Typography on the Web

An examination of current best practices

http://www.inkwell.ie/typography

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Abstract

Scope of the research

This thesis examines various methods of embedding and using typography in websites. It compares and contrasts the ‘core’ font-stacks, extended font-stacks, embedding technologies (such as Image replacement, sIFR and Cufón) and the use of the CSS @font-face specification in an attempt to find the most effective methods of employing type on the Web.

A website was built to test best practice in the use of typography. Font sizes, line heights, line lengths, typographic hierarchy and vertical rhythm are examined in detail.

Responsive design, media queries and mobile devices are outside the scope of this paper. The research covers type rendering and practices on the main browsers on Windows XP and 7, OS X and Ubuntu 10.04. It does not cover other Linux varieties, Unix, iOS, Android or any mobile devices.

Models of legibility and reading are also outside the scope of this research.

Purpose of the research

Typography exists to honour content, but much of the typography on the web is poor in quality. Font choices, typographic specification, Operating system and browser rendering and typeface availability all contribute to the problem. This thesis seeks to establish an effective solution to these issues and to offer that solution in the form of a freely available stylesheet, released under a creative commons (CC) license.

Methodology

The thesis has two components, the research paper, and a website. The paper examines the various methods and underlying technologies used in web typography. It also details the testing of the various font technologies and the quality of the rendering. The methodology is necessarily qualitative, particularly in relation to Operating Systems text rendering – fonts either render acceptably at all sizes or not.

The criteria used for font selection is quite strict. Fonts selected for testing must have a minimum of four styles, ideally, but not necessarily, including regular, regular italic, bold and bold italic. Exceptions have been made for fonts which don't have italics (or obliques) but have at least four different weights. In both cases, this is to ensure sufficient typographic variation to achieve a useable hierarchy in text.

Fonts also must render well on all platforms and at all sizes. Fonts which performed well at certain sizes, but not at others, were excluded.
Testing is covered in detail in §6.5 and §6.6.

The website *(inkwell.ie/typography)* acts as a test-bed for the above and adopts the best practices recommended by accomplished practitioners in type. The testing worked in two ways – firstly as a method of gaining feedback from typographic practitioners and secondly as a method of comparing and contrasting type rendering across the various browsers and operating systems.

The website went through a number of iterations during development, and the link to key versions was sent to a number of typographic practitioners and posted on typography related websites *(see appendices 4 & 5)*. Feedback from these exercises informed further iterations of the website.

Findings

Traditionally, it has been impractical to directly specify a font in a webpage as there is no way of determining if that font is available on an end-users computer. The use of font-stacks is an attempt to define a system of preference – if a specified font is available it will be displayed, if not a second preference will be used and so on. Due to its' nature this approach is limited in scope. It has the further disadvantage in that many of the more available fonts (e.g.: Helvetica, Palatino) are designed for print and merely digitized for screen use. Their legibility therefore is not optimized for screen, particularly at smaller sizes. Replacing the text with an image of the text in the desired font is a widespread but impractical approach. Type rendered in this way does not scale and is not semantic.

Embedding technologies such as *sIFR* (scalable Inman Flash Replacement) and Cufón aim to bridge this gap. sIFR converts text to dynamically created Flash files while Cufón converts to dynamically created image files. SIFR is difficult to set up and will not display locally, due to security settings in the Flash plug-in. It will not work if either JavaScript is disabled or the Flash plug-in is not present (the iPhone and iPad does not run Flash). Once configured, sIFR works reasonably well and it is scalable and semantic. Its' use is permitted by most typefaces EULA[1]. sIFR does have occasional display glitches, however and it also places a high demand on the processor, as the text needs to be vectorised on the fly.

[1] EULA (End User License Agreement). Each typeface has an accompanying EULA which sets out the terms of acceptable use. Most commercial fonts expressly forbid type embedding.

Cufón was intended to be a simpler replacement for sIFR. It essentially converts the typeface to JavaScript and displays as an image. It is easy to set up and use; however the generated text is neither scalable nor selectable. Cufón is specifically prohibited by many EULAs, as it is possible to reverse-engineer a font from the generated JavaScript files. Neither sIFR nor Cufón are suitable for large passages of text. Their use should be restricted to headings only.

The CSS @font-face selector would seem to be the holy-grail, then, as it allows fonts to be embedded directly in a page. The raw fonts need to be converted to a number of web formats (browser manufacturers have not agreed a standard format) but this is an easy process. Once converted, the fonts are displayed natively – no JavaScript or plug-in is required. In practice though, @font-face is hindered by poor on-screen rendering and by many font's EULA (End-user license agreement). Like Cufón, it is possible to convert the web formats back to TrueType or OpenType formats.
Fonts require extensive hinting to display well on (pre Vista) Windows systems. Hinting is skilled work, time consuming and expensive. Few typefaces therefore, are hinted well and those that are tend to be expensive. A further drawback is that hinting adds significantly to the file-size of a font. This may not be an issue for many users but is an issue for those with low-bandwidth connections or on mobile devices.

While the CSS specification has improved considerably (with the release of CSS3 modules) a number of factors remain weak. The hyphenation selector is a blunt instrument, which rather than aiding typography serves more to impede the natural flow of text. Kerning remains a further bugbear, with many browsers ignoring kerning tables entirely. Currently only Firefox uses kerning tables as intended.

The number of fonts designed specifically for the screen is low. These fonts with ‘open’ faces are vastly outnumbered by digitized versions of printer fonts, which are usually more ‘closed’ in nature. On a positive note, Operating Systems rendering engines have improved considerably. Windows XP remains weak in this area, but with the release of DirectWrite in Vista and Windows 7, typographic rendering on these systems is at least the equal of OS X’s CoreText and Ubuntu’s text display.

Significance

Major developments are currently underway in the realm of web typography. CSS4 is in the draft stage and CSS3 typographic controls are already widely supported. The OpenType (woff) format’s support for extended ligatures and contextual alternates will further expand the creative possibilities.

Javascript libraries such as *Lettering*, *Widon’t* and *CSS-Matrix* offer more typographic control over aspects of typography such as kerning, widows and anti-aliased text-rotation.

> *“This is the best time to be a web designer.*
> *We can make great websites; we can use great type … we’re shaping all of this stuff, right now.”*
>
> \- Santa Maria (2012)[2]

[2] Santa Maria, J (2012) *On Web Typography* (http://vimeo.com/34178417)

Nevertheless, it is apparent that typography on the web still has a long way to go. The @font-face selector opens the prospect of pure web typography but is currently crippled by typefaces EULAs. The number of well-hinted typefaces is currently quite low, although commercial services such as TypeKit are addressing this. It should be noted that many of those fonts are digitized printer fonts, rather than screen fonts. Javascript libraries like the aforementioned *Lettering* work by wrapping each letter in a span – acceptable in headings, but entirely inappropriate for large passages of text.

It is to be hoped that the final release specification of CSS4 coupled with updated browsers will do much to eliminate some of the difficulties within type rendering, but the significant market share of Windows XP means that type choices may be restricted for some time to come.

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Introduction

In the west, Johann Gutenberg is credited with inventing the printing press and first Latin movable type between 1448 and 1452. If we take this milestone as a staring point, typographers and designers working with Latin type have had hundreds of years to perfect the practice. While Gutenberg's black letter bibles look archaic by todays standards, typefaces we recognise and would be comfortable with, appeared surprisingly soon after. Nicolas Jenson's Roman was designed in 1469 and the ubiquitous Garamond by Claude Garamond has been around since 1528.

Practitioners in type then, have had over 550 years to refine and codify the use of typography. Why then, is much of the typography on the web so poor?[3]

There are a number of factors at play here —

- Web publishers
- Scope of HTML and CSS
- Browser and OS rendering engines
- Typeface availability & quality

0.1 Web publishers

The democratic nature of the web has allowed everyone to publish a website. There are parallels with the desktop publishing revolution of the 1980s. The introduction in 1985 of *MacPublisher* followed by *PageMaker* and *QuarkXpress* coupled with the *Apple Laserwriter* printer brought publishing to the masses. The quality of general design and typography dropped substantially for a number of years as clients bypassed design professionals in

[3] http://webtypography.net/sxsw2007/

favour of self-publishing[4]. Gradually the clients realized the value of design and returned to the design industry for their printed material.

Similarly on the web, visual web editors such as *FrontPage*, *PageMill* and others brought web publishing to the masses. More recent developments like content management systems *(CMS)* such as *WordPress*, *Joomla* and *Drupal*, coupled with readily available templates further encourage self publishing. While there are some very good templates available, these tend to concentrate on layout and visual design rather than embracing typographic standards.

Even where organisations employ a designer, the process of website building frequently has said designer handing his designs to a developer to implement. Many things can change at this point - the developer may not be faithful to the design specifications, the designer may have chosen unworkable fonts in their design. Even now, many designers and developers still rely on the core web fonts, (Arial, Helvetica, sans-serif or Georgia, Times, serif).

Many prominent sites give little consideration to hierarchy, type size, line-spacing or whitespace[5]. It is fair to say that there are few sites on the web, which give typography the attention to detail it deserves.

0.2 Limitations of HTML and CSS

Typography is hindered by the specification of HTML and CSS themselves. Print designers routinely kern letter pairs or adjust tracking to avoid widows and orphans (stray words separated from the parent text, usually at the end of

[4] Reference For Business, http://www.referenceforbusiness.com/small/Co-Di/Desktop-Publishing.html Accessed Apr 12, 2012

[5] http://designfestival.com/top-5-peeves-of-bad-web-design/ Accessed Apr 12 2012
http://www.webdesignshock.com/great-websites-with-ugly-design/ Accessed Apr 12 2012

a paragraph or the start of a page). There is a letter spacing property in CSS, which equates to tracking, but kerning is currently not possible in CSS. Avoiding widows and orphans is also not possible, although Widon't, a javascript plug-in, attempts to solve this problem by adding a non-breaking word space between the last two words in each paragraph.

This can only be partially successful as the designer cannot completely control which font the text would be displayed in, or to a degree, its size. A certain amount of text reflow across browsers is inevitable.

CSS4 promises improved typographic controls, but only a draft specification exists at the time of writing.

0.3 Browsers and Operating Systems

The variety of browsers across diverse operating systems causes further difficulty. What one browser supports is not necessarily supported by the next. Firefox for example, uses the fonts internal kerning tables while Internet Explorer does not, which produces different letter spacing between the two and consequently a different text flow.

Operating systems use different technologies to render fonts. Font smoothing in OS X is very different to Windows Cleartype. Helvetica Neue, for example, renders beautifully on OS X but notoriously badly on Windows. Some browsers (Safari 1.0 on windows XP) use their own rendering engine while others leave the rendering to the operating system.

The variation in font file formats across platforms (TrueType, Postscript, Opentype) gives rise to further inconsistencies - Windows uses the ClearType rendering engine to smooth Truetype, but not Postscript or Opentype, for example. In IE9 on Windows Vista and 7, DirectWrite enhances Cleartype.

0.4 Typeface availability and quality

The traditional approach to web typography is to use the core web fonts, ensuring that the specified font is available on the end users computer. This is obviously very limiting in terms of typographic choice and a number of techniques have been developed to mitigate this. Web designers used image editors such as Photoshop to create images of their chosen fonts, which are then used to replace the html element. Technologies such as sIFR, FLIR and Cufón emerged to make this kind of replacement more dynamic, but image replacement can have a detrimental effect on the accessibility of a web page. It can also impact negatively on SEO *(search engine optimisation).*

The introduction of @font-face was intended as a panacea to designers - the ability to embed fonts directly in the page should allow the creative control they wanted but preserve the accessibility of the text. In practice @font-face is hindered by fonts EULA *(End-user License agreement),* fonts are poorly hinted and many of the freely available fonts are poorly drawn and lack kerning tables.

> *"We are currently in the Wild West of web typography."*
>
> - Thomas Phinney, 2011[6]

[6] Phinney, T (2011) *Webcast: Web Typography Best practices* blog.webink.com/training/web-typography-best-practices-resources/

0.5 The Serif versus sans-serif debate

Conventional wisdom amongst Graphic and Web Designers suggests that serif typefaces are more legible than sans-serif when used in print, with the converse being true on-screen. Empirical studies have not confirmed this conclusion. Research by Ole Lund and Alex Poole[7] found no significant difference in legibility between serif and sans-serif, either in print or on-screen. This project therefore, will examine both types. There is a toggle on the top right of the website to switch between serif and sans-serif (not supported in Safari 5.01).

0.6 Aims and objectives

The purpose of this research is to examine current techniques and best practices in typography on the web and identify their strengths and weaknesses. The conclusions of this examination will result in a series of practical recommendations and be implemented in a number of downloadable stylesheets. These may be included in other stylesheets, frameworks or CMS.

0.7 Limitations of the research

The research covers type rendering and typographic practice on the main desktop browsers on Windows XP and 7, OS X and Ubuntu 10.04. It does not cover other Linux varieties, iOS, Android or mobile devices.

The commercial font foundries (Typekit, Fontdeck, WebInk etc.) have a substantial presence in the web-fonts market. Their offerings currently number in the thousands. Due to reasons of cost it is not possible to examine

[7] http://alexpoole.info/which-are-more-legible-serif-or-sans-serif-typefaces

their products in detail. The free services (Google and Fontsquirrel) also offer hundreds of fonts. Certain criteria *(see chapter 6 §5)* were used to make a selection of fonts for examination.

There is an ongoing debate[8] between typographers and cognitive psychologists as to how we read and as to what defines legibility and readability. Both groups accept that we read in saccadic movements (rapid jumps of the eye) from one word or phrase to another. Where they differ is in terms of how we perceive the words. Typographers opine that we recognise word shapes, or *bouma*, and make a distinction between legibility and readability. William Berkson[9] quotes from J.Ben Lieberman's Types of Typeface (1967) –

> *"Legibility is based on the ease with which one letter can be told from another… Readability is the ease with which the eye can absorb the message and move along the line."*

Cognitive psychologists, on the other hand hold that we read by recognising individual letterforms (parallel letterwise recognition). This debate seems unresolved and is outside the scope of this research.

0.8 The ideal

In an ideal world, typefaces specified by designers would be viewable as intended, by end users. Tools would exist which would enable typographers to

[8] http://opentype.info/blog/2011/06/14/how-do-we-read-words-and-how-should-we-set-them/

[9] http://typophile.com/node/8049

control factors such as kerning, hyphens, ligatures, orphans and widows. Operating systems and browsers would render the fonts beautifully and faithfully.

Some of these tools exist today. Web designers can choose from a wide range of typefaces and embed them in their webpages, specify their size, line-height, weight, style and colour. They can control line length to a large extent and set baseline grids. The `optimizeLegibility` property enables ligatures in those typefaces which have them.

Others tools exist as javascript libraries such as *lettering* and *widon't*, which attempt to solve kerning issues and widows, respectively.

CSS4, which is in a draft stage at the time of writing promises more typographic controls with extended pseudo-classes and selectors[10]. Wider adoption of OpenType promises extended character sets with alternative and contextual glyphs.

Operating System and browser rendering continues to improve, with Microsoft's replacement of GDI ClearType with DirectWrite ClearType constituting a very positive move, while Internet Explorer 9's subpixel positioning is now a match for Firefox.

While Phinney holds that today, we are in *"the wild west of web typography"*, tomorrow certainly looks more promising.

[10] http://www.w3.org/TR/2011/WD-selectors4-20110929/

Chapter 1

Literature Review

1.1 History and background

The history, origins and development of typography are very well documented. The craft of typography has had a remarkably long gestation. The Chinese created the first printed book in the year 868[11], having invented engraved wooden type circa 650[12]. They invented movable ceramic type between 1041 and 1049. The Koreans invented the first movable metal type around 1230. Johann Gutenberg is credited in the West with the invention of the printing press 1440 and 1450. Gutenberg's invention is significant as it established and popularized a printing process which became widespread. It can be asserted that Latin typography had its' genesis in the mid fifteenth century, although written works date back much further.

In his book *The Gutenberg Galaxy* (1962), Marshall McLuhan quotes from David Diringer's *The Alphabet* (1967) –

> *"The fact that alphabetic writing has survived with relatively little change for three and a half millennia... is the best evidence for its suitability to serve the needs of the whole modern world."* (p47-48)

McLuhan is more concerned with the contrast between oral traditions and reading traditions and how those reading traditions affected society and culture than with typographic detail and legibility, however.

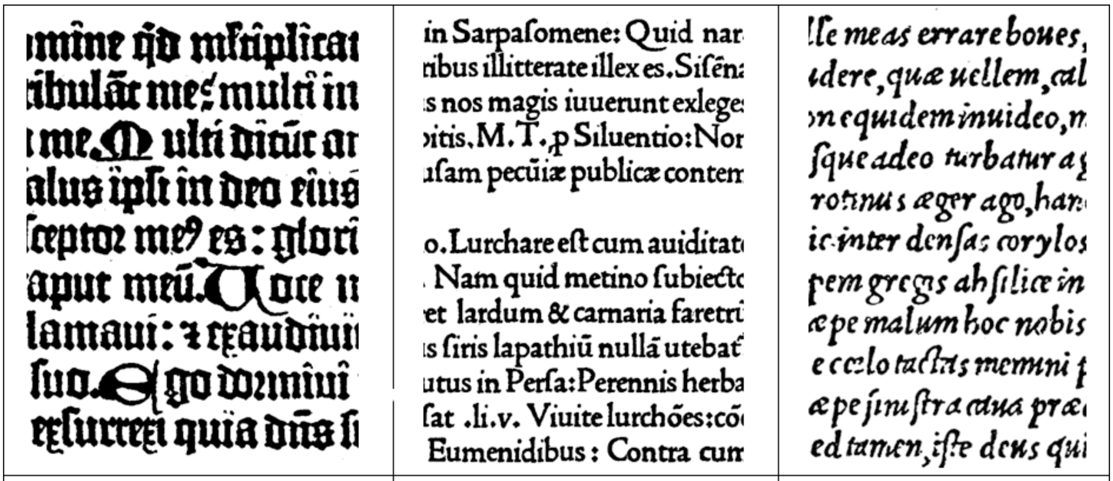
Diringer in turn traced the alphabet's origins back to pictograms in the ancient middle-east, but again his chief concern was contrasting the societal

[11] Columbia University of New York, http://afe.easia.columbia.edu/song/readings/inventions_timeline.htm

[12] Philip's Key Events in History, 2002 p 41, 49

changes brought about by the accessibility of an alphabet as opposed to thousands of pictograms which could only be understood by a highly educated elite; typographic practice was not examined.

Robin Dood's *From Gutenberg to Opentype* (2006) was more enlightening in terms of the historic development of the printed letterforms. A lecturer at the London College of Communication specializing in design history and typographic theory, his history establishes that many of the typographic paradigms we use today, were first established by pioneer practitioners such as Gutenberg, and shortly thereafter by Jenson, Manutius, Caxton and Garamond. The *Blackletter* or *Fraktur* letterforms of Gutenberg quickly gave way to what became known as *Venetian* type, based on the more legible hand lettering of Italian scribes. Elements such as hyphenation, italics, capitals and lowercase were all established before 1600.



Gutenberg Fraktur - 1452 | **Jensen's Roman - 1469** | **Mantius' Italic - 1501**

Fig 1: Comparison of Blackletter, Roman and Italic letterforms

> *"Aldus Manutius' Roman defined the essential form of printed letters in Europe for the following three centuries".*
>
> - Ben Archer, 2007[13]

The useful timeline on the same site illustrates how many of these typefaces keep appearing in various guises over the years, right up to present day. As recently as 1989, the Adobe Corporation released a digital version of the afore-mentioned *Garamond*.

Dood's examination continues through the development of the grotesque typefaces of the late 19th, to the proliferation of typographic styles of the 20th century, such as Modernism, De Stijl, Bauhaus and the first Display faces of the postwar years. He examines milestone typefaces in some detail, for example, Bembo, Futura, Helvetica and Palatino, among others. Dood concludes with an examination of Adobe's Opentype font format and a selection of digital type foundries, including Carter & Cone, the creators of Georgia and Verdana.

While Dood is very thorough with the history of type, digital aspects comprise only a small section of the book and no mention is made of web typography. Fredrick Hamilton's *The Uses of Italic* (1918, The Gutenberg Project) corroborates Dood's and Archer's timeline of italic development *(see Archer, §1.3.4).*

[13] Archer, B (2007) http://www.100types.com/100types.com.10manutius.html

1.2 Typographic best practice

This research is focused primarily on typography in its functional form – typesetting and legibility. Expressive typography is not relevant to this research, therefore prominent twentieth century typographic practitioners such as David Carson and Neville Brody have been excluded. The constructivist and de-constructivist movements are also not included for the same reason.

In *Getting it right with Type* (2000), Victoria Squire examines type in practice – legibility of typefaces, leading and line length, and hierarchy are among the aspects covered. She also has a useful section dealing with the elements of layout, from columns and grids to footnotes and bibliographies. While Squire's exploration of type and typography is very thorough, only two pages are devoted to screen typography, and then in little detail.

Robert Bringhurst's *The Elements of Typographic Style*, first published in 1992 and currently in its 4th edition (called version 3.1) is widely regarded among typographic professionals as the Typographers Bible. On the rear cover, Hermann Zapf, the designer of Optima and Palatino describes it thus –

> *"Written by an expert, Robert Bringhurst's book is particularly welcome in an age where typographic design is sometimes misconstrued as a form of private self-expression for designers."*

Zapf's comment is particularly relevant in this age of democratized publishing. *The Elements of Typographic Style* is a dense, incredibly detailed exploration of high level typographic communication. From typefaces and obscure glyphs to typesetting, Bringhurst leaves no stone unturned in his quest for typographic perfection. This book is invaluable in many ways – choosing appropriate typefaces, legibility, leading, line length, rhythm and structural forms are but a few of the topics examined.

Although its publication precedes the web, and devotes only a small section to digital type, its value lies in its use and examination of typographic exemplars.

Paul Felton's *The Ten Commandments of Typography / Type Heresy* (2006). Is divided into two distinct sections: The rules, where he distills typographic practice to ten commandments; and breaking the rules, where he disregards the afore-mentioned.

It is the former section, which is relevant to this research. These simplified guidelines are more accessible to the non-typographer than Bringhurst's detail and should prove useful in influencing a general purpose stylesheet, although some are not relevant or applicable, as marked out below*.

This list is paraphrased from Felton's original.

1 Have no more than three typefaces in one document.

2 Have large headlines at the top of the page.

3 Use 8 – 10 pt for body copy*
(not appropriate for screen typography).

4 A typeface that is not legible is not a typeface.

5 Type should be correctly kerned *
(see §6.7 and §7.2.4 for further information on kerning).

6 Lay stress discretely upon text elements

7 Don’t set body text in all-caps

8 Use a baseline grid

9 Use flush-left ragged-right alignment

10 Use between 40 and 70 characters per line.

There is a small variance between Felton’s and Bringhurst’s recommendations; for example Felton recommends line lengths of 40 – 70 characters while Bringhurst recommends 45 – 65, but such variations are minimal. The real value in Felton’s work is in its’ simplicity.

1.3 Web Typography

Although a number of books have been published dealing specifically with typography on the web, most have not aged well. *Typography, the best work from the Web* (1999) by Carlson/Molina/Fleishman, for example, is very outdated, dealing with typography purely in an aesthetic way. Much of the type and websites shown are image based (the book predates the semantic web) and typefaces have been chosen for stylistic reasons rather than legibility. Furthermore, the styles are heavily influenced by the deconstructivist movement, especially popular in the 1990s, which attempted to distance itself from the more rigid modernist forms, and indeed from Bringhurst’s classic typography.

The constantly changing nature of the web means that published works on the subject rapidly find themselves obsolete. Many of the specifications in CSS3 and HTML 5 for example, are already supported by the latest versions of the main web browsers. This is despite the fact that CSS3 is not due to reach full specification until 2014, and HTML 5 until 2022 (w3c.com). Indeed, there are many sites and forums already discussing the specs for CSS4 and HTML6. Search results for “web typography” on Amazon reveal that the more recent and likely relevant works are only available for pre-order at the time of writing. All the other works listed date from 2003 and earlier.

Color & Type for the Screen by Verushka Gotz (1998) deals with various issues related to screen typography, including suitability, styles, sizes, line spacing and aliasing (which she describes as smoothing). The detail however, is superficial, and no mention is made of either Georgia (designed in 1993) or Verdana (1996). Much of the information on type is obsolete, but her examination of colour and contrast remains valid.

Richard Rubinstein’s *Digital Typography* (1988) is geared primarily for the print designer, but the section on making digital letterforms is enlightening in terms of font *colour* (contrasting weight of strokes in a typeface) and structural detail.

> *“Designs with relatively large x-heights are attractive at lower resolutions because they make better use of the available space, and simultaneously appear larger on the screen…”*
>
> - Richard Rubenstein[14]

[14] Rubenstein, R (1998) *Digital Typography*, p90

The web itself has proved to be the best source of current information on web typography. While Google gives 5,870,000 results in a search for web typography, a certain few sites stand out in terms of their contributors' provenance. There are a number of websites relevant to this research such as 24ways.org, Typotheque.com, Ilovetypography.com, Typophile.com and AlistApart.com among others. They share many contributors and cover much of the same ground, therefore a selective approach is used here.

1.3.1 A List Apart

A List Apart (alistapart.com) in its own words, explores the design, development, and meaning of web content, with a special focus on web standards and best practices. Its contributors include Eric Meyer (author of the css reset), Jeffrey Zeldman (co-founder of the Web Standards project) and Jason Santa Maria (founder of TypeKit). Although the scope of A List Apart is wider than typography, it has an excellent section devoted to the subject with 23 detailed articles on web typography and a further six on web fonts.

Richard Rutter (*How to text in CSS* – 2007) and Peter K Sheerin both have articles dealing with text sizing and specifically with the *EM* as a unit of measurement in preference to pixels or points. These articles use a base (paragraph) font-size set in pixels (14 – 16px), but all subsequent sizes set in ems. With a base size of 16 px, 1 em equals 16px. A heading might then be set as 1.4ems. The em has the advantage of being proportional – changing the base font-size has the effect of changing all other measurements proportionally. Their font-size is in contrast with Felton's third rule (8 – 10 pt body text), which is more appropriate for print.

Sheerin goes further in his piece, *The Trouble With EM 'n EN (and Other Shady Characters)*(2001) detailing *Unicode* and specialist glyphs such as dashes, hyphens, quotes and spaces. This article is very useful in it's conformance to Bringhurst's work, but certain aspects may not be relevant to the creation of a general-purpose stylesheet. Unicode symbols must be hard-coded as part of the HTML, which would not be under this author's control.

Wilson Milner's *Setting Type on the Web to a Baseline Grid* (2007) is a helpful guide to creating consistent multi-column layouts and coherent typography. He recommends using a consistent line-height across all text elements, based on the base font size. In his example he uses a base size of 12px text with 18px line spacing. Larger elements such as a 24px heading receive a bottom margin of 18px (or alternatively, top and bottom margins of 12px respectively) to preserve alignment. His aim is to create a harmonious vertical rhythm.

Milner defends his use of the pixel as a base unit because it is easier to maintain and adjust than relative units such as the *em*. Although the em can be specified to the third decimal place, screens are drawn in pixels. Em measurements would therefore be rounded up or down to the nearest pixel unit, potentially breaking the baseline grid.

Richard Fink's article *The look that says book* (2010) builds on Milner's examination of columnar layout and looks specifically at justification and hyphenation. His comparison of the advantages and disadvantages of the soft-hyphen are especially useful. The soft-hyphen permits words to be hyphenated as necessary, allowing paragraphs to be justified. He accepts that a drawback of the soft-hyphen is that it must either be hard coded in the html, or added dynamically using javascript such as hyphenator.js. Both approaches would significantly bloat the html code.

More Perfect Typography (2010) and *More Meaningful Typography* by Tim Brown (2011) further extends on Milner and Fink by suggesting the golden mean (1.618) as a method of defining scales. He also covers recent developments in CSS and browser development in terms of font rendering.

> *"So: as a web designer, font rendering is mostly out of your hands. But it's important to remember that certain styles within your control can have an effect. When testing, keep in mind that different styles for contrast, size, color, and rotation can result in significant differences."*
>
> \- Tim Brown (2010)[15]

Brown's identification of a typefaces 'sweet spot' - a size at which it renders best, is especially enlightening. His practice of identifying that size, then using it as the base of his modular or harmonious scale should prove useful, although he admits that *"maths is by no means a replacement for the designers eye"*.

[15] Brown, T (2010) *More perfect typography: Build Design Conference* http://vimeo.com/17079380/

Taming Lists (2002) by Mark Newhouse is an early article but still valid in most respects. Newhouse deals with the disparities between the various browsers' methods of dealing with lists and suggests a number of methods of dealing with them. Most of these differences are due to the browsers default padding and margins. The article precedes Eric Meyer's *CSS reset* and Nicolas Gallagher & Jonathan Neal's *normalize.css,* which both solve most of these issues. The remainder of the article deals with inline lists, replacing or removing bullet points, default indents and using pseudo-elements, a css method of adding content to HTML elements.

Jason Santa Maria explores the challenges caused by the democratization of and availability of typefaces through @fontface in *On Web Typography* (2009). The parallels between the explosion of web publishing and the earlier desktop publishing revolution are notable as *everyman* now has the ability to create web typography, if badly. Noting that creators and users often have personal preferences, he quotes[16] type designer Zuzana Licko –

> *"We read best what we read most."*

Santa Maria recommends starting with an appropriate typeface for body copy. Such a typeface should have a generous x-height and some personality, but not enough that the typeface distracts from the content. He then suggests pairing the selected type with another for headings, serif with sans-serif for example. He offers guidelines accessible to everyman in an attempt to make a general improvement in typography on the web.

[16] http://www.alistapart.com/articles/on-web-typography/

> *"Contrast is probably the most important thing to keep in mind. When pairing typefaces, it's important to be able to tell that there are two distinct typefaces in play, but contrast has other uses as well. Very different typefaces can play off of each other in complementary ways or resist each other to create a bit of tension, while typefaces that appear too similar can weaken the message and confuse a design's visual language."*
>
> - Santa Maria (2009)[17]

Santa Maria also points out that many typefaces have specific cultural references or connections with particular time periods. It is therefore important to match the subject matter with an appropriate typeface choice. Typeface families with a good selection of weights and styles, give flexibility without having to introduce a second face. He does concede that sometimes typeface pairings "just feel right", even when logic suggests they shouldn't.

> *"Play a bold off of a light or italic weight for contrast, or try all caps or small caps with a bit of letter-spacing for a subhead. If you choose typefaces that only contain a single weight, you may find it very difficult to create the contrast that a passage requires to adequately distinguish sections visually."*
>
> - Santa Maria (2009)[18]

[17] http://www.alistapart.com/articles/on-web-typography/

[18] http://www.alistapart.com/articles/on-web-typography/

1.3.2 Typotheque

Typotheque.com has two articles which are particularly relevant to this work. *Font Hinting* (2010), by Peter Bil'ak examines various methods of type rendering across various operating systems and browsers. He goes further, detailing how type is drawn and hinted in the case of Truetype (the dominant font format on Windows) – essentially redrawn for use at different sizes.

Bil'ak's work explains why so few fonts are hinted and gives examples of both hinted and un-hinted fonts at various sizes *(see chapter 5, §2)*. Alternative formats such as Postscript are also covered. He predicts the eventual death of hinting, but with Windows XP holding a 58.4% market share (his statistic, now 43% at the time of writing), this day is a long way off.

In *Typeface as Program* (2011), Erik Spiekermann is interviewed by Jurg Lehni and discusses the various issues surrounding the copyright and licensing of fonts. Licensing is one of the major issues facing designers and typographers on the web. Many commercially designed fonts, including Spiekermann's, are becoming available for web embedding from Typekit (which has been acquired by Adobe at the time of writing).

Spiekermann explains that fonts are considered software in terms of licensing. The letter shapes cannot be copyrighted, but the code that describes those shapes can. This distinction has, perhaps, led to the licensing models widely used for webfonts, where use of a font is licensed annually for specific domains.

> *"Software companies like Microsoft charge up to 100 dollars per user and year for the use of their programs. If that method was applied to the licensing of fonts, it would result in massive sums for big corporations like Bosch with 60,000 users."*
>
> - Erik Spiekermann, 2011[19]

1.3.3 Bringhurst on the web

The Elements of Typographic Style Applied to the Web (commenced 2005, webtypography.net) by Richard Rutter is an ongoing attempt to apply Bringhurst's principles to the web. The site currently deals with just two sections of eleven from the source book– *Rhythm & Proportion*, and *Harmony & Counterpoint*. Having said that, those sections are among the most relevant to this work.

His guidelines are similar to Felton's (§1.2), with a few additions.

1 Letterspace strings of Capitals, small-caps and numbers

2 Don't letterspace lowercase without reason

3 Choose a line-height which suits the typeface[20]

4 Set opening paragraphs flush left

5 Add extra space before and after quotations

6 Indent or center quotations

7 Don't compose without a scale

[19] http://www.typotheque.com/articles/typeface_as_programme_erik_spiekermann

[20] Tim Brown's suggestion of the golden mean should be used as a guideline only. A Typeface with a large x-height may require less line-spacing than one with a lower x-height.

Certain sections, such as "*Don't compose without a scale"* equates to Felton's baseline grid and may be extended using Tim Brown's modular approach.

1.3.4 100 Types

100types.com is the practical project work of a Masters Degree in Art & Design by Ben Archer at AUT University in Auckland, NZ. It is a historical overview of some of the more important typeface beginning with Gutenberg's Bible Textura and ending with Bodoni 26 in 1999.

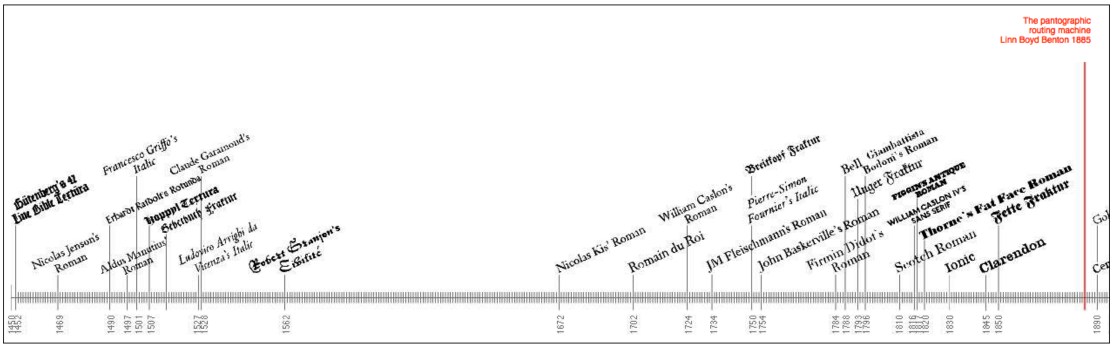


Fig 2: Timeline of typeface design from 100 types

Its usefulness lies both in its historical information and in its graphical portrayal of the timeline and relationships between the various typefaces and styles.

1.3.5 Extensis Webcast / web-seminar

The web font and font-management company Extensis ran a web based seminar in September 2011, delivered by Thomas Phinney, designer of Hypatia Sans and treasurer of Atypl, the International Typographic Association. This consisted of three separate webcasts, part one on choosing and combining fonts for websites, part two on setting type for the web, and part three dealt with OpenType support on the web.

Phinney describes OpenType as the new frontier for web type, with support already in place in Firefox, in development on Internet Explorer and expected support in the Webkit browsers over the next year. The `moz-font-feature-settings` CSS property permits control over kerning, ligatures, alternates, real small caps and stylistic sets. While TrueType includes kerning tables, some ligatures (fi & fl) and can include small caps, OpenType is the only format which offers support for contextual alternates and stylistic sets.

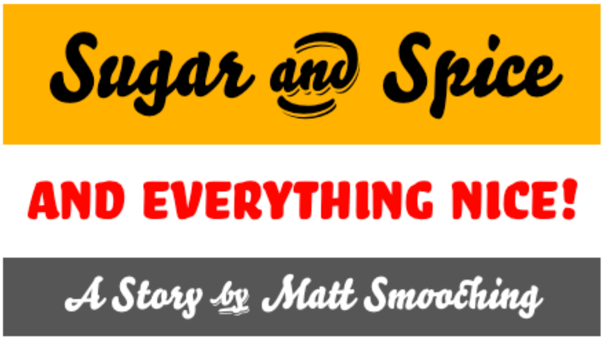


Fig 3: Note the contextual alternates 'and', 'by' & 'ch'.

Alternates are alternative letterforms, for example swooshes, while contextual alternates take the concept further allowing typographic flourishes depending on the textual context. While support is currently limited, it seems that OpenType will enhance the typographic possibilities on the web.
Phinney admits that web typography is currently in a *"wild west"* stage of development, with numerous competing techniques and hacks widely in use.

1.3.6 Snook.ca

Jonathan Snook extends Rutter & Sheerins work on Em units in his article on the REM unit, a new specification in CSS3. He points out that the EM is relative to the size of its parent, which can cause a compounding error effect, particularly noticeable, but not restricted to list based menus.

> *"The problem with em-based font sizing is that the font size compounds. A list within a list isn't 14px, it's 20px. Go another level deeper and it's 27px!"*
>
> - *Snook (2011)*[21]

The *rem*, or 'root em' is intended to solve this problem by making the rem relative to the root element. This means that a single font size may be declared on the html element, and all rem units may be declared as a percentage of that. He also specifies a fallback for older browsers, with the result that all current browsers can have resizable text, with consistent and predictable sizing in older versions.

1.3.7 W3C.org

The World Wide Web Consortium (W3C) is the organisation, which sets down the standards for the web. Led by the inventor of the web, Tim Berners-Lee, it comprises various member organisations and interested parties. The HTML and CSS specifications are set by the W3C and implemented by the browser creators. Draft specifications (CSS3 for example) are implemented using browser prefixes to test the specifications and may or may not be used in the final release. The W3C is the official source of information both in terms of specification but also in terms of web architecture and the principles of the semantic web.

[21] Snook, J (2011) *Font sizing with Rem* http://snook.ca/archives/html_and_css/font-size-with-rem/

1.3.8 Columbia.edu

Columbia University's *Timeline of inventions*[22] is a useful resource for establishing and contrasting the dates of invention of the various technologies. In the western world, for example, Johann Gutenberg is generally credited with the invention of the printing press and the first printed book around 1456. The Chinese had actually created the first printed book in 868 AD and the first movable type between 1041 and 1049. Philip's *Key Events in History* gives 650AD as the invention date of wood block printing and 1050AD for movable ceramic type.

1.4 Summary

It is apparent that the printed work cannot keep up with the rapid pace of development on the web. Recently published works are often obsolete as soon as they are published or have been superceded by new specifications or rendering technologies. Regardless, the central practice of typography, honed over 500 years, remains undiminished. Printed works, and Bringhurst's work in particular exemplify the central ambition for typography.

Practitioners such as Rutter, Santa Maria, Snook and Brown offer up-to-date explorations of this ambition being realized through the available technology. If there is a flaw, it is that the information is disparate, scattered and aimed at the professional typographer. What is required is a coalescing and refining of all of this information, that any web publisher may use it.

[22] http://afe.easia.columbia.edu/song/readings/inventions_timeline.htm

1.5 Project Aims

The aims of this research then therefore can be summarised as follows –

- Collect and combine all the available information.
- Test available web-fonts for performance and legibility.
- Create a series of accessible typographic guidelines based on those of Bringhurst, Felton et al.
- Design and build a website to host and display the guidelines.
- Provide a downloadable, flexible CSS stylesheet incorporating the guidelines in terms of font embedding, font stacks, type-sizes, line spacing, hierarchy and line-length.

This stylesheet would be released into the public domain through Creative Commons and could offer an adaptable yet solid structure on which to improve general typography on the web.

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Chapter 2

Font-stacks

2.1 Introduction

Because there is no way of determining whether a font specified by a website designer is installed on every computer, font-stacks are defined which provide a system of graceful degradation - i.e.: if the specified font is not installed, the browser will choose an appropriate replacement. Thus, font stacks are defined as a list of fonts, in order of preference.

```
body{font-family:Arial, Helvetica, sans-serif;}
```

In the case above the fonts would be rendered in Arial first, and if unavailable, in Helvetica and as a last resort, in the operating systems default sans-serif.

2.2 Font stacks: Core Web Fonts

The so-called core web fonts are those fonts, which are installed by default on almost all computers. CSS specifies five basic font types - serif, sans-serif, cursive, fantasy and monospace.

Two of these, cursive *(handwriting fonts such as Brush Script and Comic Sans)* and fantasy *(display fonts such as Papyrus and Curlz MT)* are not suitable for body text and should be used for headings and subheadings only. The remainder form the basis of legible copy on the web. Serif and Sans-serif fonts are most appropriate for body copy, with monospaced fonts being used to represent computer code.

> *"Font stacks are prioritized lists of fonts, defined in the CSS font-family attribute, that a browser will cycle through until it finds a font that is installed on the user's system"*
>
> - Nathan Ford (2008)[23]

Serif fonts are traditionally[24] considered more legible than sans-serifs, at least in print. The serifs on the letterforms are said to aid the flow of text. On screen the serifs can become a liability, particularly at smaller sizes as browsers attempt to render the extra visual information. Recent serif designs such as Georgia and Cambria have been designed specifically for screen output and do much to address this issue.

The basic font stack for serifs is as follows –

```
font-family:Georgia, "Times New Roman", Times, serif;
```

Sans-Serifs lack the tails of serifs and tend to be more geometric in form. They also lack the contrast in stroke, which is characteristic of the serif font. This consistency of stroke weight makes sans-serif fonts very useable on-screen, and legibility tends to be superior to serifs at smaller sizes, e.g.: less than 12px.

Here is the basic sans-serif font stack –

```
font-family:Verdana,Arial, Helvetica, sans-serif;
```

[23] Ford, N (2008) *Better CSS Font Stacks*
http://unitinteractive.com/blog/2008/06/26/better-css-font-stacks/

[24] http://alexpoole.info/which-are-more-legible-serif-or-sans-serif-typefaces

Monospaced fonts also known as fixed width or non-proportional fonts, are fonts whose glyphs or letters each occupy the same amount of horizontal space. They are commonly used to represent computer code, and occasionally, to create *ASCII*[25] images. The CSS code displayed on these pages are set in Courier New, a monospaced font.

```
font family:”Courier New”, Courier, monospace;
```

The core web font stacks are severely limited by a lowest common denominator approach. This has resulted in a homogenous uniformity in web typography with a near ubiquity of Arial in particular.

2.3 Expanded font stacks

Richard Rutter, Nathan Ford and Amrinder Sandhu, among others, have written extensively about extending the number of fonts available to web designers. The basic font stacks are based on a lowest common denominator approach, selecting only those fonts common to all computers. There are however, a significant number of fonts installed on a large percentage of computers, which could be added to the basic stacks. This would allow those users with the fonts installed to view pages set in those fonts, while degrading to the basic stacks for those users who do not.

In the example overleaf, Garamond has been added to the front of the serif font stack. Users with Garamond installed will now have their page set in Garamond while those that don't will see Georgia.

[25] http://inkwell.ie/typography/ascii.html

```
    {font-family:Garamond, Georgia, Times, serif;}
```

In this way it is possible to extend the basic font stacks significantly. As well as increasing the availability of typefaces this approach also facilitates other operating systems such as Linux, which have a different set of fonts installed.

> *"Think about typefaces beyond the core web fonts"*
>
> \- Richard Rutter (2009)[26]

Richard Rutter has devised a font matrix[27], which is a useful tool in determining font availability across Windows and Mac operating systems. The matrix dates from 2007, but the statistics in the tables 1, 2 & 3 from Codestyle.org are more current.

Table 1 - Most common fonts on Windows (Dec 2011)

Serif	**%**	**Sans-serif**	**%**
Georgia	99.48	Verdana	99.84
Times New Roman	99.69	Tahoma	99.95
Palatino Linotype	99.42	Arial	99.84
Book Antiqua	86.09	Trebuchet MS	99.74
Garamond	86.24	Lucida Sans Unicode	99.37
Cambria	54.51	Franklin Gothic Medium	97.87
Constantia	53.81	Calibri	54.76
Goudy Old Style	51.30	Candara	54.31
Baskerville Old Face	49.10	Gill Sans MT	51.74
Bodoni MT	47.89	Segoe UI	45.04

[26] http://clagnut.com/blog/2255/

[27] http://media.24ways.org/2007/17/ fontmatrix.html

Table 2 -Most common fonts on Linux (Dec 2011)

Serif	%	Sans-serif	%
Century Schoolbook	99.28	URW Gothic L	99.28
URW Bookman L	98.81	Nimbus Sans L	98.57
URW Palladio L	98.57	Deja Vu Sans	97.37
Nimbus Roman	98.33	Deja Vu Sans Light	94.94
Deja Vu Serif	97.37	Deja Vu Sans Condensed	91.17
Bitstream Charter	92.36	Free Sans	84.01

Table 3 - Most common fonts on OS X (Dec 2011)

Serif	%	Sans-serif	%
Times	99.37	Helvetica	100
Georgia	97.63	Geneva	98.84
Times New Roman	97.63	Lucida Grande	100
Hoefler Text	88.70	Arial	98.73
Baskerville	88.60	Verdana	99.05
Didot	87.72	Helvetica Neue	98.58
Big Caslon	85.10	Trebuchet MS	94.2
Palatino	79.71	Gill Sans	91.52
Lucida Bright	99.68	Futura	91.01
Garamond	23.84	Optima	90.14

Nathan Ford has a detailed examination of improved font stacks[28] grouped by *serif / sans-serif / monospaced* and by individual typeface characteristics,

[28] http://unitinteractive.com/blog/2008/06/26/better-css-font-stacks/

such as x-height and narrow face or condensed. He further breaks down the font stacks into suitability for paragraphs and titles. The lists overleaf are a selection of his paragraph choices.

2.3.1 Serif font-stacks

- Baskerville, Times, “Times New Roman”, serif;
- Garamond, “Hoefler Text”, Palatino, “Palatino Linotype”, serif;
- Georgia, Palatino,” Palatino Linotype”, Times, “Times New Roman”, serif;
- Cambria, Georgia, Times, “Times New Roman”, serif;
- “Copperplate Light”, “Copperplate Gothic Light”, serif;
- Georgia, Times, “Times New Roman”, serif;
- Palatino, “Palatino Linotype”, Georgia, Times, “Times New Roman”, serif;
- Palatino, “Palatino Linotype”, “Hoefler Text”, Times, “Times New Roman”, serif;
- Times, “Times New Roman”, Georgia, serif;

2.3.2 Sans-serif font-stacks

- Geneva, “Lucida Sans”, “Lucida Grande”, “Lucida Sans Unicode”, Verdana, sans-serif;
- Arial, “Helvetica Neue”, Helvetica, sans-serif;
- “Century Gothic”, “Apple Gothic”, sans-serif;
- “Franklin Gothic Medium”, “Arial Narrow Bold”, Arial, sans-serif;
- Futura, “Century Gothic”, “Apple Gothic”, sans-serif;

```
- “Gill Sans”, Calibri, “Trebuchet MS”, sans-serif;
- “Helvetica Neue”, Arial, Helvetica, sans-serif;
- Impact, Haettenschweiler, “Arial Narrow Bold”, sans-serif;
- “Lucida Sans”, “Lucida Grande”, “Lucida Sans Unicode”, sans-serif;
- Tahoma, Geneva, Verdana, sans-serif;
- “Trebuchet MS”, “Lucida Sans Unicode”, “Lucida Grande”, Arial, sans-serif;
- “Trebuchet MS”, Tahoma, Arial, sans-serif;
- Verdana, Tahoma, Geneva, sans-serif;
```

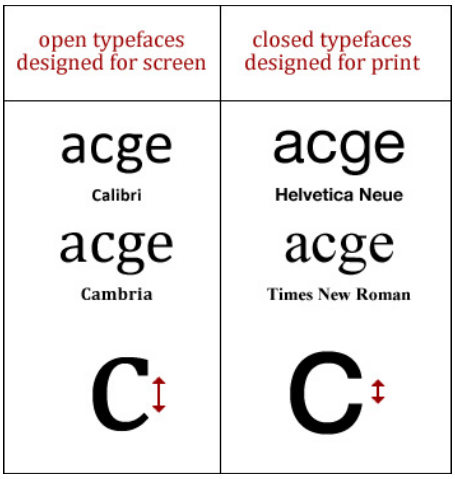
2.3.3 Monospace

```
- Consolas, “Lucida Console”, Monaco, monospace;
- “Courier New”, Courier, monospace;
```

2.4 Printer fonts versus screen fonts

Many of the fonts listed above are digitised versions of printer fonts. While they will display reasonably well across the various systems, fonts designed for screen will be more legible.

Typefaces designed specifically for screen are more open *(fig 4, overleaf)* and serif faces have less contrast between the thick and thin strokes, leading to improved legibility on-screen.


open typefaces designed for screen
closed typefaces designed for print
acge
Calibri
acge
Helvetica Neue
acge
Cambria
acge
Times New Roman
C
C

Cambria, Constantia and Georgia are common serif faces which have been designed specifically for use on-screen. Calibri, Verdana, Lucida (various), Tahoma and Trebuchet MS are the equivalent sans-serif faces.

Fig 4: Open typefaces for screen and closed typefaces for print

2.5 Screen optimized font-stacks

While Constantia has been designed for screen and is well hinted, it has a small x-height, which limits its' legibility at small sizes (<14px). With that in mind this writer suggests the following font-stacks –

2.5.1 Screen optimized serif font-stacks

```
Cambria, Georgia, "Times New Roman", Times, serif;
```

2.5.2 Screen optimized sans-serif font-stacks

```
Calibri, Verdana, Arial, "Helvetica Neue", Helvetica,
sans-serif;
Tahoma, Geneva, Verdana, sans-serif;
"Lucida Sans Unicode", "Lucida Grande", Arial, sans-
serif;
"Trebuchet MS", Tahoma, Arial, sans-serif;
Impact, Haettenschweiler, sans-serif;
```

2.6 Summary

The tables above show that there are many widely available typefaces beyond the core web fonts. The fact that most are simply digitized versions of printed fonts, however, hinders their usefulness in font-stacks. Most of these fonts do not have the extensive hinting *(see §4.4.3)* that their screen optimized counterparts possess. It seems that the core web font-stacks may be expanded, but only marginally.

Chapter 3

Font embedding technologies

3.1 Image replacement

Using images instead of text has been around as long as the `<img>` tag. Designers frustrated by the lack of typographic control routinely created designs in image editors and in worst-case scenarios, created websites entirely from images. Today, this is almost universally considered bad practice, because the content of an image cannot be indexed by search engines (without horribly dense alt tags). The bandwidth overhead is also increased substantially, both with the extra markup required and the image sizes themselves.

Nevertheless, image replacement still remains in use, and is in fact, extremely common. Every website using a logo in their header is using a form of image replacement. The use of an image representing the brand coupled with an `<alt>` tag is ubiquitous on the web.

The simplest approach is to insert the image directly into the html, and include an alt tag. While this approach is accessible, it is not semantic. An extended and superior approach is to include the text contained in the image as a `<span>` or `<h1>` in the HTML, and use CSS to hide the text but insert a background image. This approach maintains accessibility and should not adversely impact SEO.

The technique is simple and effective for use with static elements such as an identity, but can become labour intensive if, for example every heading was to be styled in this fashion. It would also mean that many website updates would also require image editing. FLIR *(FaceLift Image Replacement)* was developed by Cory Mawhorter to solve this problem by making the process dynamic. FLIR works by replacing text with png images created dynamically on the host server by a php script (GD or ImageMagick). The use of php could be viewed as a disadvantage, as servers running .Net cannot run FLIR. Mawhorter's site is no longer online, so it was not possible to test this technique. It is unclear if FLIR is still being supported, but a version of it has been forked to run as a WordPress plug-in.

3.2 sIFR

Shaun Inman developed Inman flash replacement as a method of replacing generic type in webpages with a user specified Flash based replacement. Mike Davidson and Mark Wubben took Inman's concept and made it scalable, renaming it sIFR.

The technique works by embedding a font in a flash swf movie and using javascript to call on that swf to replace selected html elements. The text remains selectable and accessible. This approach relies on the user have the Flash plug-in installed and JavaScript enabled. If either is absent, the type degrades to whatever is specified in the CSS.

The sIFR zip unpacks to a number of files, comprising a .fla (Flash) a CSS file, two javascript files and some supplementary files. The .fla file must be opened and its original font changed to the desired one. An .swf file is then exported which contains the required glyphs. If specialised glyphs are needed the embed function in Flash can be used. The sifr-config.js file then needs to be edited to reflect the name of the exported swf file. Finally, a few lines of javascript are pasted to the html page.

Note: the javascript links must come after the links to the global and sIFR stylesheets. There are many tutorials detailing the above, many of which did not work for this author. This writer found Mark Wubben's tutorial be the most straightforward. SIFR is nonetheless awkward to set up. It requires Flash Studio to edit the .fla and export the .swf, knowledge of HTML, CSS and JavaScript, and will not work locally due to security settings in the Flash plug-in. It does not work with every font; many tried by this author did not display, and of those that did some rendering glitches remained.

Using sIFR can cause slower load times, because of the increased number of server calls for the various JavaScript, swf and CSS files, even though the files themselves are quite compact. It also has a processing overhead as the browser has to parse the swf files. This makes it unsuitable for large bodies of text, although it works quite well as a heading replacement. Possibly the biggest argument against using sIFR comes for Mark Wubben himself —

> *"Given that we're well into 2011 at the time of writing, you should really think twice about deploying sIFR. Instead take a look at Typekit or Fontdeck. There hasn't been an update to sIFR since October 2008, and consequently it's probably riddled with bugs.*
> *Seriously, don't use it. It's unsupported software."*
>
> - Mark Wubben (2000)[29]

[29] novemberborn.net/sifr3

3.3 Cufón

The central aim of Cufón was to become the successor to sIFR, which as stated above, is difficult to set up. It consists of two parts, an online font generator (essentially a front-end to FontForge) and a JavaScript rendering engine, which is uploaded to the target site. The font generator allows the user to upload the chosen font (EULA permitting), where it is converted firstly to an SVG *(Scalable Vector Graphic)* file, then to VML *(Vector Markup Language)* and finally to JSON *(JavaScript Object Notation)*. SVG is not retained in the generated file due to speed issues. Because the file is essentially JavaScript no plug-in is required for viewing the converted text.

In practice Cufón is very easy to set up and use. The font generator interface allows the user to upload normal, bold, italic and bold italic fonts and group them under a user-specified font family name. The user then selects which glyphs are required from a checkbox list. Latin is checked by default and would be sufficient for most users, unless specialised characters are required. The user can select all glyphs but this is not recommended as the resulting file will be unnecessarily large.

The interface also allows restricting the usage to specific domains, which is a requirement of some typefaces EULA. Finally, the user can include or exclude kerning tables. The inclusion of these tables slightly increases the file size of the generated font but is highly recommended for improved type performance.

> *“Technologies such as this encourage the use of typefaces other than the standard set we’re all used to (Arial, Georgia, etc.).”*
>
> - Cameron Moll (2009)[30]

Implementing Cufón is as simple as linking to two provided JavaScript files, the former being the rendering engine, and the latter the font itself. A snippet of JavaScript is then pasted into the head of the page which specifies which html elements should be replaced. Cufón replaced elements can be styled like any other html element using CSS, e.g.: font-size, color, etc. Font weights and italics may only be used if the corresponding fonts were included in the upload to the font generator.

The example on the accompanying website took no longer than five minutes to set up, from uploading the OldStyle font to its inclusion on the page.

3.3.1 Legal note

The use of Cufón requires an extended or separate license from some Type Foundries, e.g.: Berthold, FontFont, FontSmith, Hoefler & Frere-Jones, ITC and Linotype. Adobe fonts are known to be safe for use[31]. Foundries are understandably cautious of licensing for Cufón, as the possibility exists that the Cufón code could be reverse engineered to reproduce the original font file. Before using Cufón it is vital to check the desired font’s EULA.

[30] http://cameronmoll.com/archives/2009/03/cufon_font_embedding/

[31] http://cufon.shoqolate.com/generate/

Summary

Image replacement techniques are still widely used, but many of the implementations are inappropriate. With the exception of branding, this author recommends that image replacement has no place on the semantic web. In contrast, techniques such as sIFR and Cufón may well be appropriate. In practice sIFR is awkward to implement and does not work if either JavaScript is disabled or the flash plug-in is absent. It is also unsuitable for body copy as the flash plug-in needs to read and render the text on-the-fly.

Cufón is currently supported by IE 6/7/8/9, Firefox 1.5+, Safari 3+, Opera 9.5+, and Google Chrome. It loads quickly as it is entirely JavaScript, particularly when compressed. While it can be used for larger bodies of text, it has a significant drawback in that Cufón text cannot be selected. The recommendation therefore, is to limit its use to headings/sub-headings and navigation elements.

Chapter 4

Font embedding with @font-face

4.1 Introduction

Font embedding has long been the ‘holy-grail’ for web designers. Although it was part of the CSS2 specification, it was removed in CSS2.1 only to be re-introduced in CSS3. Internet Explorer has actually supported @font-face since version 5.5 and all the major Browser developers have now implemented it. Simply put, @font-face is a CSS rule, which downloads a font (from either its host server or from a type service such as Typekit or Google Fonts) to the browser for page rendering.

4.2 Using @font-face

In practice using @font-face is easy, though not without some quirks. Although all the browsers support the specification, there is no standard font format. Embedded OpenType *(.eot)*, TrueType *(.ttf),* Scalable Vector Graphic *(.svg)* and Web Open Font Format *(.woff)* are all in use today.

Internet Explorer supports EOT and since IE9, WOFF but not SVG or TTF. Firefox supports TTF, WOFF but not EOT or SVG[32].
Opera and Webkit browsers don't support EOT. What this means is that a number of formats need to be generated, allowing the browser to select the appropriate one for use.

Font Squirrel has an excellent web font generator, which handles the conversion of fonts and the generation of the CSS code. The example overleaf is used for the decorative fleurons on the website accompanying this paper —

[32] http://webfonts.info/wiki/index.php?title=@font-face_browser_support

```
@font-face{
font-family: 'PrintersDevilsRegular';
src: url('webfonts/printersdevils-webfont.eot');
src: url('webfonts/printersdevils-
webfont.eot?#iefix')format('embedded-opentype'),
url('webfonts/printersdevils-webfont.woff') format('woff'),
url('webfonts/printersdevils-webfont.ttf') format('truetype'),
url('webfonts/printersdevils-
webfont.svg#PrintersDevilsRegular') format('svg'); font-
weight: normal; font-style: normal;
}
```

Note the different formats. Each of these font files needs to be uploaded to the host server. The 2nd line is a user defined font name, which can be called on simply by adding the font name to the start of any font stack, e.g.:

```
h1{font-family: PrintersDevilsRegular, Arial Helvetica, sans-
serif;}
```

4.3 Font hosting services

An alternative approach is to use a type hosting service, such as Google Fonts, Typekit or Fontdeck. These host the necessary files, and the site simply links to them. The Google service is free, while Typekit and Fontdeck are commercial, but the availability and quality of the fonts on the commercial services is superior.

4.3.1 Typekit

Typekit was launched in 2009 and was acquired by Adobe in 2011. This writer reviewed the service shortly after the launch. It is without doubt the best service at present, with many of the major type foundries on-board, including Adobe, Bitstream and Exljbris. At the time of writing, it hosts 704 professionally designed fonts and their font variants are more extended than the free services. Many faces are available in weights from Ultralight to Black, with styles in italics and obliques, condensed and extended. The service is fast, users will not notice any delay in font rendering. A caveat is that most are designed for print, and simply licensed for use on the web.

4.3.2 Fontdeck

Fontdeck was created in 2010, as a collaboration between Clearleft, a British web design company and OmniTi, an American software company. They represent some of the same foundries as Typekit, such as Exljbris, but their type suppliers are independent, for the most part. Fontdeck has a very large display font section, but serifs (102 fonts) and sans-serifs (266) are also well covered. The categories used are inaccurate in places, with some serifs under the sans-serif category.

Note: some of the typefaces included in both categories would be better described as display faces, e.g. Ollivette is a distressed font based on a typewriter typeface. This might work well as a heading but is totally unsuitable for body copy.

4.3.3 Google Web-fonts

Google's web font service is free, but the quality of the hosted fonts is variable. Most of the fonts on offer are for display fonts (novelty fonts) however there is a selection of serif and sans-serif fonts available. These will be examined in more detail in §6.5.4 and §6.6.

4.3.4 Pricing models

If there is a criticism of Typekit, it relates to their pricing model, which is subscription based. It also scales with visitor numbers. While this is not a problem for corporate users, this authors experience with SME clients is that they are usually unwilling to add ongoing costs to their web presence. Typekit does offer a free service, limited to two fonts, but the site must display the Typekit logo. This may be sufficient for personal users. Fontdeck on the other hand, uses a flat annual fee model regardless of site traffic (up to 1 million page views per month, when price scaling kicks in). Their pricing is more affordable and varies from one font to another (average price is $7.50pa). They also offer a free service, limited to 20 ip addresses, which is useful for site development.

At WebType, Steve Matteson recently extended the Georgia family, and David Berlow has extended the Verdana family, both now offering ten weights, italics and obliques, small caps and alternate numerals. These extensions of the core web fonts would do much to improve typographic colour on the web, however their pricing is high— $560 per annum per family for the hosted service rising to $5600 for self-hosting. This unfortunately takes those fonts out of the hands of most users.

4.4 Disadvantages of using @font-face

4.4.1 FOUT

An issue with using @font-face is FOUT (flash of unstyled text). This occurs as some browsers (some versions of Firefox, Opera and Internet Explorer), load the page then apply the style. Normal text will load, then flicker as it redraws as the embedded font. More recent browser releases appear to be applying a fix. Webkit browsers such as Chrome and Safari don't have this problem as they keep the text invisible until it is ready to be rendered.

4.4.2 Filesize and bandwidth issues

On Windows, particularly those versions prior to Vista, fonts need to be hinted to display well. Well-hinted fonts essentially have individual outlines for a number of smaller font-sizes, typically 9pt – 14pt (Peter Bi’lak, Typothetique). This has a large effect on the overall size of the font, as a number of font outlines must be downloaded. The number of styles used further compounds this.

For example, Ubuntu Sans is a freely available webfont designed for the Linux Ubuntu operating system. It is available in nine styles – light, regular medium, bold and their italics; it also includes a condensed variation. While these variations undoubtedly offer the designer great opportunities as regards typographic colour, they also have a large overhead. The Ubuntu font pack from FontSquirrel is over 1.5MB in size. Admittedly this includes all the web formats, but the individual formats are all quite large *(see table 4)*.

Table 4: Typical file-size comparison of web font-formats

Webfont format	**Filesize**
Embedded OpenType	213k
Scalable Vector Graphic	634k
TrueType	446k
Web Open Font Format	244k

This has implications for websites serving these fonts as their bandwidth requirements and hence cost, can rise significantly. It also places a delay on rendering the fonts on-screen, making FOUT more noticeable. Perhaps more significantly, mobile browsers will experience longer delays, as 3G networks are considerably slower than both wired and WiFi networks. Most mobile users also have monthly bandwidth limits, which could be used up quickly if each site visited uses @font-face.

4.4.3 Poor rendering of un-hinted fonts

Hinting is a skilled, time-consuming and expensive process and as a result, most fonts are not hinted. Peter Bi'lak estimates that 99% of all fonts, including commercial releases, are not hinted. This means that most fonts will not display well on Windows XP, which, at the time of writing, has a market share of 43%[33]. This will be examined in more detail in Chapter 6.

[33] http://www.netmarketshare.com/operating-system-market-share.aspx?qprid=10

4.5 EULA restrictions

The *End User License Agreement* (EULA) which accompanies each font, is currently the biggest obstacle to widespread font embedding. Licensing is a hot topic among type designers and type users alike. Type designers invest considerable time and effort in creating effective legible type and wish to protect their investment. At the Offset conference in Dublin, 2012, David Wall of *Conor & David* told this author that their typeface *Orga*[34], available in 8 weights and obliques, took six years of design and development. It has not yet been hinted. Speaking at the same conference and using Hoefler & Frere Jones as a model foundry, Jessica Hische[35] suggested that a hinted typeface in a similar number of variants could cost as much as $1.5 million to develop.

Type foundries fear, justifiably, that their intellectual property may be downloaded from sites and used for unlicensed purposes. Self-hosting of embedded type makes it easy for unscrupulous users to either download the various *woff*, *eot* and *ttf* or hotlink directly to them. For this reason, commercial services such as Typekit use various obfuscation methods to hide the url of their fonts while serving them.

An EULA typically grants the user a non-exclusive right to use the software (in this case, font). At no point does the user own the font. It will specify under which circumstances the font may be used. Most commercial EULAs either prohibit font embedding or require extended licensing. Many also prohibit their use in alternative technologies such as Cufón.

[34] http://www.typegroup.ie/

[35] Personal correnspondance, see appendix 8

4.6 In Summary

The increasing number of freely available fonts for the web is encouraging, however the quality of many of these fonts is questionable. Poor kerning tables means that many are particularly unsuitable for body copy, restricting them to headlines and subheadings. Most are available in one weight only, although a few have bold and italic variants. Most browsers have little or poor support for kerning and lack the sub-pixel positioning (using the red, green & blue sub pixels which combine to make a pixel as we know it) that would make kerning more accurate *(see §5.4)*.

The commercial services offer superior typefaces, many of them well hinted despite being designed for print, but their pricing/licensing model puts them outside the range of many users. There is currently a dearth of well-hinted typefaces designed specifically for the screen[36].

A significant disadvantage of font embedding, especially for mobile devices, is the bandwidth overhead. On 3G networks and with 4G still a way off, the extra bandwidth required to download a few variants of a font, can cause long delays in page rendering.

[36] Peter Bi'lak, Hinting, 2010, http://www.typotheque.com/articles/hinting

Chapter 5

Browser and OS type rendering

5.1 Background

The methods used by various operating systems to render type vary widely, even through generations of the same OS. Methods which had worked successfully on CRT (cathode ray tube) displays, had to be adapted as users moved to LCD (liquid crystal displays). Aliased type (monochrome 'jaggy' text) gave way to grayscale anti-aliased (smoothed) text which then gave way to sub-pixel (using the red, blue and green sub-pixels) rendered text.

Versions of Windows up until Vista (2000, XP) used whole pixel positioning to display their fonts via bi-level rendering (monochrome, aliased), font smoothing (grayscale, anti-aliased) or GDI ClearType (sub-pixel rendering, horizontal only, anti-aliased). Whole pixel positioning aligns the letters to the pixel grid, producing crisp text, but sacrificing font metrics (the stylistic shape of the type as intended by the type designer). ClearType, the superior method on LCD displays, was disabled by default on XP as it didn't perform well on CRT displays.

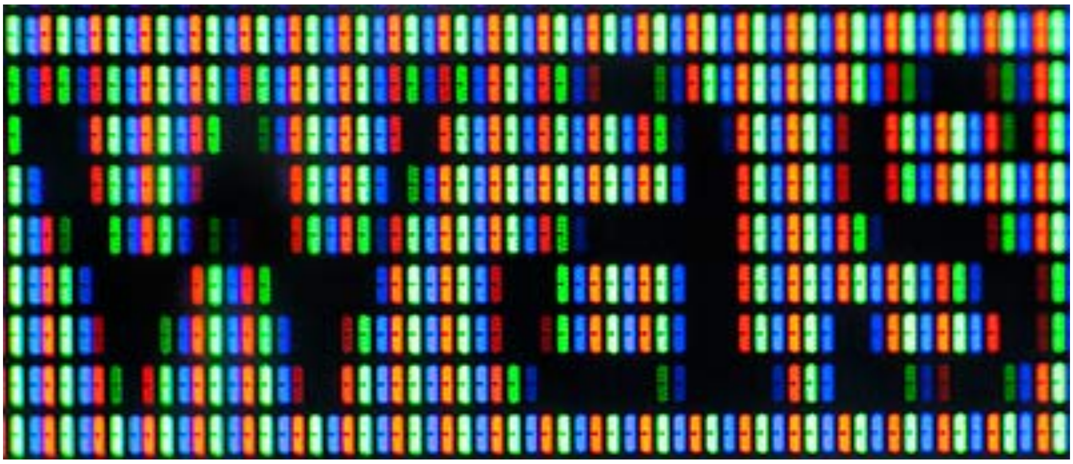


Fig 5: Close up, displaying the red, green and blue sub-pixels.

5.2 Font Hinting

Fonts need to be hinted to display well with ClearType. Hinting works reasonably well on LCD displays at their native resolutions, but can make text display considerably worse at non-native resolutions (producing blurry colour fringing) as sub-pixel values are no longer valid. Hinting is probably best described as screen optimizing. The majority of fonts are designed for print resolutions (typically 1200ppi and above) as vector outlines and scaled dynamically on the display screen. The problem becomes evident at smaller sizes when those outlines can no longer be described accurately on the pixel grid and the font degrades sometimes to the point of illegibility.

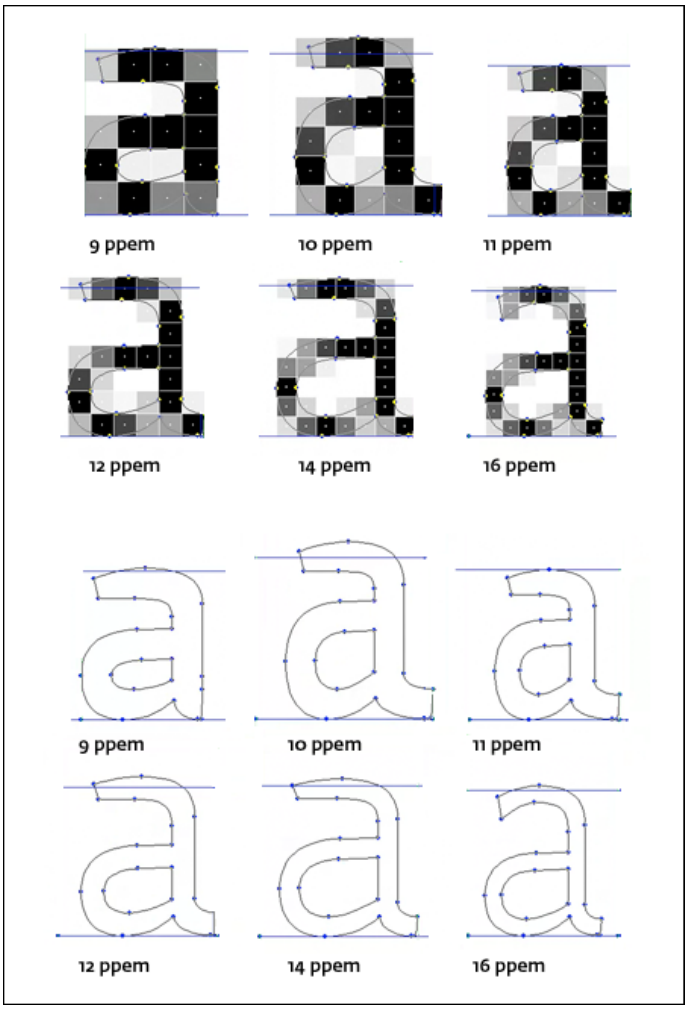


Fig 6: Font hinting displayed as pixels and outlines (Peter Bi'lak)

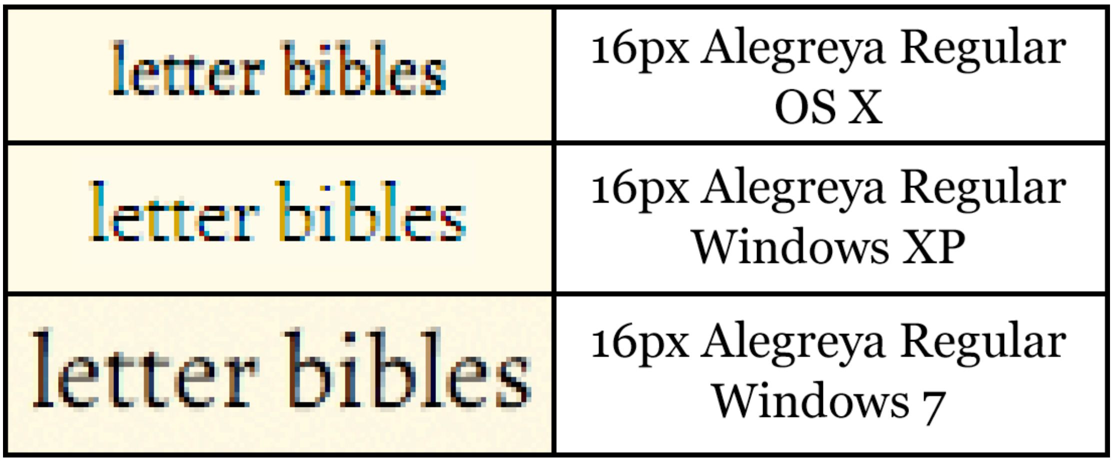
Peter Bi'lak describes hinting as –

> *"programming instructions that fine-tune a font's rasterisation, the process by which its mathematically ideal outlines are mapped onto a monitor's pixels."*

Note: Unlike TrueType fonts, Postscript fonts do not support hinting and consequently their display on the pre-Vista systems is particularly poor.

5.3 Operating systems

The two main operating systems take fundamentally different approaches to type rendering. Windows systems sacrifice font metrics to preserve sharpness and pixel-grid alignment. OS X, on the other hand, preserves font metrics at the expense of legibility at smaller sizes, typically below 10px.



letter bibles	16px Alegreya Regular OS X
letter bibles	16px Alegreya Regular Windows XP
letter bibles	16px Alegreya Regular Windows 7

Fig 7: Close-up comparison of type rendering on Windows XP, 7 and OS X

Compare the letter pairs *b*, *e*, *l* and *t* in fig 7. On OS X, each letter is different while on Windows XP each pair is identical. On Windows 7 there is a slight variance in the anti-aliasing, but the underlying font metrics are identical.

5.3.1 DirectWrite and ClearType

Since the release of Windows Vista in 2005, it and subsequent releases have replaced GDI with DirectWrite, which improves the rendering of both TrueType and OpenType fonts (which are often not hinted). DirectWrite uses sub-pixel anti-aliasing both horizontally and vertically, while still making use of hinting. Font metrics are preserved to a large extent while font smoothing and kerning are both enhanced. DirectWrite with Cleartype is enabled by default on Windows Vista and 7.

5.3.2 CoreText

On Apple computers, QuickDraw was the main method of displaying type on pre-OS X systems, from OS 8.5. It enabled the anti-aliasing of Truetype fonts. Adobe's Type Manager was also common among design professionals as it allowed the anti-aliasing of Postscript fonts.

With the advent of OS X, ATM was no longer required as the Quartz rendering engine now provided that functionality. Since Tiger (10.4), Quartz has been extended by CoreText. It uses sub-pixel positioning, and anti-aliases both horizontally and vertically. This approach preserves font metrics at the expense of sharpness, particularly at smaller sizes. CoreText does not rely on font-hinting.

5.3.3 Ubuntu

Ubuntu 10.04 can be configured to display text using aliased, anti-aliased or sub-pixel rendering. Users can also specify none, slight, medium or full levels of hinting. This writer has noted that specifying full hinting can give rise to unusually wide spacing on certain fonts at small sizes (the open source Ubuntu at 10px). That problem does not arise with medium hinting.

5.4 Browser text rendering

Browsers generally defer to the Operating Systems type-rendering engine. This means that on OS X, Firefox, Safari, Chrome and Opera will all use CoreText to display identical text. Similarly, browsers on Windows will employ whichever text rendering system is specified, with an exception. The original release of Safari for Windows used its own CoreText style rendering system. Disliked by users, it remains an option, but has been disabled by default in subsequent releases.

IE7 has a HTML ClearType setting enabled by default which over-rides the XP system setting, meaning IE7 users will see text rendered with sub-pixel rendering by default. With IE9 the system settings are also ignored and DirectWrite is employed by default. See §6.6 for font-rendering comparisons.

5.4.1 Browser letter spacing

While browsers defer to the host OS for rendering settings, they do impose their own letter-spacing. Firefox can letter-space in increments of 0.01 ems, Opera uses increments of 0.05 ems while Webkit[37] browsers' letterspace in a cruder increment of 0.075 ems. Internet Explorer versions prior to IE9 use increments of 0.05ems while IE9 equals Firefox's 0.01 increments.
See §6.7 for letter-spacing comparisons.

[37] Late addition, 4/5/12: Google have announced that they are currently working on adding subpixel support to the WebKit rendering tree - http://trac.webkit.org/wiki/LayoutUnit

5.5 In summary

While older versions of Windows have had somewhat crude type rendering, the release of DirectWrite and IE9 have allowed Windows to equal or exceed OS X in terms of the quality of display, although fonts still need hinting for best results.

All of the current operating systems and browsers offer high quality text rendering with good support for font metrics and some support for kerning. A caveat is that Windows XP with its inferior text rendering still has a market share of 43%[38], as of Mar 2102, with this likely to continue for some time, particularly among corporate users.

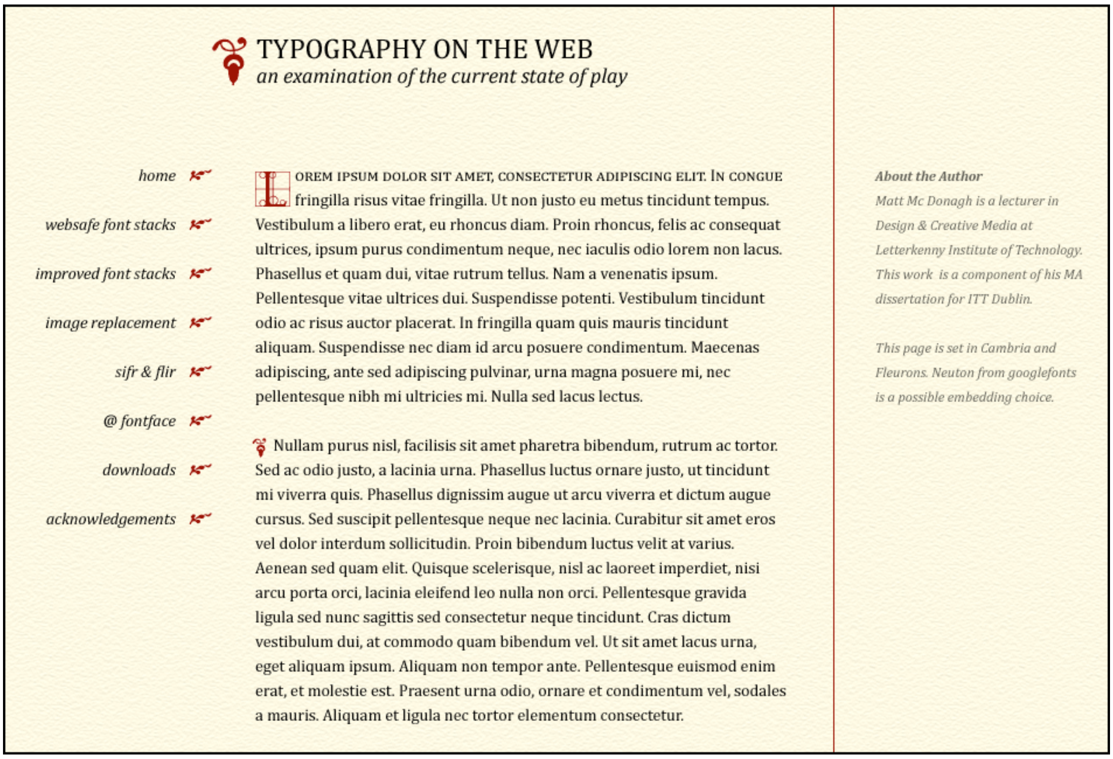
[38] http://www.netmarketshare.com/operating-system-market-share.aspx?qprid=10

Chapter 6

Building and testing the website

6.1 Page Layout

There are many capable grid systems available to web designers today, most being based around a 960 or 980 pixel width. Although some newer versions are wider, this writer decided on a 960 width, as it comfortably accommodates all monitor sizes from 1024 x 768 pixels upwards. Despite using the 960 width as a starting point, grid frameworks were not utilised, as they include a lot of code (for varied column sizes), which will not be used. Instead, the CSS code was written specifically for this site.



TYPOGRAPHY ON THE WEB
an examination of the current state of play

LOREM IPSUM DOLOR SIT AMET, CONSECTETUR ADIPISCING ELIT. IN CONGUE fringilla risus vitae fringilla. Ut non justo eu metus tincidunt tempus. Vestibulum a libero erat, eu rhoncus diam. Proin rhoncus, felis ac consequat ultrices, ipsum purus condimentum neque, nec iaculis odio lorem non lacus. Phasellus et quam dui, vitae rutrum tellus. Nam a venenatis ipsum. Pellentesque vitae ultrices dui. Suspendisse potenti. Vestibulum tincidunt odio ac risus auctor placerat. In fringilla quam quis mauris tincidunt aliquam. Suspendisse nec diam id arcu posuere condimentum. Maecenas adipiscing, ante sed adipiscing pulvinar, urna magna posuere mi, nec pellentesque nibh mi ultricies mi. Nulla sed lacus lectus.

Nullam purus nisl, facilisis sit amet pharetra bibendum, rutrum ac tortor. Sed ac odio justo, a lacinia urna. Phasellus luctus ornare justo, ut tincidunt mi viverra quis. Phasellus dignissim augue ut arcu viverra et dictum augue cursus. Sed suscipit pellentesque neque nec lacinia. Curabitur sit amet eros vel dolor interdum sollicitudin. Proin bibendum luctus velit at varius. Aenean sed quam elit. Quisque scelerisque, nisl ac laoreet imperdiet, nisi arcu porta orci, lacinia eleifend leo nulla non orci. Pellentesque gravida ligula sed nunc sagittis sed consectetur neque tincidunt. Cras dictum vestibulum dui, at commodo quam bibendum vel. Ut sit amet lacus urna, eget aliquam ipsum. Aliquam non tempor ante. Pellentesque euismod enim erat, et molestie est. Praesent urna odio, ornare et condimentum vel, sodales a mauris. Aliquam et ligula nec tortor elementum consectetur.

About the Author

Matt Mc Donagh is a lecturer in Design & Creative Media at Letterkenny Institute of Technology. This work is a component of his MA dissertation for ITT Dublin.

This page is set in Cambria and Fleurons. Neuton from googlefonts is a possible embedding choice.

Fig 8: Initial website design

A template design was created in Photoshop (fig 8 above). This allowed rapid layout, type, alignment and colour adjustments before committing to any code. A three-column layout was used with sizing initially dependent on the centre column, which has a width of 500 pixels. This gives a comfortable line-length average of 70 characters per line (depending on font specified, and platform). This is also a reason that a fluid or responsive system was not used, as line-length can fluctuate widely depending on window size. The navigation and right-sidebar sections are both 200 pixels wide, with the remaining space left to gutters.

6.2 Units of Measurement

While the initial design was measured in pixels, a version of the website was converted to *ems*. The em is a proportional unit, based on a root font-size. In the case of the website, the root-size is 16px, specified in the `<body>` tag. One em in this case, equals 16px. All subsequent measurements are set in ems. An em may be specified to three decimal places.

The main advantage to using ems is its' scalability. The entire design may be resized simply by changing the root font-size. The change to ems however, produced widely inconsistent rendering between the various browsers *(see §6.4 and appendices 1 and 2)* particularly in relation to the pseudo elements used throughout the website. The final version of the website reverts to pixel based units.

6.3 Images

Early iterations of the site used a background image and images for the fleurons and decorations used throughout. It seemed more appropriate however, given the subject matter, to take a purer approach and use typefaces throughout. The pseudo-elements `:before` and `:after`, coupled with the `content` property, allowed the insertion of both Unicode symbols and letters. Those letters could then be specified in a dingbat (symbol) font.

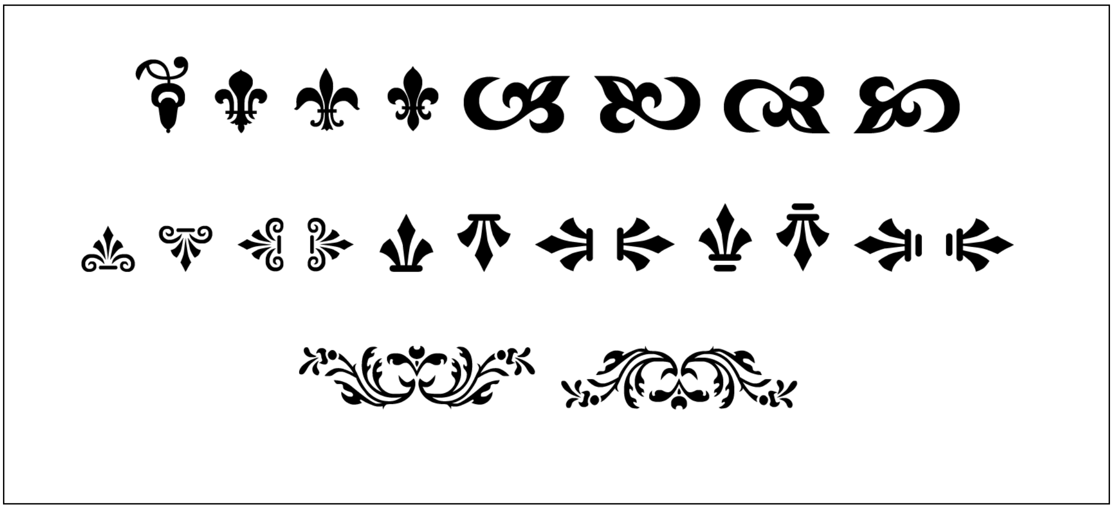


Fig 9: Printers Devils

To that end, the author created a dingbat typeface using TypeTool called *PrintersDevils*, which include all the decorative symbols used in the serif version of the site. *PrintersDevils* is influenced by individual glyphs from *Wingdings2* and *Fleurons* by Altech. The sans-serif version substitutes those symbols with suitable Unicode characters, such as section breaks (§), asterisks and bullets.

Those images, which have been used throughout the site, are part of the content; in compliance with the semantic web, they are included in the HTML, rather than the CSS stylesheet.

6.4 Website testing

Each website build was created using the code editor in Dreamweaver and viewed and debugged in Firefox, using Firebug. Each iteration of the website was uploaded to *inkwell.ie/typography* and tested in the browsers listed overleaf. Screenshots of the tests are included on the accompanying DVD.

Windows XP

- Internet Explorer 6
- Internet Explorer 8
- Firefox 9.01
- Opera 11.0.9
- Chrome 16.0.9
- Safari 5.1.2

Windows 7

- Internet Explorer 9
- Firefox 10.0.2
- Opera 11.61
- Chrome 16.0.1
- Safari 5.1.2
-

OS X 10.5.8

- Firefox 10
- Chrome 16.0.9
- Opera 11.61
- Safari 5.0.6

Ubuntu 10.04

- Firefox 9.0.1
- Opera 11.61
- Epiphany 2.30.2

This approach was used to find and remedy unsupported selectors and specifications. It contributed to the decision to remove all decorative imagery (§6.2) as transparent pngs are not supported by IE6. Also revealed was the inconsistent treatment of the `:first-letter` pseudo selector in Firefox in comparison to the other browsers. It was also used to check consistent behavior of the baseline grid set in the stylesheet. All browsers with the exception of Opera on all platforms behaved consistently, while Opera used double line-spacing on the navigation section.

Most browsers displayed the pseudo-elements (:`before, :after, :first-letter` and `:first-line`) consistently. IE6 ignored these, but they otherwise had no negative impact on page display. The webkit browsers (Chrome and Safari) have a bug where `text-transform:uppercase` is not displayed when applied to the `:first-line` pseudo element[39]. A work-around is to use `font-variant`, and increase the font-size. Browsers will generate a faux version of small-caps by using a reduced size of the uppercase letters. This solution can be seen on the sans-serif version of the website.
It is not an issue on the serif version as the specified font is AlegreyaSC – a small-caps variant.

As already mentioned in §6.2, when the pixel units were converted to ems the browsers differed significantly in their placement of the pseudo-elements. Firefox and the Webkit browsers were reasonably consistent, but Opera and Internet Explorer 6, 8 and 9 varied widely *(see appendices 1 and 2).*

[39] http://www.quirksmode.org/bugreports/archives/safari/index.html

More comprehensive screen shots of the browser tests are available on the accompanying DVD).

6.5 Typographic choices

The choices of fonts are necessarily limited by their availability. Font-stacks have been chosen using screen display characteristics and platform availability as the main criteria.

Embedded fonts have been limited to the free services – Google Fonts and FontSquirrel. Although both of these services offer a large range of fonts, the selecting was restricted initially to serif and sans-serif fonts only. Many of the available fonts were only available in one or two styles and were also excluded. The criteria used for selection was as follows –

- The font must have at least four styles, including bold weights,
- The font should include an italic, or if not, a light variant,
- The font should have a medium to large x-height,
- The font should be ‘open’ in character.

Eight sans-serifs and four serifs were selected based on these criteria. These fonts and their performance will be examined in § 6.6. Extended font families offer a variety of weights and styles, which enhance both the hierarchy of the type and the vertical rhythm of the content.

6.5.1 Serif versus sans-serif and legibility

Conventional wisdom among Graphic and Web Designers suggests that serif typefaces are more legible than sans-serif when used in print, with the converse being true on-screen. Empirical studies have not confirmed this conclusion. Research by Ole Lund[40] (2010) and Alex Poole[41] (2010) found no significant difference in legibility between serif and sans-serif, either in print or on-screen. This project therefore, examines both types. The website includes a toggle switch at the top left to switch between serif and sans-serif display.

6.5.2 Font-stacks: Serifs

The site initially used a Constantia font-stack, degrading to Georgia for serifs, however, following a number of Typophile users reporting difficulties with Constantia's small x-height the font-stack was changed to Cambria, degrading to Georgia. Both Cambria, designed by Jella Bosma, and Georgia, designed by Matthew Carter, have large x-heights and are open fonts designed specifically for screen. See tables 2, 3 & 4 in Chapter 2 for font-stack availability.

6.5.3 Font-stacks: Sans-serifs

The first iteration of the site used Calibri degrading to Gill Sans as its' font-stack. Again, following feedback from Typophile, Gill Sans was changed to Lucida Grande/Lucida Sans, both of which are designed for screen, unlike Gill Sans, which is merely a digitized printer font.

6.5.4 Embedded Fonts with @font-face

The final version of the site extends the *Cambria* font-stack with *Alegreya*, designed by *Juan Pablo del Peral* (one of the winners at AtypI Letter2 competition). *Alegreya* is available in 12 styles from Google Fonts and

[40] 2010, http://www.dkds.dk/nyheder/legibletypeface2010

[41] http://alexpoole.info/which-are-more-legible-serif-or-sans-serif-typefaces#part2

FontSquirrel. The FontSquirrel offering was used initially as it allows the web-formatted fonts to be downloaded (useful for file-size comparisons) and embedded directly in the site, but performance was poor, either loading very slowly or not at all on a number of occasions. This is not a criticism of FontSquirrel, rather the speed of the site hosting service *(hostireland.com)*. See §7.4 for further information on performance.

Alegreya was selected as it offers good performance across all browsers and systems and a large range of styles and weights. Of particular importance is the small-caps style, which is used in the opening line of each page. Neither Cambria, Constantia nor Georgia includes a small-caps variant, instead substituting a reduced size version of their uppercase. This substitution is noticeably in a lighter weight due to the size reduction.

The sans-serif font-stack was also extended with the addition of *Ubuntu*, again available from Google Fonts and FontSquirrel. Ubuntu was designed as an open-source font by Dalton Maag, for the Ubuntu OS. Available in 9 styles, it too, is well hinted and the resulting file-sizes are also quite large. The performance of the web-fonts will be examined in the next section.

6.6 Font testing and performance

A separate website (http://www.inkwell.ie/webfonts-testing) was created to examine the performance of the selected webfonts. This included an index page linked to serif and sans-serif sections. Each font has a test page including a bold heading, italics (if available, light if not) and a paragraph in a range of sizes. These pages were tested in the same browser and Operating System list covered in §6.4, primarily to test font hinting and display performance.

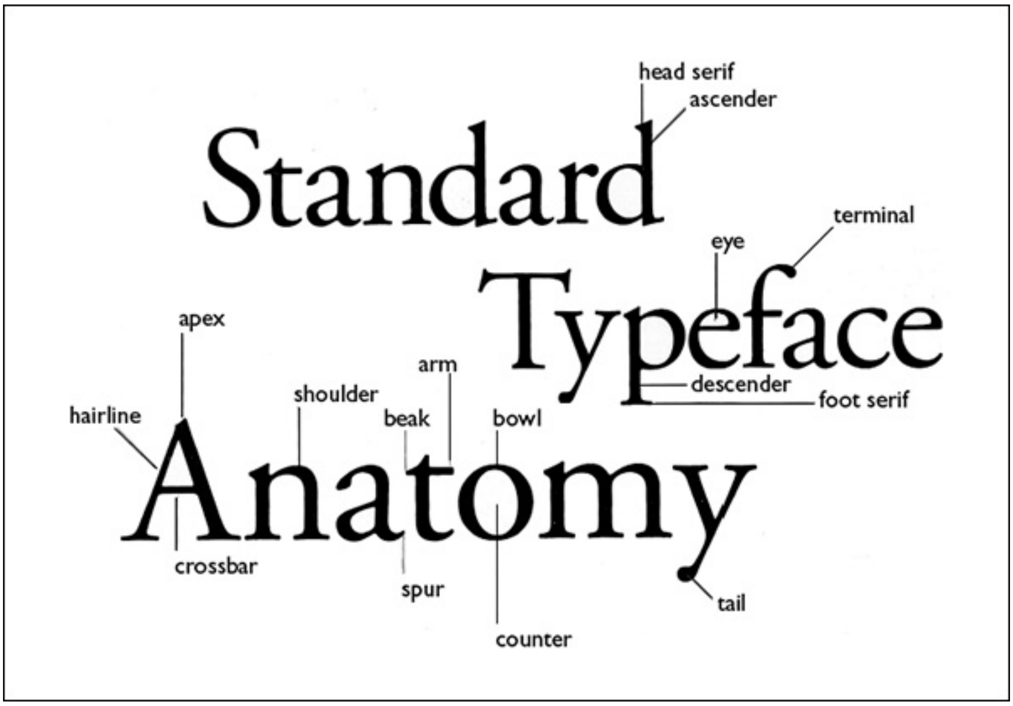


Fig 10: Anatomy of a typeface

© Matt Ottewill – http://www.planetoftunes.com/dtp/typography.htm

6.6.1 Font testing: Serifs

Four serif fonts were chosen – Alegreya, Droid Serif, Gentium Serif and Vollkorn. Of these Droid Serif and Vollkorn were available in four styles only, while Alegreya and Gentium had twelve and eight respectively.

All these fonts have italics.

While all of these fonts displayed well on OS X and Ubuntu, Droid Serif had an issue with the lowercase t at 18px and below. This was evident in both Windows XP and 7.

The table overleaf lists the main characteristics for each font. The notes column is relevant to Windows XP and 7 only.

Table 5: Hinting performance of selected Serif fonts

Alegreya				
Styles	**Hinting**	**Open**	**Legibility limit**	**Notes**
12	Good, all weights & styles	Yes	10px	Good performance across all browsers and OS. Includes Small-caps variant.
Droid Serif				
4	Mainly good at all sizes & weights	Yes	10px	Good performance for the most part. Slight descender on lowercase t exaggerated from 18px and below.
Gentium Serif				
8	Good, all weights & sizes	Yes	10px	Good performance across all browsers and OS. High contrast between strokes not evident at smaller sizes.
Vollkorn Serif				
4	Good, all weights & sizes	Yes	10px	Reasonable performance across all browsers and OS. Dropped crossbar on lowercase t at some sizes. Slab serif treatment varies between sizes. Regular hinting more consistent than bold.

As can be seen from the table above, both Alegreya and Gentium offer good performance across all the various browsers and Operating Systems, while both Droid Serif and Vollkorn have some hinting issues. Note the lower-case '*t*' in Droid Serif *(Figure 11, overleaf)*. The heavy spur on the base is accentuated at all sizes below 16px and serves to distract the eye.

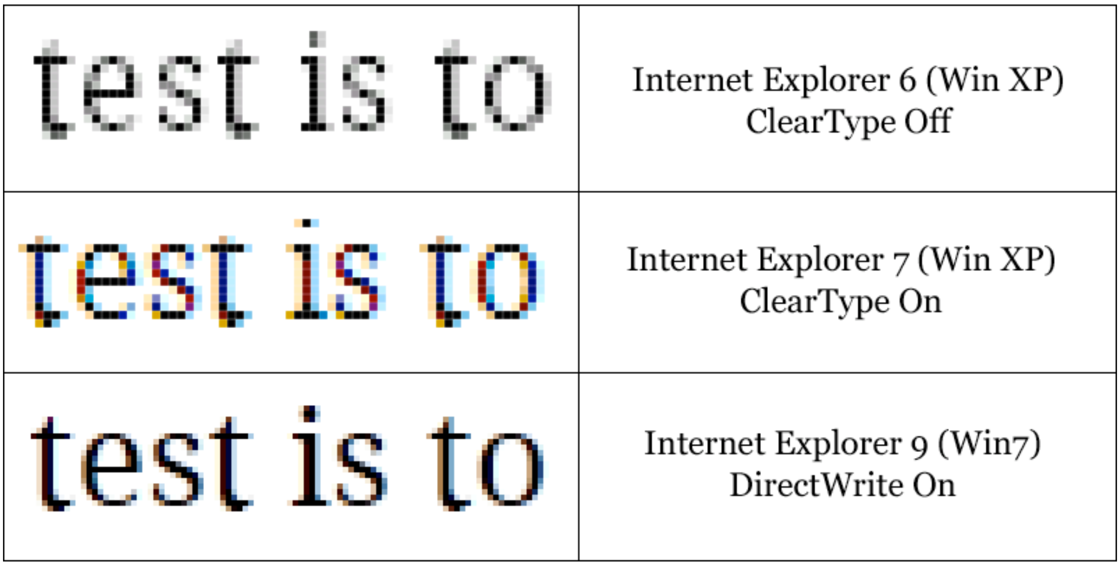

test is to
Internet Explorer 6 (Win XP)
ClearType Off
test is to
Internet Explorer 7 (Win XP)
ClearType On
test is to
Internet Explorer 9 (Win7)
DirectWrite On

Fig 11: Droid Serif – note spurs on lowercase t

Gentium has a high contrast between its' thick and thin strokes while Alegreya is more evenly weighted. Gentium's contrast can give rise to what William Berkson[42] describes as the 'picket fence', which causes type to dazzle.

> *"A typeface designed for reading comfort will also try to avoid this 'picket fence' and the associated dazzle."*
>
> \- William Berkson (2010)

Alegreya, with its' more even contrast and open letterforms, avoids this dazzle and has the added benefit of possessing a small-caps variant along with a wide choice of weights and italics. A drawback of using Alegreya and its' variants is an increased file-size.

[42] http://ilovetypography.com/2010/11/02/reviving-caslon-part-2-readability-affability-authority/

Table 6: Alegreya web format file-sizes

Alegreya Web-format file-sizes	
Webfont format	**Filesize**
Embedded OpenType	699k
Scalable Vector Graphic	1033k
TrueType	696k
Web Open Font Format	384k

Version 6 of the website embedded the font directly but suffered performance issues as the font sometimes displayed slowly (delaying display on the WebKit browsers, which do not display until the web-font has loaded) or on one occasion, not displaying at all.

The seventh version of the site changed from direct embedding to Google's hosted services, which improved performance. This author concludes that his hosted service (hostireland) is considerably slower than Google's servers.

6.6.2 Font testing: Sans-serifs

Using the same criteria as the serifs resulted in a selection of eight sans-serif fonts. Of these, Colaborate and Titillium have no italics or obliques (an italic is a differently styled slanted face while an oblique is merely a slanted variant of the family face) and Colaborate has some hinting issues in its' bold variant *(fig 12, overleaf)*. Note the lowercase '*a*' and '*e*' with ClearType enabled. This is not evident at 18px but appears at 14px and 24px.

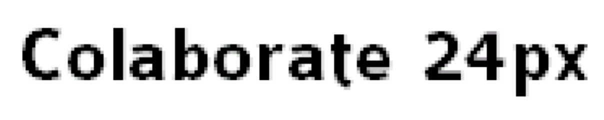
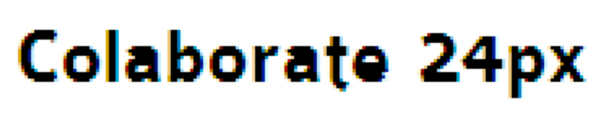
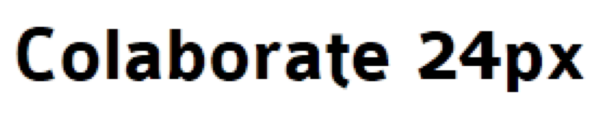
	Internet Explorer 6 (Win XP) ClearType Off
	Internet Explorer 7 (Win XP) ClearType On
	Internet Explorer 9 (Win7) DirectWrite On

Fig 12: Comparison of ClearType renderings - note lower case e and a with ClearType on

Of the remainder, only Amaranth, Open Sans and Ubuntu offer good hinting across all weights, styles and sizes.

Amaranth is a distinctive font with some calligraphic flourishes – the descender on the lowercase ‘f’, the tail on the lowercase ‘i’ and the curve on the lowercase ‘y’ being particular identifiers. It is, in fact, *too* individual a font for the purposes of this project, its’ personality is a little too frivolous *(fig 13)*.

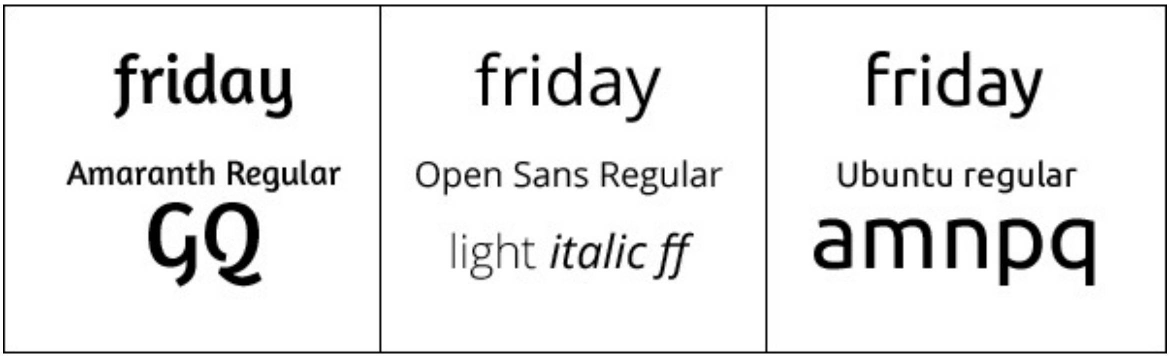


Fig 13: Comparison of Amaranth, Open Sans and Ubuntu letterforms

> *"Typography exists to honor content ...*
>
> *In a world rife with unsolicited messages, typography must often draw attention to itself before it will be read. Yet in order to be read, it must relinquish the attention it has drawn."*
>
> \- Robert Bringhurst (1992)[43]

Open Sans, on the other hand is a very neutral, open font. Its' personality only becomes evident in italic or light versions. Ubuntu strikes a good compromise between personality, neutrality and legibility. It is clean and open in body text, but has subtle features, which allow it to function well at display sizes. Diagonals are gently curved, ascenders are chiseled rather than square and the lowercase m, n p, q and a lack spurs. Ubuntu also has a greater variety of weights and styles available. Nine styles are currently available, with another four styles in development.

As with Alegreya, it's combined file-size is significant, although not as large as the aforementioned, as its' letterforms are simpler.

Table 7: Ubuntu web format file-sizes

Ubuntu Web-format file-sizes	
Webfont format	**Filesize**
Embedded OpenType	213k
Scalable Vector Graphic	634k
TrueType	446k
Web Open Font Format	244k

[43] Bringhurst, R (1992) *The Elements of Typographic Style*, p17

Table 8: Hinting performance of selected sans-serif fonts

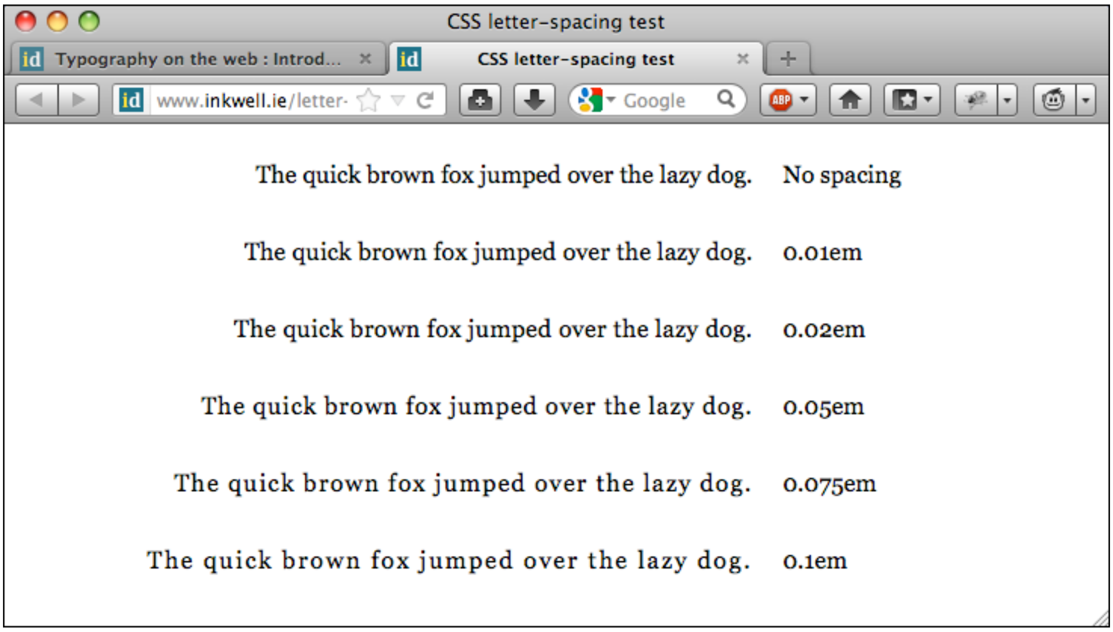
Amaranth				
Styles	**Hinting**	**Open**	**Legibility limit**	**Notes**
4	Good, all weights & styles	Yes	10px	Good performance across all browsers and OS.
Cantarell				
4	Regular weights good. Bold partially hinted.	Yes	10px	Quite good performance. Small counters in boldface, some letters filling in at 24px and 14px.
Colaborate				
5	Good regular hinting. Bold partially hinted.	Yes	10px	Reasonable performance. No italics/obliques. Regular weights well hinted, bold weights less so. Fill-in at 18px.
DejaVu				
8	Good regular hinting. Bold partially hinted.	Yes	10px	Good performance for the most part. Well hinted regular, but bold only partial – fill-in at 18px.
Open Sans				
10	Good, all weights & styles	Yes	10px	Good performance across all browsers and OS.
Overlock				
7	Reasonable hinting. See notes.	Yes	10px	Good legibility for the most part, (body and dot connected on I, crossbar on t lowered). Best used for display (24px+)
Titillium				
7	Reasonable hinting. See notes.	Yes	10px	No italics/obliques. Regular hinted to 10px. Bold hinted at 16 and 18px, but not at 14, 24 and 32px.
Ubuntu				
9	Good, all weights & styles	Yes	10px	Good performance across all browsers and OS. Large range of weights and obliques.

6.7 Browser testing: letter spacing

While Operating Systems control type rendering, it is the browsers which control letter-spacing. Typekit CEO, Tim Brown, in personal correspondence, criticized sub-pixel positioning support amongst the leading browsers.

> *"Firefox excels at this (sub-pixel positioning) and Webkit browsers are a mediocre second – they support kerning (tracking) via the buggy, SVG derived property-value pair "text-rendering:optimizeLegibility""*
>
> - Tim Brown, 2012[44]

A further page was therefore built (http://www.inkwell.ie/letter-space-test) to examine the letter spacing capabilities of each browser *(figs 14, 15 and 16*).



The quick brown fox jumped over the lazy dog. No spacing

The quick brown fox jumped over the lazy dog. 0.01em

The quick brown fox jumped over the lazy dog. 0.02em

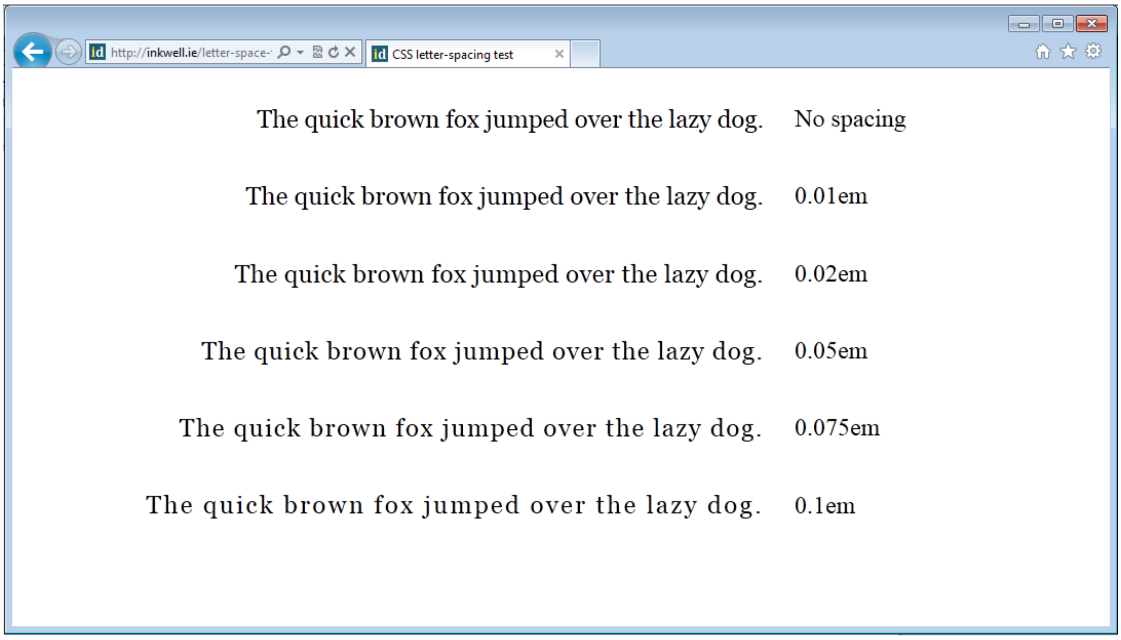
The quick brown fox jumped over the lazy dog. 0.05em

The quick brown fox jumped over the lazy dog. 0.075em

The quick brown fox jumped over the lazy dog. 0.1em

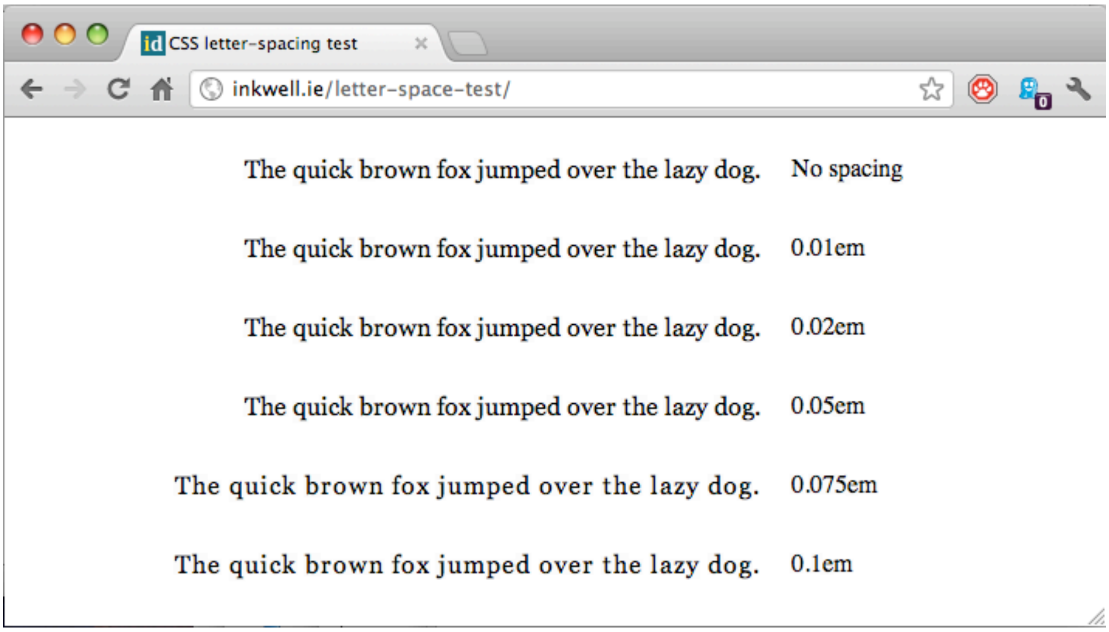
Fig 14: Letter spacing test page, Firefox 11 on OS X

[44] Brown, T (2012) Personal correspondence, see appendix 6



The quick brown fox jumped over the lazy dog.	No spacing
The quick brown fox jumped over the lazy dog.	0.01em
The quick brown fox jumped over the lazy dog.	0.02em
The quick brown fox jumped over the lazy dog.	0.05em
The quick brown fox jumped over the lazy dog.	0.075em
The quick brown fox jumped over the lazy dog.	0.1em

Fig 15: Letter spacing test page, Internet Explorer 9 on Windows 7



The quick brown fox jumped over the lazy dog.	No spacing
The quick brown fox jumped over the lazy dog.	0.01em
The quick brown fox jumped over the lazy dog.	0.02em
The quick brown fox jumped over the lazy dog.	0.05em
The quick brown fox jumped over the lazy dog.	0.075em
The quick brown fox jumped over the lazy dog.	0.1em

Fig 16: Letter spacing test page, Chrome 18 on Windows 7

The findings confirmed Brown’s statement as regards the superiority of Firefox over the WebKit browsers, but revealed that IE 7 was superior to the WebKit browsers and that IE 9 on Windows 7 matched Firefox’s letter-spacing increments *(see table 9, overleaf)*.

Table 9: Browser letter-spacing increments

Browser	**Operating System**	**Minimum letter-spacing Increment**
Internet Explorer 9	Windows 7	0.01em
Internet Explorer 7	Windows XP	0.05em
Firefox	OS X	0.01em
Chrome	OS X	0.075em
Opera	OS X	0.05em
Safari	OS X	0.075em

6.8 Iterations

The website underwent a number of iterations before the final release. Each version was browser tested in Windows XP, Windows 7, OS X and Ubuntu. The initial design was browser tested both using the Browsershots.org online service and directly by the author on Windows XP, windows 7, OS X and Ubuntu. A link to the second iteration was sent to a number of practitioners, of whom Tim Brown of TypeKit responded. His response to the content was very positive, but stated that he had difficulty staying oriented on the site, and suggested grouping or reorganizing the navigation *(see appendix 6)*.

The following iterations (v2-v6), while further adding content, also refined the navigation system *(see fig 17, overleaf)*. A javascript based sub-menu system was used in versions 3 to 5. At this point a link was posted on the typography section of the social news website Reddit. Following feedback from a number of commenters (see *appendix 5)* the javascript menu was dropped in favour of a more streamlined, grouped system of unordered lists.

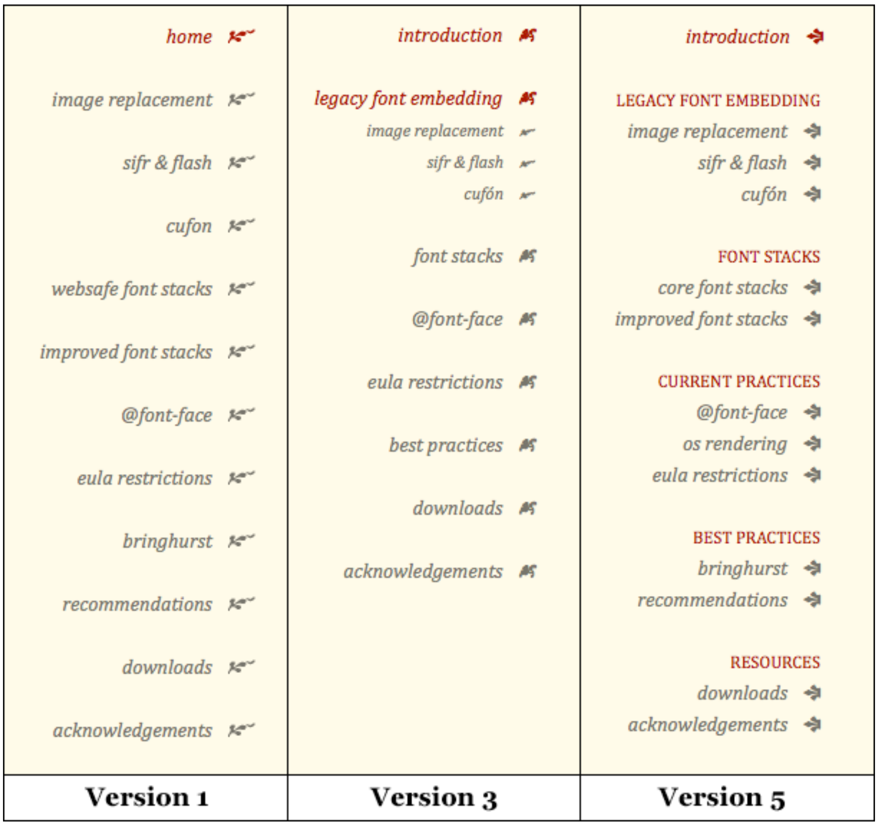


Fig 17: Iterations of the navigation system

Version 5 of the website was submitted to the typography website *Typophile*. This site is essentially an online forum frequented by professional typographers and type designers. The font stacks and font sizes were adjusted following feedback from Typophile *(appendix 7)*. Constantia, one of Microsoft's 'C' fonts, was replaced with Cambria, which has a larger x-height, and Trebuchet MS was removed from the sans-serif font stack.

The sixth version added the embedded fonts Alegreya and Ubuntu, which were hosted on the website. Browser testing revealed variable performance – the fonts loaded slowly, with noticeable FOUT and the embedded fonts refused to load on one occasion, defaulting to Cambria.

Font hosting was moved to Google's web font service in version 7; this proved faster and more reliable.

The penultimate version of the website had all units converted to ems, but this led to widely varying renderings of the pseudo-elements, particularly in versions of Internet Explorer *(see appendices 1 and 2),* therefore the final release reverted to pixels as a base unit (as justified by Milner[45]).

Many minor visual and text changes were made throughout the process, but the major changes are marked in table 10, below.

Table 10: Website development iterations

Version 1	Layout, browser testing, bug-fixes.
Version 2	Introduced sans-serif toggle. Sent site link to Tim Brown
Version 3	Changed structure and navigation (javascript drop-down menu) based on Brown's advice. Submitted site link to reddit.com/r/typography
Version 4	Removed un-necessary imagery and lines. Further refined navigation based on feedback from Chris Newton via Reddit. Submitted link to Typophile.
Version 5	Adjusted font-stacks based on recommendations from Typophile. Dropped dynamic menu and replaced with a visually simpler group of titled unordered lists.
Version 6	Added the embedded fonts Alegreya and Ubuntu to the font-stacks. Fonts hosted on-site.
Version 7	Changed hosting of web-font from local to Google's web fonts service.
Version 8	Base font-size increased from 14px to 16px. All site measurements converted to em units. Workaround added for Webkit first-line uppercase bug in sans stylesheet.
Version 9	Reverted to pixel based units due to widely varying browser displays. Final release.

[45] Milner, W (2007*), Setting Type on the Web to a Baseline Grid -Don't fear the pixel*

Chapter 7

Conclusions and recommendations

7.1 Conclusions

It is apparent that while typography on the web has come a long way since the `<font>` tag first appeared, there is still a long way to go in comparison to typography in print. CSS3 offers increasing capabilities in terms of typographic control, but cannot as yet control kerning, orphans or widows. It can be anticipated that the CSS4 specification, currently in development, will build on this progress. It is for the browser manufacturers to build in support for font's kerning tables, which most currently ignore by default[46]. In the meantime, it is nevertheless possible to publish pages of a good typographic quality. Font size, type hierarchy, line-heights and line-length are all under the control of the web designer *(see §7.2 for a list of recommendations).*

The current move towards responsive design (where the page design responds to the size of the viewport) brings further challenges, in terms of ideal line lengths. The use of media queries, min and max-widths on text containers and using the em as a unit of measurement can help mitigate this *(see §7.2.8).*

Windows XP retains a 43% market share among desktop users and with its' default of turning ClearType off, is a significant obstacle in alternative typefaces appearing on websites, as developers continue to support this platform. Embedded fonts are currently viable, but limited, for the same reason. When using @font-face for body copy, it is of utmost importance to choose open-fonts, which have been hinted well, in all variants.

[46] Brown, T (2012) personal correspondence, (see appendix 6)

The replacement of GDI Cleartype with DirectWrite in Windows 7 is a positive improvement in text rendering. While it still relies on hinting to draw the letterforms, it is much more faithful to the type metrics. Furthermore, its' ability to improve the rendering of un-hinted PostScript and OpenType fonts is very useful, and will likely become more important as more OpenType fonts become available.

7.2 Recommendations

It behooves the typographer to treat their content with respect, attention to detail and restraint. As we have seen in the previous sections, there are currently a number of techniques and practices, which can be utilised to improve general typography on the web. Most enjoy wide browser support. Those which don't offer support (IE6), ignore these techniques and display is otherwise not adversely affected. By combining the guidelines of Bringhurst, Felton and Rutter and making those adjustments appropriate to screen text delivery, this author offers the following typographic recommendations –

1. Use two typefaces or less, to achieve typographic hierarchy
2. Use 14 - 16 px for body copy
3. Use well-hinted, legible, open typefaces
4. Headlines should be correctly kerned
5. Don't letterspace lowercase without reason
6. Letterspace strings of capitals, small-caps and numbers
7. Use flush-left ragged-right alignment
8. Use between 40 and 75 characters per line
9. Use a line-height which suits the typeface

10 Don’t set body text in all-caps

11 Set opening paragraphs flush left

12 Add extra space before and after quotations

These recommendations have been implemented in the stylesheets, available from the *downloads* section of the website.

7.2.1 Use two typefaces or less, to achieve typographic hierarchy

Passages of text need a visual hierarchy in order to be readable. This can be achieved through the use of different typefaces for headings and paragraphs, for example. The aim is to achieve a contrast between those elements, allowing the eye to easily discern the structure of the document. Matching typefaces is an acquired skill – it is all too easy to choose typeface pairings, which are inappropriate or lack sufficient contrast.

A simple approach is to pair a sans-serif with a serif, using the sans for headings and the serif for paragraphs, or vice versa. An alternative approach is to choose a single typeface, which contains a wide variety of styles. *Alegreya*, for example, has 12 styles, with weights from regular to black, italics and small caps. This single font has sufficient contrast between its styles to achieve the hierarchy required.

HTML and CSS support a standard range of type hierarchy specifications including six heading tags, the paragraph tag and blockquote tag. These can be further supplemented by using classes to adjust those settings for specific uses, for example text in a side bar.

HTML5 introduces further tags such as `<article>`, `<aside>`, `<header>` and `<section>`. Collectively, these give users of type effective control over the hierarchy of their content, from the main page heading to section headings, subheadings, to paragraphs asides and quotes.

> *"Typography exists to honor content."*
>
> - Bringhurst (1992)[47]

To this end it is important to let each hierarchy setting reflect its purpose in the text. A `<h1>` should have more prominence than a `<h2>` and so on. Prominence, and by extension, hierarchy, can be achieved through size, but also through weight and colour.

7.2.2 Use 14- 16px for body copy

This is a fluid measurement, based largely on the average monitor resolutions. As monitors have grown in size and resolution, pixel sizes have diminished in a real sense. When the average monitor resolution was 1024 x 768 pixels a base type size of 10 - 12 pixels was common. Resolutions have increased dramatically in recent years, 1920 x 1080 pixels is not uncommon today.

Using a base size of a minimum of 14 or 16 pixels is more appropriate to these high resolutions. This size does depend on the individual font specified - faces with large x-heights such as Verdana can maintain legibility at relatively small sizes. With a font with a low x-height, a size of 18 pixels may be more

[47] Bringhurst,R (1992) *The Elements of Typographic Style*, p17

appropriate. For example, in the website accompanying this paper, the serif *Alegreya* is set in 16px, while the sans-serif *Ubuntu* is set in 14px, as it has a considerably higher x-height.

The base or root size should be specified in pixels in the `#body` selector. All subsequent measurements should be set in ems. The em is a proportional unit, based on a root font-size. An em may be specified to three decimal places. The main advantage to using ems is its' scalability. The entire design may be resized simply by changing the root font-size. The em is generally a preferable measurement to the pixel due to its' scalability. It is particularly useful in this age of responsive web design.

A disadvantage of using ems is that they suffer from inheritance. Take the example of a list menu system with sub-menus. The font-size of 1.2 ems will be inherited and compounded by the submenu giving a multiplication of values. Assume a root size of 16px = 1em. The list size will then be 16 x 1.2 = 19.2px. The submenu will inherit the 19.2 value and apply the 1.2 value to it giving a size of 23.04px. CSS3 includes the rem (root em) specification to remedy this, but only the more recent browser releases offer support.

7.2.3 Use well-hinted, legible, open typefaces

Although it is possible to extend the core font-stacks, many of the additions recommended by Ford and Sindhu are digitized printer fonts, which are either closed in nature (Helvetica) or have a low x-height (Garamond). The "C" fonts released by Microsoft and installed by default with Microsoft Office (Cambria, Calibri, etc.) are a useful addition to the core stacks.

When choosing an embedded font, it is important to apply the same considerations. An exception can be made for typefaces in large, display sizes (approximately 48px and larger). Using a unique font can do wonders for a websites brand and individual identity. The emergence of CSS font embedding coupled with services such as Typekit, Fontdeck, FontSquirrel and the Google fonts API have largely superceded the earlier embedding technologies such as FLIR, sIFR and Cufón. While FLIR and Cufón may be obsolete, there still may be occasions when sIFR might be useful, such as when a fonts' EULA does not permit conversion to a web format.

As well as the afore-mentioned services, there are also a number of free font catalogues such as DaFont where individual font licenses may permit conversion to web formats. All the current major browsers and legacy versions of Internet Explorer, right back to version 4, support embedding.

A significant drawback of embedded fonts is that the bandwidth overhead for embedded fonts can be quite high, particularly with elaborate and/or well hinted fonts. This may not be an issue on desktop systems but would place a considerable overhead for mobile (3G) users. This may be alleviated in the future as true 4G networks are rolled out.

7.2.4 Headlines should be correctly kerned

Most browsers ignore font's built-in kerning tables (with the exception of Firefox) and kerning errors will be more pronounced at large sizes. The Javascript library *Lettering.js* can be a useful tool in kerning the letter-pairs in headlines. It works by wrapping a span around each letter, which may then be letter-spaced using CSS. This approach is a little cumbersome, and wholly inappropriate to body text, both due to the labour overhead and to the bloating of the code.

This author would recommend its' use with display fonts in headings only.

7.2.5 Don't letterspace lowercase without reason

Typefaces are designed with whitespace around each letter, with kerning tables adjusting this space based on individual letter-pairs. Increasing the letter-spacing can impede (Rutter, 2004-10) the legibility of the text as this whitespace is extended.

> *"A man who would letterspace lower case would steal sheep, Frederic Goudy liked to say."*
>
> - Bringhurst (1992)[48]

Both Bringhurst and Rutter concede that certain typefaces *can* benefit from letterspacing, for example Impact and Haettenschweiler, but these should really be used for display only.

7.2.6 Letterspace strings of capitals, small-caps and numbers

Strings of numbers, abbreviations and small-caps should be letter spaced using the CSS `letter-spacing` property. A spacing of 5 – 10% (0.05 – 0.01 ems) is sufficient.

[48] Bringhurst (1992) *The Elements of Typographic Style*, p31

> *"Many typographers like to letterspace all strings of numbers as well. Spacing is essential for rapid reading of long, fundamentally meaningless strings such as serial numbers, and is helpful even for shorter strings such as phone numbers and dates."*
>
> - Rutter (2004-2010)[49]

7.2.7 Use flush-left ragged-right alignment

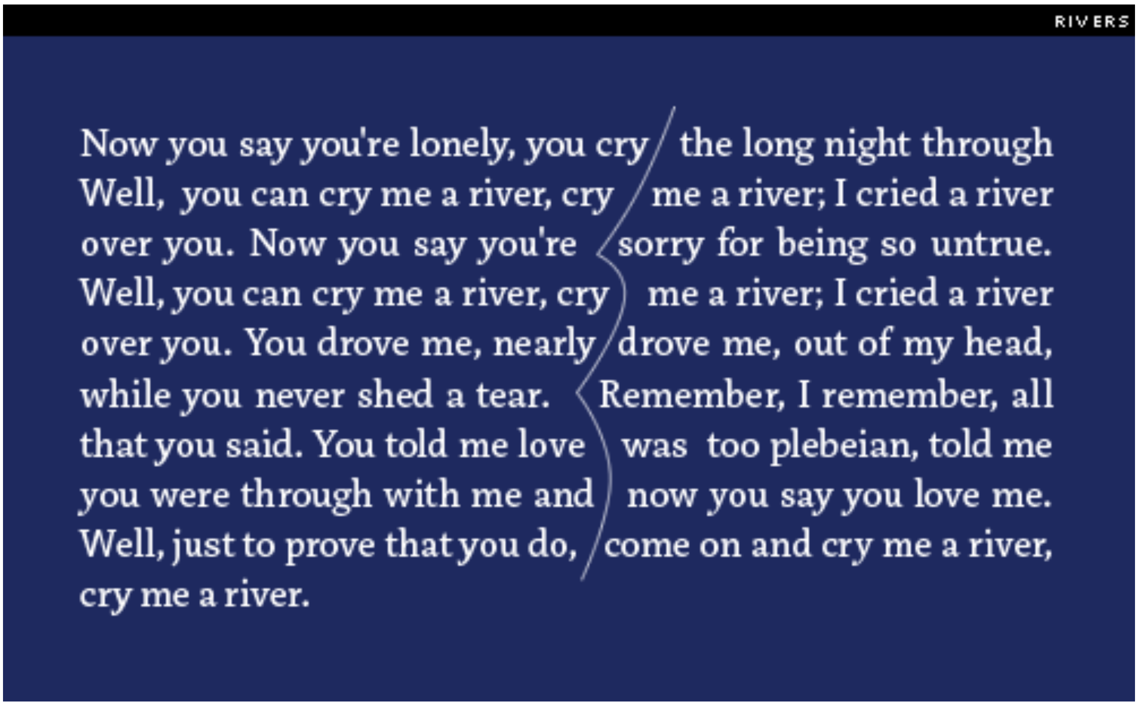
Effective justification of text can only be achieved with long lines and the hyphenation of long words. Designers in print routinely track (letter-space) individual lines to avoid large word spaces and *rivers (see fig 18, overleaf)*, a process currently not possible in web typography.

Since most websites use multi-column grids which reduce line length and while hyphenation is, at the moment, a draft specification, the recommendation is to set paragraphs flush-left and ragged right.
This prevents rivers appearing through the text, which are both unsightly and distracting.

> *"Renounce the use of other alignments, for they bring extra torment upon already busy eyes."*
>
> - Felton (2006)[50]

[49] http://www.webtypography.net/Rhythm_and_Proportion/Horizontal_Motion/2.1.6/

[50] Felton,P (2006) The Ten Commandments of Typography/Type Heresy, p35



RIVERS

Now you say you're lonely, you cry the long night through
Well, you can cry me a river, cry me a river; I cried a river
over you. Now you say you're sorry for being so untrue.
Well, you can cry me a river, cry me a river; I cried a river
over you. You drove me, nearly drove me, out of my head,
while you never shed a tear. Remember, I remember, all
that you said. You told me love was too plebeian, told me
you were through with me and now you say you love me.
Well, just to prove that you do, come on and cry me a river,
cry me a river.

Fig 18: Typographic rivers

7.2.8 Use between 40 and 75 characters per line

Rutter describes this as "choosing a comfortable measure". This measure can only be applied to the main content area and will depend on the base font size. With a base size of 16px, a content div with a width of 500px will give approximately 70 characters per line (depending on the font used). If setting measurements in ems a width of 40ems should be used.

Because many site designs today are fluid or liquid (resizing depending on the viewers window size) a more flexible approach can be used. The CSS `min-width` and `max-width` properties can be used to set limits on this resizing.

```
#text-box{
     min-width:400px; /* 33ems */
     max-width:600px; /* 45ems */}
```

7.2.9 Use a line-height which suits the typeface

Some browsers add line-space by default (Safari and Internet Explorer) while others don't (Firefox). CSS resets such as Eric Meyers or normalize.css will remove this allowing a global line-height to be set. The size of this line-height is dependent on the size of the x-height of the font, the typographic colour of the font and on the line length.

The typographic colour refers to the *'blackness'* of a font. A darker font will need more line-spacing than a lighter one. The line length is possibly more significant – the eye needs sufficient line-spacing, to easily move from the end of one line to the start of the next. Many typographers (Tim Brown) suggest using the *golden mean* (1.618) as a good ratio of type size to line-height while others (Rutter, Santa Maria) hold that this is an arbitrary figure and the measurement should be considered, based on colour, line-length, x-height and individual font characteristics.

This author tends to agree with the second viewpoint, and finds that if the eye can comfortably move from one line to the next without getting lost, the line-height which best achieves that has served its' purpose. In practice this can be anything from 1.3 to 1.8, although 1.5 is a good starting point.

The selected line-height should then be used consistently on all elements. It is also useful as a unit of measurement in determining paddings, margins and indents. Multiples of the line-height may also be used without breaking out of the underlying baseline grid.

7.2.10 Don’t set body text in all-caps

The received wisdom amongst typographers is that lowercase is more legible than uppercase, because we recognize word shapes. This, hypothetically, is an easier process with lowercase because the ascenders and descenders create more distinctive word shapes or *‘bouma’*.

Recent research by cognitive psychologists (Kevin Larson, 2004, *The Science of Word Recognition*) however, suggests that we use letters within the word to recognize the word. Ralf Herrmann, while accepting this scientific model (known as parallel letterwise recognition) holds that lowercase is more legible, as ascenders and descenders aid individual letter recognition.

> *“In such situations, ascenders and descenders will support reading, even though not in the sense of whole word shapes, but in the sense of single letter recognition.”*
>
> - Herrmann (2011)[51]

Typographers then, should avoid setting multiple lines of text in capitals. An exception is the first line of the opening paragraph on a page.
Traditionally these have been set in small-caps; the `:first-line{text-variant:small-caps;}` property supports this in CSS.

A caveat is that the majority of typefaces (especially screen designed typefaces) do not have a small-caps variant. It is possible to replace `text-`

[51] Herrmann, Ralph (2011) *Wayfinding & Typography* *http://opentype.info/blog/2011/06/14/how-do-we-read-words-and-how-should-we-set-them/*

`variant:small-caps` with `text-transform:uppercase` and decrease the font-size slightly. This approach is less than ideal, however, as the smaller capitals will display in a lighter weight than the rest of the (larger) body text.

7.2.11 Set opening paragraphs flush left

An indent in the first line of a paragraph is a widely used method of marking the start of a section within the body of a text. The opening paragraph does not need such a marker and should therefore not be indented.

Valid alternatives to the indent include block paragraphs (a paragraph followed by a line break) outdents, and ornamented indents such as a *pilcrow* or the *hedera* used on the accompanying website. This can be accomplished by using the `:before` pseudo-element.

7.2.12 Add extra space before and after quotations

A line space should be added before and after a block quotation. This space should conform to the baseline grid. If a line-height of 1.6em is being used, for example, a margin of 1.6em should be applied to the blockquote at the top and bottom. Blockquotes are indented in browsers by default.

> *"However the block quotations are set, there must be a visual distinction between main text and quotation, and again between the quotation and subsequent text."*
>
> - Bringhurst (1992)[52]

[52] Bringhurst R (1992) *The Elements of Typographic Style*, p41

This author suggests over-riding the default indent and replacing it with a multiple of the base unit, for example 1.6em, 3.2em, 4.8em etc. Alternatively, blockquotes may be centered, or indented and centered.

Blockquotes are commonly set in italics as their visual basis in handwriting lends them a personal voice. The font-size of the blockquote may be different to the main body, but it should conform to the baseline grid.

7.3 Unicode characters, Flourishes & Pseudo-elements

Unicode is the standard protocol for character encoding on the web. As well as the latin character set, it supports non-English language characters and modifiers such as accents, Arabic, Hebrew and Chinese character sets, among others. Specialist characters such as hyphens, em dashes, geometric symbols and dingbats are also included.

It is necessary to hard-code Unicode characters into the HTML. An em-dash, for example, is encoded as `&#8212;` and an accented ó as `&oacute;`.

Unicode characters may be included in the CSS using pseudo-elements and the `content` declaration, but the symbol codes are slightly different to the html codes[53]. In CSS the codes must be preceded by a forward slash "\" (without quotes). It is also important to note that content added in this manner is not semantic and therefore not indexable.

Flourishes, traditionally known as printers' ornaments, printers' devils or fleurons are decorative embellishments generally used to add an aesthetic quality to a page. They are more commonly known as dingbats today and variations are installed by default on both Windows and OS X systems

[53] http://ss64.com/ascii.html

(Wingdings and Webdings 1, 2 and 3). These default fonts are limited stylistically, but there are many free dingbat fonts available both on FontSquirrel, DaFont and elsewhere which extend the range of styles considerably. Fleurons are functional as well as aesthetic enhancements, often being used to signify section breaks, paragraph breaks and page endings. The website pages use a fleuron known as a *Hedera* (a stylized ivy leaf) to mark section breaks and as a site logo. The sans-serif variant uses the formal Unicode section break (§) symbol.

Pseudo elements, while offering new opportunities in adding content to stylesheets are limited to an extent by inconsistent support across some of the browsers. Opera, in particular, has a range of bugs relating to the use of the `:first-line` pseudo-element *(see appendix 1),* `:first-line` is applied to the entire paragraph. Pseudo elements can also push the baseline grid out of alignment if the inserted content is in a larger font-size. Negative margins or reduced line-heights are necessary to compensate for the extra space added. Internet Explorer 9 also displays unusual behaviour with the positioning of pseudo-elements when measurements are set in ems *(see appendices 1 and 2)*.

7.4 Further study

It has not been possible (due to the costs involved) to examine the commercial services, Typekit and Fontdeck, in any depth. As both present themselves as premier type services, a detailed examination of their offerings, using the same criteria as used for the free services, is warranted.

Claimed improvements in unhinted Opentype and PostScript rendering on Windows 7, through DirectWrite, also deserve investigation.

Acknowledgements

Acknowledgements

I would like to thank the following for their valuable time, input and criticisms; Tim Brown in particular for his typographic input and advice. I would also like to thank the commenters from Typophile and from the typography subreddit on Reddit, especially Chris Newton for his detailed critique. Finally, I would like to thank my wife for her patience while my head was in the books.

Dedicated to my son Luke.

Supervisor

Deirdre Kennedy, I.T.Tallaght

Dissertation Readers

Mary Gallagher, Lecturer, History of Art & Design

Cormac O'Kane, Lecturer, Animation

Project readers

Joe Coll, Lecturer, Graphic Design

Michiel Drost, Lecturer, Type designer & Typographer

Kelda Gibson, Lecturer, Graphic Design

Paul Marley, Lecturer, Graphic Design

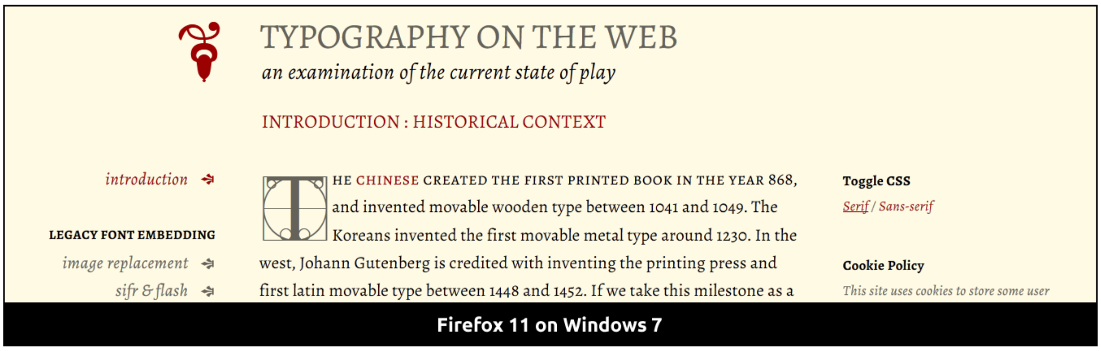
Advice & criticism

Tim Brown, CEO, Typekit

Appendices

Appendix 1

Serif variant, measurements in ems on Windows 7



TYPOGRAPHY ON THE WEB

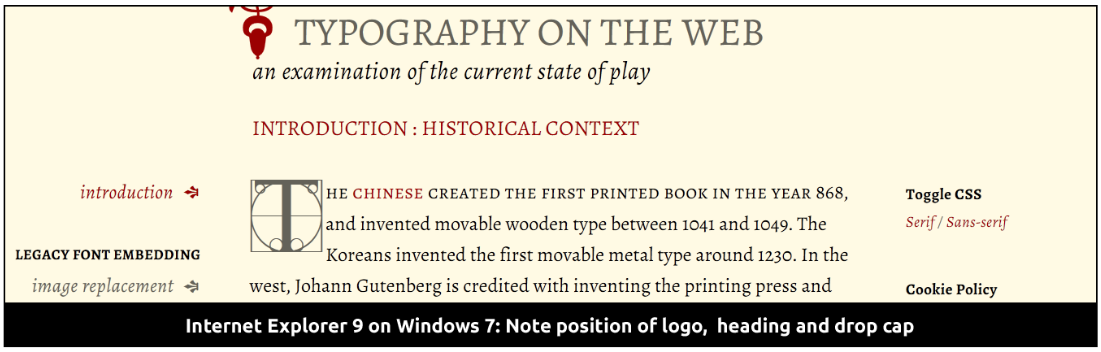
an examination of the current state of play

INTRODUCTION : HISTORICAL CONTEXT

THE CHINESE CREATED THE FIRST PRINTED BOOK IN THE YEAR 868, and invented movable wooden type between 1041 and 1049. The Koreans invented the first movable metal type around 1230. In the west, Johann Gutenberg is credited with inventing the printing press and first latin movable type between 1448 and 1452. If we take this milestone as a

This site uses cookies to store some user

Firefox 11 on Windows 7



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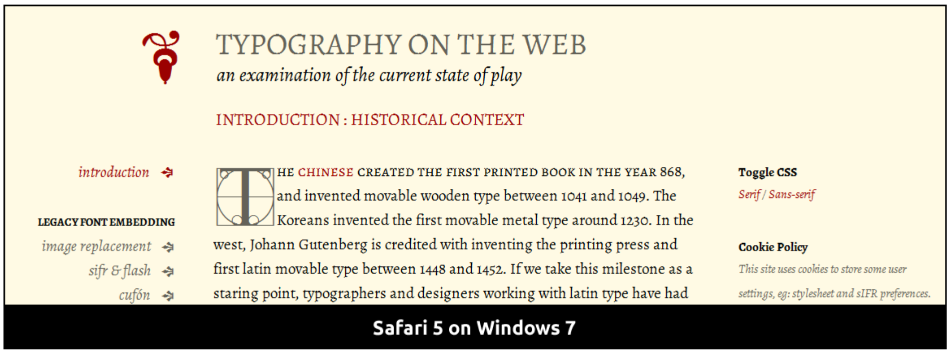
Internet Explorer 9 on Windows 7: Note position of logo, heading and drop cap



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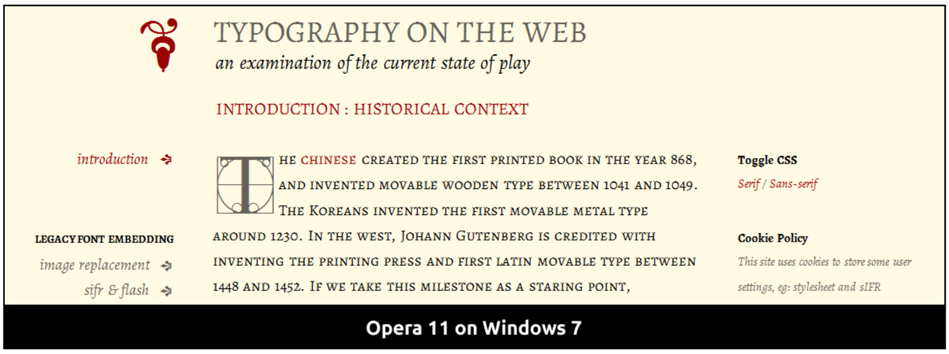
Safari 5 on Windows 7



TYPOGRAPHY ON THE WEB

an examination of the current state of play

INTRODUCTION : HISTORICAL CONTEXT

THE CHINESE CREATED THE FIRST PRINTED BOOK IN THE YEAR 868, AND INVENTED MOVABLE WOODEN TYPE BETWEEN 1041 AND 1049. THE KOREANS INVENTED THE FIRST MOVABLE METAL TYPE AROUND 1230. IN THE WEST, JOHANN GUTENBERG IS CREDITED WITH INVENTING THE PRINTING PRESS AND FIRST LATIN MOVABLE TYPE BETWEEN 1448 AND 1452. IF WE TAKE THIS MILESTONE AS A STARING POINT,

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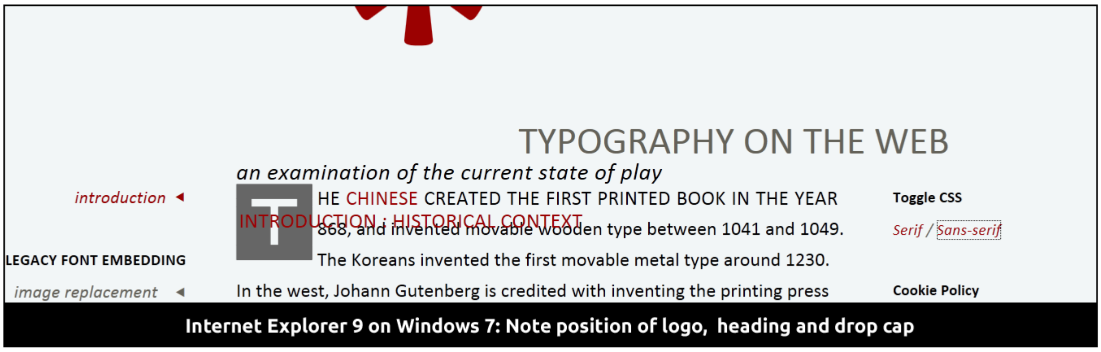
Opera 11 on Windows 7

Note: Full screenshots are included on the accompanying DVD.

Appendix 2

Sans-serif variant, measurements in ems, on Windows 7



TYPOGRAPHY ON THE WEB

an examination of the current state of play

introduction ◂

LEGACY FONT EMBEDDING

image replacement ◂

T HE CHINESE CREATED THE FIRST PRINTED BOOK IN THE YEAR

INTRODUCTION : HISTORICAL CONTEXT

868, and invented movable wooden type between 1041 and 1049.

The Koreans invented the first movable metal type around 1230.

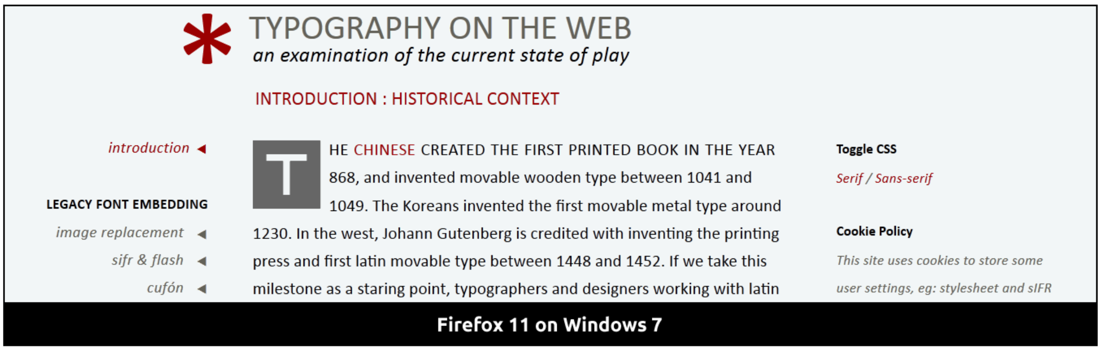
In the west, Johann Gutenberg is credited with inventing the printing press

Toggle CSS

Serif / Sans-serif

Cookie Policy

Internet Explorer 9 on Windows 7: Note position of logo, heading and drop cap



TYPOGRAPHY ON THE WEB

an examination of the current state of play

INTRODUCTION : HISTORICAL CONTEXT

introduction ◂

LEGACY FONT EMBEDDING

image replacement ◂

sifr & flash ◂

cufón ◂

T HE CHINESE CREATED THE FIRST PRINTED BOOK IN THE YEAR 868, and invented movable wooden type between 1041 and 1049. The Koreans invented the first movable metal type around 1230. In the west, Johann Gutenberg is credited with inventing the printing press and first latin movable type between 1448 and 1452. If we take this milestone as a staring point, typographers and designers working with latin

Toggle CSS

Serif / Sans-serif

Cookie Policy

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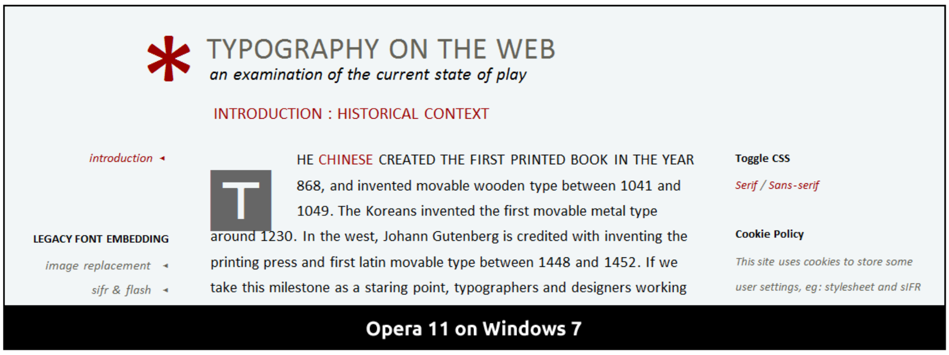
Firefox 11 on Windows 7



TYPOGRAPHY ON THE WEB

an examination of the current state of play

INTRODUCTION : HISTORICAL CONTEXT

introduction ◂

LEGACY FONT EMBEDDING

image replacement ◂

sifr & flash ◂

HE CHINESE CREATED THE FIRST PRINTED BOOK IN THE YEAR 868, and invented movable wooden type between 1041 and 1049. The Koreans invented the first movable metal type T around 1230. In the west, Johann Gutenberg is credited with inventing the printing press and first latin movable type between 1448 and 1452. If we take this milestone as a staring point, typographers and designers working

Toggle CSS

Serif / Sans-serif

Cookie Policy

This site uses cookies to store some user settings, eg: stylesheet and sIFR

Opera 11 on Windows 7

Appendix 3

Typographic practitioners

An email introducing myself and explaining the scope and goals of my research, together with a link to the website was sent to the following –

Brown, Tim

Hische, Jessica,

Hoefler, Jonathan

Rutter, Richard

Spiekermann, Erik

Tannam, Bobby

Of these, Tim Brown, Jessica Hische and Bobby Tannam responded.

Appendix 4

Postings on Typographic forums

A few paragraphs explaining the scope and goals of the research were posted along with a link to the website on the following –

Reddit.com/r/typography

http://www.reddit.com/r/typography/comments/qtihp/
an_examination_of_web_typography_an_ma_project/

Typophile.com

http://typophile.com/node/91026

Appendix 5

Selected comments from reddit.com/r/typography

Chris Newton

Interesting site. I think your content is generally good, and I have only a few criticisms to make here after scanning the whole site once.

The section on improved font stacks could briefly mention the problem of printer fonts: several of those stacks would look terrible on most computers I have here, because old school printer fonts would take precedence over screen-optimised alternatives with the orders given. This is a common problem with including things like Palatino and Helvetica in font stacks that will be viewed on Windows machines, and even professional designers fall into the trap all too often.

When talking about embedding techniques and @font-face, you could consider the implications for low-bandwidth connections and mobile devices, where the overheads of downloading extra web fonts are not trivial. I think you mentioned this very briefly on the recommendations page, but it's a very significant practical concern today and probably will remain so for at least a few years.

When it comes to EULAs, I think you're being rather kind to the foundries and font-as-a-service businesses. I could describe what I think of their delusions about licensing and pricing in the Internet age, but I won't do so in polite company! However, you might consider the limitations of the font-as-a-service business model for agencies/freelancers designing sites for clients, where the ongoing dependence on a third-party service and the typical lack of pricing guarantees can be a significant barrier to adoption of any such fonts at all. Maybe you could compare and contrast with other typical costs such as stock imagery, domain name registration and web hosting. In general, I think perhaps the commercial/legal side of web fonts is the weakest part of your discussion, because you acknowledge the issue and allocate a whole page to it, but then don't really explore it.

Please don't bring nonsense like golden ratios into your recommendations. That kind of magic number is relevant in certain parts of design, for example in some systematic paper sizes. Otherwise, it's just a number, and IMHO making it out to be anything else damages your credibility.

I'd be a little careful in the recommendations about line lengths. A lot of people think they know a lot of good rules of thumb about line lengths. When you study the empirical data from actual research, those rules of thumb don't always stand up to scrutiny. Again, this is an area that is so well entrenched now that even professional designers will happily parrot what their teachers taught them, without any sort of independent study of whether it's actually effective in practice. At the very least, know the difference between characters and words. ;-)

In terms of presentation, IMHO there are several less-than-ideal typographic choices, some of which go against the grain of your own recommendations on the final pages. I think this harms your credibility given the subject matter.

The text is set in 14px Constantia. For a font with such a small x-height, I suggest that a minimum of 16px is essential if you don't want those with imperfect vision to be zooming your site all the time, and even 18px might be more appropriate here. Sufficiently large text is even more important given that this is a very long piece of work for reading on-line. As an aside, the page on improved font stacks incorrectly says the site is using a Cambria stack. Personally, I'd probably prefer it if it were, but that's just a matter of taste.

You have odd uses of HTML in places, particularly the apparently random use of <br> instead of a new paragraph, and the use of <em> for titles. The former does mess the layout up in quite a few places.

The site uses straight quotes instead of typographer's quotes, hyphens instead of real dashes, etc.

I think the hyphenation does more harm than good. There's probably a whole section waiting to be written about the difficulty of doing hyphenation and justification properly on the Web given the limited tools available in the standards, if you feel like extending the piece a little. In any case, I would definitely get rid of all those mid-word breaks.

I didn’t notice at first that the material in the right-hand sidebar is different from page to page and not just navigation/background info. Perhaps you could do something to distinguish the parts that are more like main content (such as the pros and cons of different font replacement techniques) from the parts that are secondary such as navigation and links to sources.

And finally, here are a couple of points on usability.
A spelling check would be beneficial at some point. There are quite a few typos. I think your sometimes-collapsing menu on the left is trying a bit too hard to be clever. It’s not immediately obvious which parts will collapse/expand and which will go immediately to another page, so clicking on a top-level link does different things at different times. Given that all of your pages are far longer than the menu, I would recommend just expanding it fully at all times and having everything that looks like it should be a link act like a link there.

AptMoniker
Just know this: there are two main problems facing web opentype right now. The first problem with type for the web, is hinting. The openness and flexibility of the web has caused major issues when trying to design type. Browsers throw out hinting data, render type differently, etc. Secondly, most type designs can't survive web scaling. Sure everything can work fine at 48pts, but bring it down to 10pixels and it's a completely different game. This also relates back to the first problem because if browsers are dumping hinting data then s--- goes blocky, quickly. Hell, even WITH hinting data, the screen just sucks for type.

Appendix 6

Email correspondence from Tim Brown, Typekit

Hi Matt,

Thanks for your note, for these kind words, and for mentioning my work in your site.Wow, this is thorough! At a glance, which is about all I can muster at the moment, it seems as though you're citing excellent resources and summarizing the issues well. I did catch this one thing:

> *" Poor kerning tables means that many are particularly unsuitable for body copy, restricting them to headlines and subheadings."*

It's not necessarily that kerning tables are poor, but that browsers lack support for kerning, and lack the subpixel positioning that would make kerning more accurate. Firefox excels at this, and WebKit browsers are a mediocre second (they support kerning via the buggy, SVG-derived property-value pair "text-rendering: optimizeLegibility").

Overall, I'd say my single criticism is that I had a difficult time getting (and staying) oriented on the site. I found myself gravitating toward the left nav, but still confused about the sequence and scope of its sections. The first few items are a bit of hacky history, the next few are about web fonts and the natural mechanisms within CSS, and the final two (before downloads/acknowledgements, that is) are about typesetting. Maybe rewording or grouping nav items, or adding headings to the nav, might help?

Really nice collection of stuff you have here. Thanks for sharing it with me!

Tim

Hi Matt,

“I just wanted to query you further re: kerning. My original comment was meant in relation to many of the free fonts (much of dafonts catalog) rather than the professional offerings.”

I see. That is a valid concern.

“When you refer to subpixel positioning are you talking about font-hinting or just the individual browsers rendering?”

Individual browser rendering. In the same way that subpixel rendering uses the R, G, and B slices of pixels to render type at a higher resolution, some browsers (Firefox) use subpixel positioning for letterspacing and word spacing, so kerning is more accurate.

> Many thanks again for your very prompt and helpful comments.
> You can see where I've acted on your advice here -
http://www.inkwell.ie/type-website-v2

You're welcome. Nice!

Tim

Appendix 7

Selected comments from Typophile

Full text here - http://typophile.com/node/91026

Don McCahill

Having the option to switch between serif and sans serif was nice, but the font size is bad, and in the sans the tracking is way too tight for the font. You could offer options for larger size, which is probably more important ... Not sure of the font. It is too small for me to identify clearly.

Aaron Bell

...the fundamentals yes, but I wouldn't go so far as to say that one should design a webpage experience to replicate that of a book (Of course, I'm also one who believe's Bringhurst's book as more of guidelines than actual rules) ... Exactly, functional typography. I get that many feel Bringhurst's book is the pinnacle of all things, but functional typography on screen is actually different (in some ways) from functional typography in print. But there's room for differing opinions.

T Mac

In the sans view you have a paragraph space, an indent and a pilcrow. It looks like the pilcrows are actually meant to be section marks? And then sometimes you have no paragraph space and no indent. Choose one, but not all. Perhaps a section mark followed by indented paragraphs would be nice. And of course setting your type to a pixel size isn't the best web practice, is it?

The author, in response to TMac –

The pilcrow may not have been the best choice. It's meant as a section break. I chose pixels over ems to set the baseline grid and solve an issue with child elements - I originally had a submenu system system.

T Mac in response to the author

I understand. It's curious that this website states the "section sign" is a paragraph sign in Europe, while the pilcrow is a section mark. Just the opposite of North America.

http://www.fileformat.info/info/unicode/char/a7/index.htm

http://www.fileformat.info/info/unicode/char/b6/index.htm

Appendix 8

Email correspondence from Jessica Hische

Hey Matt!

Sorry for the delay in getting back to you. The foundry I was speaking of is H&FJ, and the numbers (… ~$1.5 million) were estimated based on how many employees they have and how long I know that they worked on it.

All the best,

J

Howdy Matt!

I don't offer my typefaces as webfont yet for a pretty simple reason—when I drew them (buttermilk in particular), I corrected a lot of spacing errors with ligatures and kerning. As you probably know, these features aren't available in all browsers, which means that my typefaces look like crap except in the most modern of browsers. For this reason, I don't allow @font-face use of my typefaces and don't host them anywhere to be used as typefaces. I do hope to release typefaces that can be used as webfonts in the future, and am working on one now that I will probably release through Typekit to start. I prefer hosted services vs. self hosting, because of the added benefit of being able to silently update the typeface if I start seeing tweaks that need to be made, something that wasn't possible without bothering your customers before.

My fonts are not hinted, as most of the type I've made up to this point is display type, and hinting is the most important for text. I know that typekit does some level of hinting for foundries that they work with, though not hand-hinting. Hinting in general adds a lot of time and cost to the production of typefaces if you do it by hand or hire someone else to do it by hand, and since it only matters for on screen use on windows, and none of my typefaces are available for web yet, it hasn't been something I've had to be concerned about.

All the best,

J

CD contents

01 Website

02 Webfonts testing website

03 Webfonts screenshots

04 Letter-space testing website

05 Letter-spacing screenshots

06 Browser & OS testing

07 Development files

08 Website iterations

09 Thesis (docx and pdf)

Image Credits

http://www.gutenberg.org

Gutenberg Bible

Jenson’s Roman

Mantius’ Roman Italic

http://www.100types.com/100types.com.timeline.html

Typographic timeline

http://ilovetypography.com/2008/04/11/extreme-type-terminology-part-3/

Typographic rivers

All other images by the author.