

Typography

for Scientific and Business Documents

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What's the Big Deal?

This paper is about typography. But first, I digress...

Most of us agree that the use of correct grammar—or at least something approaching it—is important in our printed documents. Of course “printed documents” refers not just to words printed on paper these days, but also to things distributed by slide and overhead projection, electronic broadcasting, the web, etc. When we write something down, we usually make our words conform to accepted rules of grammar for a selfish reason: we want the reader to think we know what we’re doing! But grammar has a more fundamental purpose. By following the accepted rules, we help assure that the reader *understands* our message.

If you don’t get into the spirit of things, you might look at typography as just another set of rules to follow. But good typography is important, because it serves the same two purposes as good grammar. That is...

Good typography helps us in two ways:

1. It helps the reader understand our message.
2. It makes our documents (and hence, us) look more professional.

With those goals in mind, let’s look at some guidelines for good typography in scientific and business documents, at least for those written in American English.

Characters

Quotes

Nothing says “I don’t care about typography” more than using inch and foot marks (" and ') in place of real quotation marks, which curl inward. Most modern software applications take care of this for you automatically. If you’re stuck using a program that doesn’t, you’ll have to enter the correct characters manually. (Occasionally you’ll actually *need* foot or


inch marks, so you’ll probably get to enter those manually anyway.[†] Nothing is perfect...)

In American English, punctuation marks are usually placed before closing quotes rather than after them (*e.g.* She said “No!”). But don’t do this if it would confuse the message (*e.g.* Did she say “no!”?). Careful placement of periods and commas is particularly important when user input to computers is described:

For username, type “john.”	<i>Wrong</i>
For username, type “john”.	<i>OK</i>
For username, type j ohn .	<i>Even better, if font usage is explained</i>

Dashes

The three characters commonly referred to as “dashes” are:

- hyphen (this is what you get when you type the  key)
- en dash
- em dash

The names “en dash” and “em dash” refer to the fact that these characters are approximately as wide as an *N* and *M*, respectively. Or actually they didn’t originally, but that’s a good way to remember which is which. There are strict rules for which dash is used in various situations even in regular typography, and scientific typography adds additional rules. Here’s a short list:

hyphen:

- *compound nouns*: avant-garde
- *phone numbers*: 800-123-4567
- *hyphenation*: antidisestablishmentarianism

[†]To make matters worse, real inch and foot marks are slanted (" and '). At least that part is easy to do—just set them in italic type. You’ll see more about italic type later in this paper.

en dash:

- *numeric ranges:* 1983–89
- *subtraction sign:*[†] $(x + 3)(y - 6)$
- *unary minus sign:*[†] -1
- *double compound:* MIME-compliant-e-mail
adjectives program ↙ *This one*

em dash:

- *punctuative dash:* Some writers—like me—
use dashes frequently.
- *summarizing clauses:* Peace, quiet, and warm
breezes—these things he liked!

In the old days of typewriters, we typed two hyphens to simulate an em dash. Some modern programs (e.g. Word) now convert two consecutive hyphens to an em dash automatically.

Spaces with dashes and other symbols

Small spaces are often used surrounding en and em dashes. (I've used 3-point spaces in this document.) But be careful—look at this example from mass spectrometry:

- (M-H)⁺ Positive ion formed by *addition* (bonding) of H⁺ to M
- (M - H)⁻ Negative ion formed after *loss* of H⁺ from M
(*Note extra space around the en dash.*)

Also, don't put a space between a unary minus sign and the numeral following it. But spaces *are* used around subtraction signs and other mathematical operators (e.g. 2 + 4 - 3) except when part of superscripts or subscripts.

Spaces between sentences

You might want to sit down for this one. *Type just one space after periods, etc., at the end of sentences.* The practice of typing two spaces that so many of us learned long ago was taught for typewriters, which use a monospaced font. It's still an acceptable practice for e-mail correspondence, since your recipient may not see his/her mail in proportional fonts.

Foreign letters

Some commonly used Greek letters look a bit like English letters. Don't interchange them! For example,

- mu:** The lowercase Greek letter mu looks like this: μ . The English letter *u* looks like this: u. Thus *microsecond* is abbreviated “ μ s,” not “us.”
- u:** Again, this is not a mu. Instead, the lowercase roman-type *u* is the abbreviation for “atomic mass unit” (e.g. P weighs 31 u).

While we're on the topic of abbreviated units, note that *liter* is usually abbreviated “l”, not “L”. An “mL” is a millilambert. But to confuse matters, the *American Chemical Society* (ACS) has defined “L” to be the symbol for liters in ACS publications, so “mL” is a milliliter in *Analytical Chemistry* but a millilambert in physics journals.

Ellipses

Use a real ellipsis character (...) rather than three periods to avoid accidental line breaks inside the ellipsis. Some programs (e.g., Word) will change three consecutive periods to an ellipsis automatically.

Italics**Don't underline!**

Oh, typewriters again... Since most typewriters didn't make italic type, typists used underlining to simulate it. Here's a good rule: Don't underline anything, ever! (Well, almost ever... *Quiz:* Can you find an exception in this document?) Software designers were slow to learn this, so keyboard and toolbar shortcuts for underlining are often just as convenient in many programs as shortcuts for italic and bold type.

Units

In general, units are *not* set in italic type (e.g. 5.2 kg, 48 μ l). A common exception from chemistry is *molarity*, often represented by an italic capital *M* (e.g. 5.0 M HCl). Some publications, however, use a roman-type *M* for molarity too (e.g. 5.0 M HCl).

Mathematical variables and functions

A number of rules involving italic type in mathematics are listed in the *variables* and *abbreviated functions* sections on page 4.

Small Caps**Acronyms**

Strings of all-capital letters really ought to be set in smaller type (e.g. do you know what WYSIWYG stands for?) to avoid SCREAMING at the reader. But except in very fine typography, it's usually OK to ignore this. And avoid small caps in cases where you must use acronyms *and* other groups of concatenated upper-case letters—chemical formulas, for example, in the same document (e.g. don't write DNA and R-COOH). Also, you'll find it's difficult to pluralize acronyms set in small caps (e.g. Learn your ABCs; Learn your ABCs?).

A.M. & P.M.

The proper form is small caps with periods (e.g. 8 A.M.), though it's common to use lowercase letters (e.g. 3 p.m.) instead. Please don't use full-sized capitals, except maybe in e-mail.

Stereoisomers

The correct form for the D and L sugars is small caps (e.g. D-(+)-glucose). But small caps are *not* used for the R and S stereoisomer notation (e.g. R-(+)-glyceraldehyde). By the way, those are hyphens, not en dashes.

[†] But see the *Subtraction and minus signs* section on page 4

Line Breaks

Line breaks usually take care of themselves in prose text. But in titles, lists, etc., try to put breaks at logical points in the phrase. *Quiz*: Which of the following is better?

- Low-power subspace field absorbs inertial forces
- Low-power subspace field absorbs inertial forces

(The second one is better.)

Also, never allow a line break to occur between a number and its corresponding unit (e.g. don't allow $6.17252 \times 10^3 \text{ N}\cdot\text{m}^2/\text{kg}^2$). Use a *non-breaking space* to avoid this.

In slide presentations and other forums where the audience has limited time to grasp your message, careful attention to line breaks is especially important. For example,

Line breaks
can be used correctly,
to aid comprehension

Or they can be
used like
this, which has
the opposite
effect

Occasionally, you'll have to take drastic measures—hyphenation, adjusting the *Kerning* (the tiny spaces used between characters), or, as a last resort, rewriting the text—to fix line breaks.

Fonts

Selection of fonts is a *big* topic. Font usage has nothing to do with computers, by the way; font design and font selection have existed—more or less as *art*, one could say—for hundreds of years. The font you are reading now was designed in 1964, based loosely on designs of Claude Garamond that date from the 16th century!

Serif & sans serif

The two most common font classifications are *serif* fonts, for designs having extra little lines at the ends of the strokes (e.g. F), and *sans serif* fonts, for designs that don't (e.g. F).

A common and very reasonable practice is to use serif fonts for body text and sans serif fonts for headings, as was done in this document.

Two is enough!

A difficult lesson to learn—*believe me, I know!*—is that just *two* fonts are sufficient for most types of documents. Of course this doesn't count specialized things like *symbol* fonts for Greek letters in equations, various *dingbat* fonts for special bullets, etc. For long documents, we don't usually count italic and bold versions within a given font family as separate fonts (it would be hard to stay within the two-font limit otherwise), since very little of the text is set in these

extra styles. But in very design-oriented projects such as advertising posters or business cards, every variation counts.

Contrast

Don't be afraid of contrast. *Quiz*: Which design has better contrast?

1. Design Issues

The first point I'd like to make is that our font selection is very important.

2. *Design Issues*

The first point I'd like to make is that our font selection is very important.

Of course it's easy to go too far in this area. Remember your goal is to make the message clearer, not to show off the weirdest fonts you have.

Bullet Items

Periods

Periods are generally not used after bullet items that are incomplete sentences. If one or more bullet items are complete sentences, however, *all* items should end with a period. Some presentation programs (e.g. PowerPoint) can add or remove periods automatically.

Bullet style

Pick a style and use it consistently. Don't be afraid to map bullets to hierarchical levels:

- ▶ Introduction
- ▶ Advantages
 - + *Faster*
 - + *Cheaper*
- ▶ Disadvantages
 - + *Less reliable*
 - + *Toxic*

(Yes, I've mapped *font style* to the hierarchical levels in this example too.) Any presentation program (e.g. PowerPoint) can take care of this automatically; please don't try to defeat this feature and make up something silly, like this:

- This bullet is a fake em dash typed as two hyphens.

Miscellaneous Math Issues

Complex equations require special software. Such equation-editing utilities (e.g., MathType) take care of most typographical concerns automatically:

$$p(y)dy = \frac{1}{\sqrt{2\pi}} e^{-y^2/2} dy$$

But in regular text, the issues discussed in the following section are worth addressing.

Zeros

It's a good idea to put a zero before the decimal point in numbers less than one (e.g. 0.2) to avoid confusion. You don't have to pronounce it "zero-point-two," of course. When discussing probability, where the quantity can't exceed 1, the zero is commonly omitted (e.g. $p = .98$).

Subtraction and minus signs

The hyphen is not a subtraction sign, as can be seen easily by comparing it to the standard plus sign:

$$1 + 2 - 3 \quad -1$$

A good substitute is an en dash:

$$1 + 2 - 3 \quad -1$$

But the *real* minus sign (and plus sign, division sign, etc.) is provided in the Symbol font:

$$1 + 2 - 3 \quad -1$$

Multiplication signs

The \times is not a multiplication sign, as can be seen easily by comparing it to a real one:

$$3 \times 5 \text{ No} \quad 3 \times 5 \text{ Yes}$$

The multiplication sign is available in most Windows fonts; on a Macintosh you'll have to use the Symbol font.

Fractions

The most common fractions (i.e., $\frac{1}{4}$, $\frac{1}{2}$, & $\frac{3}{4}$) are provided in standard Windows fonts, but not in Macintosh fonts. To make other fractions, though, you might want to use a Macintosh. That's because the *fraction bar* or *solidus* character ($\frac{\quad}{\quad}$) is not easily available from Windows. The procedure is to type a small, raised numerator, a fraction bar, and a small denominator:

$$7 \text{ + / + } 8 \rightarrow 7/8$$

If you don't have access to a fraction bar, you'll have to use a regular slash:

$$7 \text{ + / + } 8 \rightarrow 7/8$$

On the other hand, if you have access to an *expert-set*[†] font, you can build the whole thing out of *superior* and *inferior numerals*, plus the fraction bar, of course:

$$7 \text{ + / + } 8 \rightarrow 7/8$$

Here's an enlarged view of the regular *vs* expert-set versions:

$\frac{7}{8}$	$\frac{7}{8}$
regular	expert-set

[†] Expert sets contain not only the superior and inferior numerals, but also *ligatures* so you can type beautiful words like "*<u>iest*." You probably won't need those, however, since high-quality fonts have sufficient kerning rules to simulate ligatures with standard *f*, *l*, and *i* characters (e.g. *fluffiest*).

Variables

Most variables are set in italic type (e.g. $2x$, a^{2+b}) except for vectors and matrices, which are usually set in bold type (e.g. $\mathbf{A \cdot x = b}$). Note that the numerals are *not* set in italic. *Quiz*: Which of these looks correct?

1. ...which is solved to yield $f(t) = at$ as expected

2. ...which is solved to yield $f(t) = at$ as expected

(You did pick the second one, right?)

In superscripts and subscripts, italic type is used only for characters used in a mathematical sense rather than as an abbreviation for a word, etc. Thus:

$$m_i n_j \quad a^x + b^{2y} \quad e^{-x^2}$$

is correct, but so is:

$$K_M \quad V_{\max} \quad t_{\text{meas}}$$

(The first of these, K_M , is the Michaelis constant commonly seen in enzymatic kinetics.)

Abbreviated functions

Trig and log functions, etc. are *not* set in italic. Thus:

$$\sin(10y) \quad \log a \quad \exp(-2)$$

Acronyms & Abbreviations

This isn't strictly a typography issue, but there are guidelines for abbreviations in formal documents and presentations.

First use of acronym: The first time a *new or obscure acronym* (NOA) is used, set the phrase in italics followed by the acronym in parentheses.

First use of word: The first time you use a *neologism* (new word), set it in italic or bold type. If you provide a definition, it should follow immediately, enclosed in parentheses.

Laziness: Abbr. words in a doc. or present. just because you're used to doing so in prvt. notes, etc. can lead to lg. neg. rxns. from your audience.



Got it?

OK, so does this seem like too much work? Is it really that important? As with many other skills, the application of careful typographical decisions is often a thankless task, since typography is usually noticed only when it's bad. But remember our two goals: to make the document look professional (or, from the thankless-task viewpoint, at least to avoid making it look non-professional), and to help the reader obtain the desired information without distraction. Every author wants his/her documents to be read. So let's help those readers! If the typography is taken care of, our readers can concentrate entirely on our message. Of course we still have the content to worry about...

Appendix

Entering Special Characters in Windows

Entering special characters has always been easier on the Macintosh than on the Windows platform. Many Windows programs (e.g., Word, Publisher, CorelDraw) now provide some assistance for special characters. Often, however, you must resort to one of two older, more clumsy methods:

- Using the *Character Map* accessory program, select the desired characters, copy it, and paste it into your document. (I keep Character Map running in the background on my computer all the time.)
- Or looking up the numeric code for the desired character (e.g., 0151 for an em dash) and typing it into the numeric keypad while holding down the  key (e.g. -0151). An easy way to find the codes is to use Character Map, but a few common ones are shown below:

...	0133	‘	0145
-	0150	’	0146
-	0151	“	0147
μ	0181	”	0148

Bibliography

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The Non-Designer's Design Book

Robin Williams (Berkeley, Peachpit Press, Inc. 1994)

The Chicago Manual of Style, 14th Ed.

(Chicago, Univ. of Chicago Press, 1993)

The ACS Style Guide

Janet S. Dodd, Ed. (Washington D.C., American Chemical Society, 1986)

Digital Type Design Guide

Sean Cavanaugh (Indianapolis, Hayden Books, 1995)

Microsoft Publisher 97 Companion

This manual comes with Microsoft Publisher 97. The booklet supplied with Publisher 95 is also very useful.

Colophon

This document was produced with Microsoft Word 97. Body text was set in 10-point Savoy and SavoySmCaps, fonts based on the Oldstyle font Sabon. Headings were set in 14-point roman and 12-point italic Function, a font based on Futura, a common Geometric sans serif font. Some of the more complex math examples were set in Times New Roman, and the keystrokes were illustrated in Keystroke. In the first example of (poor) font contrast on page 3, both the heading and the body paragraph were set in Times New Roman. For the second example of (good) font contrast, the heading was set in italic Arial Rounded MT Bold and the body paragraph was set in Garamond. The fraction bar, superior, and inferior numerals were set in Minion Expert, due to a font licensing issue with Savoy Expert.

Savoy, SavoySmCaps, and Function are PostScript™ fonts from SoftMaker, Inc. The remaining typefaces are TrueType™ fonts from Monotype Corporation except for Keystroke, which is from Corel Corporation.

The most recent version of this paper is available on the web at:

www.yefchak.com/typography