Digital typography: a primer

Keith Chi-hang Tam

Ever since the advent of printing with movable type, typography and technology had become inseparable. If we were to accept the definition of typography as the mechanical production of written language, then we must have an intimate understanding of our prevailing typesetting technology — the computer and its software and peripherals — in order to become competent typographic designers. Craftsmanship is inherent in our technology; creativity is also built upon the foundation of understanding the technology.

Key concepts

The 'desktop publishing' revolution   The 'desktop revolution' of graphic design and typography began its life in 1985. Three companies were responsible: Apple, Adobe and Aldus. PostScript is a device-independent page description language invented by Adobe. Along with Aldus PageMaker, the first 'desktop publishing' application and Apple's first affordable, 300-dpi laser printer, the LaserWriter — all running on an Apple Macintosh — they made professional typesetting from the desktop a reality. And the rest is history.

Typefaces and fonts   A digital font, in short, is a piece of computer software that contains a collection of vector 'drawings' along with spacing and kerning data that could be accessed through the keyboard. Of course, these 'drawings' are often letters which, when combined sensibly, form meaningful words.

A family of typeface consists of a number of variant fonts that share a common design. A standard typeface such as Times Roman may consist of a regular, and italic, a bold and a bold italic; more extensive families may consist of a number of weights and widths with respective italics, small caps and expert fonts. Display or pictorial typefaces may simply be single fonts.

Character and glyph   A character refers to 'the smallest semantic unit of a language' — or simply put, a sign in a given language, for example a lowercase *e*, an uppercase *A* or a figure *8*. A glyph, on the other hand, is 'the specific form characters can take in a font' — or the visual forms that represent a single letter. There could be more than one glyph that represents one single character. For example the letter *e* can take the form of a swash e̦, an ordinal ᵉ, or a small cap ᴇ. These are the different glyphs.

With the limited character/glyph set of a typical PostScript Type 1 font, one character is often assigned to only one glyph. Alternate glyphs have to be accessed via separate fonts. With the introduction of OpenType fonts, one character could be mapped on to many different glyphs, allowing the representation (visual form) of a character to be independent from the actual linguistic value of a character.

Making fonts   Fonts are made using font creation software programs such as Macromedia Fontographer and FontLab. FontLab is one of the most sophisticated font creation programs that provide drawing tools, spacing and kerning features, scripting capabilities and OpenType building tools. The result could be exported as Type 1, TrueType and OpenType format fonts.

Font licensing and copyright   Most fonts can now be bought online and downloaded instantly, twenty-four-seven, via type foundries' websites or websites like *myfonts.com* or *fontshop.ca*. When you 'purchase' a font, you don't actually own it but are acquiring a license from the designer (or type foundry) for the right to use it. It is essentially the same as buying software. A font license agreement (EULA) would generally state how many computers or printers you're allowed to use the font with at one physical location. Should you need to pass the font onto a third party for, say production purposes, that third party would have to also purchase a license for the font. Be sure to read the EULA carefully. It is illegal to borrow fonts from others or lend fonts to others. Type design is a dying art. The amount of work invested into a typeface could span for years, if not decades; and yet the economic return is hopelessly minimal. So please, always support fellow designers and use fonts responsibly and ethically.

Font formats

PostScript Type 1   PostScript Type 1 is the most commonly used font format amongst graphic design professionals. Adobe Systems first introduced it to the Macintosh platform in 1985. PostScript is a page description language that processes and transfer scalable, vector-based graphics and type from the computer onto a printed page, independent of what device is being used. The quality is only bound by the resolution of the printer being used. PostScript, combined with Aldus PageMaker (the first page-layout program) made the 'desktop publishing' revolution possible. Unlike older computer fonts that were based on fixed-size 'bitmap' images, PostScript font outlines are described as smooth curves using mathematical formulas.

In the early days of PostScript Type 1 fonts, the screen display quality of these fonts was crude at best and almost illegible at worst. These supposedly 'scalable' fonts did not scale well on screen. Screen fonts of various frequently used sizes had to be installed in order to have a somewhat better screen representation. Any sizes that are not installed appeared jagged on screen. It wasn't until Adobe Type Manager was released when truly fluid scalability became a reality. Adobe Type Manager is still required in MacOS 9 (and below) and the Windows platform for PostScript Type 1 fonts to function properly.

Although Type 1 is a format that has almost 20 years of proven track record in graphic arts, Type 1 fonts still have a number of shortcomings. One of these is that Type 1 fonts need two files to function properly: a bitmap 'suitcase' file (containing at least one bitmap size) plus a PostScript font file. Without either one of these, the font will not appear on your font menus or won't print smoothly. Another shortcoming is the requirement of Adobe Type Manager control panel to display smoothly on screen (as mentioned above) and to print smoothly on non-PostScript printers, for example most cheap inkjet printers. Type 1 fonts also only allow a maximum of 256 characters in a
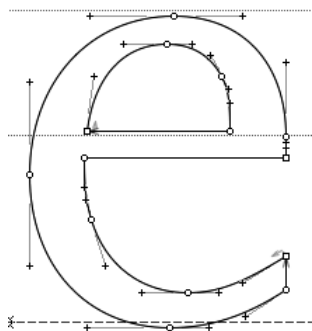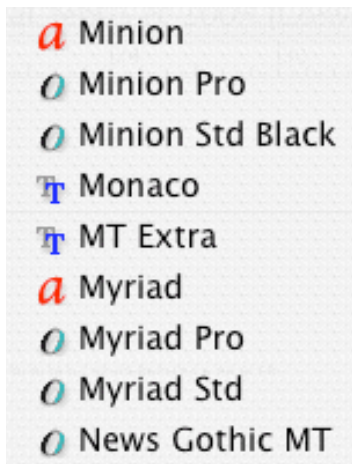

A glyph drawing in PostScript Type 1 format, using bézier (cubic) curves.

font, which is a serious limitation for non-Latin fonts with extremely large character sets. When advanced typographic variants — for example small caps, additional ligatures, fractions, etc. — are needed, additional fonts called 'expert sets' are required.
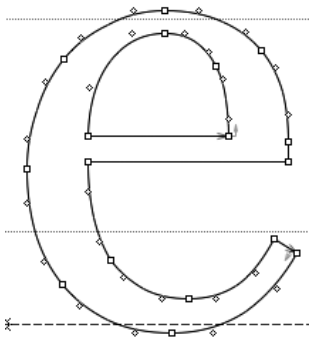
TrueType   TrueType is a font format that was jointly developed by Apple and Microsoft as a rival to the widely adopted PostScript Type 1 format in the late 1980s. TrueType fonts are also scalable, vector-based fonts, but instead of using cubic (bézier) curves as in Type 1 fonts, TrueType fonts uses quadratic curves to describe their outlines. Unlike PostScript Type 1 fonts, TrueType fonts only need a single suitcase file to function properly. Graphic design professionals often look down on TrueType fonts as 'amateur'. This is partly attributed to the fact that all of the default MacOS and Windows system fonts are in TrueType format, and few TrueType fonts come with advanced typographic variants such as expert sets. Also, in their early days, TrueType fonts did have incompatibility problems with the 'industry standard' page description language PostScript, but these problems don't seem to exist any more. TrueType fonts tend to function the best in office-type applications, such as AppleWorks, Word, PowerPoint and Excel, and are generally the preferred font format for general office use.

One of the great advantages of TrueType fonts is their sophisticated hinting capability, which ensure clean, crisp and highly legible bitmap display for on-screen use. Matthew Carter's Verdana and Georgia are prime examples of expertly hinted fonts. These should always be specified for web pages.

Although TrueType fonts technically perform as well as Type 1 fonts, it might still be best to avoid them for print use. It is definitely advisable to avoid (default) TrueType fonts such as Arial or Verdana in order to distinguish our work from that of amateurs!

OpenType   OpenType is a new font format that is increasingly adopted by both graphic design professionals and general users alike. OpenType is a format jointly developed by Adobe and Microsoft in the 1990s to unite and standardize the Type 1 and TrueType formats. OpenType is essentially a 'wrapper' for Type 1 and TrueType fonts. One of the main advantages of OpenType is its cross-platform compatibility — a single OpenType font can be used in both Windows and MacOS platforms, licensing permitting. Through the use of Unicode encoding, an OpenType font can have as many as 65,000 characters in a single font file. This large character set is enough for every conceivable language in the world, including Chinese. This large character set also allows sophisticated typographic features to be accessed from a single font file — for example small caps, different types of figures, ligatures — without having to use additional font files.

Adobe's 'Pro' fonts are fonts with huge character sets that include advanced typographic features like small caps, swash characters, alternate characters, ligatures, ordinal numbers and letters, fractions, ornaments, as well as Greek and Cyrillic characters, all contained in a single font file. These advanced features, though attractive, are only supported in a the latest versions of Adobe applications. Other programs, for example QuarkXPress, allow you to use OpenType fonts but only grant you access to their first 256 characters, so none of the advanced features may be used.

A glyph drawing in TrueType format, using quadratic curves. Note that it has more control points than the PostScript counterpart.

In the InDesign font menu, font formats are denoted by an icon next to the font name. The red 'a' denotes PostScript Type 1, 'TT' for TrueType and 'O' for OpenType.

Font management   Fonts are usually stored in the System Folder under MacOS 9 or in several confusing locations under MacOS X. The best way to organize them (when you have a sizable library) is to use a font management program such as Suitcase or FontReserve. These programs allow you to organize fonts into folders and activate and deactivate them at will. Fonts could also be automatically loaded as documents are opened. MacOS X Panther 10.3.5 or above comes with a font management utility called FontBook which might be good enough for most tasks.

Advanced typography

'Expert' typography   In a 'standard' font, for example the system font Palatino, only four font variants are included: a regular, an italic, a bold and a bold italic. These are often inadequate for professional use. Fonts for professionals are often available as large families consisting of many weights (light, regular, bold, semibold, heavy, black) and widths (condensed/expanded). 'Expert' typographic features are often available as separate additional fonts often called 'expert sets' or other names. With OpenType Pro fonts, these features are built into a single font file and could be accessed by choosing menu commands in the latest versions of Adobe applications.

Small caps   Small caps are more than scaled down versions of the standard capital letters. True small caps are drawn to optically match the weight of lowercase letters. They are often slightly wider than regular caps and are designed to be used together. Standard capitals, on the other hand, are often (not always) designed to match with lowercase letters but not each other. The small caps button in many layout programs produce digitally scaled small caps which look amateurish.

Coranto Faux Small Caps
Coranto True Small Caps

Figures   'Modern' or lining figures (1234567890) that share the same visual weight as capital letters and line up neatly in columns are usually provided as the standard figure set in most fonts. Old style or non-lining figures (1234567890) are figures with ascenders and descenders that work more harmoniously with lowercase letters in continuous text. These are usually provided in expert fonts, small caps or old-style figure (osf) fonts, but some fonts (such as most FontFont fonts) have them as standard. These figures don't line up neatly in columns in tabular work. OpenType Pro fonts have a further two sets — lining old style and proportional lining — which could be useful. Figures might also come as superiors or inferiors ($^{1234567890}_{1234567890}$) useful for references for footnotes.

0123456789
0123456789
0123456789
0123456789

Proportional oldstyle, proportional lining, tabular lining and tabular oldstyle figures.

Fractions   Some Expert or Pro fonts come with sets of optically adjusted fractions or allow you to build your own. Fractions require similar optical adjustments to Small Caps. A solidus(⁄) should be used, not a virgule (/), the standard slash.

$^{98}/_{100}$ *not* 98/100

Alternates and swash characters   These are 'special' characters that are might be just a bit different from the usual character set, archaic or more exuberant. Swash characters are sometimes provided for italic fonts.

R A M ſ e t n

Ligatures   Ligatures are two or more letters that are designed as one character. The ampersand is the most common ligature (*et*, Latin for 'and'), and fi and fl ligatures are provided as standard for most fonts. Sometimes ffi and ffl are provided. Other unusual ligatures might be provided simply for visual pleasure, such as Zuzana Lick's Mrs Eaves. Others might be archaic, such as ct st ſh ſi ſt etc provided for typefaces like Adobe Caslon Pro or Warnock Pro.

ffi ffl fj ffj ct st ſh ſi ſl ff ſt

Optical sizes   In the days of metal type, fonts were cut size for size. Each size was 'designed' according to their contexts of use. With digital type, a font is no longer tied to any particular size. Types that are designed to appear in small sizes have rather different functional and aesthetic requirements than those that are used for display purposes, at large sizes. For example, type for small sizes need to generally be more robust, wider in proportion and lower in contrast in order to not appear weak. If the same font were used for large sizes, it would look cumbersome and unwieldy. Some typeface families are size-sensitive and may consist of font variants for a range of sizes. The 72 pt variant would have crisper serifs, higher contrast, more condensed widths and tighter spacing; whereas the 8 pt variant would have chunkier serifs, lower contrast, wider characters and looser spacing. Some of Adobe's Pro OpenType optical typefaces have font variants named 'caption', 'regular', 'subhead' and 'display'.

OHamburg
OHamburg

Adobe Minion Pro's caption and display variants.

General working practice

- Never type two spaces after periods. It is simply a bad habit carried from the days of the manual typewriter. If you need bigger spaces, use the em or en spaces (or tabs); if you need smaller spaces, use thin or hair spaces. These can be accessed through the Type > Insert White Space menu command in InDesign.

- Don not hit return twice between paragraphs. Spaces between paragraphs can be finely adjusted via paragraph settings, by inputting 'space before' and 'space after' values. If you

need to force a line break, use *option + return*. Never use multiple returns to force page or column breaks. Use the *Type > Insert Break Character* menu command to break columns, frames or pages.

- Never use word spaces to align text. Unlike typewriter fonts, which are monospaced, most digital fonts are proportionally spaced and therefore won't line up with word spaces. Use tabs to define fixed spaces.

- Do not use the auto/default leading. Change your line increments depending on line length, point size and typeface chosen to ensure comfortable reading.

Hyphen, en dash and em dash

- Never use single or double hyphens as dashes. This is another hangover from the manual typewriter. Use en dashes — like they do in the UK, or em dashes — like we do in North America. Thin spaces are often needed at either side of the em dash. (On the Mac, the keystroke for the en dash is *option + hyphen*, and for the em dash, *option + shift + hyphen*.)

- Never use caps or underline to emphasize words. Yet another hangover from the manual typewriter. Use *italic*, SMALL CAPS, **bold** or change font or colour.

Faux 'italic' type
True italic type

Faux bold
True Bold

- Do not use asterisks (*) or hyphens (-) as bullets. The bullet character (•) could be accessed by pressing *option + 8*. Press *option + 9* for a midpoint (·).

- Use a word-processing program to input your text. It is better not to type directly in a layout program. A word-processing program is designed for writing. It makes counting words, editing, checking spelling (or grammar) so much easier and lets you focus on what you're writing rather than how it looks.

- Make sure you have true italic and bold fonts installed on your system. Never digitally embolden or slant type. InDesign does not allow you make faux italic or bold type, which is good news.

70% Digitally condensed Myriad

Myriad Condensed typeface

- Do not artificially condense or expand type, unless you know the fonts are designed with the flexibility for distortion in mind, for example Gerard Unger's Coranto and Vesta. Use specially designed condensed or expanded versions of a typeface where available.

Typography on screen

How's type on screen different? Unlike typography in print, which depends on light reflecting off the surface of the paper and into the reader's eyes, typography on screen works with light that is emitted directly from the screen into the eyes. The process of reading can therefore be quite tiring. If considerations are not taken to allow for the best possible reading condition, readers can easily be put off by your text. Another essential difference between typography in print and on screen is of course resolution. The resolutions of most computer screens are between 72 and 96 pixels per inch, while most of our everyday printed matters are around 2500 dots per inch. Even the common office laser printer has a much higher resolution than the computer screen, at 600 dots per inch. Until screen resolutions improve to such a degree that they match our print quality, as designers we'll have to do our best within the bounds of what seems like a serious constraint.

One of the advantages of typography on screen is that the text has the potential to be 'live' — the text remains as text instead of a stagnant image on paper. This means the
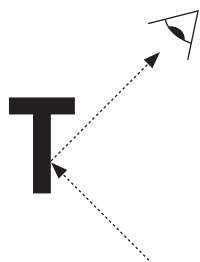
Reading type in print
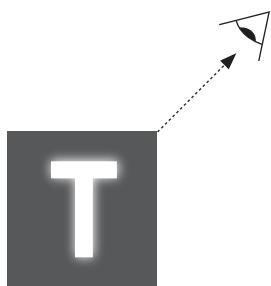
Reading type on screen

text is editable and searchable — the semantic meaning is maintained. Live text, especially on HTML-based websites, could be generated by linking to a database of timely information and called upon when needed. Pages could be built on the fly. Many e-commerce websites are database-driven. Another advantage is that hyperlinks could be assigned to words and phrases, so cross-referencing and user interaction is possible.

Typography on screen could also take on motion and be combined with sound. Letterforms, words and phrases in this context become actors that could tell stories and convey emotions. TV motion sequences and film titles fall within this genre of type on screen. Type in motion could also be combined with interactivity to create plugin-based websites, games, interactive CD-Roms and DVDs using Flash or Shockwave technology.

At small sizes (typically the common sizes we would use for print), the number of pixels available to represent each character is small, due to the coarse resolution of the screen. Most issues for typography on screen only occur at small sizes. At large sizes resolution would not be an issue at all, and the same principles for print typography apply.

Aliasing and anti-aliasing   Until fairly recently, most computers were only capable of displaying 'aliased' (bitmapped) text on screen. The pixels are either 'turned on' or 'turned off'. This made type look very jagged on screen. Expertly hinted TrueType fonts (see below) should always be used for aliased text.

Anti-aliasing is a method to give the illusion of smooth outlines through the use of varying levels of gray surrounding the outline of the character. Anti-aliasing tends to work better at larger sizes, since the fuzzy outline could result in eyestrain and fatigue. At smaller sizes it might still be best to avoid the use of anti-aliasing. This could be turned off below a preferred point size at the system level.


aliased (bitmap)

anti-aliased (grayscale)

ClearType and CoolType   ClearType and CoolType are new sub-pixel font rendering technologies developed by Microsoft and Adobe respectively. Different colour values at the sub-pixel level are used (instead of simply tints of the font colour) to give a crisper image of the character. This technology is built in to the current version of Adobe Acrobat and Microsoft's e-book Reader, but only work on LCD displays.

Hinting   In short, hinting is a way to instruct the computer exactly which pixels are turned on in order to give the best possible bitmap image of the characters at small sizes at low resolution. The outline of the characters is modified by mathematical instructions at given sizes, so the desired combination of pixels is turned on.

unhinted   hinted
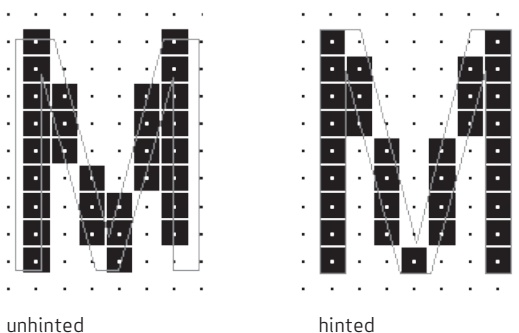
These illustrations were taken from the Microsoft Typography website: www.microsoft.com/typography

Currently, the most sophisticated hinting technology is found in TrueType fonts. Most Windows and Macintosh system fonts are expertly hinted to give the optimum quality and legibility. Expertly hinted fonts are absolutely necessary for older operating systems that do not support anti-aliased display of type, especially for the display of HTML-based websites and word-processing in a business setting. This is perhaps not as necessary in the latest versions of the Macintosh and Windows operating system, since anti-aliasing is now built-in. Most Postscript Type 1 fonts, or Postscript-flavoured OpenType fonts are either not hinted or are hinted poorly. Avoid using these aliased at small sizes.

Type for HTML-based websites   Most web pages are saved as HTML pages and displayed in browsers. HTML stands for 'HyperText Mark-up Language', a format that allows text to be assigned different attributes and structures. HTML lacks sophisticated layout control and the majority of the typographic features essential to print typography. In the Internet's early years, basic things like leading, point size, or even what font the text appears in, could not be specified by the designer. Finer typographic control is now possible with the introduction of Cascading Stylesheets (CSS, see below).

For HTML-based websites it is best (if not essential) to stick with system fonts that are common to both the Macintosh and the Windows platforms. A list of fonts in descending order of preference could be specified by the designer, so that if a font is not available on the viewer's system there are backups to fall back on. The most common as well as perhaps the most legible font for on-screen reading is Matthew Carter's Verdana. The high legibility is achieved through the large x-height, open counters, wide character widths, wide spacing and simple shapes.

Cascading Stylesheet (CSS)   Cascading Stylesheets are essentially like stylesheets in InDesign or QuarkXPress. These are predefined styles that could be applied to HTML pages, allowing the separation of content and presentation. Standard HTML tags (like body text, paragraphs, different levels of headings, table cells, etc) could be modified and given more elaborate typographic attributes than what standard HTML are capable

of. Leading, type size, case, letterspacing, colour, alignment, as well as sophisticated layout and positioning could all be specified using Cascading Stylesheets. Cascading Stylesheets could be added to individual HTML pages, or multiple HTML pages could be linked to an external stylesheet file (.css). Even interactivity actions (links, rollovers, etc) can be specified in css.

Web typography: some pointers

- Always specify type sizes in pixels rather than points. Due to the differences in screen resolutions for Macs and PCs, the same point size would render larger on the PC than on the Mac. Specifying your type in pixels (for example 12 px) would rectify this.

- Set your type slightly larger than you would for print. 8 to 10 point might be perfectly readable for a book, but on screen it is usually too small to be read comfortably. Your type size should be at least 11 pixels, preferably higher, especially when your text is going to be anti-aliased or is in a seriffed typeface. I find Verdana at 11 px to be an excellent size to work with, but Georgia or even Arial at the same size look a bit too small. Verdana at 12px is readable but the spacing seems a little cramped. However at 13 px it looks perfectly fine. You have to find out by trial and error.

- From the usability point of view, it is perhaps better to design your site with flexibility in mind, allowing users to increase the type size without destroying design integrity.

- Make your leading larger than you would for print. A good starting point might be to add 6 to 7 pixels to the point size. If your type size is 11 px, a good spacing would be 18 px. Again, you'll have to find out by trial and error.

- Make sure your lines are of reasonable lengths. Long lines that span across the entire width of the screen is difficult to read. White space and shorter lines give the reader's eyes a place to rest and provide a psychologically more pleasant reading environment.

- Avoid using colours of extreme contrasts. Black type of a stark white background hurts the eyes, since the background is more powerful that the text itself. Softening the contrast would make the reading experience more pleasant. For example a light grey background would bring the value of the background closer to that of the text, a more comfortable contrast.

Type in Flash and such The basic screen typography principles for web apply here. For interactive presentations, it is not necessary to stick with common system fonts, since fonts could be embedded into Flash files. It is advisable to stick to aliased (bitmapped) type for small sizes, and there are plenty of contemporary typefaces (some are free) expertly hinted for Flash use that are highly legible even at extremely small sizes (for example 8 px). Unibody by Underware <*www.underware.nl*> is a good example and its free. For larger type it is perfectly fine to turn on anti-aliasing. <*atomicmedia.net*> offers some interesting bitmap fonts for purchasing.

Unibody Regular
Unibody Italic
Unibody Bold
Unibody Black
UNIBODY SMALLCAPS