How to make more than one math OpenType font

or the Beasts of Fonts

Bremen, 30 III – 1 IV 2011

Bogusław Jackowski and Piotr Strzelczyk
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... and that math fonts are nasty beasts to $n^{th}$ power.
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Actually, fonts are not beasts at all, but there are a few Beasts that govern the Realm of Fonts.
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Actually, fonts are not beasts at all, but there are a few Beasts that govern the Realm of Fonts.

This is exactly the reason why since 2007, when Microsoft released their math-equipped Office with the math OpenType font Cambria, only two more math OpenType fonts were created: Asana (Apostolos Syropoulos) and XITS (Khaled Hosny), both stemming from the \( \TeX \) clique.
THE BEAST OF ENTANGLEMENT
The fundamental question
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*What is a what of a what?* – Winnie the Pooh.
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It is extremely difficult to identify the nature of problems.
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It is extremely difficult to identify the nature of problems:
- which are the result of simple mistakes
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- which are the result of simple mistakes,
- which are the result of idiosyncratic decisions
The fundamental question

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- etc...
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- etc.

Of course, the identification is crucial to fix the problem.
An example – where is the math italic letter ‘h’?
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*Final Unicode Names List* (ver. 6.0, 2010) reads:

[...]
U+1D452 MATHEMATICAL ITALIC SMALL E
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The math italic letter ‘h’ has the Planck constant meaning permanently assigned:

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U+210E  PLANCK CONSTANT
= height, specific enthalpy,
simply a mathematical italic h;
this character’s name results from legacy usage
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In this particular case, misconception, idiosyncrasy and relics coincide.
THE BEAST OF MISCONCEPTION
Two basic misconceptions
Two basic misconceptions

A contemporary font could be a smarter structure than a collection of fixed (predefined) shapes. It was an ingenious idea in Gutenberg’s times. Today, instead of fancy yet obscure techniques involved in OpenType fonts (so called “features”), glyphs could be implemented as drawing programs. This would be especially beneficial in the case of math fonts.
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Also, the commonly adored Unicode often, in practice, turns out to be an obstacle. The idea of enumerating all entities used in various areas of human intellectual activities seems somewhat insane. Moreover, enumerating is static, while it is a dynamically adjustable protocol which is needed (cf. the success of the TCP/IP protocol).
THE BEAST
OF IDIOSYNCRASY
Let’s do it somehow...
Let’s do it somehow…

Tricky, peculiar solutions are vexingly frequent.
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Mathematical glyphs, vertically assembled from smaller pieces, like e.g., the radical, must be placed above the baseline in OpenType fonts and below the baseline in traditional \TeX\ fonts (more precisely, in \TeX, the top element of the radical must slightly protrude above the baseline – the amount conveys the thickness of the radical’s top rule).
THE BEAST OF RELICS
Everlasting relics
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A symptomatic example is the case of glyphs \textit{tcommaaccent} and \textit{Tcommaaccent}. According to the Adobe Glyph List for New Fonts (2010), they are just aliases for \textit{tcedilla} (U+0163) and \textit{Tcedilla} (U+0162), respectively. The Unicode Standard is unequivocal here: the Latin small letter ‘t’ with comma below should have the code U+021B, while the Latin capital letter ‘T’ with comma below – the code U+021A. After a few attempts to improve the situation, Adobe eventually gave up and reverted to the status quo ante bellum.
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The creating of the Latin Modern Math OTF was not as perplexing as it might have been. It is the result of shared experience and efforts by Barbara Beeton, Hans Hagen, Taco Hoekwater, Khaled Hosny, Alan Jeffrey, Ulrik Vieth, George Williams and others, which made our struggle against the insubordinate font matter significantly less painful.

Very many thanks!
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Very many thanks!

Of course, it is an “incunabulum” font, i.e., it is in its infancy and will be intensively developed in the nearest future.
LATIN MODERN MATH
THE DOMESTICATED MONSTER

Bremen, 30 III – 1 IV 2011   B. Jackowski, P. Strzelczyk  How to make more than one math OTF...
The objective
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It should be noted that none of the OpenType math fonts that appeared so far is perfect. In this number, of course, Latin Modern Math. Our aim, however, was not creating just one more math OpenType font. We wanted to pave the way for next math fonts, in particular, for selected TEX Gyre fonts.
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We underestimated the complexity arising from the heterogeneity of sources. But we believe that, in general, it was an appropriate approach.
The approach
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bbold10, bbold7, bbold5, eufb10, eufb7, eufb5, eufm10, eufm7, eufm5, eusb10, eusb7, eusb5, eusm10, eusm7, eusm5, lmbsy10, lmbsy7, lmbsy5, lmbx10, lmbx7, lmbx5, lmex10, lmmi10, lmmi7, lmmi5, lmmib10, lmmib7, lmmib5, lmr10, lmr7, lmr5, lmss12, lmss10, lmss8, lmssbo10, lmssbx10, lmso12, lmso10, lmso8, lmsy10, lmsy7, lmsy5, lmtt12, lmtt10, lmtt8, msam10, msam7, msam5, msbm10, msbm7, msbm5 – altogether 51 fonts.
The approach

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\begin{verbatim}
\end{verbatim}

All these fonts had to be crammed into one huge OTF file. Actually, Latin Modern Math contains more than 4500 glyphs, and many more are needed. Why is that so?!
The approach

According to the *Draft Unicode Technical Report #25* by Barbara Beeton, Asmus Freytag and Murray Sargent III, math font should contain the following groups of glyphs:

<table>
<thead>
<tr>
<th>Plain (upright, serifed)</th>
<th>Latin*, Greek and digits</th>
<th>Imr, Immi (uprighted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>bold</td>
<td>Latin, Greek and digits</td>
<td>lmbx, Immib (uprighted)</td>
</tr>
<tr>
<td>italic</td>
<td>Latin and Greek</td>
<td>Immi</td>
</tr>
<tr>
<td>bold italic</td>
<td>Latin and Greek</td>
<td>Immib</td>
</tr>
<tr>
<td>script (calligraphic)</td>
<td>Latin**</td>
<td>eusm (slanted)</td>
</tr>
<tr>
<td>bold script (calligraphic)</td>
<td>Latin**</td>
<td>eusb (slanted)</td>
</tr>
<tr>
<td>Fraktur</td>
<td>Latin**</td>
<td>eufm</td>
</tr>
<tr>
<td>bold Fraktur</td>
<td>Latin</td>
<td>eufb</td>
</tr>
<tr>
<td>double-struck</td>
<td>Latin</td>
<td>bbold (by Alan Jeffrey)</td>
</tr>
<tr>
<td>sans-serif</td>
<td>Latin and digits</td>
<td>lmss</td>
</tr>
<tr>
<td>sans-serif bold</td>
<td>Latin and digits</td>
<td>lmssbx</td>
</tr>
<tr>
<td>sans-serif italic</td>
<td>Latin and digits</td>
<td>lmssbo</td>
</tr>
<tr>
<td>sans-serif bold italic</td>
<td>Latin, Greek*** and digits</td>
<td>lmssbo</td>
</tr>
<tr>
<td>monospace</td>
<td>Latin</td>
<td>lmssbo</td>
</tr>
<tr>
<td></td>
<td>Latin and Greek***</td>
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<tr>
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* plus basic diacritical characters

** caps only (like in CMs – temporarily?)

*** caps only (temporarily)
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- the preparation of a Python-based FontForge-geared engine (FFDKO) for converting POSTSCRIPT Type 1 fonts into the OpenType format – an enhanced equivalent of the MakeOTF utility from Adobe Font Development Kit for OpenType
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- converting of the POSTSCRIPT Type 1 font generated by METATYPE 1 into the OpenType format using FFDKO.
Future works
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- complementing math data (TEX-based kerns, OpenType-specific kerns, improving the placement of axes, etc.),
- adding selected OTF features (ssty, onum, etc.),
- a question: which glyphs should have index forms?
Conclusions
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- does it make sense to produce $\TeX$ math fonts simultaneously with OTF ones (no chance for compatibility anyway)?
The OpenType math fonts project is supported by \TeX\ Users Groups, in particular, by the Czechoslovak \TeX\ Users Group CS TUG, the German-speaking \TeX\ Users Group DANTE e.V., the Polish \TeX\ Users Group GUST, the Dutch-speaking \TeX\ Users Group NTG, TUG India, UK-TUG, and – last but not least – TUG.


The author of the opening (and closing) photo _Roots of Entanglement_ is Marek Ryćko.
THANK YOU FOR YOUR ATTENTION
and
Welcome to EuroBachoTEX 2011
April/May 2011