Linotype-Hell

Technical Information

PostScript Font Basics

This document is the first of two articles on the technical aspect of fonts. It will cover elementary font concepts that are important in understanding just how type is set using the PostScript** page description language. The next article will cover how to take these concepts and use them in practice.

Fonts and Typefaces

Just what is the difference between a font and a typeface? To understand this, let's look at the historical development of movable type. As early as 255 B.C. the Chinese were using ceramic stamps pressed into soft clay to certify the authenticity of documents. Inked characters that could be rearranged and reused were developed in 1401 A.D. by Pi Shêng in China. Finally, in 1444 a German named Johann Gutenberg began to cast letters out of a mixture of lead, tin, and antimony. Many of the terms that we use today are based on the cast letters developed by Gutenberg.

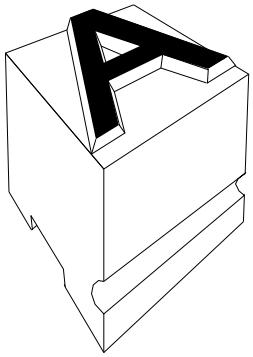

Figure 1 - A single cast letter from a hot metal font.

With movable type, there is a distinction between the cast letter and the impression that it makes when inked. The cast letter is the source of the printed letter. If you gathered an entire set of these cast letters, numbers, and other characters in a single point size and style, you would have a **font** (see Figure 1).

6 point Bodoni
9 point Bodoni
12 point Bodoni
15 point Bodoni
18 point Bodoni

Figure 2 - The same typeface in different sizes. With cast letters each of these sizes would be printed from a separate font.

The raised surface of a letter forms the 'face' where ink is transferred to paper. The printed result from an entire font is known as the **typeface** (see Figure 2).

Different variations on a typeface (see Figure 3) are called **styles**. Variations in the style, weight, and character width of a typeface make up a **typeface family** (see Figure 4).

Janson Roman
Janson Italic
Janson Bold
Janson Bold-Italic

Figure 3 - The four type styles of Janson.*

With the advent of electronic fonts, the clear distinction was lost between the physical font and the letters printed from it. There was no more cast letter, just a collection of electronic data. And because a font can now be mathe-

Helvetica 25 Ultra Light
Helvetica 55 Roman
Helvetica 95 Black

Figure 4 - Three members of the Helvetica family.*

matically resized at very precise units (as low as .001 of a point), sizes are not exclusively tied to a particular font. This change has made the relationship between the terms font and typeface even more confusing. Many people, in fact, use the terms interchangeably. However, if you take history as your guide, the term font should describe solely the electronic data, since it is the source of the printed characters. The term typeface should be used to describe what comes out of a printer or imagesetter. For example, what Linotype-Hell sells to a customer is a font, the customer installs that font on a computer, and uses it to output text in a particular typeface.

Font
The source of the printed letter (whether physical or electronic)

Typeface
The printed result

Categorizing Fonts

There are two basic ways of categorizing fonts: by their nature or by their function. If you categorize them by their nature, there are two types of fonts: bitmapped and outline. If you categorize them by their function, there are also two types: screen and printer. Often, the term *screen font* is used as a synonym for *bitmapped font*; likewise, the term *printer font* is used as a synonym for *outline font*. Unfortunately this can be misleading, particularly because of recent technology developments (see section on ATM, Adobe Type Manager**). As we will see, it is better to categorize fonts as bitmapped and outline rather than to describe them by their function.

Bitmapped and Outline Fonts

Bitmaps are grid-like collections of data that store each point on the grid as a pixel (see Figure 5). Bitmaps can require a lot of storage and do not resize well. Outlines are mathematical formulations of the letter shape using curves and lines. They are usually much smaller in storage size, and can be resized without degrading the letter form.

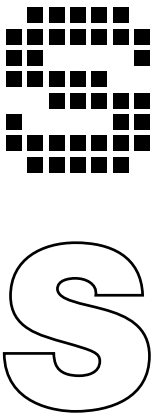

Figure 5 - Bitmapped letter (top) and outline letter (bottom)

As a general rule, bitmapped fonts:

- Are primarily, but not exclusively, for screen display.
- Are often referred to as screen fonts.
- Should be installed in all the sizes you intend to use frequently (unless you are using ATM).
- Are stored and moved within a Macintosh** computer in containers called *suitcases* (see Figure 6).

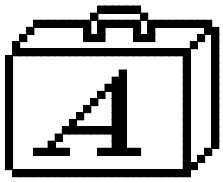

Figure 6 - Macintosh icon for a collection of bitmapped fonts (usually referred to as a screen font suitcase).

- May be used for the printer, but will result in jaggy output (see Figure 8).
- Provide a table with character widths to allow on-screen typesetting.
- Tell the output device which font to use on the page.

On the other hand, outline fonts:

- Are primarily, but not exclusively, for output to printer.
- Are also known as vector, scalable, or printer fonts. (See icon in Figure 7.)
- Are, in the case of PostScript fonts, composed of Bézier curves (smooth curves that can be linked together with seamless joints).
- Contain information about the size and shape of each character that the printer uses to output a document.

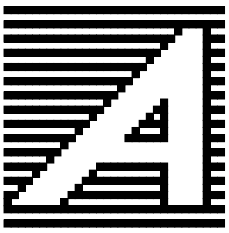

Figure 7 - Macintosh icon for an outline font (often referred to as a printer font).

- Allow you to print your typeface at any size, angle, shade of gray, or resolution and still have it print with clarity and precision.
- May be used for screen display with ATM (see following page).

Resizing Fonts

Often bitmapped fonts are used for screen display, and when this is the case a separate font should be used for each size that will be displayed on the screen. In this sense, bitmapped fonts are similar to cast letters because a separate font is necessary for each size. But unlike cast letters, it is possible for a smaller bitmapped font to be enlarged to display a larger size on screen. The only drawback is that the resulting on-screen text will look jaggy. (See Figure 8.) Outline fonts, on the other hand, may be enlarged without the risk of creating jaggies. (This occurs in much the same way that a synthetic graphic can be enlarged without degrading the image, while scanned graphics cannot. See Scanned File Size document, #3053.)

Figure 8 - Original and enlarged bitmapped font (top) and original and enlarged outline font (bottom)

The Raster Image Processor

The device that takes the fonts and interprets them so that the printer or imagesetter can print them is called a Raster Image Processor (RIP). It has to determine which pixels are turned on or off to create the text, linework, and halftones that make up a page.

Ultimately, the RIP turns everything into a collection of on or off marks called a raster (a bitmap essentially). And if the RIP only has access to bit-mapped fonts, it will have to resize them and reproduce them with the jaggies that are inherent within bitmapped fonts. On the other hand, it will take outline fonts and reproduce them as best it can depending on the resolution of the printer or imagesetter. The higher the resolution, the smoother the resulting characters.This concept, called device independence, is one of the basic reasons Adobe Systems Inc. had for developing PostScript. They wanted to create a language that could speak to many different kinds of printers (with a wide range of resolutions), and produce the best looking output that any of these printers were capable of achieving.

ATM (Adobe Type Manager)

A new technology, ATM for short, has been introduced that allows outline fonts to be used as screen fonts. ATM still requires bitmapped screen fonts for sizes under twelve points, but this technology marks a vast improvement in screen display. ATM is now available from Linotype-Hell for use on the Macintosh computer.

The two primary advantages of ATM are as follows:

- Screen representations of fonts can now be produced using outline fonts. As a result, type of all sizes looks much better on screen.
- Bitmapped screen fonts are only needed for reproducing sizes under twelve points. This dramatically reduces the storage required for fonts.

Hints, Encryption, and Formats

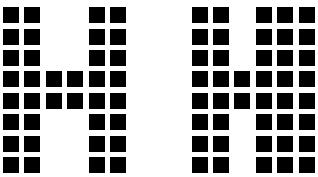

Figure 9 - Enlarged illustration of hinted type (left), and unhinted type (right).

Making small printed type look good at low resolutions is difficult. When outline fonts are scaled at lower resolutions, fewer pixels are available to create a given letter. If the automatic scaling program calculates one stem of a capital H as two pixels, while the other is assigned three (when they are meant to be equal), the result will be an unbalanced letter (see Figure 9). Adobe Systems Inc., in developing PostScript, created a font technology that did more than just make it possible to have outline fonts. They included something called **hints**, algorithms that are part of a font and improve its ability to produce good-looking letters at low resolutions.

Encryption is the process used to protect font information (hints and character data) from inspection or modification. However, ever since Adobe released the Type 1 font format† (in March of 1990) the issue of hints,

encrypted, and unencrypted fonts has become something of a moot point. Now that the standard is open, all type manufacturers may use the hinting that was once limited to Adobe-licensed manufacturers. In addition, the U.S. patent office has recently held that type manufacturers' character data (the actual computer code itself) is copyrightable.

† The Type 1 font format includes the ability to allow encryption. The Type 3 font format does not. There is no public Type 2 font format.

Font Metrics

Font metrics determine how much space surrounds each character. All kerning and letterspacing†† issues are handled through font metrics.

†† Kerning is the ability to individually adjust the space between pairs of characters. Letterspacing refers to the ability to globally adjust the space between characters.

For outline fonts, the mathematical border of each letter, number, or symbol is defined by a bounding box (see Figure 10). Kerning and letterspacing can all be defined relative to this box. This information is also included in the Adobe Font Metrics (AFM) file. It is there so that software developers can access the font metric information from within a program.

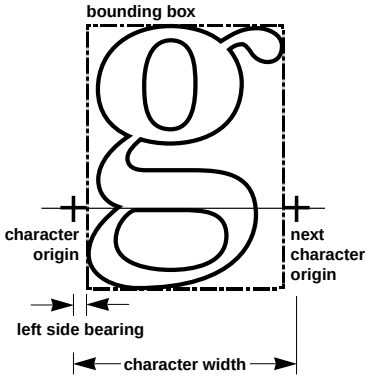

Figure 10 - Bounding box for an outline character.

For bitmapped fonts, the character width information is stored in a table within the font itself. Of course, it is important that the width information be accurate between the font used for screen display and the font used for printer output, otherwise line breaks on screen might not match the line breaks as output from the printer. To be sure that the line breaks match, the LaserWriter** driver makes adjustments where necessary in letter and wordspacing to assure that what you see is what you get.

The way that kerning and letterspacing are handled depends on the software application that is being used. Some applications give you little control, while others allow you to build tables of kerning pairs or set specific tracking values. Check your application for the amount of flexibility that it allows.

Conclusion

If you buy a single font diskette from Linotype-Hell, it will have four things on it: bitmapped fonts in suitcases (probably referred to as screen fonts), outline fonts (probably referred to as printer fonts), AFM files, and a downloader. Issues related to downloading, as well as installation, placement, storage and effective use of fonts will be covered in the companion piece to this article.

For more information on the subject of fonts, an excellent resource is The Macintosh Font Book by Erfert Fenton. It is available from Peachpit Press (1085 Keith Avenue, Berkeley, CA 94708, 1-800-283-9444).

Comments

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