

The *MathTime Professional* Fonts
Or, How I Wasted the Last Twenty Years of my Life
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The PracT_EX Journal, February 2006

People who have been wearily following my dalliance in the world of fonts may be wondering how I came to have an interest in type design. The answer to that is very simple: I've never had any interest in type design. If, 20-some years ago, when I was contemplating the next edition of my *Calculus* book, some one had offered me a reasonable set of math fonts (ones that could be used with Times, or with the Baskerville font in which *Calculus* is typeset) for the modest price of \$1,000, say, then I would have jumped at the chance to obtain it.

But no one did; on one side were the freebie people, who were producing lots of unsuitable fonts with MetaFont, on the other side real type design establishments, which couldn't be expected to foolishly invest time and money in the creation of fonts of interest only to the freebie freaks. So I had to foolishly supply the time and money myself.

Of course, I knew absolutely nothing about fonts. Professional type designers would probably say that I still know nothing about fonts, but I certainly know more than I did then, and a lot more than I ever wanted to know. What's more, back in those ancient times, MetaFont was the only tool I had even heard of, and, confounded as I was by elementary matters like the difference between 10pt and 10pt#, I despaired of ever learning enough MetaFont to do anything with it. So I relied on a MetaFont expert to produce some fonts, and had the pleasure of creating humongous pixel files, mailing back desired changes drawn on large printouts, reiterating this process *ad infinitum*, etc.

By the time it was possible to envision the eventual completion of this project, the prices of PostScript printers had descended from the stratosphere, and it became clear that I really needed PostScript fonts. So another artisan was hired to turn out PostScript versions. Now large sample characters were trivial to produce, and desired changes both easier to indicate and to realize, so that the project proceeded apace. So did the costs. Realizing that ignorance is not always financial bliss, I borrowed a Mac and learned the rudiments of Fontographer (at that time available only on the Mac, though I naturally switched to the PC version as soon as possible, thereby avoiding the insane issue of the same font being different files on two different machines). Thus I could not only produce PostScript fonts, but I could "draw" characters in the way that seemed natural to me, as outlines, rather than using "pens".

And thus were born the original *MathTime* fonts.

By the time I was ready to produce a typeset version of my *Differential Geometry* books, however, I lusted for more. I had to admit to myself that Knuth was right in insisting on separate designs for smaller type sizes, as in the days of cold-metal type; using scaled down versions of the 10pt fonts for superscripts just didn't look all that good (good enough for an elementary text like *Calculus*, perhaps, but not for an author's special pride and joy). But I didn't know how to go about making designs for smaller sizes, and I didn't find Knuth's smaller sizes for Computer Modern to be particularly compelling examples to follow.

Luckily, among the numerous type catalogs that had been accumulating on my shelves, in a small font catalog issued by Monotype (long before it had merged with Agfa) I found not only the presumably "true" Times New Roman font, but also something called Times Seven, and something else called Times Small Text. Since I had read in Walter Tracy's book *Letters of Credit* that Times New Roman was created in 9, 7 and $5\frac{1}{2}$ point sizes, I immediately surmised that Times Seven was the 7 point design and Times Small Text the $5\frac{1}{2}$ size (the people at Monotype were only able to tell me that they used Times Small Text for printing in small type sizes). That means that their Times, used at 10 point, is actually a magnification of a font meant to be used at 9 points, but, I rationalized, that isn't so bad, even if one were using the fonts together with Times text, since it's fine for the math fonts to be a bit more prominent than the text fonts (as they are, by design, in Knuth's Computer Modern).

I bought these fonts with great expectations, and sure enough, Times Seven looked ungainly when used at 10 points, but provided quite a nice 7 point font, and Times Small Text looked quite good at $5\frac{1}{2}$ points. I had struck gold. Opening the fonts Times Seven and Times Small Text in Fontographer, and comparing with Times, I was not only able to get a good idea of the sort of modifications required to produce smaller point sizes, but I was

even able to specify a sequence of various Fontographer-provided modifications to the characters in Times that produced a very creditable approximation to the shape of the characters in the other fonts. So now I knew how to get smaller sizes for new characters that I had produced. (There were still a lot of adjustments that had to be done by hand, making me wish that there were a programmable Fontographer, a sort of MetaFontographer.)

$$\left\{ \begin{array}{l} \textit{MathTimeProfessional} \text{ equation: } \alpha\beta\gamma^{\alpha\beta\gamma^{\alpha\beta\gamma}} \\ \textit{MathTimeProfessional} \text{ letters } \alpha\beta\gamma \text{ at text size } \alpha\beta\gamma \\ \text{for superscripts } \alpha\beta\gamma \text{ at text size } \alpha\beta\gamma \\ \text{for second-order superscripts } \alpha\beta\gamma \text{ at text size } \alpha\beta\gamma \end{array} \right\}$$

Along the way, I took advantage of the fact that I was working for myself, and not an overweening company or organization, to enhance the fonts with all sorts of other improvements of a more radical nature. I had always hated “extensible” parentheses, so I decided to have individually designed parentheses of large sizes. This turned out to be a somewhat complicated matter, especially when I later decided to produce other individually designed large delimiters, as well as individually designed square root signs:

$$\sqrt{\begin{pmatrix} \mathbb{A}_{11} & \dots & \mathbb{A}_{1n} \\ \mathcal{A}_{21} & \dots & \mathcal{A}_{2n} \\ \vdots & \ddots & \vdots \\ \mathfrak{A}_{n1} & \dots & \mathfrak{A}_{nn} \end{pmatrix}} \quad \text{instead of} \quad \sqrt{\begin{pmatrix} \mathbb{A}_{11} & \dots & \mathbb{A}_{1n} \\ \mathcal{A}_{21} & \dots & \mathcal{A}_{2n} \\ \vdots & \ddots & \vdots \\ \mathfrak{A}_{n1} & \dots & \mathfrak{A}_{nn} \end{pmatrix}}$$

In the first place, even allowing 256 characters on the extension font, one would run out of room for all the additional characters needed. Even worse, the large ones simply couldn’t be put on the font, because of PostScript restrictions on the size of characters in a font. Reducing the size of all the characters, and then using the font at a magnified size wouldn’t work either, because the smaller size characters would end up so small that there wouldn’t be enough space for all the points needed to specify them accurately. I had to place larger size delimiters on different fonts, a total of 3 different ones, which are then used at magnifications of 2, 4, and 8 times. This also required a different syntax than the admirable `\left . . . \right` [what one really wants is not *one* extension font, but an allowed *series* of extension fonts, where the NEXTLARGEST element on one font can be in another font].

All these additions were originally hacked together rather quickly for my own use, and then more carefully constructed when the *MathTimeProfessional* fonts were offered for sale. Examples of all these special features are not given here, but they may be found on the website www.pctex.com, where the fonts are sold. (Other interesting hacks, not made part of *MathTimeProfessional*, are mentioned in the colophon to the first volume of the *Differential Geometry* books.)

Of course, of the making of special features there is no end, and a few more (like the individually designed vertical and horizontal curly braces illustrated above) have been added to *MathTimeProfessional II*, the latest version, often in response to suggestions made on the PCT_EX font forum. But I’ve provided so many fonts, and so many special features, that I have reason to hope that this dissolute period of my life may finally have come to completion.