A Sample Piece of Type

From 'De Præparatione Evangelica' of Eusebius printed by Nicolas Jenson in Venice, 147

melius nobis atq; beatius excogitari poteſt? Nōne uitæ:lucis:ueritatis
bonorumq; omniū ipſe fons atq; largitor eſt?Annon ipſe ut cuncta &
ſint & uiuant cauſam in ſe ipſo complectitur?qua ergo re indigebit q
eius amiciciā adeptus eſt?qui rex omniū creatorē caritate ſibi coiūxit?
qui patrem atq; tutorem illum ſibi aſcripſit?Non poſſumus profecto
dicere quin omnia quæ ad animam :quæ ad corpus:queq; ad externa
pertineant optimé beatiſſimeq; is poſſideat:qui caritate proximus deo
factus:beatiſſimā eius amiciciā exacta exquiſitaq; religione cōſecutus
eſt.Hanc ergo ſalutarem hominum ad deum conuerſioné atq; aīciciā
ab omnipotenti déo miſſus deus uerbum quaſi lucis ifinitæ ſplendor
cunctis annūciat.Non hincaut altúnde:ſed undiq; cunctis ex gétibus
ad deum uerum:græcos ſimul et barbaros omnem ſexū: omné ætaté:
diuites et pauperes:ſapientes et cohtra:líberos ac ſeruos magna uoce
cōuocat:hortaturq; omni ſtudio ac cura hoc donū ſuſcipiamus.Nam
ſicuti eiuſdem naturæ atq; ſubſtantiæ nos omnes creauit: ſic rurſum
cognitionem et caritaté ſuam æqualiter omnibus propoſuit qui gīam
eius ex toto animo cōplectuntur et colunt. Hanc dei erga nos caritaté
Chriſtus qui ipīus dei patris uerbum eſt ipſe quoq; deus:nó reſpiciés
ad peccata hominum:ſed ſe ipſū eis recōcilians uniuerſo ſicut diuīna

A sample which illustrates the qualities and attributes of set type. It is from 'De Præparatione Evangelica' of Eusebius printed by Nicolas Jenson in Venice, 1470.

Calligraphic-style Fonts- Problems and Solutions

BY ANDY BENEDEK

I find it rather strange to be talking about fonts here at the Edward Johnston Foundation because it is my understanding that it was Edward Johnston's belief that what emerged from the pen was sacrosanct. The subsequent re-touching of letterforms was severely frowned upon. Creating fonts, on the other hand, is all about the art of compromise, because in a font every character has to work with every other character. Font design is thus an iterative process of, first, designing characters followed by a number of cycles of testing and of adjusting their design, spacing and kerning.

Be that as it may, as I am here to talk about font creation and the creation of calligraphic style fonts in particular, probably the best place to start is with a brief description of the font creation process. Of course, there will be variations from the following, but in general the first stage is the creation of the letterforms themselves. These may emerge directly from a broad-edged pen or brush, be drawn, constructed or incised.

Once a complete set of letterforms has been completed, the second stage is to convert them into a digital format so that they can be manipulated on a computer screen. Early computer representations of letterforms used dots or pixels which were either black or white. Nowadays, letterforms are represented by mathematically-defined outlines. The big advantage is that when outline letterforms are enlarged the image is re-calculated for the new size and its resolution is that of the output device. In contrast to this, enlarged pixel based images are blocky in appearance as the pixels are simply enlarged, unless individual fonts are created for each size of use, as was done in the past by punchcutters.

In general, the digitisation process is accomplished by scanning the letterforms and then using the images as templates around which the outlines are drawn. In the case of incised lettering, a rubbing may be taken from the lettering and the rubbing scanned to create templates. The form of mathematical curve used most frequently nowadays is that developed by the French mathematician Pierre Bézier, so it is not surprising that the outlines are called Bézier curves. Although TrueType fonts use a different form of mathematical curve, they are usually digitised using Bézier curves and then converted.

When all the characters have been digitised, comes the third stage of letter spacing; that is: the task of assigning widths to the characters so that when they are placed adjacent to one another in a line of text they do not collide with one another.

Once a preliminarily spaced font has been achieved, it is usual to print out samples of text to ascertain how the characters work in combination. From the print-out, it may become apparent that some characters are too heavy or too light, too wide or too narrow. In any event, some adjustments are nearly always necessary. After the adjustments, more sample text is printed and the cycle repeated until acceptable letterforms are obtained. Letter spacings may also be adjusted at this stage or may be adjusted subsequently, again in an iterative process.

Letter spacings, it should be remembered, are also a compromise and this inevitably results in some combinations, for example AV and LT, between which the spacing is particularly less than ideal. The spacing of such combinations can be adjusted by defining them as 'Kerning Pairs' so that when these particular combination of characters appears in text, the spacing in between them is adjusted by a pre-defined amount. When the characters appear in any other combination, their normal spacing is assumed.

After kerning, 'Hints' may be added to character outlines to aid their rendering on low resolution output devices such as 72dpi computer screens. Hints are additional instructions which are embedded within the font to ensure, for example, that stem widths that should be
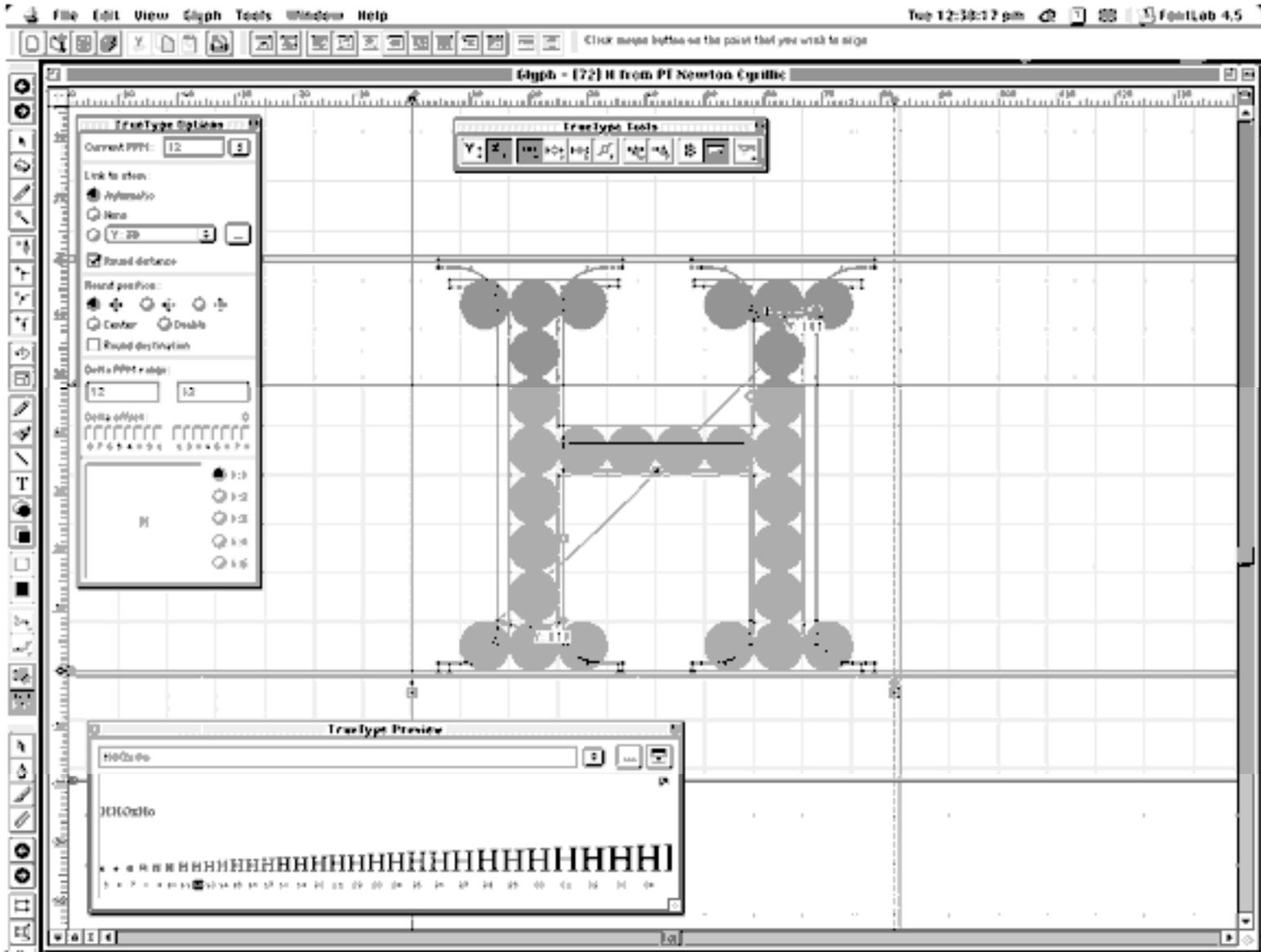
Hinting: TrueType font PT Newton Cyrillic

identical are rendered identically when output. Hinting may be carried out automatically by the font creation application or it may be accomplished manually. Typically, Adobe PostScript Type 1 fonts are hinted automatically and TrueType fonts for use at small sizes on screen are manually hinted.

After hinting, the final part of the font creation process is the generation of the font in a suitable format for use.

CALLIGRAPHIC-STYLE FONTS

The font creation process as just described is a general one which is applicable to all styles of fonts. But calligraphic-style fonts are a special case and in this respect it is instructive to compare the letterforms in a piece of set type and in a piece of calligraphy.

Of course, there are exceptions to almost everything stated below, but in general type is governed by the requirement that all characters must work with one another. Furthermore, there is, generally, only a single

representation of each character and the design of each character is pre-conceived. For example, there is only one design of the lower-case 'a' and there are generally no variations in character shapes with context, with the possible exception of some character combinations such as fi and fl, for which ligatures may be available. Character spacings are pre-determined, although some global tracking and manual kerning may be applied in the page layout application. Adjacent characters do not overlap each other save in the case of joined scripts when the overlap is relatively small and constant.

In contrast to the uniformity and homogeneity of type, a handwritten piece of calligraphy is characterised by variation. Whilst all characters are similar – if that is the intention – each varies, to some extent. For example, all the 'a's will be slightly different from one another, sometimes intentionally due to their context and sometimes unintentionally due to a lack of precision or due to the interaction of the pen or brush with the surface texture of the medium being written upon. Adjacent characters may interact with one another to a very significant extent and there may or may not be an underlying structure to the piece. In fact, much calligraphy today is characterised by great freedom and spontaneity.

TECHNICAL ASPECTS OF FONTS

Before we consider the solutions to creating calligraphic fonts, a few words about the technical aspects of fonts are in order as each of the following font formats imposes its own limitations. Foremost of these limitations is the number of usable characters a font can contain and this involves what are known as encodings. The subject of encodings is a complex one, but suffice it to say that for the purpose of this talk encodings can be considered as sets of characters. For example, a Macintosh encoded font contains a different set of characters to that of a Windows encoded font.

Early font formats, as described below, have encodings with a theoretical maximum of 256 characters. In contrast, later font formats, based on Unicode, can contain over a million characters which gives rise to considerable scope in font design. Unicode is a universal standard encoding which accommodates all the characters of all the major scripts in the world. Each script has a designated range of codes assigned to its characters. There is also a 'Private Use' region which is reserved for user-defined characters – a feature which is of considerable importance to calligraphic-style fonts.

FONT FORMATS

Bit-mapped fonts – this was the very first font format for the Macintosh in which the characters were comprised of pixels. Scale a 24pt bit-mapped font and the image of the characters become increasingly blocky with size. Optimised, bit-mapped fonts are excellent for screen use, but they can only contain a maximum of 256 characters.

PostScript fonts – these were the first high-quality fonts for the Macintosh. The character shapes are stored as scalable Bézier outlines rather than pixels. The PostScript font format was developed by Adobe and has a maximum of 256 characters.

TrueType fonts – this font format was developed by Apple. TrueType fonts (TT) use scalable outlines, though of a different mathematical form to PostScript fonts. In general, PostScript fonts are preferred for printing whilst TT fonts, with their more powerful hinting technology, are preferred for screen, and hence internet, use. There are two TT variants: one for the Macintosh and one for Microsoft Windows. The specification for Macintosh TT fonts has, with the exception of the QuickDraw GX fonts mentioned below, remained static whilst that for Windows has evolved in line with the introduction of updated versions of of this operating system. Macintosh TT fonts have a maximum of 256 characters whilst Windows TT fonts can have many more—as will be mentioned later.

QuickDraw GX – this format was an extended version of the original Macintosh TT font format. A QuickDraw GX font can contain up to 65,536 characters. And indeed some contained the characters for all the family variants (bold, italic and bold italic) plus small caps and swash variants, etc. Wonderful though these fonts were, QuickDraw GX fonts never found widespread acceptance because they were Macintosh specific.

OpenType fonts – this is one of the latest font formats to emerge and in some ways is similar to the above GX format in terms of capabilities. Unlike GX fonts, however, they are Macintosh and Windows compatible – that is, the same font file works on both of these platforms.

OpenType fonts, being Unicode based, can contain – in the Private Use region of the encoding – a wide variety of alternative characters, ligatures (of any number of characters), old style numerals, titling caps, subscripts, superscripts, ordinals, etc.

OpenType fonts may also possess a wide range of 'Features'. I say may possess because it is entirely up to the designer of the font whether or not to implement a particular feature. Features, as defined in the OpenType specification, are divided into two groups, namely

The original piece of calligraphy from Hermann Zapf which inspired the font Zapfino. It displays the typical attributes of calligraphy of freedom and spontaneity.

'Substitutional' features and 'Positional' features.

Substitutional features involve the availability of alternative characters and ligatures in the font which can be selectively substituted for the base set of characters. Examples of single characters that may be available for substitution are alternative characters with swashes for both the first and last characters in a word, old-style non-lining numerals, ordinals, super- and sub-scripts and titling caps. Ligatures are groups of two or more characters which may be substituted. Traditionally, ligatures consist of a pair of characters joined or linked in some way, such as fl or fi, but in OpenType, ligatures can consist of two, three or even more characters which may or may not be linked in any way. It is this latter capability which gives OpenType the amazing capabilities for simulating calligraphic letter forms.

Positional features modify the spacing between characters and/or their vertical position with respect to the baseline. Typical examples are the re-spacing of text when set in all caps and the raising of brackets when used adjacent to numerals and caps-only text.

Substitutions are grouped according to type. For example, basic ligatures, such as fi, ffi and ffl which have been incorporated in fonts for many years, are defined as simply 'Ligatures' whilst any others can be defined as 'Discretionary Ligatures'. Other features are categorised similarly. Features can be applied to only selected text or can be applied to all the text. This takes the capabilities of OpenType fonts way beyond that of expert sets.

Although the acceptance of OpenType fonts is still somewhat in the balance, OpenType fonts will undoubtedly gain some acceptance because the format is backed by both Adobe and by Microsoft and because of their cross-platform compatibility which makes moving documents from one platform to another much easier and trouble-free than hitherto. However, it is doubtful whether all the typographic niceties will survive because including them in fonts is both very time-consuming and expensive to produce and because few software applications support them. Unfortunately, the presence of features in an

The same text as of the original piece of calligraphy set in Apple's version of the font Zapfino.

OpenType font is not sufficient, in itself, for them to be of use—it is also necessary for the application in which the font is being used to support them. To date, only Adobe's page layout application, InDesign, exploits a wide range of them. Even the 'just announced' v6 of Quark XPress will, I understand, support few, if any, OpenType features.

Apple's .dfonts – This font format was introduced by Apple with Mac OS X and is very similar to OpenType. Some fonts, such as Zapfino, have a very large range of alternative characters and when used in the likes of TextEdit, a software utility supplied with MacOS X, is capable of similar alternative character and ligature substitutions to OpenType. Suffice it to say that this font format is unlikely to gain widespread acceptance because of its lack of cross-platform compatibility.

So now we have reached the core of this talk. How can a piece of set type have the characteristics of a freely and spontaneously written piece of calligraphy? The purist would say: it can't, so why try? The pragmatist would say: well, life is full of compromises and so why not forgo some of the more extreme characteristics of calligraphy if some success can be achieved?

In this regard, I think it is appropriate to take the lead from Hermann Zapf, one of our greatest living calligraphers, who is undoubtedly a pragmatist. His comments when talking of Zapfino, a script face he designed in the early 1990s, made this plainly evident. He said, 'You can't get the life and freshness of a broad-edged pen with a machine, but Zapfino may compete with the many badly-designed calligraphic alphabets that have infected

Working drawings from the development of Zapfino.

This shows the power of automatic ligature substitution. The upper word is comprised of Zapfino's standard characters, whilst below is the result of invoking automatic ligature substitution.

**Working drawings from the development of Zapfino.**

the PC and Macintosh market since the 1990s. It should be considered an alphabet opposing bad taste in alphabet design'.

Clearly, there are some styles of calligraphy which just cannot in any meaningful way, be simulated with accuracy, but there are some styles which can be simulated with the aid of a suitably designed font. Of the latter, it can be said that the more lively the calligraphy, the greater the number and variety of characters that are required to simulate it—and that is where limitations of the fonts formats play a decisive rôle. To illustrate the point let us look at a few examples, beginning with the simplest.

Take Adobe's Duc de Berry font. Designed by Gottfried Pott in 1990 for Linotype's 'Type Before Gutenberg' series, Duc de Berry is a revival of one style of the blackletter known as 'bastarda'. Bastarda letters are formed by com-

bining the stiff, vertical, formal shapes of the textura blackletter style with the more fluid curves and strokes of humanistic handwriting. Simple, because the letterforms are un-connected and a single representation of each character together with a small number of ligatures suffices to give a reasonable simulation – all of which can be accommodated within the limit of 256 characters imposed by early font formats.

Another, but different, solution for which 256 characters is adequate is that of 'Songlines' – a font derived from Michael Harvey's hand-drawn script illustrating a page in the *The Ever-born Landscape* – a limited edition of Johannes Thurnau's poem published by the Burgert Handpresse, Berlin in 1992. It differs from the Duc de Berry type solution in that it is a caps-only font with an alternative set of caps in the lower-case character posi-
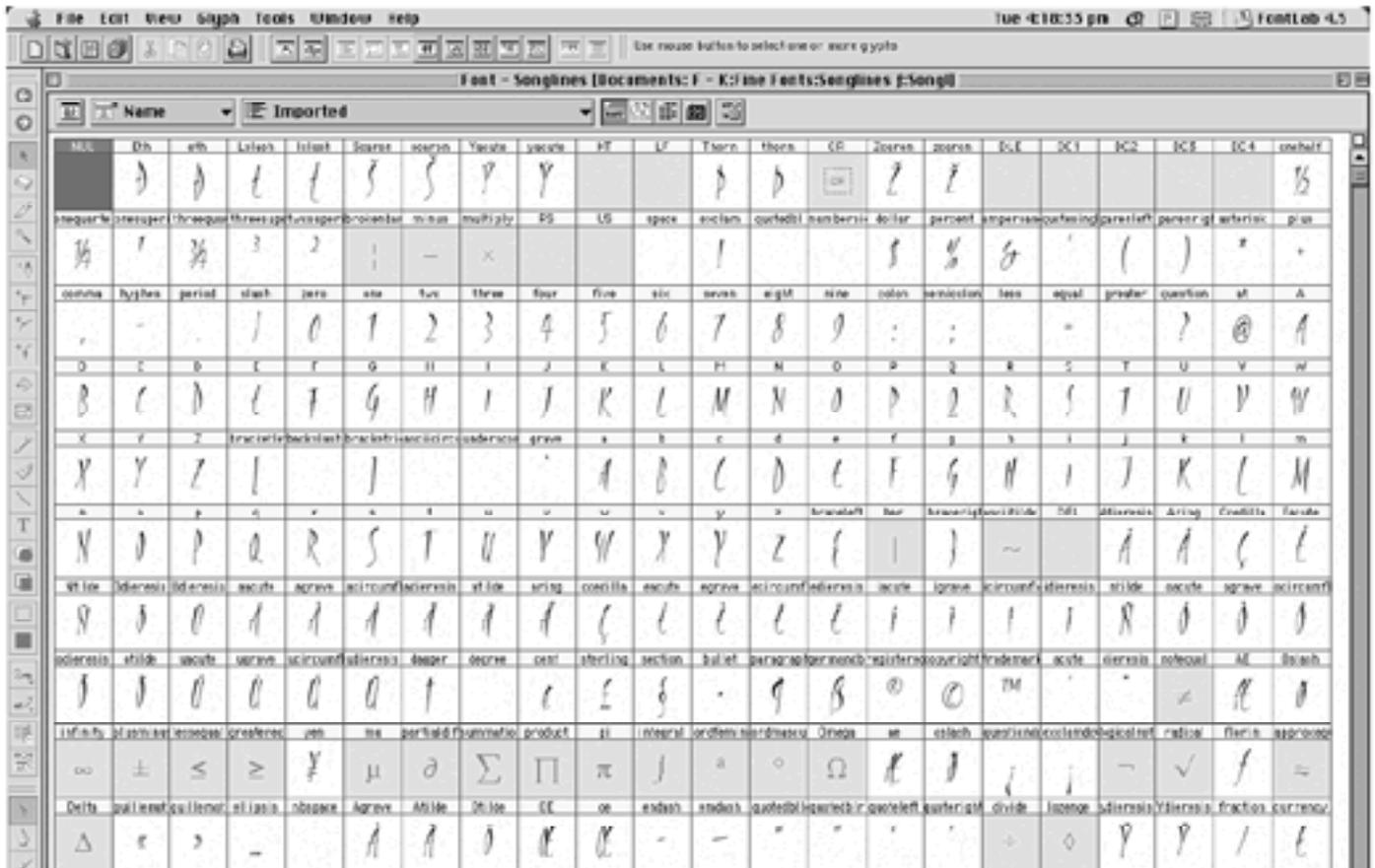
The Songlines' character set.

Michael Harvey's hand-drawn script illustrating a page in the "The Ever-born Landscape"—a limited edition of Johannes Thurnau's poem published by the Burgert Handpresse, Berlin in 1992 **together with the same text set in 'Songlines'.**

tions. In use, the font has been designed so that text can be set in just the upper-case or just the lower case characters. But the full vitality of text set in this font only emerges when a judicious combination of upper- and lower-case letterforms is used. The simplest way to achieve a varied and lively text using Songlines is to type the text in, say, all lower-case characters and then to go back through the text replacing some of the characters with upper-case characters. In the slide, one can see how effectively the Ls can be interchanged.

For fonts that require only a few characters above the basic 256, an auxiliary font called an 'Expert Set' can be used. Conventionally, expert sets are used to supply such typographic refinements as additional ligatures, small caps, swash characters and non-lining numerals. (NOTE: small caps are an additional set of upper-case characters with a cap-height optically equal to the height of the lower-case characters. Non-lining numerals are numerals of an old-style nature with ascenders and descenders. Lining numerals all have the same height which corre-
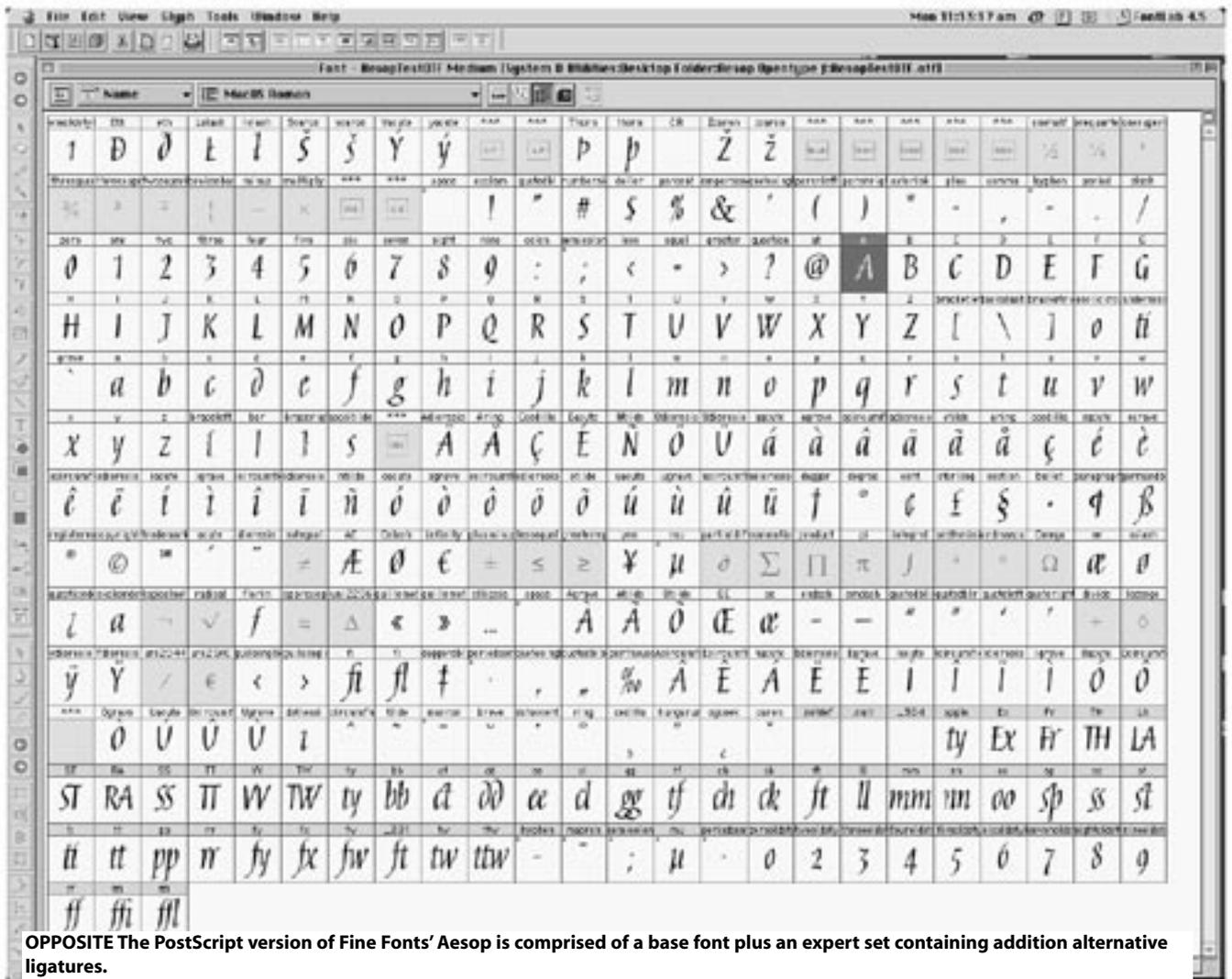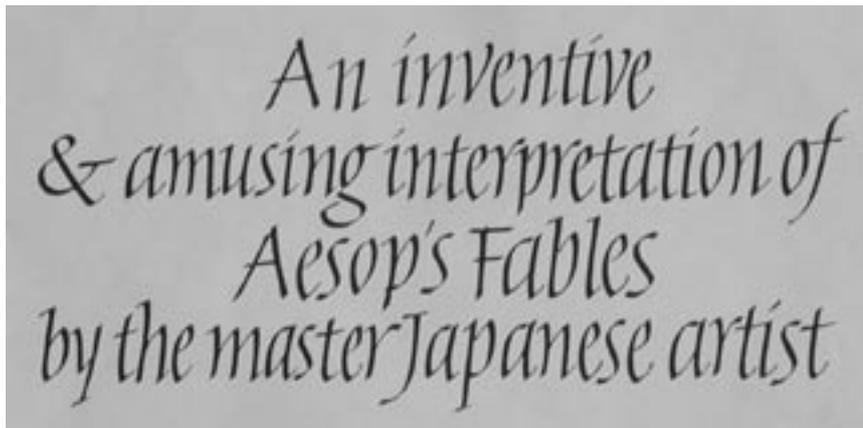
OPPOSITE The PostScript version of Fine Fonts' Aesop is comprised of a base font plus an expert set containing addition alternative ligatures.

THIS PAGE (top) Michael Harvey's original lettering for Aesop. This image shows the character set of the OpenType version of Aesop. (lower) The advantage of OpenType is that all the characters can be accommodated within a single font and automatic ligature substitution can be invoked to automatically replace particular character combinations with an appropriate ligature.
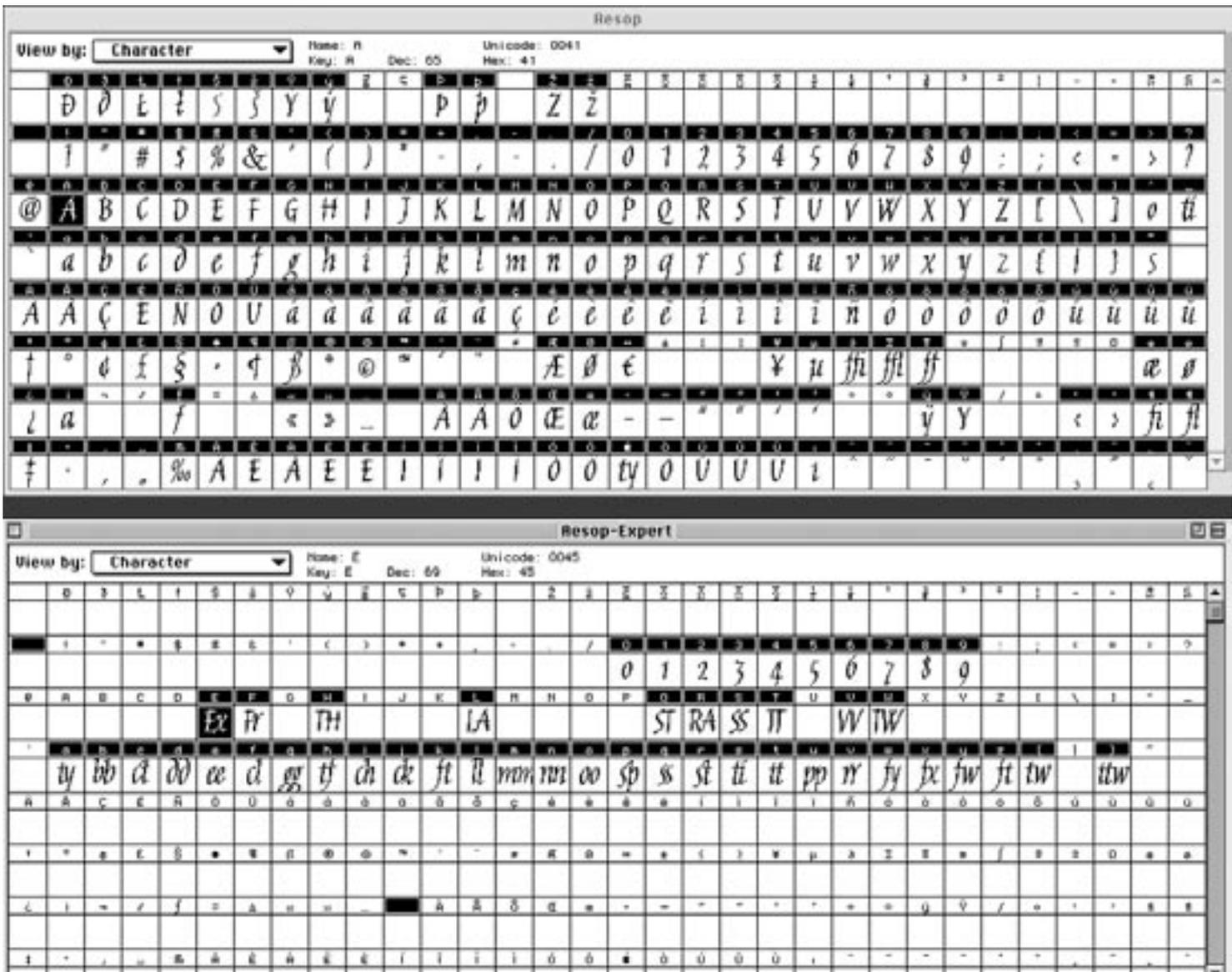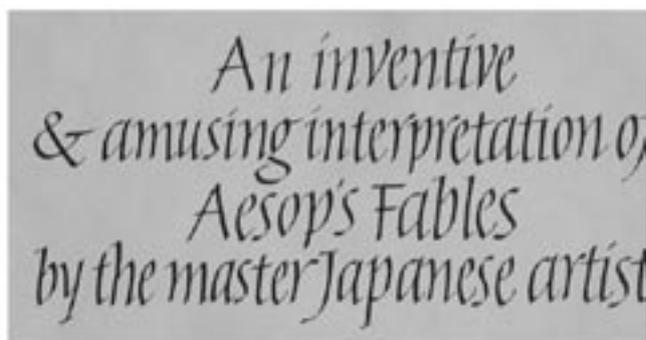
sponds approximately to the cap-height). An example of this solution, providing textual variety, is Aesop from Fine Fonts. Aesop is based on a pen-drawn script designed by Michael Harvey. It is characterised by a lively sense of movement and grace which is achieved both by the design and by the variety of the letterforms. Numerous ligatures and contextual alternatives were drawn and digitised by Michael and supplied as an expert set to accompany the base font.

It has to be said, however, that the use of expert sets is neither an elegant nor really a practical solution to the problem of providing textual variety. Setters of type soon become weary of repeatedly switching to and from the expert set to access the additional characters and, as a consequence, quickly learn to avoid them like the plague.

Undoubtedly, the best solution to meeting the requirements of calligraphic-style fonts is the OpenType format. OpenType provides both the additional capacity for all the alternative characters, ligatures, etc. and the capability for their substitution. Not that OpenType provides a perfect solution, nor is it sufficient within itself. The OpenType font format was not specifically designed for calligraphic-style fonts – if it had been then there might well have been a larger number of 'classes' of 'features' to give greater substitutional control. And it is not a sufficient solution in itself, because the application in which

Michael Harvey's original lettering for Aesop together with the same text set in the font.

MacOS X. Zapfino was begun in 1993 to exploit modern font technology and was released in 1998 in a simplified arrangement of four fonts combined with many ornaments, ligatures and alternative characters—some with extra-long desenders. Unfortunately, the Apple version of Zapfino is only usable with 'TextEdit', an Apple supplied text utility, and as such can only be considered as an example of what is possible with modern font technology.

To sum up, then: in the foregoing I have tried to describe the requirements of calligraphic-style fonts and the limi-

Caflisch Script Pro, the Adobe OpenType font which has a large number of alternative characters and multi-character ligatures which, when automatically substituted, enrich the text and give it a lifelike handwritten quality.

the fonts are used must support OpenType features. Take the feature which enables alternative forms of characters to be substituted at random. The OpenType specification includes this capability, but, as yet, no application, including InDesign, has implemented it. The OpenType font format is, nonetheless, a powerful solution which will cause many calligraphic-style font designers to burn the 'midnight oil' for quite some time.

So, acutely aware of the impracticality of providing an expert set for use with Aesop, an OpenType version is under development. The automatic substitution of alternatives, as characters for which ligatures exist are typed in, is a joy to behold. Swapping between fonts is a thing of the past and spell-checkers still function correctly, which is certainly not the case when expert sets are used.

A similar, but more extensive, example of a calligraphic-style OpenType font is Caflisch Script from Adobe. This has an extensive range of alternative characters and multi-character ligatures which, when automatically substituted, enrich the text, giving it an uncanny lifelike and handwritten quality. Unlike most fonts, which have ligatures mostly comprised of two, and occasionally three characters, Caflisch Script has ligatures containing up to four characters, and this adds significantly to the quality of the text.

Good though Caflisch Script is, it is outshone for sheer exuberance by Zapfino – a .dfont Apple supplied with

tations of the various font formats in use today. I have also described the OpenType font format and what it has to offer in the way of meeting the requirements, together with some examples of what can, and has, been achieved. In the event that what I have described has aroused some enthusiasm, let me dampen it a little. Creating OpenType fonts is not for the faint-hearted. A great deal of work is required together with a modicum of programming ability. Fontographer, the application which made font creation accessible to so many font designers by shielding them from the technicalities of the subject, is no longer adequate as it has not been updated for about eight years. Now FontLab is the application of choice. FontLab is a very powerful application and offers much, but in providing all the necessary tools for modern font creation, it has lost Fontographer's simplicity. C'est la vie.