# PRINTING TUFTE WITH CSS

*Håkon Wium Lie*

# Printing Tufte with CSS

*princexml.com*

This book contains excerpts from "A Tufte-style Book", Copyright © 2015 The Tufte-LaTeX Developers

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.

# *Contents*

1 Codex 13

2 The code 17

3 Maps 21

4 The Design of Tufte's Books 25

5 The wave 31

*for Edward R. Tufte, and his statues*

*for Walter Bender, and his green machine,*

*for the Prince programmers*

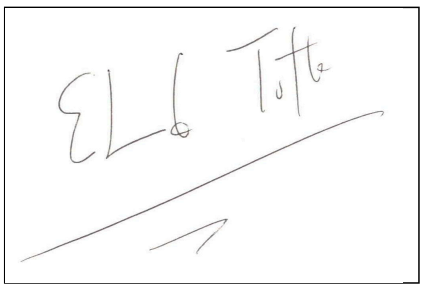
# *Introduction*



In 1990, I was a graduate student at the MIT Media Lab, a wonderful playground for programmers, designers, and artists. Most of our work was shown on computer screens. Myself, I spent two years working on a giant cathode-ray tube with a 2k resolution, capable of showing a broadsheet newspaper page.

There were regular talks by invited luminaries. One of them was Edward Tufte. He was invited by my advisor, Walter Bender, who thought highly of him. Tufte's talk was fascinating and the pictures he showed were beautiful.

After the talk, I first confirmed that his last name is, indeed, of Norwegian origin. Then I purchased two of his books. One was "The Visual Display of Quantitive Information", the other was the newly issued "Envisioning Information". Opening these books is a revelation. Beautiful typography, printed on thick paper, bound by a hard cover. Richly illustrated, with a slew of figures and sidenotes.



Edward Tufte's signature in this author's copy of *Envisioning information*. The book was signed after Tufte's talk at MIT in 1990.

When I later started developing Cascading Style Sheets (CSS), computer screens were the main target. But, even from the very first proposal, being able support printed books was a goal. CSS1 did not have the capabilities to create a Tufte-like book, nor did CSS2. But inch by inch, column by column, page by page, CSS has grown up and this document will show how you can start formatting a Tufte-like book yourself.

The CRT from 1990 is probably buried in a landfill somewhere. But the books I brought with me from the lecture are still treasured items on my bookshelf.

# *Acknowledgements*

In 2015 a group of LaTeX enthusiasts reverse-engineered the layout of Tufte's books and created a template for anyone to use. I am grateful for their work and I have borrowed a particularly well-researched chapter from their report.

I am indebted to the Prince programmers who created the formatter which produced the PDF version of this book. CSS has been extended with some new properties and values, the these new features were worked out with the programmers in Melbourne. In particular, Mark Brown and Michael Day have been instrumental adding support for sidenotes in CSS.

Dave Liepmann has done wonderful work with CSS stylesheet which encodes Tufte's designs. While the style sheet used in this document is different, Dave's style sheet is highly recommended for reuse.

Tufte's books are typeset with a classic serif typeface. The first editions were typeset in Montype Bembo, in lead! Later, an electronic font named «ET Book» that closely resembles Bembo was been designed by Dmitry Krasny, Bonnie Scranton, and Edward Tufte. It has been released with a generous license, thank you.

The texts on *Maps* and Aivazovsky are borrowed from Wikipedia, perhaps the most amazing project to appear on the web.

Finally, I wan to thank Walter Bender, my mentor in typography. He introduced me to Tufte's work. Without Walter, CSS would probably not have been created.

# 1 Codex



Edward Tufte's books are beloved for the insight they provide into fascinating topics, and also for their beautiful design. Opening a Tufte book give readers a near-religious experince which, for a moment, restores faith in humanity.

You realize that someone, back in time, has been thinking intelligently about how to represent an important idea. That abstract thinking has been preserved on paper or a canvas. Then Tufte, the Indiana Jones of infographics, has discovered the unknown treasure in a dark and dusty corner of an obscure archive, and carefully reproduced the precious sample.

When opening the book, you can study the thoughtfully placed figure and compare it to other thoughtfully placed figures from other times and places. The similarities cannot be coincidental! There must be a human connection, in a complex web of information!

Through buying the book you have become part of a movement, a discreet network of discerning donors who support Tufte's info-expeditions. As a perk you get to put his books on your shelves where your friends, and perhaps the next generations, may discover them.

Someone will find them, someone will learn, some young person will take their eyes off the phone for a minute and experience the treasures of a paper book. All is no not lost, humanity may still prevail.

Tufte's books have hard covers with a woven fabric on on the outside. The book title is printed on the spine. The reading direction is from top to bottom, which is customary on English and Italian books. The spine of German and French books typically read from bottom to top.

AFTER the first infatuation, an urge to analyze sets in. What exactly is it that make these books so compelling? The hard cloth covers? The thick, creamy paper? The classy fonts? The sidenotes?

Some people have meticulously analyzed the books to find answers. A group of Latex enthusiasts has studied the books and published a "Tufte template" to produce a Tufte-like book.[1] The document you are currently reading is also a template for create a book with a Tufte-like appearance.

Arguably, Prince has a tougher job than browsers as it has to split the manuscript into pages, a process known as "pagination". The difference between paged and scrolled presentations may seem trivial; anyone can tear a sheet of paper in two. But that difference has long-standing historical implications.

[1] Latex is a computer program used in document preparation. It builds on TeX, an earlier system developed by Donald Knuth to format his seminal book son *The Art of Computer Programming*.

Scrolled documents came first. Early documents were written on vellum and papyrus, an rolling these into scrolls protected the content. But scrolls are fragild and impractical to transport. When the ancient Romans started cutting scrolls into sheets, transport and storage became easier. Suddenly it was possible to stack books, put them in your travel bag, or store them on shelves. Libraries could be formed.

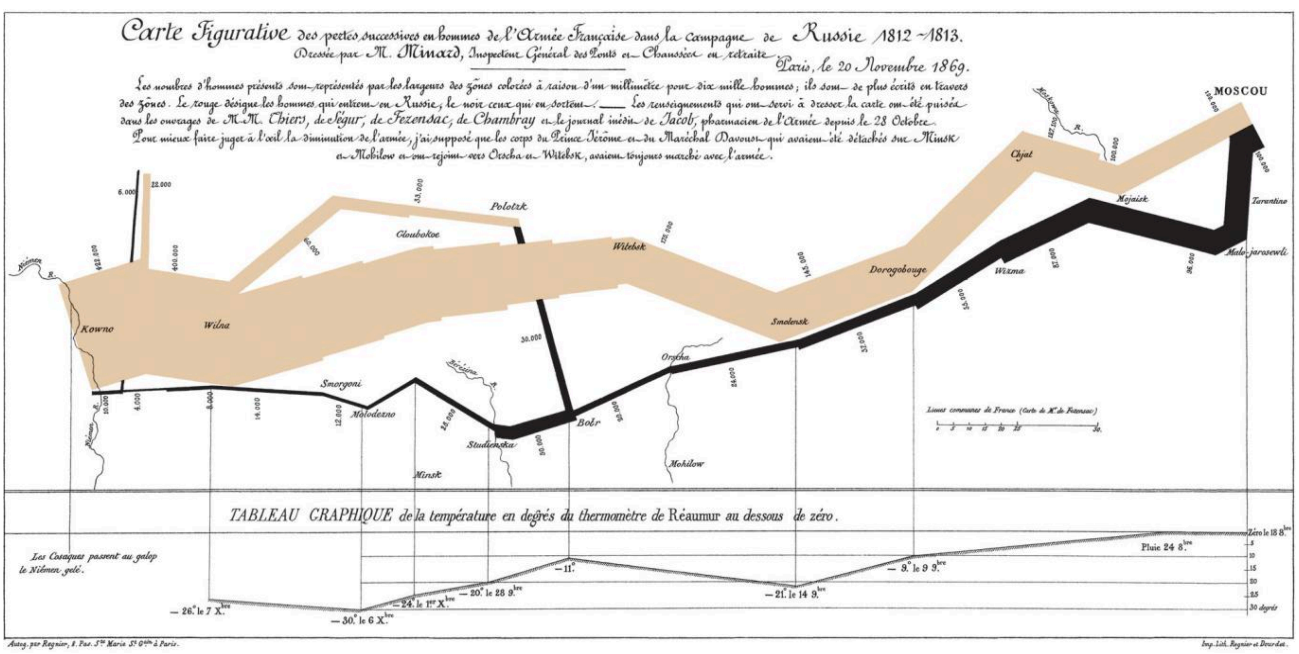
This invention is known as the "codex". A codex, much like the modern book, is bound by stacking pages and binding one edge. While the codex was a consumer-friend format, it was still a rare product due to being handwritten on expensive material. Gutenberg changed that around 1450 years later. His development of an efficient printing press made it economical to publish books and thereby distribute information to many.

Gutenberg's invention transformed Europe. We had the renaissance, the reformation, and the industrial revolution. These changes would not have happened without printed books, and they are sometimes referred to as the «Gutenberg effect». But the changes mostly affected Europe and the west. As such, the world wide web is more ambitious; its name signals a will to tranform the whole world.

THE WORLD WIDE WEB is the only invention which can challenge the codex and printing press in terms of impact on our civilization. Still, the web took a step backwards by reintroducing scrolled documents. In web browsers, documents that take up more than a screenful are given a scrollbar to move up and down in the document. This is a convenient

The *Codex Gigas* was created in the early 13th century in the Benedictine monastery of Podlažice in Bohemia.

A treatise on Tufte is not complete without the map of Napoleon's ill-fated 1812 campaign in Russia. The illustration was made by Charles Joseph Minard, a French civil engineer known for his work in information graphics. Minard was 31 years old when the *Grande Armé* crossed into Russia, but thankfully – both for him and us – he had not chosen a military career.



solution on computer screens, but an important component is missing: the aestetical experience of browsing a well-desiged book and seeing balanced spreads of pages opening in front of your eyes. If we want future generatsions to have this experience, we must learn to make beautiful books from web content. This doucument describes techniques which may be useful.

Lorem ipsum dolor sit amet, con sectetur adip iscing elit, sed do eius mod tempor in cididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exer citat ion ullamco laboris nisi ut aliquip ex ea com modo consequat. Duis aute irure dolor in repre henderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.

Lorem ipsum dolor sit amet, con sectetur adip iscing elit, sed do eius mod tempor in cididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exer citation ullamco laboris nisi ut aliquip ex ea commodo consequat.

Lorem ipsum dolor sit amet, con sectetur adip iscing elit, sed do eius mod tempor in cididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exer citation ullamco laboris nisi ut aliquip ex ea commodo consequat.

Gutenberg is credited with having invented the printing press. But he invented far more than the press itself. He developed oil-based ink, metal tools for casting movable type, and he pioneered an efficient production process for printing documents.

# Gill Sans

Aa Qq Rr

*Aa Qq Rr*



COLLEGIUM

abcdefghijklm

nopqrstuvwxyz

0123456789

# 2 The code



To follow this guide, you will need some knowledge of HTML and CSS. Also, on your computer you will need a web browser, and a recent version of Prince. The browser formats the HTML and CSS on your screen, be it mobile or stationary. Prince reads the the same files and turns them into a PDF file which can be printed.

LET'S LOOK at some code, starting with the easy things. Tufte's books all use the same page size, which can be expressed in CSS:

```
@page {
  size: 220mm 264mm;
}
```

That is, the page is 220 millimeters wide, and 265 millimeters high. [2] Next is adding page margins:

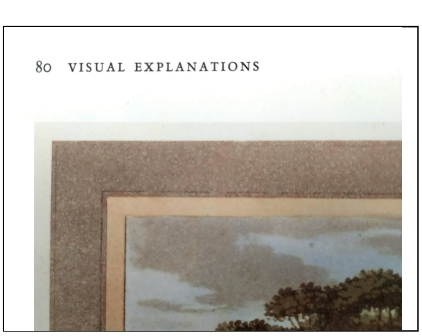
[2] CSS supports a range of other units for expressing lenghts, including inches and typographic points.

```
@page {
  size: 220mm 264mm;
  margin: 27mm 22mm 23mm 27mm;
}
```

The four values set the top/right/bottom/left margins, respectively. Page numbers can also be expressed with simple code:

```
@page:left {
  @top-left {
    content: counter(page);
  }
}
```

The code above expresses that, on left pages, in the top left areas, the page number should be shown. But looking at a sample page, we see that it has a running header; after the page number comes the title of the book. Therefore, we need to add some spacing and a string:



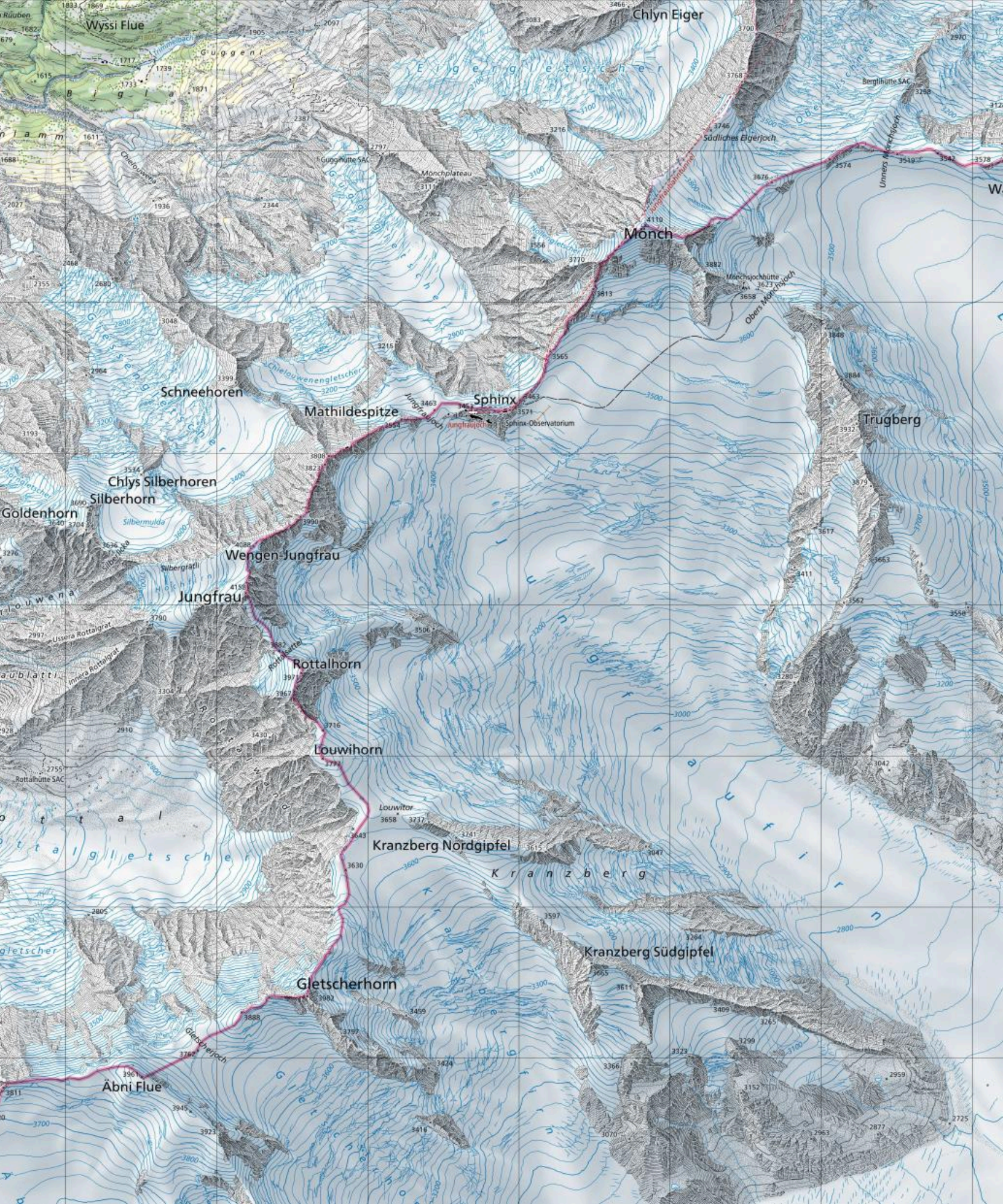

The running header on left pages.

```
@page:left {
  @top-left {
    content: counter(page) "\A0\A0\A0" string(title);
    font-variant: small-caps;
  }
}

h1 { string-set: title contents }
```

The spacing is somewhat cryptic: "\A0" is the hexadecimal Unicode for *NO-BREAK SPACE*. The *title* is found by copying the content of the `h1` element.

[describe sidnotes, page floats etc]



Wyssi Flue
Chlyn Eiger
Eigergletscher
Berglihütte SAC
Südliches Eigerjoch
Unners Mönchsjoch
Mönch
Mönchsjochhütte
Obers Mönchsjoch
Schneehoren
Mathildespitze
Sphinx
Sphinx-Observatorium
Jungfraujoch
Trugberg
Chlys Silberhoren
Silberhorn
Goldenhorn
Silbermulda
Wengen-Jungfrau
Jungfrau
Rottalhorn
Louwihorn
Louwitor
Kranzberg Nordgipfel
Kranzberg
Kranzberg Südgipfel
Gletscherhorn
Gletscherjoch
Äbni Flue
Rottalhütte SAC
Ussera Rottalgrat
Innera Rottalgrat
Rottalsattel
Chielouwenengletscher
Mönchplateau
Guggihütte SAC
Jungfraubahntunnel
Jungfraufirn
Kranzbergfirn
Gletscherhorn

# 3 Maps

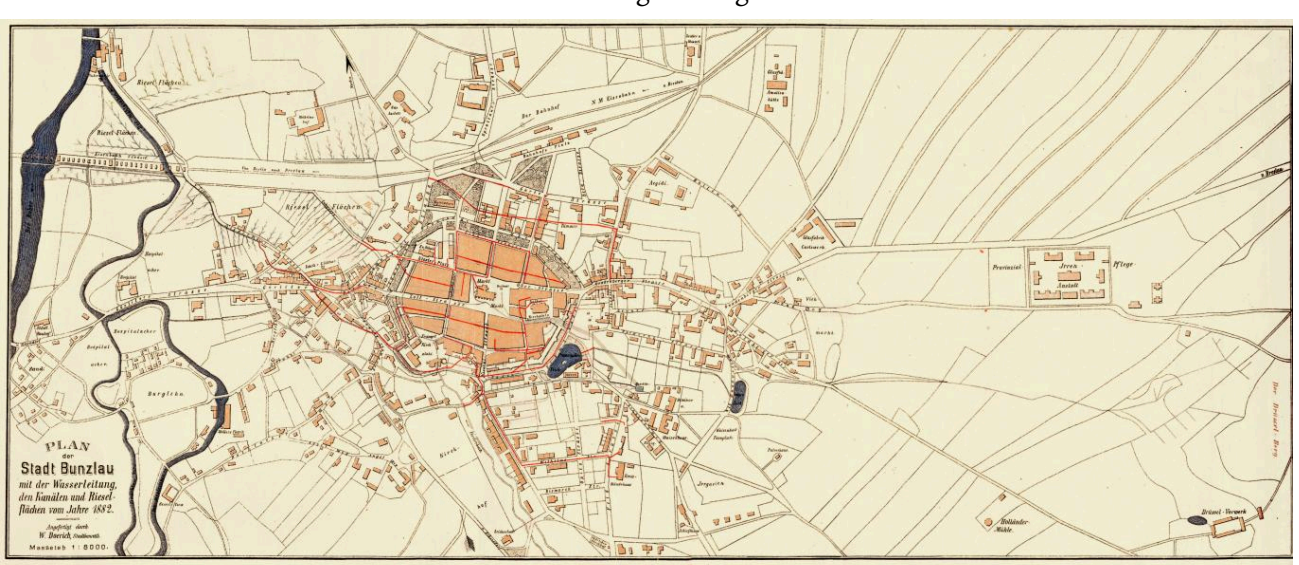


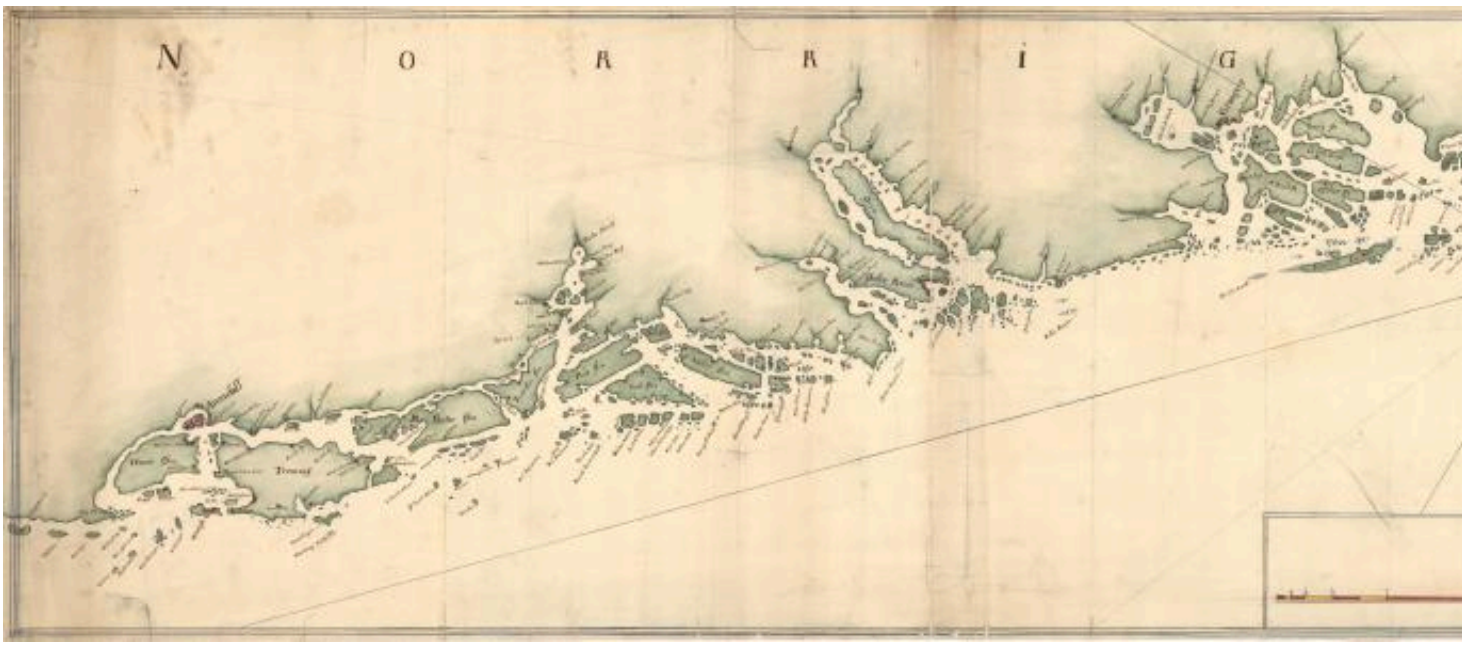
The text in this chapter is copied from Wikipedia

The design and production of maps is a craft that has developed over thousands of years, from clay tablets to Geographic information systems. As a form of Design, particularly closely related to Graphic design, map making incorporates scientific knowledge about how maps are used, integrated with principles of artistic expression, to create an aesthetically attractive product, carries an aura of authority, and functionally serves a particular purpose for an intended audience.

Designing a map involves bringing together a number of elements and making a large number of decisions. The elements of design fall into several broad topics, each of which has its own theory, its own research agenda, and its own best practices. That said, there are synergistic effects between these elements, meaning that the overall design process is not just working on each element one at a time, but an iterative feedback process of adjusting each to achieve the desired gestalt.

Maps of the world or large areas are often either "political" or "physical". The most important purpose of the political map is to show territorial borders; the purpose of the physical is to show features of geography such as mountains, soil type, or land use including infrastructures such as roads, railroads, and buildings. Topographic maps show elevations and relief with contour lines or shading. Geological






maps show not only the physical surface, but characteristics of the underlying rock, fault lines, and subsurface structures.

From the last quarter of the 20th century, the indispensable tool of the cartographer has been the computer. Much of cartography, especially at the data-gathering survey level, has been subsumed by Geographic Information Systems (GIS). The functionality of maps has been greatly advanced by technology simplifying the superimposition of spatially located variables onto existing geographical maps. Having local information such as rainfall level, distribution of wildlife, or demographic data integrated within the map allows more efficient analysis and better decision making. In the pre-electronic age such superimposition of data led Dr. John Snow to identify the location of an outbreak of cholera. Today, it is used by agencies of humankind, as diverse as wildlife conservationists and militaries around the world.

Lorem ipsum dolor sit amet, con sectetur adip iscing elit, sed do eius mod tempor in cididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exer citat ion ullamco laboris nisi ut aliquip ex ea com modo consequat. Duis aute irure dolor in repre henderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.

Lorem ipsum dolor sit amet, con sectetur adip iscing elit, sed do eius mod tempor in cididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exer citat ion ullamco laboris nisi ut aliquip ex ea com modo consequat. Duis aute irure dolor in repre henderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.

Lorem ipsum dolor sit amet, con sectetur adip iscing elit, sed do

A beautiful French nautical chart or map of Martinique issued in 1831. It ffers sumptuous detail both inland and at sea. There are depth soundings as well as notes on undersea features such as banks and shoals.

This map from around 1710 shows the Norwegian coastline stretched out to fit a long and narrow sheet.

eius mod tempor in cididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exer citat ion ullamco laboris nisi ut aliquip ex ea com modo consequat. Duis aute irure dolor in repre henderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.

Lorem ipsum dolor sit amet, con sectetur adip iscing elit, sed do eius mod tempor in cididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exer citation ullamco laboris nisi ut aliquip ex ea commodo consequat.

Lorem ipsum dolor sit amet, con sectetur adip iscing elit, sed do eius mod tempor in cididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exer citat ion ullamco laboris nisi ut aliquip ex ea com modo consequat. Duis aute irure dolor in repre henderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.

Lorem ipsum dolor sit amet, con sectetur adip iscing elit, sed do eius mod tempor in cididunt ut labore et dolore magna aliqua.

Lorem ipsum dolor sit amet, con sectetur adip iscing elit, sed do eius mod tempor in cididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exer citat ion ullamco laboris nisi ut aliquip ex ea com modo consequat. Duis aute irure dolor in repre henderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.

Lorem ipsum dolor sit amet, con sectetur adip iscing elit, sed do eius mod tempor in cididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exer citat ion ullamco laboris nisi ut aliquip ex ea com modo consequat. Duis aute irure dolor in repre henderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.

# 4 *The Design of Tufte's Books*



This chapter is a reprint of *A Tufte-style Book*, published by the *The Tufte-LaTeX Developers*

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).

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

[3] 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 *VDQI*, this

page is blank; in *EI* and *VE*, this page holds a frontispiece; and in *BE*, 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 it 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 | *VDQI* | *EI* | *VE* | *BE* |
|---|---|---|---|---|
| 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 |
| 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 Ducks* 107
6 *Data-Ink Maximization and Graphical Design* 123
7 *Multifunctioning Graphical Elements* 139
8 *Data Density and Small Multiples* 161
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
*Patallelism: 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.

Neither Bembo nor Gill Sans are freely available on the web, but there are good-looking alternatives. This document uses Cabin and Crimson Pro. In addition, the Bera Mono typeface is used for `monospaced` type.[4]

The following font sizes are defined by the \TL classes:

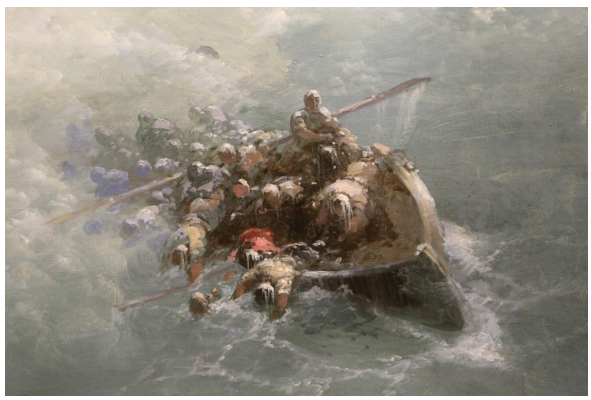
[4] *Editor's note: The font situation has improved since this chapter was published in 2015. In this imprint, "ET Book" is used for the body font, and "PT Mono" is used for monospaced fonts*

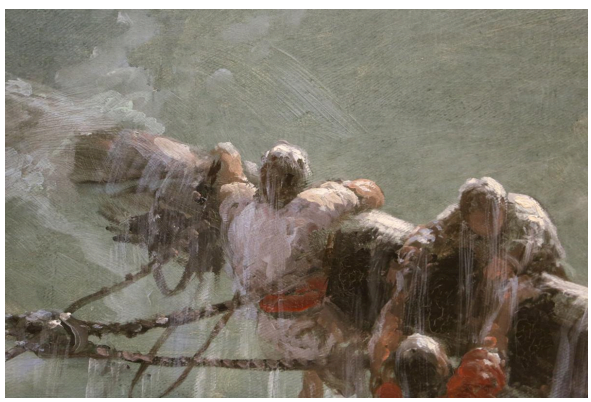
## *Headings*

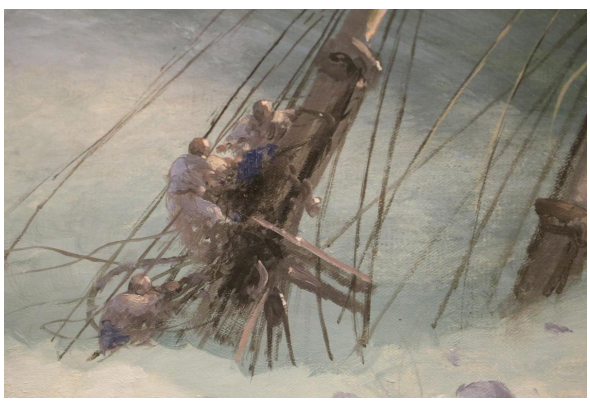
Tufte's books include the following heading levels: parts, chapters, sections, subsections, and paragraphs. Not defined by default are: sub-subsections and subparagraphs.

## *Sidenotes*

Sidenotes carry much of the information in Tufte's books. Chapters have a sidenote area to the right of the main column. Figures in the sidenote area are a maxium of 52mm wide. Textual notes appear in ragged right with a maxium width around 55mm. The result is an optical alignment where the average line length is around the same as the maximum width of figures.







# 5 *The wave*

A cow swimming to an uncertain future.

Ivan Konstantinovich Aivazovsky was a Russian Romantic painter who is considered one of the greatest masters of marine art. He painted *The Wave* in 1889.

Baptized as Hovhannes Aivazian, he was born into an Armenian family in the Black Sea port of Feodosia in Crimea and was mostly based there. Following his education at the Imperial Academy of Arts in Saint Petersburg, Aivazovsky traveled to Europe and lived briefly in Italy in the early 1840s. He then returned to Russia and was appointed the main painter of the Russian Navy. Aivazovsky had close ties with the military and political elite of the Russian Empire and often attended military maneuvers. He was sponsored by the state and was well-regarded during his lifetime. The saying "worthy of Aivazovsky's brush", popularized by Anton Chekhov, was used in Russia for describing something lovely. He remains highly popular in Russia in the 21st century.

A primarily Romantic painter, Aivazovsky used some Realistic elements. Leek argued that Aivazovsky remained faithful to Romanticism throughout his life, "even though he oriented his work toward the Realist genre." His early works are influenced by his Academy of Arts teachers Maxim Vorobiev and Sylvester Shchedrin. Classic painters like Salvator Rosa, Jacob Isaacksz van Ruisdael and Claude Lorrain contributed to Aivazovsky's individual process and style. Karl Bryullov, best known for his The Last Day of Pompeii, "played an important part in stimulating Aivazovsky's own creative development," according to Bolton. Aivazovsky's best paintings in the 1840s–1850s used a variety of colors and were both epic and romantic in theme. Newmarch suggested that by the mid-19th century the romantic features in Aivazovsky's work became "increasingly pronounced." She, like most scholars, considered his Ninth Wave his best piece of art and argued that it "seems to mark the transition between fantastic color of his earlier works, and the more truthful vision of the later years."

One of the most prominent Russian artists of his time, Aivazovsky was also popular outside Russian Empire. He held numerous solo exhibitions in Europe and the United States. During his almost 60-year career, he created around 6,000 paintings.

# *Index*

Bembo 12, 29
Gill Sans 29
LaTeX 12
ragged right 29