to read academic literature like monographies, scientific journal articles, conference proceedings, technical reports etc., which is relevant for the topic of your thesis. (see “Research Methods” below)
It is sometimes recommended to prepare the thesis by studying an appropriate book.

4. Citation Styles
Based on: “The Mayfield Handbook of Technical & Scientific Writing”
http://web.mit.edu/writing/temp2/home.htm
- Using the exact wording of another author in your paper must be quoted exactly and put in quotation marks in your paper’s text.
- Not only exact wording but also knowledge and ideas from another person must be marked directly in your paper’s text as the other’s work!
- Cited source must be added in short form directly to the specific text passage. When citing references in the text, do not use footnotes; instead, refer to the source by the author’s name and the date the paper was published.
Name of cited author(s) and year of publication should appear directly in the text to memorize the sources.
- Numbers or abbreviations for used publications are obsolete.
- The reader should be aware of the cited authors directly when reading the text without the need of switching between the current text section and the literature cited section

Avoid to interrupt the flow of reading, insert citation e.g. like
- “Graham (2005) examined that...”
- “The project group performed best (Patterson 1999, Franklin 2004), although the presentation left too many main questions open (Scott, 2004)”

Citation source with two authors: Name both authors in the text (e.g. (Smith/Miller 2007)
Citation source with more than two authors: Name first author’s last name + et al. (abbreviation of Latin term “et alii” which means “and others”) (e.g. Sneider et al. 2003)

- This short form is for the use in the text only. In the “List of referenced Literature”, all names should be listed, usually last name preceding initials. (see the corresponding section below)
- There are different conventions about citation styles. No matter which convention you use: Be consistent, do not mix different citation styles.
- All academic fields have specific systems and styles for citing sources: Common ground of all is to provide readers with sufficient information to find a cited source without difficulty.
- Some common citation styles are:
  - ACM, see e.g. http://moon.cse.yzu.edu.tw/~acm/docs/ihhuang/citation/
  - Institute of Electrical and Electronic Engineers (IEEE):
  - American Psychological Association Style (APA) (in-text information linked to a list of references; author-date style - very common, often used style)
  - Modern Language Association (MLA) (changed style from in-text numbers to in-text information in the 1980s; author-page style)

- See examples at the section “List of referenced Literature” in “XI. Sections of a Scientific Paper”

5. Start writing and keep writing!
Note down occurring questions or problems. Further research during the writing process detracts from the main thoughts. Necessary further research can be done when the main thoughts are put down on paper.

V. Editing Process
- Check all data for accuracy
  - Review errors concerning
    - Content
    - Procedures
    - Wording, spelling and grammar

VI. Writing Style
Based on: “General Technical Writing Guidelines”
http://owl.english.purdue.edu/workshops/hypertext/reportW/generalguidelines.html
“Improving your Writing Style” http://www.wisc.edu/writing/Handbook/Style.html
- Use clear, short, significant sentences
- Use short, plain wording
- Omit unnecessary words and wordy phrases; see examples at “Plague Words and Phrases” http://grammar.ccc.commnet.edu/grammar/plague.htm
- Use complete sentences (subject + main verb)
- Avoid gender-related terms when writing about multiple persons of different gender
- Use correct vocabulary, spelling, punctuation and sentence structure
- One paragraph contains only one topic, e.g. in the introduction describe the relationship of your work in one paragraph, but your paper’s research question in another paragraph
- Begin each paragraph with a significant sentence
- Write in active voice
- Write positive statements instead of negations

VII. English as Second Language (ESL)
- For students with English as second language (also EFL, ESOL, or EAP) there are numerous websites available which provide:
  - Support in writing
  - Information about spelling, grammar and punctuation
  - Exercises for improving your skills
- Examples of ESL websites:
  - Comprehensive website which provides a glossary of grammar terms, idioms, forums with teachers’ online help, tests, etc.: http://www.usingenglish.com/
  - For improving your English by practicing; Quizzes, tests, exercises and puzzles contributed by teachers: http://a4esl.org/
  - Ask about specific grammar and vocabulary uncertainties at the BBC Learning English section: http://www.bbc.co.uk/worldservice/learningenglish/grammar/

VIII. Formatting Styles
- Receive a clearly arranged overview of your paper’s content by formatting it.
- Always use one formatting style consistently in your scientific paper.
- Consider an internal logic and order of your paper’s structure for readers to find information at a glance.
- Clarify and emphasize your paper’s content by sectioning it via headings and subheadings
- Use specific typography styles as different fonts and typefaces to highlight text segments
- Use white space or rather isolate text segments from other content to emphasize them
- Use bulleted or enumerated lists to present a hierarchical order of content
- Formatting of visuals:
  - Details must be visible
  - Visuals must not extend page
  - Visuals must be numbered and entitled

IX. Proofread Process
- Print out your paper
- Proofread separately for
  - Correct content
  - Correct spelling, wording, grammar and punctuation
  - Correct use of format
- If English is not your mother tongue, preferably ask a native speaker to proofread your Paper

X. Plagiarism
Based on: “Don’t Plagiarize!!” http://www.beyondutopia.net/writing-survivalguide/plagiarism/
“Plagiarism Invention” http://www.beyondutopia.net/writing-survival-guide/intervention/
“How not to plagiarize” http://www.utoronto.ca/writing/plaqsep.html
- Plagiarism means to use another person’s intellectual property without indicating it
- In academic writing plagiarism is forbidden and not acceptable
- Possible punishment if plagiarism is detected:
  - At university:
    - Failing of the certain course
    - Expulsion from studies
    - Revocation of your degree (plagiarism does not become time-barred)
  - At work:
    - Losing job
    - Paying a fine
To avoid plagiarism:
- Do not copy and paste text segments
  - Do not copy text segments or paragraphs without assigning them to the original author’s work
  - Do not copy multiple authors’ text segments and compile them as your scientific paper
  - Describe another person’s work, idea, thought or the like in your own wording
  - Write down what you memorize from a researched source using your own wording without looking at the source again
- If you quote from a scientific paper which you wrote for another class or published already, you also have to reference the original source.
- Never let other persons write a scientific paper for you
- Always cite every source you refer to in your paper, no matter if citing it directly or with your own words
  - Already note down your sources during the prewriting process
  - Quote exact wording only, if the specific words are very significant for your work
  - Exactly quoted wording must always be put in quotation marks
- Consider correct citation styles

Common knowledge and facts do not need to be cited. If you are not sure if some information is considered to be common to your target reader group, ask your supervisor.

XI. **Sections of a Scientific Paper**
The general outline of the thesis is according to the common practice of scientific working:

**Front page**

Title
Master Thesis (MSc)
International Inter-University Study Programme
Digital Media Bremen/Bremerhaven
at the University of Applied Sciences Bremerhaven

by
<Name>
Bremerhaven, <Year>

<Names of the supervisors>

**Declaration**
Declaration that this thesis is exclusively written by yourself with the exception of the official support of your supervisors, and that all the literature and sources used in your thesis are referenced correctly.

**Table of contents**

**Abstract**
The abstract should, in the briefest terms possible, describe the topic, purpose and scope of the thesis, the approach and methods used, the principal findings, and the author’s major conclusions. It should be written last to reflect accurately the content of the report. The length of abstracts vary but seldom exceed 200 words.

**Introduction**
In the introduction, the motivation for the scientific paper is explained. This section should describe clearly but briefly the background information on the problem and the actual state of research (with proper literature citations) and, based on that, the derivation of a clearly defined scientific problem. Besides this, the approach to the problem has to be mentioned. A clear relationship between the current project and the scope and limitations of earlier work should be made so that the reasons for the project and the approach used will be understood.
At the end of the introduction the reader should be aware about the following:
1. What is the scientific problem and the specific purpose of the study (the aim)?
2. Why is this scientific problem of interest?
3. What knowledge already exists about this subject?
4. How is this scientific problem approached (“strategy”)?

Theory / Basics
Describe the theoretical basis for your design or study, e.g. definitions, state of the art in your research area, relevant technologies, basic theories etc.

Material and methods / Your approach for solving the problem
In this part, the methods applied (and possibly their selection criteria) and the material have to be described as concisely as necessary and as shortly as possible. Then describe the procedure in enough detail that others can duplicate it. Use illustrations.

Results
Concise description of your own results, as far as they are relevant for the discipline of Digital Media.

Discussion
The discussion and interpretation of the results is the vital part of the thesis! Your own results have to be assessed and discussed in the context of other works in relation to the scientific problem. What do the results mean? How do they relate to the objectives of the project? To what extent have they resolved the problem?
Because the “Results” and “Discussion” sections are interrelated, they can often be combined as one section.

Conclusions
This part should begin with a summary of the discussion. After that, the conclusions arising from the scientific work should be stated clearly. Also appropriate is a specific outlook on open questions and future researches.
A separate section outlining the main conclusions of the project is appropriate if conclusions have not already been stated in the “Discussion” section.

List of referenced Literature
In the framework of a scientific paper it is fundamental to assess own results in the context of the existing literature. Part of that is the concise citation of the literature.
Examples how to cite:
For Books:
For chapters in books:
For articles:

Every common citation style requires specific data (name of author(s), title, date and location of publication, etc.) to be listed regarding the cited type of publication as periodical journals, books, Internet sources, conference proceedings
- Example of how to cite different kinds of literature can be found here: http://www.rw.ttu.edu/4309/how_to_cite.htm

For citing Internet sources always include the full Internet address of a source.
General form: Author. publication date. Page title. Site title. URL. date you accessed it. Paragraph number (e.g. what paragraph you found cited info in)
- Re-check the correctness of the address
Every common citation style contains specific regulations for citing electronic publications as Internet sources, CD-ROMS, software applications, etc.

- Citation Styles for Internet sources are not always standardized yet.
- Before citing Internet sources check the current requirements of the citation style you use (e.g. see “Citing Scientific Sources from the Internet” http://www.beyondutopia.net/research-citing/ or „The Mayfield Handbook of Technical and Scientific Writing” http://web.mit.edu/writing/temp2/csxlr.htm
- Citation Styles particularly for different types of online sources: http://www.bedfordstmartins.com/online/citex.html

Appendix

It is common practice to document your data in a way that other scientists can follow and reconstruct the results. You have to list e.g. the main source code of your implementations. For an extensive amount of data an electronic appendix is advisable (e.g. CD).

An acknowledgement might be placed between “Conclusions” and “Literature”.

XII. Research for Literature

A good starting point for researches is a survey paper, bibliographies and the reference sections in papers, which are relevant for your topic.

1. Online Research

Search engines and online databases:
- Enter keywords, phrases, text segments regarding your topic or problem
- Enter also synonyms of the terms
- Scan listed previews of the search engine results to look for content that might concern your research topic

Websites of specific content or from specific authors
- Work through named or linked cross references in the text or from literature cited
- Write down data of cited print media for further offline research

Note: Internet sources do not guarantee correct contents; community-managed websites (e.g. Wikipedia, blogs, forums) are no scientific sources
- Check reliability of an Internet source (cited references, persons or organizations in charge of the website, etc.)
- Preferably use peer-reviewed references, e.g.
  - Online books from the academic publisher O'Reilly http://safari.oreilly.com/ (use for free with Uni Bremen VPN-connection)
  - Online available books: http://onlinebooks.library.upenn.edu/
  - Association for Computing Machinery (ACM): http://www.acm.org/ (membership needed; special fees for students, but use for free with campus VPN-connection)
  - Scientific information online (journals, books, documents, databases): http://www.sciencedirect.com/
- Control refresh period of Internet sources; often websites are “forgotten” and not updated anymore

2. Research in Library

- Most of the printed publications are proofread, reviewed and approved by referees from publisher companies or committees.
- For latest information particularly research periodicals.
- Technical journals, magazines, annuals, newsletters, newspapers and conference proceedings are obtainable for all scientific fields.
- To find electronic databases and publications use electronic library http://suche.suub.uni-bremen.de/en/ or http://rzblx1.uni-regensburg.de/ezeit/fl.phtml?bibid=BSOL&colors=3&lang=de&notation=SQ-SU
- Publications not available in Bremen can be borrowed from other libraries against a charge via the interlibrary loan service via http://www.gbv.de/vgm/info/benutzer/02fern/index?lang=en
For more detailed information about library research ask directly at the information desk of the library.

- Research until you do not find new, valuable, consolidated findings.
- Find out if a source provides useful content for your scientific paper:
  - Skim over text (read headlines, view figures and other eye-catching content) to get a first overview of the text’s topic.
  - Read abstract (a well-written abstract contains all contents in very brief).

3. How to read a text
- **Quick orientation**: Title and subtitles, Year, Content Overview, Abstract, Introduction, Conclusion/Resume, Literature

- **Questions** to ask while reading the text:
  - Which expectations do I have concerning the text?
  - What are my main interests: getting an overview or special details?
  - What’s the topic and the main message of this text?
  - What’s the intention of the author?
  - What are the main statements, what are only hypothesis, what are evaluations and judgements?
  - What about the quality of this text? Is it persuading?

- Mark the most interesting parts of the text, while reading it.
- Write down the central messages and argumentations.

4. Citation Styles (see IV.4 Citation Styles)

XIII. Additional Helpful Sources
From the Massachusetts Institute of Technology (MIT):
- Detailed information and links for writers, speakers and teachers about how to arrange contents of each paper section; strategies of writing, ESL, grammar guides, citation styles, about plagiarism http://web.mit.edu/writing/
- Links to style and usage manuals, online dictionaries, citation styles http://libraries.mit.edu/help/writing.html
- Extensive, well-structured compilation of all relevant topics and steps of writing a scientific paper concerning content, formats, style guides, use of language, punctuation, English as second language, etc. http://web.mit.edu/writing/temp2/toc.htm

Exaggerated, satirized template showing how to structure a scientific paper; written by Georges Perec:
- “Experimental demonstration of the tomatotopic organization in the Soprano (Cantatrix sopranica L.)” http://pauillac.inria.fr/~xleroy/stuff/tomato/tomato.html