Writing a Survey Paper

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22 Nov 2016

Abstract

Writing a survey can be a traumatic endevour. It might be a student's first foray into academic research. There are often obstacles and false dawns along the way. This survey paper takes a fresh look at the process and addresses new ways of accomplishing this daunting goal.

The abstract should concisely describe what the survey is about. State the areas which are covered and also those which are not covered. Market your survey to your readership. Also, make sure you mention all relevant keywords in the abstract, since many readers read *only* the abstract and many search engines index *only* the title and the abstract.

This survey explores the issues concerning the writing of an academic survey paper and presents numerous novel insights. Special attention is paid to the use of clear and simple English for an international audience, and advice is given as to the use of technical aids to production.

Contents

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Chapter 1

Introduction

An academic survey paper presents a survey or overview of the state of the art in a particular field. Every chapter and every section should have some introductory text at the beginning, like this text. Never jump straight in to the first secion or subsection without one or more paragraphs of introductory text.

1.1 Not a Series of Summaries

A survey is *not* simply a series of summaries of papers. If I have given you say 8 papers to start you off, what you should *not* do is: divide up the papers (read two each) and produce a series of 8 unconnected paper summaries.

1.2 Read All the Papers and Research Some More

Each of you should read *all* the papers and resources: both those I gave you and those you found yourselves. Make sure you search for more papers and resources yourselves. Not just a Google search. Search the ACM [ACM, 2012] and IEEE [IEEE, 2012] digital libraries, citeseer [PSU, 2012], and mendeley [Reichelt, 2012]. You may want to use mendeley to collect your resources or maybe maintain a .bib file within an SVN repository.

Include a list of *all* the relevant papers and resources you have found and mark those you have chosen to focus on. Make sure *all* the papers and resources you found or were given appear in the bibliography.

1.3 Dividing up the Field

The hardest part of any survey is dividing up the field. Look for common concepts and threads in the papers and resources. Do they report similar or dissimilar results? Does one paper or resource support or contradict another?

Once you have all read all the papers: you need to construct a small hierarchy (taxonomy) to classify the concepts appearing in the papers and resources. Structure your survey into chapters and sections based on your taxonomy.

1.4 Composing a Title and Abstract

One useful strategy for composing a good title and abstract involves brainstorming for a list of keywords. Start by writing down a list of all the words and phrases describing important topics covered in the thesis and which potential interested readers might use as search terms to find the thesis. Then construct a title containing the most important of these keywords. Finally, compose the abstract and make sure most of the rest of the keywords are contained somewhere in the abstract. Search engines and library systems will usually index the title and the abstract, so anyone searching for any of the keywords should now be able to find the thesis. When the

thesis is approaching completion, revisit the title and abstract, an extra extra keywords and make any necessary adaptations.

1.5 Double-Sided Printing

Create and print your survey in colour and for two-sided (duplex) printing. Modern laser printers can easily handle printing out in colour and double-sided. A survey paper printed one-sided will be (unnecessarily) twice as thick and twice as heavy.

Sections, including the bibliography and any appendices, should usually (as far as possible) start on a new right-hand (odd-numbered) page. This is what the `\cleardoublepage` command does.

1.6 Single Children

As in real life, a single child is not a good idea. A chapter with only one section make no sense. A section with only one subsection make no sense. A subsection with only one subsubsection make no sense either. If a structural unit has subunits, then there should always be at least two subunits.

1.7 Make Captions Carry the Story Too

Some readers like to scan through your work from figure to figure, gaining an impression of what it is about by reading the captions. Support these readers by:

- *Writing self-contained captions*: the caption should describe the figure or table as completely as possible, without assuming knowledge of material in the running text.

- *Writing longish captions*: it is fine for captions to contain two or three sentences.

- *Stringing captions together*: Reading successive captions should also tell an abridged version of the entire story.

1.8 Avoid Orphan Floats

Every floating element (figure, table, or listing) which appears in the thesis and is given its own number such as Figure 3.1, Table 4.1, or Listing 5.1 must be discussed and referenced somewhere in the running text. An orphan float is a float which appears and has a number, but is never referenced in the flowing text.

Chapter 2

Hierarchy Browsers

If the survey were on the topic of hierarchy browsers, for example, this is how I might divide up the field.

2.1 Node-Link Hierarchy Browsers

2.1.1 Layered

2.1.2 Radial

2.2 Space-Filling Hierarchy Browsers

2.2.1 Layered

2.2.2 Radial

2.2.3 Inclusive

2.2.4 Overlapping

2.3 Evaluating Hierarchy Browsers

2.3.1 Formative Studies

2.3.2 Comparative Studies

Chapter 3

Academic Writing

Writing in an academic context is different to other types of writing. Care must be taken to follow the conventions of academic writing.

3.1 Academic Criteria

An academic survey must demonstrate the following components:

- Motivation. What problem you are addressing and why.

- Survey. A thorough review of related work in the field.

- An extensive bibliography. To demonstrate knowledge of the major works in the field, even if they have not all been read in their entirety.

3.2 Academic Integrity

It is very easy to find helpful material on the web. Resist the temptation to copy such material verbatim, even with minor changes in phrasing and word order. It is just as easy for a supervisor or advisor (or anyone else for that matter) to check the originality of a piece of text by copying a passage into Google or services such as [iParadigms, 2012].

Work submitted for academic assessment must be original and created by the stated author(s). Care must be taken to avoid both *plagiarism* and *breach of copyright*:

- *Plagiarism*: Using the work of others *without acknowledgement*.

- *Breach of copyright*: Using the work of others *without permission*.

3.2.1 Plagiarism

Plagiarism is a violation of intellectual honesty. This means copying other people's work or ideas without due acknowledgement, thus giving the reader the impression that these are original (your own) work and ideas. The Concise Oxford Dictionary, 8th Edition, defines plagiarism as:

> "**plagiarise 1** take and use (the thoughts, writings, inventions, etc. of another person) as one's own. **2** pass off the thoughts etc. of (another person) as one's own."

Plagiarism is the most serious violation of academic integrity and can have dire consequences, including suspension and expulsion [Reisman, 2005].

3.2.2   Breach of Copyright

Copyright law[1] varies in detail from country to country, but certain aspects are internationally widely accepted. In general, the creator of a work, say a piece of writing, a diagram, a photograph, or a screenshot, automatically has copyright of that work. Copyright usually expires 70 years after the creator's death. The copyright holder can grant the right for others to use or publish their work on an exclusive or non-exclusive basis.

The copyright laws of most countries have provisions for *fair use*, which generally means it is allowable to quote small parts of a work. Austrian copyright law [BKA, 2015, § 42f] allows for reasonable quotes from published works or works made publicly available with permission of the copyright holder. Austrian copyright law [BKA, 2015, § 42g] also makes certain exemptions for materials used for teaching in universities and schools. Note that significant changes to Austrian copyright law [Austrian Parliament, 2015] came into effect on 01 Oct 2015.

3.3   Acceptable Use

Academic work almost always builds upon the work of others, and it is appropriate, indeed essential, that related and previous work by others be discussed in an academic thesis. However, this must be done according to the rules of acceptable use. There are two forms of acceptable use:

- *Paraphrasing (Indirect Quotation)*: Summarising the ideas of someone else using original words and with attribution.

- *Quoting (Direct Quotation)*: Including an exact verbatim copy inside quotation marks and with attribution.

Attribution means that the original source is cited. For further information on acceptable and non-acceptable academic practice see [Weber-Wulff, 2012; Wikipedia, 2012b].

3.3.1   Paraphrasing (Indirect Quotation)

Paraphrasing means closely summarising and restating the ideas of another person, but in (your own) original words. When writing a literature survey, the relevant parts of each paper or source are generally *paraphrasd*.

One good technique for paraphrasing is:

1. Read the original source.

2. Put it down away from view.

3. *Without refering to the original*, summarise it in your own words.

When paraphrasing someone else's ideas, the original source must always be cited!

Since paraphrased text is not enclosed in quotation marks, it is not always obvious how to indicate the extent of the text which corresponds to a particular citation. If the paraphrased text only covers a single paragraph, include the citation either within or at the end of the first sentence of the paragraph, or at the end of the paragraph. Otherwise, describe the extent of the citation in words at the beginning, for example: This section is based on the work of Andrews, Kienreich et al. [2002].

---

[1]Disclaimer: I am not a lawyer. The comments here reflect the situation to the best of my knowledge at the time of writing, but do not constitute legal advice. Laws sometimes change and I make no guarantees.

3.3.2 Quoting Text (Direct Quotation)

In some circumstances, it makes sense to directly *quote* small parts of text (typically a few sentences or paragraphs) from a relevant source. When quoting directly, the *exact* words, spelling, and punctuation of the original are copied verbatim and enclosed in quotation marks.

Most of an academic paper or thesis must be in words written by the author(s) themselves. However, when an exact phrase or specific wording from another source is important, then a direct quotation should be used. In any case, the original source must be cited!

3.3.3 Quoting Images

It is common to want to include photographs, diagrams, or screenshots taken from the internet or from another work, particularly when surveying related work. Austrian copyright law [BKA, 2015, § 42f] allows images from published works to be included in scientific works for the purposes of discussion. However, it is not entirely clear what constitutes a scientific work and what not. The safest policy is always to ask permission from the owner.

For diagrams, an alternative strategy is to redraw and possibly adapt the diagram in a drawing editor such as Adobe Illustrator [Adobe, 2016] or Inkscape [Inkscape, 2016]. The original source should be cited with wording like "Redrawn from [. . .]" or "Adapted from [. . .]".

For graphs and plots, it is often possible to reconstruct the graphic from the original data using tools such as gnuplot [Williams and Kelley, 2016] or R [TRF, 2016]. The original source should be cited with wording similar to "Created from the original data [. . .] using[. . .]".

For screenshots, it is sometimes possible to obtain the original software, install it, and make new screenshots. The source software should be cited with wording similar to "Screenshot created using [. . .]".

3.3.4 Always State Both Source and Permission

Regardless of whether permission has been obtained from the copyright owner or material is being used under the provisions of a specific country's copyright law: whenever someone else's work is being used, academic integrity dictates that the original source must be cited! In addition, it is also good practice to state the terms (permission) under which the material is being used.

For each piece of included material, make two things absolutely clear:

1. *Source*: Cite the original source of the material. Use a standard LATEX 2$_\varepsilon$ citation.

2. *Permission*: Explain the legal basis for using the material. For example, give the *exact* Creative Commons licence, state the *exact* legal exemption, or state that permission has kindly been given by the named original author.

These two things should be stated in two places:

- *Caption*: At the end of the caption of the figure or listing.

- *Credits section*: In the Credits section at the front of the thesis.

All this means, of course, that if a thesis is based upon this skeleton [Andrews, 2012], then the source and permission should be stated at the appropriate place (in this case, in the Credits section).

3.4 References

3.4.1 Bib Files

Typically, one or more `.bib` files are prepared, containing various original sources and references. Listing 3.1 shows four typical entries from a `.bib` file for use with biblatex and biber. The `inproceedings` entry describes a

paper published in conference proceedings, the `article` entry describes a paper published in a journal, and the `booklet` entry is being used for internet resources and web sites (`booklet` has the advantage over `online` that it has a `howpublished` field.).

Of particular note is the `doi` field, which gives the DOI (digital object identifier) of a paper. DOIs are for academic papers what ISBNs are for books; a unique handle with which one can easily find the original. Most publishers are now assigning DOIs to new conference and journal papers and are working back in time to assign them to previously published papers. Always give the DOI of a paper where one is available. If a DOI exists but points to a subscription site, and the paper is also freely available on the web (say at the home page of an author), then use the `url` field to give the free URL as well. Do not redundantly give the same URL in the `url` field which the DOI itself resolves to.

3.4.2 Downloading Bib Entries

When `.bib` entries are downloaded or copied from the ACM Digital Library, the IEEE Digital Library, or other onlibne sources, they should *not* be used as is. They generally need to be cleaned up first and made consistent with biblatex. Listing 3.2 shows typical BibTeX entries provided by the ACM Digital Library and the IEEE Computer Society Digital Library.

To bring bib entries into line with biblatex and the examples shown in Listing 3.1, the following should be addressed:

- The title of the paper should use capitalised main words.

- Capitalisations in the title which need to be preserved (such as the R in VRwave) should be enclosed in curly brackets (VRwave).

- The `title` and `booktitle` should use capitalised main words (not all lower case).

- The `edition` field is usually be a number in inverted commas, such as `"2"`, instead of a word such as `"Second"`.

- The name of a conference should be rephrased, with the short form of the conference name in parentheses at the end (VRML'98).

- Any `year`, `month`, and `day` fields should be combined into a `date` field.

- For a conference paper, the first day of the conference should be used as the date of publication.

- The location of a conference should be in the `venue` field, not in the `address` or `location` field. The `address` field is for the address of the publisher.

- Any minus signs must be removed from the ISBN number. Otherwise, the macro used in this skeleton for handling ISBNs and linking to Amazon will break.

- Any initial `http://doi.acm.org/` or `http://doi.ieeecomputersociety.org/` must be removed from the DOI. They are *not* part of the DOI.

- If a free, unofficial version of a paper with a DOI is available at the web site of one of the authors, give this in the `url` field.

- Manually shorten any URL as much as possible: try selectively removing parameters after a question mark and try removing `www` from the domain. Do *not* use a URL shortening service like `bit.ly`, since there is no guarantee the service will be around long term. It is acceptable to use a URL shortening service maintained by the original site themselves, such as `youtu.be` for YouTube URLs.

```
1  @book{SpenceBook,
2    author       = "Robert Spence",
3    title        = "Information Visualization: Design for Interaction",
4    edition      = "2",
5    publisher    = "Prentice Hall",
6    date         = "2006-12-18"
7    isbn         = "0132065509",
8  }
9
10 @article{InfoSkyIVS,
11   author       = "Keith Andrews and Wolfgang Kienreich and Vedran Sabol and
12                   Jutta Becker and Georg Droschl and Frank Kappe and
13                   Michael Granitzer and Peter Auer and Klaus Tochtermann",
14   title        = "The InfoSky Visual Explorer: Exploiting Hierarchical
15                   Structure and Document Similarities",
16   journal      = "Information Visualization",
17   publisher    = "Palgrave-Macmillan",
18   volume       = 1,
19   number       = "3/4",
20   date         = "2002-12",
21   pages        = "166--181",
22   doi          = "10.1057/palgrave.ivs.9500023",
23 }
24 % This is a comment containing a UTF8 character ü
25
26 @inproceedings{Andrews-VRwave,
27   author       = "Keith Andrews and Andreas Pesendorfer and
28                   Michael Pichler and Karl Heinz Wagenbrunn
29                   and Josef Wolte",
30   title        = "Looking Inside {VRwave}: The Architecture and
31                   Interface of the {VRwave} {VRML97} Browser",
32   booktitle    = "Proc.\ Third Symposium on the Virtual Reality
33                   Modeling Language (VRML'98)",
34   venue        = "Monterey, California, USA",
35   publisher    = "ACM Press",
36   date         = "1998-02",
37   pages        = "77--82",
38   doi          = "10.1145/271897.274374",
39   url          = "http://ftp.iicm.tugraz.at/pub/papers/vrml98.pdf",
40 }
41
42 @booklet{InfoVisNotes,
43   author       = "Keith Andrews",
44   title        = "Information Visualisation: Lecture Notes",
45   date         = "2016-03-17",
46   url          = "http://courses.iicm.tugraz.at/ivis/ivis.pdf",
47   urldate      = "2016-09-14",
48 }
49
50 @booklet{XML,
51   author       = "{W3C}",
52   title        = "Extensible Markup Language {(XML)}",
53   howpublished = "World-Wide Web Consortium",
54   date         = "2016-03-01",
55   url          = "https://w3.org/XML/",
56   urldate      = "2016-03-01",
57 }
```

Listing 3.1: Four typical entries from a `.bib` file for use with biblatex and biber. An `inproceedings` entry describes a paper published in conference proceedings, an `article` entry describes a paper published in a journal, and a `booklet` entry is used for internet resources and web sites. The `doi` field gives the DOI (digital object identifier) of the paper.

```
 1  % From the IEEE Computer Society DL:
 2
 3  @article{10.1109/INFOVIS.2005.7,
 4  author = {Martin Wattenberg},
 5  title = {Baby Names, Visualization, and Social Data Analysis},
 6  journal = {infovis},
 7  volume = {0},
 8  year = {2005},
 9  issn = {1522-404x},
10  pages = {1},
11  doi = {http://doi.ieeecomputersociety.org/10.1109/INFOVIS.2005.7},
12  publisher = {IEEE Computer Society},
13  address = {Los Alamitos, CA, USA},
14  }
15
16
17  % From the ACM DL:
18
19  @inproceedings{1106568,
20   author = {Martin Wattenberg},
21   title = {Baby Names, Visualization, and Social Data Analysis},
22   booktitle = {INFOVIS '05: Proceedings of the Proceedings of the 2005 IEEE Symposium on
          Information Visualization},
23   year = {2005},
24   isbn = {0-7803-9464-x},
25   pages = {1},
26   doi = {http://dx.doi.org/10.1109/INFOVIS.2005.7},
27   publisher = {IEEE Computer Society},
28   address = {Washington, DC, USA},
29   }
30
31
32  % Clean, edited version for Keith:
33
34  @inproceedings{WattenbergNames,
35    author       = "Martin Wattenberg",
36    title        = "Baby Names, Visualization, and Social Data Analysis",
37    booktitle    = "Proc.\ {IEEE} Symposium on Information Visualization
38                    (InfoVis 2005)",
39    location     = "Minneapolis, Minnesota, USA",
40    organization = "{IEEE} Computer Society",
41    isbn         = "078039464X",
42    date         = "2005-10",
43    pages        = "1--8",
44    doi          = "10.1109/INFOVIS.2005.7",
45    url          = "http://www.research.ibm.com/visual/papers/final-baby-margin-nocomments.
          pdf",
46  }
```

Listing 3.2: Bib entries copied from the ACM Digital Library or the IEEE Computer Society Digital Library contain useful information, but cannot be used "as-is". They must be edited to conform to biblatex and to these thesis guidelines.

3.4.3 What to Reference

The set of references should be balanced:

- Do not have largely web sites as references. A few web sites as references is fine, most references being web sites is (usually) not so good.

- Do not have too many Wikipedia references. A few Wikipedia references is OK; more than a few is not. Wikipedia is a good *starting* point for (further) academic research, it is not a good ending point for academic research.

- Have plenty of academic conference and journal papers (with a DOI). Sometimes, both an academic paper and a project web site will be avilable – reference both as separate entries.

- Include some books (with an ISBN) if at all possible. Books still count in academic circles.

- If you know or suspect who will be reviewing or marking your thesis or paper, make sure to include some of their references. The first thing many reviewers do is check to see if they appear in the bibliography.

- No ghost references. Every reference in the bibliography should be cited somewhere in the text.

3.4.4 Citing

When a citation is included within flowing text:

- Distinguish between *textual* citations and *parenthetical* citations. Textual citations are used to embed the authors' names in the current sentence. Parenthetical citations are used at the end of a sentence.

  `\citet{Jones1990}` → Jones et al. [1990]
  `\citep{Jones1990}` → [Jones et al., 1990]

- If one specific part in a very long paper or book is being cited, always state the page number or range in the citation:

  As `\citet[pages 22--23]{Jones1990}` say → As Jones et al. [1990, pages 22–23] say

3.5 Guides to Scientific Writing

Alley [1998] is one of the classic guides to scientific writing. Other good ones include W. C. Booth et al. [2008] and V. Booth [1993].

Chapter 4

Language and Writing Style

The classic reference for English writing style and grammar is Strunk and White [1999]. The original text is now available for free online [Strunk, 1918], so there is no excuse at all for writing poor English. Readers should consult it first, then continue reading this chapter. Another good free guide is McCaskill [1990].

Zobel [2004] and Dupré [1998] are guides specifically aimed at computer science students. Phillips and Pugh [2005] gives practical advice for PhD students.

The following Sections 4.3 and 4.4 are adapted from the CHI'94 language and writing style guidelines.

4.1 Some Basic Rules of English

There are a few basic rules of English for academic writing, which are broken regularly by my students, particularly if they are non-native speakers of English. Here are some classic and often encountered examples:

- *Never* use I, we, or you.

  Write in the passive voice (third person).

Bad:	You can do this in two ways.
Good:	There are two ways this can be done.

- *Never* use he or she, his or her.

  Write in the passive voice (third person).

Bad:	The user speaks his thoughts out loud.
Good:	The thoughts of the user are spoken out loud.

  See Section 4.4 for many more examples.

- Stick to a consistent dialect of English. Choose either British or American English and keep to it throughout the whole of your thesis.

- Do *not* use slang abbreviations such as "it's", "doesn't", or "don't".

  Write the words out in full: "it is", "does not", and "do not".

Bad:	It's very simple to. . .
Good:	It is very simple to. . .

- Do *not* use abbreviations such as "e.g." or "i.e.".

  Write the words out in full: "for example" and "that is".

Bad:	. . . in a tree, e.g. the items. . .
Good:	. . . in a tree, for example the items. . .

- Do *not* use slang such as "a lot of".

  Bad: There are a lot of features...
  Good: There are many features...

- Do *not* use slang such as "OK" or "big".

  Bad: ...are represented by big areas.
  Good: ...are represented by large areas.

- Do *not* use slang such as "gets" or "got".

  Use "becomes" or "obtains", or use the passive voice (third person).

  Bad: The radius gets increased...
  Good: The radius is increased...

  Bad: The user gets disoriented...
  Good: The user becomes disoriented...

- *Never* start a sentence with "But".

  Use "However," or "Nevertheless,". Or consider joining the sentence to the previous sentence with a comma.

  Bad: But there are numerous possibilities...
  Good: However, there are numerous possibilities...

- *Never* start a sentence with "Because".

  Use "Since", "Owing to", or "Due to". Or turn the two halves of the sentence around.

- *Never* start a sentence with "Also". Also should be placed in the middle of the sentence.

  Bad: Also the target users are considered.
  Good: The target users are also considered.

- Do *not* use "that" as a connecting word.

  Use "which".

  Bad: ...a good solution that can be computed easily.
  Good: ...a good solution which can be computed easily.

- Do *not* write single-sentence paragraphs.

  Avoid writing two-sentence paragraphs. A paragraph should contain at least three, if not more, sentences.

4.2   Avoid Austrianisms

I see these mistakes time and time again. Please do not let me read one of them in your work.

- "actual" ≠ "current"

  If you mean "aktuell" in German, you probably mean "current" in English.

  Bad: The actual selection is cancelled.
  Good: The current selection is cancelled.

- "allows to" is not English.

  Bad: The prototype allows to arrange components...
  Good: The prototype supports the arrangement of components...

- "enables to" is not English.

  Bad: it enables to recognise meanings. . .
  Good: it enables the recognition of meanings. . .

- "according" ≠ "corresponding"

  Bad: For each browser, an according package is created.
  Good: For each browser, a corresponding package is created.

- "per default" is not English.

  Use "by default".

  Bad: Per default, the cursor is red.
  Good: By default, the cursor is red.

- "As opposed to" is not English.

  Use "In contrast to".

  Bad: As opposed to C, Java is object-oriented.
  Good: In contrast to C, Java is object-oriented.

- "*anything*-dimensional" is spelt with a hyphen.

  For example: two-dimensional, three-dimensional.

- "*anything*-based" is spelt with a hyphen.

  For example: tree-based, location-based.

- "*anything*-oriented" is spelt with a hyphen.

  For example: object-oriented, display-oriented.

- "*anything*-side" is spelt with a hyphen.

  For example: client-side, server-side.

- "*anything*-friendly" is spelt with a hyphen.

  For example: user-friendly, customer-friendly.

- "*anything*-to-use" is spelt with hyphens.

  For example: hard-to-use, easy-to-use.

- "realtime" is spelt with a hyphen if used as an adjective, or as two separate words if used as a noun.

  Bad: . . . display the object in realtime.
  Bad: . . . using realtime shadow casting.
  Good: . . . display the object in real time.
  Good: . . . using real-time shadow casting.

4.3 Clear Writing

The written and spoken language of your thesis is English as appropriate for presentation to an international audience. Please take special care to insure that your work is adapted to such an audience. In particular:

- Write in a straight-forward style, using simple sentence structure.

- Use common and basic vocabulary. For example, use "unusual" for "arcane", and "specialised" for "erudite".

- Briefly define or explain all technical vocabulary the first time it is mentioned, to ensure that the reader understands it.

- Explain all acronyms and abbreviations. For example, the first time an acronym is used, write it out in full and place the acronym in parentheses.

  Bad: ... When using the GUI version, the use may...
  Good: ... When using the Graphical User Interface (GUI) version, the use may...

- Avoid local references. For example, not everyone knows the names of all the provincial capitals of Austria. If local context is important to the material, describe it fully.

- Avoid "insider" comments. Ensure that your whole audience understands any reference whose meaning you do not describe. For example, do not assume that everyone has used a Macintosh or a particular application.

- Do not "play on words". For example, do not use "puns", particularly in the title of a piece. Phrases such as "red herring" require cultural as well as technical knowledge of English.

- Use unambiguous formats to represent culturally localised things such as times, dates, personal names, currencies, and even numbers. 9/11 is the 9th of November in most of the world.

- Be careful with humour. In particular, irony and sarcasm can be hard to detect if you are not a native speaker.

- If you find yourself repeating the same word or phrase too often, look in a thesaurus such as Roget [2004] and Crowell [1922] for an alternative word with the same meaning.

Clear writing experts recognise that part of writing understandable documents is understanding and responding to the needs of the intended audience. It is the writer's job to maintain the audience's willingness to go on reading the document. Readers who are continually stumped by long words or offended by a pompous tone are likely to stop reading and miss the intended message.

4.4   Avoiding Gender Bias

Part of striking the right tone is handling gender-linked terms sensitively. Use of gender terms is controversial. Some writers use the generic masculine exclusively, but this offends many readers. Other writers are experimenting with ways to make English more neutral. Avoiding gender bias in writing involves two kinds of sensitivity:

1. being aware of potential bias in the kinds of observations and characterisations that it is appropriate to make about women and men, and

2. being aware of certain biases that are inherent in the language and of how you can avoid them.

The second category includes using gender-specific nouns and pronouns appropriately. Here are some guidelines for handling these problems:

- Use a gender-neutral term when speaking generically of people:

man	the human race
mankind	humankind, people
manpower	workforce, personnel
man on the street	average person

- Avoid clearly gender-marked titles. Use neutral terms when good ones are available. For example:

chairman	chairperson
spokesman	speaker, representative
policeman	police officer
stewardess	flight attendant

- If you are speaking of the holder of a position and you know the gender of the person who currently occupies the position, use the appropriate gender pronoun. For example, suppose the "head nurse" is a man:

  Bad: The head nurse must file her report every Tuesday.
  Good: The head nurse must file his report every Tuesday.

- Rewrite sentences to avoid using gender pronouns. For example, use the appropriate title or job name again:

  Bad: Interview the user first and then ask him to fill out a questionnaire.
  Good: Interview the user first and then ask the user to fill out a questionnaire.

- To avoid using the third person singular pronoun (his or her), recast your statement in the plural:

  Bad: Each student should bring his text to class.
  Good: All students should bring their texts to class.

- Address your readers directly in the second person, if it is appropriate to do so:

  Bad: The student must send in his application by the final deadline date.
  Good: Send in your application by the final deadline date.

- Replace third person singular possessives with articles.

  Bad: Every student must hand his report in on Friday.
  Good: Every student must hand the report in on Friday.

- Write your way out of the problem by using the passive voice.

  Bad: Each department head should do his own projections.
  Good: Projections should be done by each department head.

- Avoid writing awkward formulations such as "s/he," "he/she," or "his/her." They interfere when someone is trying to read a text aloud. If none of the other guidelines has been helpful, use the slightly less awkward forms "he or she," and "his or hers."

Remember, the goal is to avoid constructions that will offend your readers so much as to distract them from the content of your work.

4.5 When to use Capitalisation

Capitalisation means using a capital (upper case) initial letter for a word. *Lowercasing* means writing the entire word in lower case. In many common writing styles, headings and titles are partially capitalised: the first and the principal (main) words are capitalised and other words are lowercased.

Proper names, such as the names of people, towns, and countries, are always capitalised (Keith Andrews, the United Kingdom).

4.5.1 Titles and Headings

Capitalise all principal words: nouns, pronouns, adjectives, verbs, and adverbs, and the first word. Lowercase all articles, coordinating conjunctions ("for", "and", "nor", "but", "or", "yet", "so"), and prepositions.

For example:

- Here, "it" is a pronoun, which should always be capitalised.

  Bad: Saying it Directly
  Good: Saying It Directly

- Here, "is" is a verb, which should always be capitalised.

  Bad: When is Enough Enough?
  Good: When Is Enough Enough?

- Here, "in" is being used as a preposition and should be lowercased.

  Bad: The Elephant In the Room.
  Good: The Elephant in the Room.

- Here, "in" is being used as an adverb and should be capitalised.

  Bad: Handing in Your Work.
  Good: Handing In Your Work.

See Writer's Block [1998] for some slightly different rules and some more examples.

4.5.2 Captions

The short version of a caption for a figure, table, or listing should be capitalised like a heading. It appears in the List of Figures or List of Tables. The long version of a caption for a figure, table, or listing should be written as full sentences, i.e. only the first word of each sentence and any proper names are capitalised.

4.5.3 Chapters, Sections, Figures and Tables

A specific, named or numbered entity, such as a particular chapter, section, figure, table, or listing is considered to be a proper name and thus the word Chapter, Section, Figure, etc. *should be capitalised*. For example, Chapter 2, Section 4.4, Figure 6.2, Table 6.2, or Listing 3.1. However, if an entity is not specifically named or numbered, then it should *not* be capitalised. For example, when refering to the first chapter or the next section, without giving a name or number.

4.6 Use a Spelling Checker

In these days of high technology, spelling mistakes and typos are inexcusable. It is *very* irritating for your supervisor to have to read through and correct spelling mistake after spelling mistake which could have been caught by an automated spelling checker. Believe me, irritating your supervisor is not a good idea.

So, use a spelling checker *before* you hand in *any* version, whether it is a draft or a final version. Since this is apparently often forgotten, and sometimes even wilfully ignored, let me make it absolutely clear:

Use a spelling checker, please.
Use a spelling checker!
Use a spelling checker, you moron.

4.7 Use a Dictionary

If you are not quite sure of the meaning of a word, then use a dictionary. dictionary.com [2012] is a free English dictionary, TU Chemnitz [2012] and Leo [2012] are two very good English-German dictionaries.

4.8 Use a Thesaurus

If a word has been used several times already, and using another equivalent word might improve the readability of the text, then consult a thesaurus. Roget [2004] and Crowell [1922] are free English thesauri.

Chapter 5

Technical Realisation

Use LaTeX 2ε to produce your thesis. Do *not* even entertain the idea of writing your thesis with Microsoft Word. Ever.

5.1 LaTeX

LaTeX 2ε provides very comfortable features for structuring and reorganising your work. In particular, figure and section numbers are symbolic references and are automatically kept consistent. Even more importantly, when material is added or changed, LaTeX 2ε reformats your work *automatically*.

Furthermore, the Biblatex package lets you maintain a database of bibliographic entries; citations are then also made by symbolic reference. The exact appearance of citations and the bibliography is controlled by setting a particular bibliographic style. See Cottrell [1999] for plenty more reasons to use LaTeX 2ε rather than Word.

5.1.1 Literature and Online Resources

The best reference book for LaTeX 2ε is Kopka and Daly [2003] – buy it! Your advisor can become very irritated by students repeatedly asking the same basic questions instead of consulting the book. Good online resources for LaTeX 2ε include the Wikibook LaTeX [Wikibooks, 2016], Oetiker et al. [2011], Flynn [2005], the TeX Users Group [TUG, 2016] (see Figure 5.1), and the Deutschsprachige Anwendervereinigung DANTE [DANTE, 2016] (in German). LaTeX 2ε information in German is available on the local LaTeX@TUG web site [Hammer et al., 2012]. Questions can be asked in the local TU Graz newsgroup `tu-graz.latex` .

5.1.2 Installing LaTeX 2ε

For information about availability, versions, installation, etc. of LaTeX 2ε consult the online *TeX Frequently Asked Questions* [Fairbairns, 2012]. The best way to install LaTeX 2ε under Windows is to get the TeXLive 2016 [Rahtz, 2016] DVD distribution. You can download an ISO image from CTAN TeXLive [CTAN, 2016]. Under Windows 10, you can mount an ISO image by double-clicking, it is no longer necessary to actually burn the image to a DVD.

5.1.3 Installing Extra LaTeX 2ε Packages

Depending on the LaTeX 2ε package you install, you may need to install additional or more recent versions of LaTeX 2ε packages. For example, this thesis makes use of the LaTeX 2ε `titlesec` package. You can find a list of packages at your local CTAN site [CTAN, 2012]. To install a package, read the advice at `http://www.ctan.org/installationadvice/`
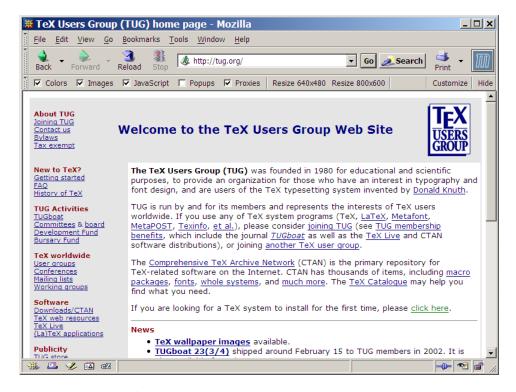
Figure 5.1: The web site of the TeX Users Group [TUG, 2016]. [Screenshot taken by the author of this thesis.]

5.1.4 Running LaTeX 2ε

When running LaTeX 2ε under Unix, check that the environment variables are set to something like the values shown here:

```
setenv TEXINPUTS .:~/tex/inputs:./inputs::
setenv BSTINPUTS .:~/tex/inputs::
setenv BIBINPUTS .:~/tex/bib:./bib::
```

LaTeX 2ε updates certain auxiliary files during translation (for example with figure numbers or captions) and makes use of them in subsequent runs. To be absolutely certain that all references are resolved correctly, run `pdflatex`, `biber`, `pdflatex`, and `pdflatex` in sequence, as shown below for this thesis:

```
pdflatex thesis
biber thesis
pdflatex thesis
pdflatex thesis
```

An alternative is to use the `latexmk` perl script:

```
latexmk --pdf thesis
```

`latexmk` can also be configured using a config file such as `$HOME/.latexmkrc` in the user's home directory:
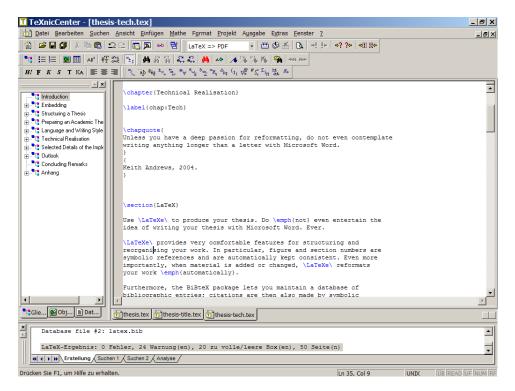
Figure 5.2: The TeXnicCenter [Wiegand and Weinkauf, 2008] integrated development environment (IDE) for LATEX 2ε. [Screenshot taken by the author of this thesis.]

```
$pdf_mode = 1;   # force use of pdflatex
```

5.1.5 Spell Checking

GNU Aspell [Atkinson, 2004] is a free open source spell checker. It can automatically ignore LATEX 2ε commands. Aspell can either be run from the command line or integrated into other packages such as Emacs.

5.1.6 Integrated Development Environments (IDEs) for LATEX 2ε

Under Windows you might want to use an integrated development environment (a fancy editor) for LATEX 2ε, which have built-in support for editing LATEX 2ε, spell checking, compiling, and so forth. The IDEs assume that you have a working LATEX 2εinstallation, so install LATEX 2εfirst. The best are Texmaker [Brachet, 2012], TeXnicCenter [Wiegand and Weinkauf, 2008] (shown in Figure 5.2), and LEd [Skorczynski and Deorowicz, 2009], all of which are free. The shareware WinEdt [Simonic, 2012] is also very good.

5.2 Including Images

Use the `graphicx` package to include images:

```
\usepackage{graphicx}
```

5.2.1   Screenshots

Screenshots should be made using software such as IrfanView or Gimp and *saved as PNG*. PNG is a lossless image format which preserves every pixel of the original image. Sometimes, novices save screenshots as JPEG (`.jpg`), which is an inherently lossy image format. Screenshots saved as JPEG invariably introduce artefacts such as smudged lines and text, due to the way that JPEG achieves its high compression rates.

5.2.2   Diagrams

Diagrams and illustrations should be drawn using a *vector* graphics editor such as Adobe Illustrator or Inkscape[Inkscape, 2016]. Archive (and hand-in) the respective source files (`.ai` or `.svg`). Convert or export the diagram to PDF for inclusion into LaTeX 2ε.

Vector graphics are based on objects such as lines, circles, polygons, and text strings and as such are freely scalable without loss of quality. In contrast, *raster* graphics are based on pixels and do not scale without loss of quality. Saving diagrams in a raster format such as PNG, GIF, or JPEG means they cannot be resized without considerable loss of quality.

5.2.3   Graphs and Plots

Tabular data can be plotted as, say, a line chart or bar chart, using the free packages `gnuplot` [Williams and Kelley, 2016] or R [TRF, 2016]. The plots should be created as SVG (vector graphics), which can then be touched up, cropped, and converted to PDF using Adobe Illustrator or Inkscape[Inkscape, 2016].

5.3   Including Listings

Use the `listings` package to include source code listings. There are three types of listing:

- *Inline*: A small snippet of code can be contained within the flow of a paragraph using `\lstinline`, for example `\lstinline!var i:integer;!` produces `var i:integer;`.

- *In-Place displayed*: An in-place displayed listing is a block of code listed at the place where it occurs. Use in-place displayed listings for short blocks of source code upto max n lines (I use $n = 3$). Create an in-place displayed listing with the `lstlisting` environment, but without using the `float` parameter.

- *Floating displayed*: A floating displayed listing is a block of code treated like other LaTeX 2ε floats (such as figures or tables). Use floating displayed listings for longer blocks of code. LaTeX 2ε places the Listing at some point later on. Create a floating displayed listing with the `lstlisting` environment, but specify the `float` and `caption` parameters. A floating displayed listing is given a number (Listing 2.1) and is listed in the List of Listings.

The `listings` package is currently not designed for use with UTF8 characters. To use UTF8 characters inside listings, you have to specify the parameter `inputencoding=utf8` and specify each character inside the `literate=` parameter to the `\lstset` command.

5.4   Biblatex and Biber

Biblatex [Lehman, 2013b] is a companion system to LaTeX 2ε, which allows you to manage sets of references in plain text files (called `.bib` files) and cite references from within your LaTeX 2ε documents. Biber [Lehman, 2013a] is a program which takes `.bib` files and manages the formatting of citations and of the bibliography itself. Biblatex and Biber have replaced the now obsolete BibTex.

Chapter 6

Selected Examples of Doing Things with LaTeX 2$_\varepsilon$ (and Test of Extremely Long Chapter Titles to See How They Work Or Not)

This chapter contains some examples of typical LaTeX 2$_\varepsilon$ usage.

6.1 First Selected Example

An example of using a table can be seen in Table 6.1.

6.2 Second Selected Example

This example shows how to inculde vector graphics in the form of PDF files. It also shows how to use subfigures within a figure.

An example of using the subfig package can be seen in Figure 6.1. Figure 6.1a shows the polygons before transformation, while Figure 6.1b shows them afterwards.

6.3 Third Selected Example

This example shows how to include a screen shot (or other raster graphic) into a LaTeX 2$_\varepsilon$ figure.

An example of how to correctly cite the source when using an image from someone else. In their 1998 paper, Andrews, Pesendorfer et al. [1998] discuss the VRwave VRML browser. Figure 6.2 shows a VRML model of a cavalry pistol from the Armoury in Graz displayed in the VRwave VRML browser.
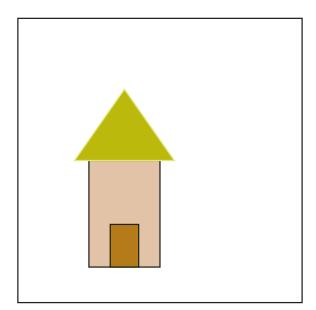
6.4 Fourth Selected Example

You can use many (but not all) of the thousands of characters available in the UTF-8 [Wikipedia, 2012a; Unicode Consortium, 2012] character encoding. For example, the German umlauts (äüö), the German sharp s (ß), or the yen symbol (¥).

You can also try some of the ≈ 100 symbols available in the textcomp package, such as the yen symbol (¥) and a circled letter A (Ⓐ).
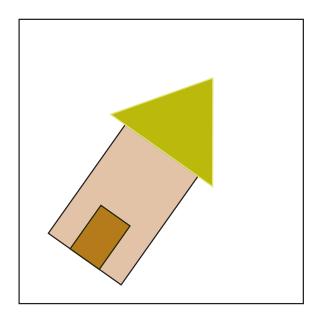
Use the vname, cname, and fname macros to define the style for variable names, class names, and file names. You can also define your own macros. The is a very long file name `/usr/data/keith/travel/austria/vienna.txt` to see how they are broken at a line end. A typical class name is HVSInformationPyramidsInputFactory.

Name	Type	Rating	Description
The Office	English	*****	The best pub in Graz. Hidden in the narrow streets of the old town. A wonderful hideout for ex-pats. A pint of Guinness for only € 3.90.
Flann O'Brien	Irish	****	In the centre of town and easy to find for marauding tourists.
O'Carolans	Irish	****	In the centre of town in a small side street next to Flann's. Small, cosy Irish pub.
O'Riginal	pseudo Irish		Austrian dive pretending to be an Irish pub. Definitely not my cup of tea.

Table 6.1: The best pubs in Graz.

(a) A object has been composed to represent an abstract version of the clock tower in Graz. Here, the object is in its initial state.

(b) The object has been scaled and rotated, and now resembles a leaning tower.

Figure 6.1: The leaning tower of Graz. An abstract model of the clock tower in Graz leaning over time. (a) shows the initial state. (b) shows the final state.

Figure 6.2: VRwave in Flip mode displaying a textured model of a cavalry pistol from the world-renowned Zeughaus (armoury) in Graz. [Image extracted from Andrews, Pesendorfer et al. [1998, page 81] under the terms of the ACM copyright. Copyright © by the Association for Computing Machinery, Inc.]

6.5 Fifth Selected Example

Sometimes, a macro (new command definition) can be useful to define the contents of table cells, particularly if these contain images. For example, Table 6.2 uses the macro called `iibox`, which takes a single parameter, the name of the particular image.

6.6 Textual Citations

Keim et al. [2006] define visual analytics as:

> "iterative process that involves collecting information, data preprocessing, knowledge representation, interaction, and decision making".

Ward et al. [2010, Chapter 7] categorise visualisation techniques for multi-variate data according to the graphical primitive used in the rendering: points, lines, and regions.

Elementary Symbols	
Document	
Assistant	
Template	
Document Types	
Text document	
Spreadsheet document	
Presentation document	
Database document	
Applications	
Word	
Excel	
Powerpoint	
Access	
Generated Icons	
Word text document	
Excel spreadsheet document	
Powerpoint presentation document	
Access database document	
Word template	
Powerpoint template	
Access template	
Word template assistant	
Powerpoint template assistant	
Access template assistant	

Table 6.2: Iconic language for Windows NT 4.0 documents.

Chapter 7

Concluding Remarks

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