

THE PUBLIC IS MORE FAMILIAR WITH BAD DESIGN THAN GOOD DESIGN. IT IS, IN EFFECT, CONDITIONED TO PREFER BAD DESIGN, BECAUSE THAT IS WHAT IT LIVES WITH. THE NEW BECOMES THREATENING, THE OLD REASSURING.

PAUL RAND

A DESIGNER KNOWS THAT HE HAS ACHIEVED PERFECTION NOT WHEN THERE IS NOTHING LEFT TO ADD, BUT WHEN THERE IS NOTHING LEFT TO TAKE AWAY.

ANTOINE DE SAINT-EXPURÉY

...THE DESIGNER OF A NEW SYSTEM MUST NOT ONLY BE THE IMPLEMENTOR AND THE FIRST LARGE-SCALE USER; THE DESIGNER SHOULD ALSO WRITE THE FIRST USER MANUAL... IF I HAD NOT PARTICIPATED FULLY IN ALL THESE ACTIVITIES, LITERALLY HUNDREDS OF IMPROVEMENTS WOULD NEVER HAVE BEEN MADE, BECAUSE I WOULD NEVER HAVE THOUGHT OF THEM OR PERCEIVED WHY THEY WERE IMPORTANT.

DONALD E. KNUTH

THE TUFTE-LATEX DEVELOPERS

A TUFTE-STYLE BOOK

PUBLISHER OF THIS BOOK

Copyright © 2009 The Tufte-LaTeX Developers

PUBLISHED BY PUBLISHER OF THIS BOOK

TUFTE-LATEX.GOOGLECODE.COM

Licensed under the Apache License, Version 2.0 (the “License”); you may not use this file except in compliance with the License. You may obtain a copy of the License at <http://www.apache.org/licenses/LICENSE-2.0>. Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an “AS IS” BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

First printing, June 2009

Contents

The Design of Tufte's Books 11

On the Use of the tufte-book Document Class 17

Bibliography 23

Index 25

*Dedicated to those who appreciate \LaTeX
and the work of Edward R. Tufte and Donald E. Knuth.*

Introduction

This sample book discusses the design of Edward Tufte's books¹ and the use of the `tufte-book` and `sample-handout` document classes.

¹ Edward R. Tufte. *The Visual Display of Quantitative Information*. Graphics Press, Cheshire, Connecticut, 2001. ISBN 0-9613921-4-2; Edward R. Tufte. *Envisioning Information*. Graphics Press, Cheshire, Connecticut, 1990. ISBN 0-9613921-1-8; Edward R. Tufte. *Visual Explanations*. Graphics Press, Cheshire, Connecticut, 1997. ISBN 0-9613921-2-6; and Edward R. Tufte. *Beautiful Evidence*. Graphics Press, LLC, first edition, May 2006. ISBN 0-9613921-7-7

The Design of Tufte’s Books

THE PAGES of a book are usually divided into three major sections: the front matter (also called preliminary matter or prelim), the main matter (the core text of the book), and the back matter (or end matter).

THE FRONT MATTER of a book refers to all of the material that comes before the main text. The following table from shows a list of material that appears in the front matter of *The Visual Display of Quantitative Information*, *Envisioning Information*, *Visual Explanations*, and *Beautiful Evidence* along with its page number. Page numbers that appear in parentheses refer to folios that do not have a printed page number (but they are still counted in the page number sequence).

Page content	Books			
	VDQI	EI	VE	BE
Blank half title page	(1)	(1)	(1)	(1)
Frontispiece ²	(2)	(2)	(2)	(2)
Full title page	(3)	(3)	(3)	(3)
Copyright page	(4)	(4)	(4)	(4)
Contents	(5)	(5)	(5)	(5)
Dedication	(6)	(7)	(7)	7
Epigraph	–	–	(8)	–
Introduction	(7)	(9)	(9)	9

² The contents of this page vary from book to book. In *VDQI* this page is blank; in *EI* and *VE* this page holds a frontispiece; and in *BE* this page contains three epigraphs.

The design of the front matter in Tufte’s books varies slightly from the traditional design of front matter. First, the pages in front matter are traditionally numbered with lowercase roman numerals (*e.g.*, i, ii, iii, iv, . . .). Second, the front matter page numbering sequence is usually separate from the main matter page numbering. That is, the page numbers restart at 1 when the main matter begins. In contrast, Tufte has enumerated his pages with arabic numerals that share the same page counting sequence as the main matter.

There are also some variations in design across Tufte's four books. The page opposite the full title page (labeled "frontispiece" in the above table) has different content in each of the books. In *The Visual Display of Quantitative Information*, this page is blank; in *Envisioning Information* and *Visual Explanations*, this page holds a frontispiece; and in *Beautiful Evidence*, this page contains three epigraphs.

The dedication appears on page 6 in *VDQI* (opposite the introduction), and is placed on its own spread in the other books. In *VE*, an epigraph shares the spread with the opening page of the introduction.

None of the page numbers (folios) of the front matter are expressed except in *BE*, where the folios start to appear on the dedication page.

THE FULL TITLE PAGE of each of the books varies slightly in design. In all the books, the author's name appears at the top of the page, the title is set just above the center line, and the publisher is printed along the bottom margin. Some of the differences are outlined in the following table.

Feature	<i>VDQI</i>	<i>EI</i>	<i>VE</i>	<i>BE</i>
Author				
Typeface	serif	serif	serif	sans serif
Style	italics	italics	italics	upright, caps
Size	24 pt	20 pt	20 pt	20 pt
Title				
Typeface	serif	serif	serif	sans serif
Style	upright	italics	upright	upright, caps
Size	36 pt	48 pt	48 pt	36 pt
Subtitle				
Typeface	—	—	serif	—
Style	—	—	upright	—
Size	—	—	20 pt	—
Edition				
Typeface	sans serif	—	—	—
Style	upright, caps	—	—	—
Size	14 pt	—	—	—
Publisher				
Typeface	serif	serif	serif	sans serif
Style	italics	italics	italics	upright, caps
Size	14 pt	14 pt	14 pt	14 pt

THE TABLES OF CONTENTS in Tufte's books give us our first glimpse of the structure of the main matter. *The Visual Display of Quantitative Information* is split into two parts, each containing some number of chapters. His other three books only contain chapters—they're not broken into parts.

Edward R. Tufte

The Visual Display of Quantitative Information

SECOND EDITION

Graphics Press · Cheshire, Connecticut

Edward R. Tufte

Envisioning Information

Graphics Press · Cheshire, Connecticut

Edward R. Tufte

Visual Explanations

Images and Quantities, Evidence and Narrative

Graphics Press · Cheshire, Connecticut

EDWARD R. TUFTE

BEAUTIFUL EVIDENCE

GRAPHICS PRESS LLC

Contents

PART I GRAPHICAL PRACTICE

1	Graphical Excellence	13
2	Graphical Integrity	53
3	Sources of Graphical Integrity and Sophistication	79

PART II THEORY OF DATA GRAPHICS

4	Data-Ink and Graphical Redesign	91
5	Chartjunk: Vibrations, Grids, and Dunks	107
6	Data-Ink Maximization and Graphical Design	123
7	Multifunctioning Graphical Elements	139
8	Data Density and Small Multiples	166
9	Aesthetics and Technique in Data Graphical Design	177
	Epilogue: Designs for the Display of Information	191

Contents

ESCAPING FLATLAND	12
MICRO/MACRO READINGS	37
LAYERING AND SEPARATION	53
SMALL MULTIPLES	67
COLOR AND INFORMATION	81
NARRATIVES OF SPACE AND TIME	97
EPILOGUE	121

Contents

Images and Quantities	13
Visual and Statistical Thinking: Displays of Evidence for Making Decisions	27
Explaining Magic: Pictorial Instructions and Disinformation Design	55
The Smallest Effective Difference	73
Parallelism: Repetition and Change, Comparison and Surprise	79
Multiples of Space and Time	105
Visual Confections: Juxtapositions from the Ocean of the Streams of Story	121

Contents

Mapped Pictures: Images as Evidence and Explanation	12
Sparklines: Intense, Simple, Word-Sized Graphics	46
Links and Causal Arrows: Ambiguity in Action	64
Words, Numbers, Images — Together	82
The Fundamental Principles of Analytical Design	122
Corruption in Evidence Presentations: Effects Without Causes, Cherry Picking, Overreaching, Chartjunk, and the Rage to Conclude	140
The Cognitive Style of PowerPoint: Pitching Out Corrupts Within	156
Sculptural Pedestals: Meaning, Practice, Depedestalization	186
Landscape Sculptures	196

Typefaces

Tufte’s books primarily use two typefaces: Bembo and Gill Sans. Bembo is used for the headings and body text, while Gill Sans is used for the title page and opening epigraphs in *Beautiful Evidence*. Since neither Bembo nor Gill Sans are available in default L^AT_EX installations, the Tufte-L^AT_EX document classes default to using Palatino and Helvetica, respectively. In addition, the Bera Mono typeface is used for monospaced type. The following font sizes are defined by the Tufte-L^AT_EX classes:

L ^A T _E X size	Font size	Leading	Used for
\tiny	5	6	sidenote numbers
\scriptsize	7	8	—
\footnotesize	8	10	sidenotes, captions
\small	9	12	quote, quotation, and verse environments
\normalsize	10	14	body text
\large	11	15	B-heads
\Large	12	16	A-heads, TOC entries, author, date
\LARGE	14	18	handout title
\huge	20	30	chapter heads
\Huge	24	36	part titles

Table 1: A list of L^AT_EX font sizes as defined by the Tufte-L^AT_EX document classes.

Headings

Tufte’s books include the following heading levels: parts, chapters,³ sections, subsections, and paragraphs. Not defined by default are: sub-subsections and subparagraphs.

³ Parts and chapters are defined for the tuftebook class only.

Heading	Style	Size
Part	roman	24/36×40 pc
Chapter	italic	20/30×40 pc
Section	italic	12/16×26 pc
Subsection	italic	11/15×26 pc
Paragraph	italic	10/14

Table 2: Heading styles used in *Beautiful Evidence*.

Paragraph Paragraph headings (as shown here) are introduced by italicized text and separated from the main paragraph by a bit of space.

Environments

The following characteristics define the various environments:

Environment	Font size	Notes
Body text	10/14×26 pc	
Block quote	9/12×24 pc	Block indent (left and right) by 1 pc
Sidenotes	8/10×12 pc	Sidenote number is set inline, followed by word space
Captions	8/10×12 pc	

Table 3: Environment styles used in *Beautiful Evidence*.

On the Use of the tufte-book Document Class

The Tufte- \LaTeX document classes define a style similar to the style Edward Tufte uses in his books and handouts. Tufte’s style is known for its extensive use of sidenotes, tight integration of graphics with text, and well-set typography. This document aims to be at once a demonstration of the features of the Tufte- \LaTeX document classes and a style guide to their use.

Page Layout

Headings

This style provides A- and B-heads (that is, `\section` and `\subsection`), demonstrated above.

If you need more than two levels of section headings, you’ll have to define them yourself at the moment; there are no pre-defined styles for anything below a `\subsection`. As Bringhurst points out in *The Elements of Typographic Style*,⁴ you should “use as many levels of headings as you need: no more, and no fewer.”

The Tufte- \LaTeX classes will emit an error if you try to use `\subsubsection` and smaller headings.

IN HIS LATER BOOKS,⁵ Tufte starts each section with a bit of vertical space, a non-indented paragraph, and sets the first few words of the sentence in SMALL CAPS. To accomplish this using this style, use the `\newthought` command:

```
\newthought{In his later books}, Tufte starts...
```

Sidenotes

One of the most prominent and distinctive features of this style is the extensive use of sidenotes. There is a wide margin to provide ample room for sidenotes and small figures. Any `\footnotes` will automatically be converted to sidenotes.⁶ If you’d like to place ancillary

⁴ Robert Bringhurst. *The Elements of Typography*. Hartley & Marks, 3.1 edition, 2005. ISBN 0-88179-205-5

⁵ Edward R. Tufte. *Beautiful Evidence*. Graphics Press, LLC, first edition, May 2006. ISBN 0-9613921-7-7

⁶ This is a sidenote that was entered using the `\footnote` command.

information in the margin without the sidenote mark (the superscript number), you can use the `\marginnote` command.

The specification of the `\sidenote` command is:

```
\sidenote[⟨number⟩][⟨offset⟩]{Sidenote text.}
```

Both the `⟨number⟩` and `⟨offset⟩` arguments are optional. If you provide a `⟨number⟩` argument, then that number will be used as the sidenote number. It will change of the number of the current sidenote only and will not affect the numbering sequence of subsequent sidenotes.

Sometimes a sidenote may run over the top of other text or graphics in the margin space. If this happens, you can adjust the vertical position of the sidenote by providing a dimension in the `⟨offset⟩` argument. Some examples of valid dimensions are:

```
1.0in    2.54cm    254mm    6\baselineskip
```

If the dimension is positive it will push the sidenote down the page; if the dimension is negative, it will move the sidenote up the page.

While both the `⟨number⟩` and `⟨offset⟩` arguments are optional, they must be provided in order. To adjust the vertical position of the sidenote while leaving the sidenote number alone, use the following syntax:

```
\sidenote[][⟨offset⟩]{Sidenote text.}
```

The empty brackets tell the `\sidenote` command to use the default sidenote number.

If you *only* want to change the sidenote number, however, you may completely omit the `⟨offset⟩` argument:

```
\sidenote[⟨number⟩]{Sidenote text.}
```

The `\marginnote` command has a similar *offset* argument:

```
\marginnote[⟨offset⟩]{Margin note text.}
```

References

References are placed alongside their citations as sidenotes, as well.

This can be accomplished using the normal `\cite` command.⁷

The complete list of references may also be printed automatically by using the `\bibliography` command. (See the end of this document for an example.) If you do not want to print a bibliography at the end of your document, use the `\nobibliography` command in its place.

To enter multiple citations at one location,⁸ you can provide a list of keys separated by commas and the same optional vertical offset argument: `\cite[⟨offset⟩]{Tufte2006,Tufte1990}`.

```
\cite[⟨offset⟩]{bibkey1,bibkey2,...}
```

This is a margin note. Notice that there isn't a number preceding the note, and there is no number in the main text where this note was written.

⁷ The first paragraph of this document includes a citation.

⁸ Edward R. Tufte. *Beautiful Evidence*. Graphics Press, LLC, first edition, May 2006. ISBN 0-9613921-7-7; and Edward R. Tufte. *Envisioning Information*. Graphics Press, Cheshire, Connecticut, 1990. ISBN 0-9613921-1-8

Figures and Tables

Images and graphics play an integral role in Tufte’s work. In addition to the standard `figure` and `tabular` environments, this style provides special figure and table environments for full-width floats.

Full page-width figures and tables may be placed in `figure*` or `table*` environments. To place figures or tables in the margin, use the `marginfigure` or `marginfigure` environments as follows (see figure 1):

```
\begin{marginfigure}
  \includegraphics{helix}
  \caption{This is a margin figure.}
  \label{fig:marginfig}
\end{marginfigure}
```

The `marginfigure` and `marginfigure` environments accept an optional parameter `<offset>` that adjusts the vertical position of the figure or table. See the “Sidenotes” section above for examples. The specifications are:

```
\begin{marginfigure}[<offset>]
  ...
\end{marginfigure}

\begin{marginfigure}[<offset>]
  ...
\end{marginfigure}
```

Figure 2 is an example of the `figure*` environment and figure 3 is an example of the normal `figure` environment.

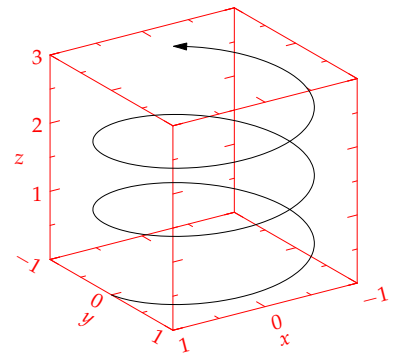


Figure 1: This is a margin figure. The helix is defined by $x = \cos(2\pi z)$, $y = \sin(2\pi z)$, and $z = [0, 2.7]$. The figure was drawn using Asymptote (<http://asymptote.sf.net/>).

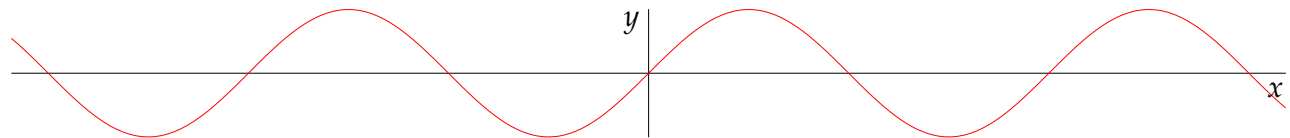


Figure 2: This graph shows $y = \sin x$ from about $x = [-10, 10]$. Notice that this figure takes up the full page width. Figure 3: Hilbert curves of various degrees n . Notice that this figure only takes up the main textblock width.

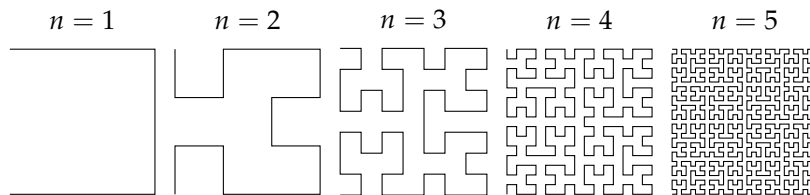


Table 4 shows table created with the `booktabs` package. Notice the lack of vertical rules—they serve only to clutter the table’s data.

Margin	Length
Paper width	8 1/2 inches
Paper height	11 inches
Textblock width	6 1/2 inches
Textblock/sidenote gutter	3/8 inches
Sidenote width	2 inches

Table 4: Here are the dimensions of the various margins used in the Tufte-handout class.

Full-width text blocks

In addition to the new float types, there is a `fullwidth` environment that stretches across the main text block and the sidenotes area.

```
\begin{fullwidth}
Lorem ipsum dolor sit amet...
\end{fullwidth}
```

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Typography

Typefaces

If the Palatino, Helvetica, and Bera Mono typefaces are installed, this style will use them automatically. Otherwise, we'll fall back on the Computer Modern typefaces.

Letterspacing

This document class includes two new commands and some improvements on existing commands for letterspacing.

When setting strings of ALL CAPS or SMALL CAPS, the letterspacing—that is, the spacing between the letters—should be increased slightly.⁹ The `\allcaps` command has proper letterspacing for strings of FULL CAPITAL LETTERS, and the `\smallcaps` command has letterspacing for SMALL CAPITAL LETTERS. These commands will also automatically convert the case of the text to upper- or lowercase, respectively.

The `\textsc` command has also been redefined to include letterspacing. The case of the `\textsc` argument is left as is, however. This allows one to use both uppercase and lowercase letters: THE

⁹ Robert Bringhurst. *The Elements of Typography*. Hartley & Marks, 3.1 edition, 2005. ISBN 0-88179-205-5

INITIAL LETTERS OF THE WORDS IN THIS SENTENCE ARE CAPITALIZED.

Document Class Options

The tufte-book class is based on the L^AT_EX book document class. Therefore, you can pass any of the typical book options. There are a few options that are specific to the tufte-book document class, however.

The **a4paper** option will set the paper size to A4 instead of the default us letter size.

The **sfsidenotes** option will set the sidenotes and title block in a sans serif typeface instead of the default roman.

The **twoside** option will modify the running heads so that the page number is printed on the outside edge (as opposed to always printing the page number on the right-side edge in **oneside** mode).

The **symmetric** option typesets the sidenotes on the outside edge of the page. This is how books are traditionally printed, but is contrary to Tufte's book design which sets the sidenotes on the right side of the page. This option implicitly sets the twoside option.

The **justified** option sets all the text fully justified (flush left and right). The default is to set the text ragged right. The body text of Tufte's books are set ragged right. This prevents needless hyphenation and makes it easier to read the text in the slightly narrower column.

The **bidirectional** option loads the bidi package which is used with X_YL^AT_EX to typeset bi-directional text. Since the bidi package needs to be loaded before the sidenotes and cite commands are defined, it can't be loaded in the document preamble.

The **debug** option causes the Tufte-L^AT_EX classes to output debug information to the log file which is useful in troubleshooting bugs. It will also cause the graphics to be replaced by outlines.

The **nofonts** option prevents the Tufte-L^AT_EX classes from automatically loading the Palatino and Helvetica typefaces. You should use this option if you wish to load your own fonts. If you're using X_YL^AT_EX, this option is implied (*i.e.*, the Palatino and Helvetica fonts aren't loaded if you use X_YL^AT_EX).

The **noletterspacing** option inhibits the letterspacing code. The Tufte-L^AT_EX classes try to load the appropriate letterspacing package (either pdf_TE_X's letterspace package or the soul package). If you're using X_YL^AT_EX with fontenc, however, you should configure your own letterspacing.

The **notitlepage** option causes \maketitle to generate a title block instead of a title page. The book class defaults to a title page

and the `handout` class defaults to the title block. There is an analogous `titlepage` option that forces `\maketitle` to generate a full title page instead of the title block.

The `notoc` option suppresses Tufte- \LaTeX 's custom table of contents (TOC) design. The current TOC design only shows unnumbered chapter titles; it doesn't show sections or subsections. The `notoc` option will revert to \LaTeX 's TOC design.

The `nohyper` option prevents the `hyperref` package from being loaded. The default is to load the `hyperref` package and use the `\title` and `\author` contents as metadata for the generated PDF.

Bibliography

- [1] Robert Bringhurst. *The Elements of Typography*. Hartley & Marks, 3.1 edition, 2005. ISBN 0-88179-205-5.
- [2] Edward R. Tufte. *Envisioning Information*. Graphics Press, Cheshire, Connecticut, 1990. ISBN 0-9613921-1-8.
- [3] Edward R. Tufte. *Visual Explanations*. Graphics Press, Cheshire, Connecticut, 1997. ISBN 0-9613921-2-6.
- [4] Edward R. Tufte. *The Visual Display of Quantitative Information*. Graphics Press, Cheshire, Connecticut, 2001. ISBN 0-9613921-4-2.
- [5] Edward R. Tufte. *Beautiful Evidence*. Graphics Press, LLC, first edition, May 2006. ISBN 0-9613921-7-7.

Index

- a4paper class option, 21
- \allcaps, 20
- \author, 22
- \bibliography, 18
 - bidi class option, 21
 - booktabs package, 19
- \cite, 18
 - class options, 21, 22
 - a4paper, 21
 - bidi, 21
 - debug, 21
 - justified, 21
 - nofonts, 21
 - nohyper, 22
 - nols, 21
 - notitlepage, 21
 - notoc, 22
 - oneside, 21
 - sfsidenotes, 21
 - symmetric, 21
 - titlepage, 22
 - twoside, 21
- debug class option, 21
- environments
 - figure, 19
 - figure*, 19
 - fullwidth, 20
 - marginfigure, 19
 - marginfigure, 19
 - table*, 19
 - tabular, 19
- figure environment, 19
- figure* environment, 19
- fontenc package, 21
- fonts, *see* typefaces
- \footnote, 17
- fullwidth environment, 20
- headings, 15, 17
- hyperref package, 22
- justified class option, 21
- letterspace package, 21
- license, 4
- marginfigure environment, 19
- \marginnote, 18
- marginfigure environment, 19
- \newthought, 17
- \nobibliography, 18
- nofonts class option, 21
- nohyper class option, 22
- nols class option, 21
- notitlepage class option, 21
- notoc class option, 22
- oneside class option, 21
- packages
 - bidi, 21
 - booktabs, 19
 - fontenc, 21
 - hyperref, 22
 - letterspace, 21
 - soul, 21
- sfsidenotes class option, 21
- \sidenote, 18
- \smallcaps, 20
- soul package, 21
- symmetric class option, 21
- table of contents, 14
- table* environment, 19
- tabular environment, 19
- \textsc, 20
- \title, 22
- titlepage class option, 22
- twoside class option, 21
- typefaces, 15, 20
 - sizes, 15
- X_gLaTeX, 21