Writing a Survey Paper

Guidelines for Writing a Survey Paper in Computer Science

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Abstract

Writing a survey can be a traumatic endeavour. 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 regarding the use of technical aids to production.

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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 2021] and IEEE [IEEE 2021] digital libraries. You may want to use Mendeley to collect your resources or maybe maintain a (shared) `.bib` file within a Git 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 makes no sense. A section with only one subsection makes no sense. A subsection with only one subsubsection makes 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 2021].

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 generally have provisions for quoting small parts of a work. Austrian copyright law [BKA 2021, § 42f] allows for reasonable amounts of text to be quoted in other works. It does not cover "quoting" entire images.

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. 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! For further information on acceptable and non-acceptable academic practice see [Weber-Wulff 2021; 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 *paraphrased*. 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 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!

Short pieces of text can be quotes inline using the `textquote` command. For example, Keim et al. [2006] define visual analytics as an: "iterative process that involves collecting information, data preprocessing, knowledge representation, interaction, and decision making." Longer pieces of quoted text should be put into a `displayquote` environment. For example, as Andrews [1995, page 99] explains:

> " Information in Hyper-G may be structured both hierarchically into so-called *collections*, and by means of associative hyperlinks. A special kind of collection called a *cluster* groups logically related or multilingual versions of documents. Every document and collection must belong to at least one collection, but may belong to several. Navigation may be performed down through the collection hierarchy (the collection 'hierarchy' is, strictly speaking, a directed acyclic graph), access rights assigned on a collection-by-collection basis, and the scope of searches restricted to particular sets of collections. Collections may span multiple Hyper-G servers, providing a unified view of distributed resources.
>
> Links in Hyper-G are stored in a separate link database and are bidirectional (directed, but may be followed backwards): both the incoming *and* outgoing hyperlinks of a document are always known and available for visualisation. Furthermore, Hyper-G has fully integrated search facilities including full text search with relevance scores and some limited support for similarity measures between documents.
>
> All in all, the richness of the Hyper-G data model provides plenty of scope upon which to base visualisations: hierarchical structure, (bidirectional) hyperlinks, and search and retrieval facilities. The Harmony client for Hyper-G exploits this richness to provide tightly-coupled two- and three-dimensional visualisation and navigational facilities help provide location feedback and alleviate user disorientation. "

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. By default, it must be assumed that such images are covered by copyright and *cannot* simply be used. Explicit permission *must* be obtained for each image.

Sometimes, permission is granted in advance by the owner in the form of a licence, such as one of the Creative Commons licences [CC 2017]. Other times, permission can be obtained directly from the owner by sending a friendly email request. Without permission, the image *cannot* be used.

Once copyright has expired (in general, 70 years after the death of the creator), an image passes into the public domain. However, even if a rare original historical work may technically be in the public domain, the owner of such a work controls access to it, and has copyright over any photographs or scans of the work which they create.

For diagrams, an alternative strategy is to redraw and possibly adapt the diagram in a (vector graphics) drawing editor such as Adobe Illustrator [Adobe 2021b] or Inkscape [Inkscape 2021]. The original source should be cited with wording like "Redrawn from Figure N of [. . .]." or "Adapted from Figure N of [. . .].".

For graphs and plots, it is often possible to reconstruct the graphic from the original data using tools

such as gnuplot [Williams and Kelley 2021] or R [RF 2021]. The original source should be cited with wording similar to "Created from the original data [. . .] using XY [. . .].".

For screenshots of software, it is sometimes possible to obtain the original software, install it, and make new screenshots. If possible, an original, local dataset should be used rather than the default (or a provided) dataset, so that the resulting screenshots are demonstrably new and unique. In the case of an online tool (running locally in a web browser), a local original dataset should be loaded if possible. At a minimum, the default view should be changed, so the resulting screenshot is new and unique. In both cases, the source of the software should be cited with wording similar to "Screenshot of XY [. . .] created by the author of this paper.".

3.3.4 Attribution and Permission

In general terms, for material included wholesale from elsewhere, two pieces of information must be clearly stated:

1. *Attribution*: The original source of the material must be cited.

2. *Permission*: The terms under which the material is being used must be explained. For example, give the *exact* Creative Commons licence [CC 2017], state the *exact* legal exemption, or state that permission has kindly been given by the named original author.

For figures and listings, attribution and permission should be stated at the end of the caption of the figure or listing containing the material.

3.4 References

Modern LaTeX 2$_\varepsilon$ installations use BibLaTeX [Lehman 2018] and Biber [Charette and Kime 2018] to maintain and process references. Much of the syntax and many of the conventions were carried over from the original BibTeX [Patashnik 1988] format, but BibTeX is now obsolete.

Typically, one or more `.bib` files are prepared, containing one entry for each original source or reference. Listing 3.1 shows four typical entries from a `.bib` file. 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.). Every entry type and field type is documented in the BibLaTeX manual [Lehman 2018]. The BibLaTeX Cheat Sheet [Rees 2017] provides a convenient overview.

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.

3.4.1 Cleaning Downloaded 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.

```
@book{SpenceBook,
  author       = "Robert Spence",
  title        = "Information Visualization: Design for Interaction",
  edition      = "2",
  publisher    = "Prentice Hall",
  date         = "2006-12-18"
  isbn         = "0132065509",
}

@article{InfoSkyIVS,
  author       = "Keith Andrews and Wolfgang Kienreich and Vedran Sabol and
                  Jutta Becker and Georg Droschl and Frank Kappe and
                  Michael Granitzer and Peter Auer and Klaus Tochtermann",
  title        = "The InfoSky Visual Explorer: Exploiting Hierarchical
                  Structure and Document Similarities",
  journal      = "Information Visualization",
  publisher    = "Palgrave-Macmillan",
  volume       = 1,
  number       = "3/4",
  date         = "2002-12",
  pages        = "166--181",
  doi          = "10.1057/palgrave.ivs.9500023",
}
% This is a comment containing a UTF8 character ü

@inproceedings{Andrews-VRwave,
  author       = "Keith Andrews and Andreas Pesendorfer and
                  Michael Pichler and Karl Heinz Wagenbrunn
                  and Josef Wolte",
  title        = "Looking Inside {VRwave}: The Architecture and
                  Interface of the {VRwave} {VRML97} Browser",
  booktitle    = "Proc.\ Third Symposium on the Virtual Reality
                  Modeling Language (VRML'98)",
  venue        = "Monterey, California, USA",
  publisher    = "ACM Press",
  date         = "1998-02",
  pages        = "77--82",
  doi          = "10.1145/271897.274374",
  url          = "http://ftp.iicm.tugraz.at/pub/papers/vrml98.pdf",
}

@booklet{InfoVisNotes,
  author       = "Keith Andrews",
  title        = "Information Visualisation: Lecture Notes",
  date         = "2016-03-17",
  url          = "http://courses.iicm.tugraz.at/ivis/ivis.pdf",
  urldate      = "2016-09-14",
}

@booklet{XML,
  author       = "{W3C}",
  title        = "Extensible Markup Language {(XML)}",
  howpublished = "World-Wide Web Consortium",
  date         = "2016-03-01",
  url          = "https://w3.org/XML/",
  urldate      = "2016-03-01",
}
```

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.

```
% From the IEEE Computer Society DL:

@article{10.1109/INFOVIS.2005.7,
author = {Martin Wattenberg},
title = {Baby Names, Visualization, and Social Data Analysis},
journal = {infovis},
volume = {0},
year = {2005},
issn = {1522-404x},
pages = {1},
doi = {http://doi.ieeecomputersociety.org/10.1109/INFOVIS.2005.7},
publisher = {IEEE Computer Society},
address = {Los Alamitos, CA, USA},
}


% From the ACM DL:

@inproceedings{1106568,
 author = {Martin Wattenberg},
 title = {Baby Names, Visualization, and Social Data Analysis},
 booktitle = {INFOVIS '05: Proceedings of the Proceedings of the 2005 IEEE Symposium
      on Information Visualization},
 year = {2005},
 isbn = {0-7803-9464-x},
 pages = {1},
 doi = {http://dx.doi.org/10.1109/INFOVIS.2005.7},
 publisher = {IEEE Computer Society},
 address = {Washington, DC, USA},
 }


% Clean, edited version for Keith:

@inproceedings{WattenbergNames,
  author       = "Martin Wattenberg",
  title        = "Baby Names, Visualization, and Social Data Analysis",
  booktitle    = "Proc.\ {IEEE} Symposium on Information Visualization
                  (InfoVis 2005)",
  location     = "Minneapolis, Minnesota, USA",
  organization = "{IEEE} Computer Society",
  isbn         = "078039464X",
  date         = "2005-10",
  pages        = "1--8",
  doi          = "10.1109/INFOVIS.2005.7",
  url          = "http://hint.fm/papers/final-baby-margin-nocomments.pdf",
}
```

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.

- 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 (InfoVis 2005).
- 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, but is often unnecessary.
- 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.

3.4.2 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.

3.4.3 Citing

When a citation is included within flowing text:

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

`\parencite{InfoSkyIVS}`	[Andrews et al. 2002].
`As \textcite{InfoSkyIVS} say,`	As Andrews et al. [2002] say,

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

`\parencite[pages 173--174]{InfoSkyIVS}`	[Andrews et al. 2002, pages 173–174].
`As \textcite[pages 173--174]{InfoSkyIVS} say,`	As Andrews et al. [2002, pages 173–174] say,

- Multiple sources can be combined into one citation command:

`\parencites{InfoSkyStudies}[pages 173--174]{InfoSkyIVS}`	[Granitzer et al. 2004; Andrews et al. 2002, pages 173–174].
`As \textcites{InfoSkyStudies}[pages 173--174]{InfoSkyIVS} say,`	As Granitzer et al. [2004] and Andrews et al. [2002, pages 173–174] say,

Here are two examples. The InfoSky [Andrews et al. 2002] system combined both hierarchical visualisation and placement by similarity. 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.

Chapter 4

Language and Writing Style

A comprehensive guide to writing British English is the New Oxford Style Manual [OUP 2016]. The Economist Style Guide [Wroe 2018] provides a compact indexed guide to British English usage. Zinsser [2006] is an easy to read companion.

A comprehensive guide to writing American English is the Chicago Manual of Style [UCP 2017]. The classic compact reference for American English writing style and grammar is Strunk and White [1999]. The original text is now available for free online [Strunk 1918]. Another good free guide is McCaskill [1990].

Alley [2018] is a classic guide to scientific writing. Other good ones include W. C. Booth et al. [2016] and V. Booth [1993]. Zobel [2004] and Dupré [1998] are guides specifically aimed at computer science students. Phillips and Pugh [2005] gives practical advice for PhD students. In 2017, Google made its internal Documentation Style Guide public [Google 2019].

Sections 4.4 and 4.5 of this chapter are adapted from the ACM CHI'94 conference language and writing style guidelines.

4.1 Paragraphs

Sentences should be grouped into paragraphs by topic. A new paragraph introduces a (slight) variation in topic. Paragraphs should consist of *several* sentences. In general, short paragraphs of only one or two sentences should be merged topically with neighbouring paragraphs. In LaTeX, paragraphs are separated by a blank line. Random newlines (`\newline` or `\\`) should *never* be strewn throughout your text.

4.2 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).

  - 👎 You can do this in two ways.
  - 👍 There are two ways this can be done.

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

  Write in the passive voice (third person).

  - 👎 The user speaks his thoughts out loud.
  - 👍 The thoughts of the user are spoken out loud.

  See Section 4.5 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”.

  👎 It’s very simple to. . .
  👍 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”.

  👎 . . . in a tree, e.g. the items. . .
  👍 . . . in a tree, for example the items. . .
- Do *not* use slang such as “a lot of”.

  👎 There are a lot of features. . .
  👍 There are many features. . .
- Do *not* use slang such as “OK” or “big”.

  👎 . . . are represented by big areas.
  👍 . . . 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).

  👎 The radius gets increased. . .
  👍 The radius is increased. . .

  👎 The user gets disoriented. . .
  👍 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.

  👎 But there are numerous possibilities. . .
  👍 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.

  👎 Also the target users are considered.
  👍 The target users are also considered.
- Do *not* use “that” as a connecting word.

  Use “which”.

  👎 . . . a good solution that can be computed easily.
  👍 . . . 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.

4.3 English Usage

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

- “allows to” is not English.
  - 👎 The prototype allows to arrange components. . .
  - 👍 The prototype supports the arrangement of components. . .
  - 👎 The system allows to identify issues. . .
  - 👍 Issues can be identified by the system. . .
- “enables to” is not English.
  - 👎 it enables to recognise meanings. . .
  - 👍 it enables the recognition of meanings. . .
- “per default” is not English.

  Use “by default”.
  - 👎 Per default, the cursor is red.
  - 👍 By default, the cursor is red.
- “As opposed to” is not English.

  Use “In contrast to”.
  - 👎 As opposed to C, Java is object-oriented.
  - 👍 In contrast to C, Java is object-oriented.
- “actual” ≠ “current”

  If you mean “aktuell” in German, you probably mean “current” in English.
  - 👎 The actual selection is cancelled.
  - 👍 The current selection is cancelled.
- “sensible” ≠ “sensitive”

  If you mean “sensibel” in German, you probably mean “sensitive” in English.
  - 👎 Store sensible data securely.
  - 👍 Store sensitive data securely.
- “according” ≠ “corresponding”
  - 👎 For each browser, an according package is created.
  - 👍 For each browser, a corresponding package is created.
- “adopt” ≠ “adapt”

  To “adopt something” means “etwas übernehmen” in German. To “adapt something” means “etwas anpassen” in German.
  - 👎 This convention was adapted to show. . .
  - 👍 This convention was adopted to show. . .
  - 👎 The diagram was adopted by the author.
  - 👍 The diagram was adapted by the author.
- “amount” versus “number”

  Use “number” for countable things. Use “amount” for uncountable things.
  - 👎 The amount of students. . .
  - 👍 The number of students. . .
  - 👎 The number of time. . .
  - 👍 The amount of time. . .

- "many" versus "much"

  Use "many" for countable things. Use "much" for uncountable things.

  👎 Much students failed. . .
  👍 Many students failed. . .

  👎 Many time was spent. . .
  👍 Much time was spent. . .

- "fewer" versus "less"

  Use "fewer" for countable things. Use "less" for uncountable things.

  👎 Less participants succeeded. . .
  👍 Fewer participants succeeded. . .

  👎 Fewer sand was blown away. . .
  👍 Less sand was blown away. . .

- "*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.

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

  For example: low-level, high-level.

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

  👎 . . . display the object in realtime.
  👍 . . . display the object in real time.
  👎 . . . using realtime shadow casting.
  👍 . . . using real-time shadow casting.

4.4 Clear Writing

An academic paper written in English should use simple and clear language appropriate for an international audience. In particular:

- Write simple, straightforward sentences. Do not use long, convoluted sentences with many nested clauses, purely for the whim of it, because, as is sometimes the case, it may seem like a good idea at the time, even though it is not really.

- Use common and basic vocabulary. For example:
  - "unusual" instead of "arcane"

  - "specialised" instead of "erudite".
  - "guideline" instead of "rule of thumb".

- A technical term should be defined once at first usage. It should be placed in italics where it is defined, and in normal script whenever used thereafter:

  👍 A *graph* is a set of vertices and edges. A *vertex* (or node) is an individual item.
  An *edge* (or link) is a connection between two vertices.

  Any equivalent variant terms should be listed with the definition. The preferred term should then be used consistently throughout the text, rather than any of the variant terms. Otherwise, readers are left wondering whether the variant term refers to the same thing or is something different.

- For generic English text, rather than repeating the same word or phrase too often, look in a thesaurus (see Section 4.9) for an alternative word with the same meaning.

- Explain any acronyms the first time they are used, by writing out the full phrase followed by the acronym in parentheses.

  👎 When using SVG, the figure scales freely.
  👍 When using Scalable Vector Graphics (SVG), the figure scales freely.

- Avoid local references. International readers will probably not recognise the names of the provincial capitals of Austria, for example. If local context is necessary for understanding, then describe it fully.

- Avoid "insider" jargon. Do not assume knowledge of a particular context. For example, do not assume the reader is familiar with a particular operating system or application.

- Express culturally localised things such as times, dates, currencies, and numbers in an unambiguous form. For example, 9/11 is the 9th of November in much of the world. In English, a period "." is used as the decimal point character and a comma "," is used as the thousands separator (in German, it is the other way round).

- Do not use "word plays" or puns. Phrases such as "red herring", "taking the mickey", and "like watching paint dry" require cultural knowledge of English to understand.

- Be careful with humour. Irony and sarcasm are sometimes hard to detect for non-native speakers.

Part of writing usable documents is understanding and then addressing the characteristics of the intended audience.

4.5 Avoiding Gender Bias

Two issues should be considered with regard to avoiding gender bias: avoiding characterisations or stereotypes about men or women, and avoiding biases inherent in the English language. Here are some suggestions for handling the second issue:

- Refer to people generically using a gender-neutral term:

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

- Use gender-neutral terms for job titles or roles, where possible:

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

- When refering to the holder of a specific position and their gender is known, use the correct gender pronoun. For example, assuming the chairperson is known to be a man:
  - 👎 The chairperson announced her resignation.
  - 👍 The chairperson announced his resignation.
- Avoid using a gender pronoun by repeating the job title or role if possible:
  - 👎 Interview the user first and then ask him to fill out a questionnaire.
  - 👍 Interview the user first and then ask the user to fill out a questionnaire.
- Avoid using his or her by using the plural form:
  - 👎 Each student should bring his text to class.
  - 👍 All students should bring their texts to class.
- Replace his or her with the article (the):
  - 👎 Every student must hand his report in on Friday.
  - 👍 Every student must hand the report in on Friday.
- Avoid using his or her by rewriting in the passive voice:
  - 👎 Each department head should do his own projections.
  - 👍 Projections should be done by each department head.
- Avoid awkward formulations such as “s/he,” “he/she,” or “his/her.” As a last resort, use the less awkward “he or she,” or “his or hers.”

4.6 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). The first word in a heading or title is always capitalised.

4.6.1 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.
  - 👎 Saying it Directly
  - 👍 Saying It Directly
- Here, “is” is a verb, which should always be capitalised.
  - 👎 When is Enough Enough?
  - 👍 When Is Enough Enough?
- Here, “in” is being used as a preposition and should be lowercased.

- 👎 The Elephant In the Room.
- 👍 The Elephant in the Room.

- Here, “in” is being used as an adverb and should be capitalised.
  - 👎 Handing in Your Work.
  - 👍 Handing In Your Work.

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

4.6.2 Captions

The short version (the optional parameter in square brackets) of a caption for a figure, table, or listing appears in the List of Figures, List of Tables, or List of Listings. The short caption is used like a heading and should be capitalised like a heading. The long version of a caption for a figure, table, or listing should be written as full sentences: only the first word of each sentence and any proper names are capitalised and (each sentence in) the caption ends with a full stop.

4.6.3 Chapters, Sections, Figures and Tables

A specific, named or numbered entity, such as a particular chapter, appendix, section, figure, table, or listing is considered to be a proper name and thus *should be capitalised*. For example, Chapter 4, Section 4.5, Figure 6.2, Table 7.1, 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.

4.7 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.*

4.8 Use a Dictionary

If you are not quite sure of the meaning of a word, then use a dictionary. `dictionary.com` [Dictionary.com 2018a] is a free English dictionary, BEOLINGUS [TU Chemnitz 2018] and Leo [Leo 2018] are two very good English-German dictionaries.

4.9 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. `thesaurus.com` [Dictionary.com 2018b] and Collins English Thesaurus [Collins 2018] are free English thesauri.

Chapter 5

Giving a Presentation

Academic work is almost always presented in a talk or presentation at some point in time. Giving a good presentation requires a careful balance between spoken and visual material.

5.1 Types of Presentation

Gabrielle [2010] distinguishes between four kinds of presentation, depending on the size of the audience and the amount of interaction between speaker and members of the audience:

- *Ballroom presentations*.
  Presented to a large audience, often in a darkened room. The speaker does all the talking (often no questions are allowed at the end), uses compelling visuals, and aims to entertain as well as inform.
- *Briefing presentations*.
  Used in boardroom settings to perhaps one or two dozen people. The speaker does most of the talking, but some interaction is allowed.
- *Discussion presentations*.
  Used for smaller groups upto say 10 people. The speaker does most of the talking at first, but discussion is then opened up.
- *Reading presentations*.
  A slide deck read individually either on screen or paper. It must stand on its own, without spoken support.

5.2 Guidelines for Presentations

Doumont [Doumont 2002; Doumont 2005; Doumont 2009] established four rules for professional communication:

0. *Define your purpose*.
   Define the message to be conveyed.
1. *Adapt to your audience*.
   Optimise the communication to the target audience.
2. *Maximise the signal-to-noise ratio*.
   Reduce or eliminate any extraneous "noise" which might distract from the message. Suppress rather than add. Remove every unnecessary drop of ink.
3. *Use effective redundancy*.

Both the slide deck and spoken text should stand for themselves. Text and visuals should reinforce each other: state the main point of a slide in concise text, reinforced visually as far as possible.

The slides in a presentation should convey the main message, focusing not on providing every detail, but rather on the implications that follow from them. Alley [2013] is another good guide to creating and giving scientific presentations.

5.3 Guidelines for Effective Slides

5.3.1 Usability

For usable slides:

- Slide layout, font sizes, and image placement should be consistent.
- Fonts must be sufficiently large (readable at the back of the room).
- The slide number (4 of 23) should be included at the bottom right of each slide.
- In general, dark text on a light background is more readable, unless the room is completely dark.
  [In a ballroom setting in a darkened room, light text on a dark background can be effective.]

5.3.2 Minimise Distractions

Effective slides should not compete for attention with the speaker:

- Use at most two typefaces, at few different sizes.
- Use colour variations sparingly.
- Eliminate purely decorative graphics or clip art.
- Avoid flashy distracting backgrounds.

5.3.3 Slide Content

In terms of slide content:

- Carefully design slide headings.
- Do not write full sentences. Reduce the number of words by clever rephrasing not random truncation. Bullet items should occupy at most two lines of text.
- Where detailed tables, charts, or graphics would be helpful to convey the message, distribute them to audience members in the form of a handout.

5.3.4 Academic Criteria

For academic presentations, it is important to attribute textual quotations and to state both attribution and permission for any images used.

Instead of having one or more slides of references at the end of the presentation:

- If you include a result or quotation from somewhere else, state the source as a footnote at the bottom right of the slide. Link to the original, if possible.
- If you include an image or a diagram from somewhere else, state both the source and permission as a footnote at the bottom right of the slide. Link to the original, if possible.

Chapter 6

Technical Realisation

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

6.1 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.

6.1.1 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 6.1), 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` .

6.1.2 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 latest TeXLive [Rahtz 2016] 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.

6.1.3 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/`

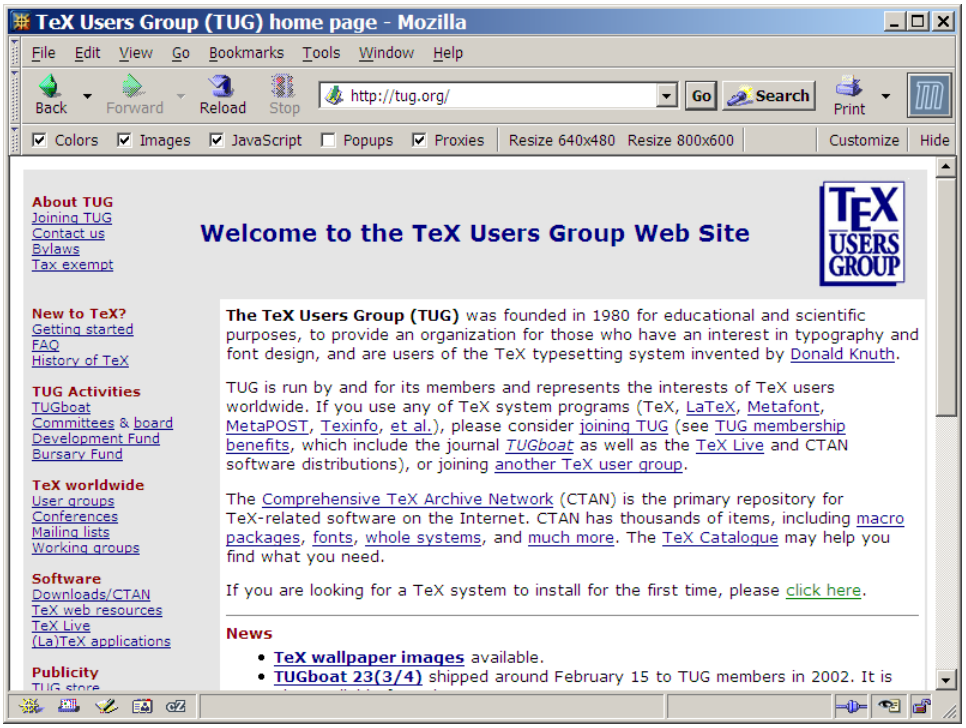

Figure 6.1: The web site of the TeX Users Group [TUG 2016]. [Screenshot taken by the author of this paper.]

6.1.4 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:

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

6.1.5 Spell Checking

GNU Aspell [Atkinson 2019] 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.

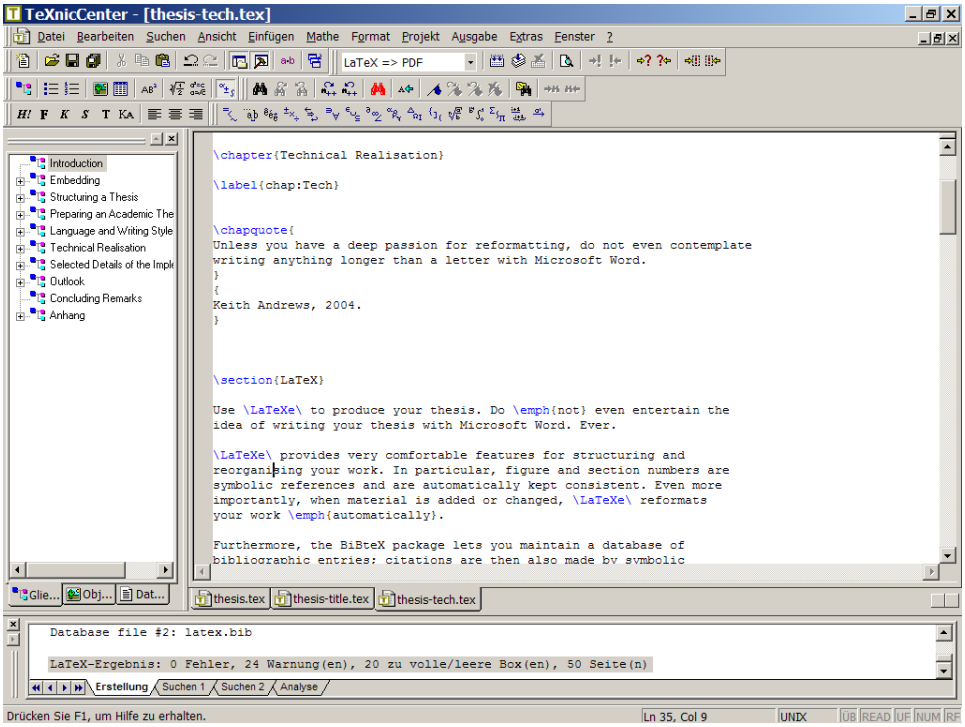

Figure 6.2: The TeXnicCenter [Wiegand and Weinkauf 2008] integrated development environment (IDE) for LaTeX 2_ε. [Screenshot taken by the author of this paper.]

6.1.6 Integrated Development Environments (IDEs) for LaTeX 2_ε

Under Windows you might want to use an integrated development environment (a fancy editor) for LaTeX 2_ε, which have built-in support for editing LaTeX 2_ε, spell checking, compiling, and so forth. The IDEs assume that you have a working LaTeX 2_ε installation, so install LaTeX 2_ε first. The best are Texmaker [Brachet 2012], TeXnicCenter [Wiegand and Weinkauf 2008] (shown in Figure 6.2), and LEd [Skorczynski and Deorowicz 2009], all of which are free. The shareware WinEdt [Simonic 2012] is also very good.

6.2 Including Images

Use the `graphicx` package to include images. For extra options, add the `adjustbox` package:

```
\usepackage{graphicx}
\usepackage[export]{adjustbox}    % valign=t, frame, ...
```

6.2.1 Screenshots

Screenshots are *raster* images composed of pixels. Screenshots should be made using software such as IrfanView or Gimp and always *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.

6.2.2 Diagrams and Charts

Diagrams and charts are most naturally expressed as *vector graphics*, composed of graphical objects such as lines, circles, polygons, and text strings. Vector graphics 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 and

charts in a raster format such as PNG, GIF, or JPEG means they cannot be resized without considerable loss of quality.

Diagrams can be drawn using a vector graphics editor, such as Adobe Illustrator [Adobe 2021b] or Inkscape [Inkscape 2021]. Make sure to archive (and hand-in) the respective source files (`.ai` or `.svg`).

Charts such as line charts and bar charts can be generated by various software packages such as R [RF 2021] and gnuplot [Williams and Kelley 2021], or online tools such as Tableau [Tableau 2021], Flourish [Flourish 2021], or Datawrapper [Datawrapper 2021]. If possible, always use a tool which can save or export the chart in a vector format, such as SVG or (vector) PDF. Many online tools, including those above, provide vector graphics export only in their pay-for plans.

For inclusion into LaTeX 2_ε, the diagram or chart needs to be in vector PDF format. If you have an SVG, you can convert it to vector PDF using Adobe Illustrator or Inkscape. With Inkscape installed, you can use the command line:

```
inkscape --export-type=pdf in.svg
```

or install the command-line tool CairoSVG [Kozea 2021]:

```
cairosvg in.svg -o out.pdf
```

Crop the diagram or chart fairly tightly. Do not leave excessive margins around the graphic itself, margins should be added by LaTeX 2_ε. Cropping can often be done in the original tool (Artboards in Illustrator). If you have a vector PDF, it can be cropped in Acrobat Pro (pay-for version) [Adobe 2021a] or with tools such as briss [laborg 2012].

6.3 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 $n = 4$). Create an in-place displayed listing with the `lstlisting` environment, but without using the `float` parameter.
- *Floating*: A floating listing is a block of code treated like other LaTeX 2_ε floats (such as figures or tables). Use floating listings for longer blocks of code. LaTeX 2_ε places the listing at some point later on. Create a floating listing with the `lstlisting` environment, but specify the `float` and `caption` parameters. A floating listing is given a number (like 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.

6.4 Biblatex and Biber

BibLaTeX [Lehman 2018] is a companion system to LaTeX 2_ε, which allows you to manage sets of references in plain text files (called `.bib` files) and cite references from within your LaTeX 2_ε documents. Biber [Charette and Kime 2018] 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 [Patashnik 1988].

Chapter 7

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

This chapter contains some examples of typical LaTeX 2ε usage.

7.1 Including Screenshots

This example shows how to include a screenshot (or other raster graphic) into a LaTeX 2ε figure. Figure 7.1 shows a VRML model of a cavalry pistol from the Armoury in Graz displayed in the VRwave VRML browser. Every table, figure, and listing should be refered to from the running text.

The caption shows an example of how to correctly cite the source when using an image from someone else. In their 1998 paper, Andrews et al. [1998] discuss the VRwave VRML browser.

7.2 Using Subfigures

The example in Figure 7.2 shows how to use subfigures within a figure with the `subfig` package. The figure is an illustration of how a responsive table looks different at different screen widths. Figure 7.2a shows the table on a narrow screen, while Figure 7.2b shows the table on a wider screen.

The source code shows usage of the `includegraphics` options `frame` to draw a frame around the graphics and `valign=t` to top align them, which are both provided by the `adjustbox` package. For this figure, it is important to ensure that both images are scaled equally, hence the use of `scale`. The exact scale factor was determined by trial and error.

7.3 Including Vector Graphics

Charts and diagrams are often naturally vector graphics, created by assembling and arranging graphical objects such as lines, boxes, circles, polygons, and text strings. They can usually be exported or saved in SVG and then converted to (vector) PDF format, or saved directly as (vector) PDF. Vector graphics have the huge benefit that they are freely scalable: they remain crisp and sharp even when zoomed in. Vector graphics are included in LaTeX as (vector) PDF files, as shown in Figure 7.3. Try zooming in to the figure in Acrobat Reader.

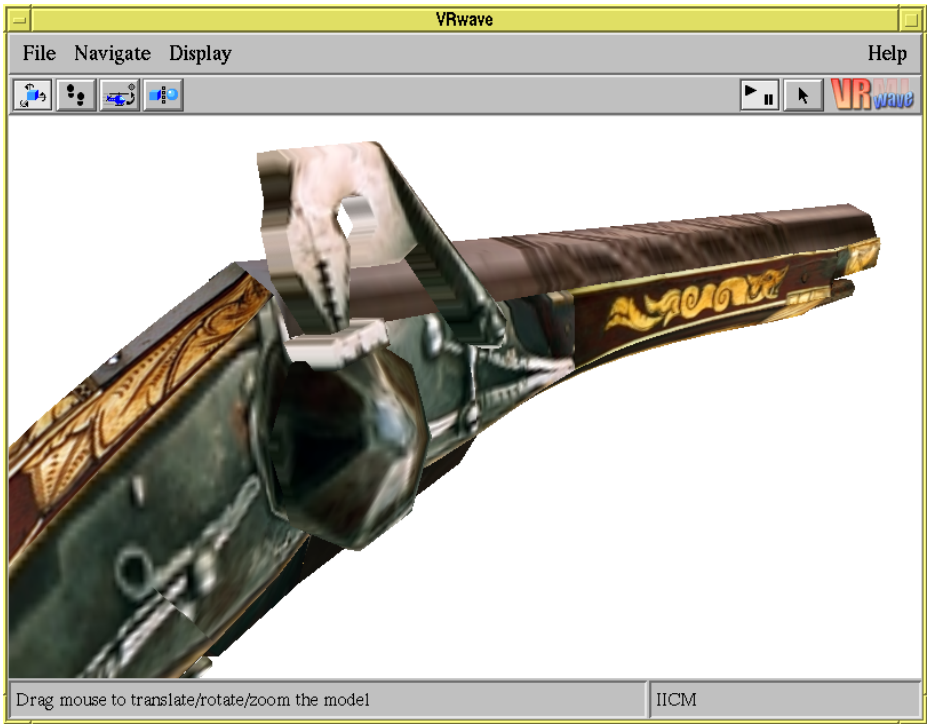

Figure 7.1: VRwave in Flip mode displaying a textured model of a cavalry pistol from the world-renowned Zeughaus (armoury) in Graz. [Image extracted from Andrews et al. [1998, page 81] and used under the terms of the ACM Copyright Policy. Copyright © by the Association for Computing Machinery, Inc.]

Responsive Tables

Statement Summary

Account	Visa - 3412
Due Date	04/01/2016
Amount	$1,190
Period	03/01/2016 - 03/31/2016
Account	Visa - 6076
Due Date	03/01/2016
Amount	$2,443
Period	02/01/2016 - 02/29/2016
Account	Corporate AMEX
Due Date	03/01/2016
Amount	$1,181
Period	02/01/2016 - 02/29/2016
Acount	Visa - 3412
Due Date	02/01/2016
Amount	$842
Period	01/01/2016 - 01/31/2016

(a) Narrow screen.

Responsive Tables

Statement Summary

Account	Due Date	Amount	Period
Visa - 3412	04/01/2016	$1,190	03/01/2016 - 03/31/2016
Visa - 6076	03/01/2016	$2,443	02/01/2016 - 02/29/2016
Corporate AMEX	03/01/2016	$1,181	02/01/2016 - 02/29/2016
Visa - 3412	02/01/2016	$842	01/01/2016 - 01/31/2016

(b) Wide screen.

Figure 7.2: A responsive table adapts itself to the available display space. On a narrow screen, each row of the table is expanded vertically. [Both images created by Keith Andrews.]

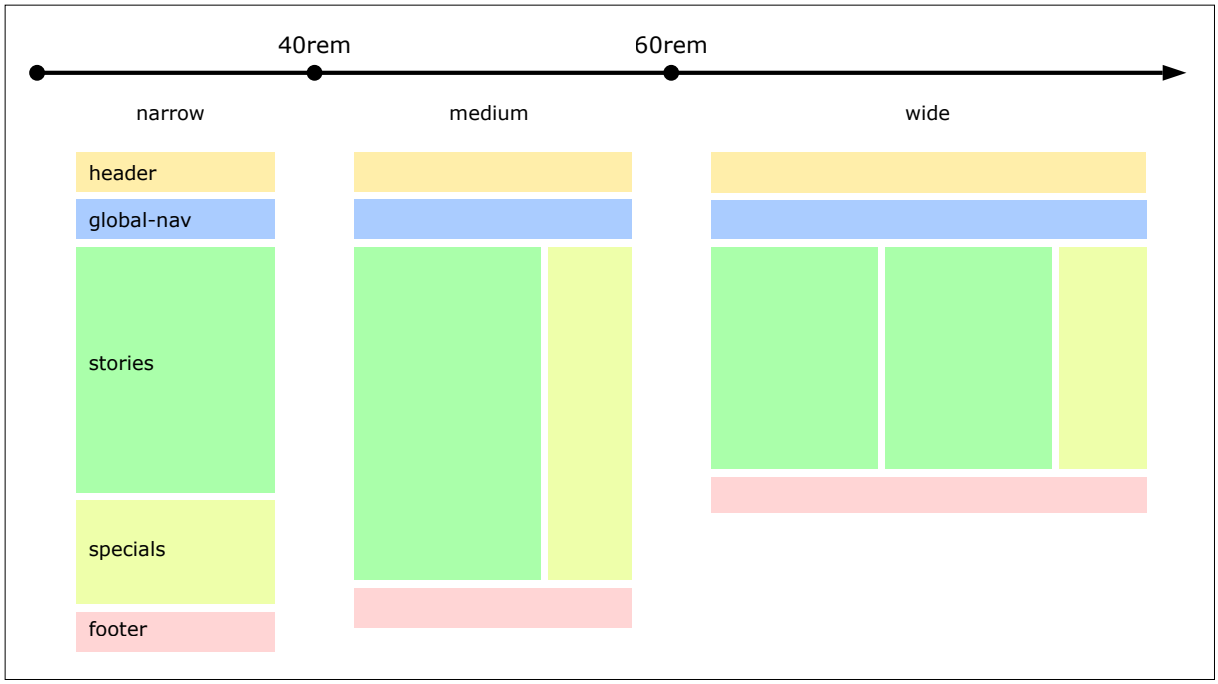

Figure 7.3: A responsive breakpoint diagram. Setting breakpoints at 40 rem and 60 rem provides for three different layouts: narrow, medium, and wide. The layout scales smoothly between breakpoints and changes at a breakpoint. [Drawn by Keith Andrews.]

7.4 Using Tables

An example of using a table can be seen in Table 7.1.

7.5 Using Special Characters and Symbols

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 (Ⓐ).

7.6 Using Macros to Style Special Names

Sometimes, a macro (new command definition) can be useful to style special names or phrases consistently. For example, if you are often refering to named components of a user interface, such as the Toolbar or Status Panel, then define a macro `uiname`, so that all such components can be styled consitently:

```
\newrobustcmd{\uiname}[1]{{\smaller\textsf{#1}}}
```

Macros like `vname`, `cname`, and `fname` can be used to style (say) variable names, class names, and file names. This is a long file name `/usr/data/keith/travel/austria/vienna.txt`. This is a typical class name in camel case HVSInformationPyramidsInputFactory.

7.7 Using Floating Listings

Listing 7.1 is floating. A floating listing is a block of code treated like other LaTeX 2_ε floats (such as figures or tables). Use floating listings for longer blocks of code. A floating listing is given a number and

Name	Type	Rating	Description
Flann O'Brien	Irish / International	*****	In the centre of town, easy for marauding tourists to find. Good food, smooth Guinness.
Dublin Road	Irish	*****	In the old town, best Guinness in Graz. Regular live music. Irish session every Wednesday.
O'Carolan's	Irish	****	In the centre of town in a small side street next to Flann's. Small, cosy, open late.
Two Brothers	Irish / English	****	Hidden in the narrow streets of the old town. Erasmus student night on Wednesday.
O'Sullivan's	Irish / Austrian	****	Cosy, friendly place, many regulars.
O'Riginal	Austrian	**	Near to Jakominiplatz. Small place with Guinness. Regular live music.

Table 7.1: Some pubs in Graz.

can be referred to explicitly, like Listing 7.1. It can be given a caption and short caption, and is listed in the List of Listings.

7.8 Using Non-Floating Diplayed Listings

The listing below shows some CSS:

```
body { color: black; background-color: silver; }
img { border: none; }
h1,h2 { font-family: Verdana, sans-serif; }
```

It is displayed (i.e. indented as a block) in-place, but is not floating. It cannot be referred to by number and is not listed in the List of Listings. As a rule of thumb, if listings have five or more lines, make them floating.

7.9 Using Inline Listings

Inline listings are used for very short snippets of code embedded within the flow of a paragraph. For example, `\lstinline!var i:integer;!` produces `var i:integer;`, which can now be discussed further. Do not break an inline listing over multiple lines (EOL).

7.10 Using Lists

A list should always be introduced by a sentence which ends with a colon. There are three kinds of standard lists in LaTeX 2ε:

- itemize
- enumerate
- description

An enumerated list has numbered items:

1. Fast
2. Good

```
<!DOCTYPE html>
<html xmlns="http://www.w3.org/1999/xhtml" lang="en" xml:lang="en">

<head>
<meta charset="UTF-8"/>
<meta name="viewport" content="width=device-width, initial-scale=1"/>
<link rel="stylesheet" href="./inm.css"/>

<title>Keith Andrews Web Page</title>
</head>

<body>

<header>
<img src="images/kalogo.svg" alt="KA Logo"/>
Keith Andrews Design
</header>

<h1>Keith Andrews</h1>

<p>
Keith lives in <a href="http://graz.at/">Graz</a>.
</p>

<p>
<img src="images/keith-s.jpg"
  alt="Photo of Keith Andrews"/>
</p>

<p>
Three desirable attributes:
</p>
<ol>
<li>cheap</li>
<li>fast</li>
<li>good</li>
</ol>
<p>
Choose any two.
</p>

<p>
<abbr title="Extensible HyperText Markup Language">XHTML</abbr>
is cool.
</p>

<table>
<tbody>
<tr><th>Beer</th><th>Price €</th></tr>
<tr><td>Puntigamer</td><td>2,60</td></tr>
<tr><td>Gösser</td><td>2,60</td></tr>
<tr><td>Guinness</td><td>4,35</td></tr>
</tbody>
</table>

<footer>
Copyright © Keith Andrews 2019.
</footer>

</body>
</html>
```

Listing 7.1: Some HTML5 boilerplate code, illustrating the typical structure of a HTML5 web page.

3. Cheap

Choose any two!

A description list has named items with corresponding definitions or descriptions:

Short Each item has a label (name) and its description.

Rather longer label By default, if the description text is rather long, it will warp around to the following lines.

Chapter 8

Concluding Remarks

At the end of your survey, give a clear recommendation as to which approach or tool to use in which situation.

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