Six GUST e-Foundry’s math fonts and what next?

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Bogusław Jackowski, Piotr Strzelczyk, Piotr Pianowski
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- Asana by Apostolos Syropoulos
- Neo-Euler by Khaled Hosny
- Lucida (commercial) by Charles Bigelow and Kris Holmes
- Minion (commercial) by Johannes Küster
- STIX by STI Pub companies
- XITS by Khaled Hosny
- GUST e-Foundry TeX Gyre collection, i.e., Bonum, Pagella, Termes, and Schola; moreover, Latin Modern and DejaVu
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DejaVu Math: a screenshot

DejaVu Math contains already more than 4200 glyphs.
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Two obtrusive questions: Do we really need more glyphs? What for?
Type case – an allegory

One can compare the contents of printer’s type case to a swarm of flies...
which is correct, because each fly/type has its own fairly complex structure,
Type case – an allegory

but I prefer to think of a font as a single, coherent, well-structured object
Arrow symbols

LM Math

TG Bonum Math

TG Pagella Math

TG Termes Math

TG Schola Math

DejVu Math
integral symbols
Calligraphic symbols

LM Math

ABA

ABA

ABA

ABA

TG Bonum Math

ABA

ABA

ABA

ABA

TG Pagella Math

ABA

ABA

ABA

ABA

TG Termes Math

ABA

ABA

ABA

ABA

TG Schola Math

ABA

ABA

ABA

ABA

DejVu Math

ABA

ABA

ABA

ABA
Calligraphic symbols

LM Math

\[
\begin{align*}
&\text{ABCDEFGHIJKLMNOPQRSTUVWXYZ} \\
&\text{abcdefghijklmnopqrstuvwxyz} \\
\end{align*}
\]

TG Bonum Math

\[
\begin{align*}
&\text{ABCDEFGHIJKLMNOPQRSTUVWXYZ} \\
&\text{abcdefghijklmnopqrstuvwxyz} \\
\end{align*}
\]

TG Pagella Math

\[
\begin{align*}
&\text{ABCDEFGHIJKLMNOPQRSTUVWXYZ} \\
&\text{abcdefghijklmnopqrstuvwxyz} \\
\end{align*}
\]

TG Termes Math

\[
\begin{align*}
&\text{ABCDEFGHIJKLMNOPQRSTUVWXYZ} \\
&\text{abcdefghijklmnopqrstuvwxyz} \\
\end{align*}
\]

TG Schola Math

\[
\begin{align*}
&\text{ABCDEFGHIJKLMNOPQRSTUVWXYZ} \\
&\text{abcdefghijklmnopqrstuvwxyz} \\
\end{align*}
\]

DejVu Math

\[
\begin{align*}
&\text{ABCDEFGHIJKLMNOPQRSTUVWXYZ} \\
&\text{abcdefghijklmnopqrstuvwxyz} \\
\end{align*}
\]

Six GUST e-Foundry’s Math Fonts and What Next?
### Calligraphic symbols

<table>
<thead>
<tr>
<th>Font Style</th>
<th>LM Math</th>
<th>TG Bonum Math</th>
<th>TG Pagella Math</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ABCD</td>
<td>ABCD</td>
<td>ABCD</td>
</tr>
<tr>
<td></td>
<td>ABCD</td>
<td>a b c d</td>
<td>a b c d</td>
</tr>
<tr>
<td>TG Termes Math</td>
<td>ABCD</td>
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</tr>
</tbody>
</table>

Why so? The reason is two-fold: first, the shape of the calligraphic script is not a crucial factor; second, license (“lice sense”) issues turn out to be a vexing barrier.
Towards a calligraphic script for DejaVu
Towards a calligraphic script for DejaVu

- The calligraphic script must be distinguishable from DejaVu Serif Italic (although the italic ‘z’ in DejaVu bears calligraphic features - \( \mathcal{Z} \)) and, at the same time, should be optically compatible with the original DejaVu Serif font (for example, because there is a relatively small difference in height between DejaVu lowercase and ascender letters, the calligraphic script should, to a certain extent, reflect this ratio).
- Each symbol must be easily identifiable, therefore such oddities as, for example, the form \( \mathcal{Z} \) of the letter “L” in the SocietyEditor font or the form \( \mathcal{Q} \) of the letter “Q” in the Swenson font, are unacceptable in this particular application.
- The calligraphic character of a single glyph must be noticeable at the first glance (hence the idea of using fissures).
- Glyphs should not have too fancy embellishments as they might hinder the positioning of sub- and superscripts (also left-hand ones).
- The calligraphic script in a math font is not intended to typeset continuous texts (likewise Donald Knuth’s calligraphic font) – the text font needs completely different sidebearings.
Towards a calligraphic script for DejaVu

DejaVu Serif Regular

abcdefgijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ

DejaVu Serif Regular Italic

abcdefgijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ

DejaVu Serif Bold

abcdefgijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ

DejaVu Serif Bold Italic

abcdefgijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ
Towards a calligraphic script for DejaVu

Computer Modern Symbol Bold (CMBSY)

\textsc{ABCDEFGHIJKLMNOPQRSTUVWXYZ}

Computer Modern Symbol (CMSY)

\textsc{ABCDEFGHIJKLMNOPQRSTUVWXYZ}

Callimat Regular

\textsc{abcdefghijklmnopqrstuvwxyz}

\textsc{ABCDEFGHIJKLMNOPQRSTUVWXYZ}

Callimat Bold

\textsc{abcdefghijklmnopqrstuvwxyz}

\textsc{ABCDEFGHIJKLMNOPQRSTUVWXYZ}

DejaVu Serif Regular

\textsc{abcdefghijklmnopqrstuvwxyz}

\textsc{ABCDEFGHIJKLMNOPQRSTUVWXYZ}

DejaVu Serif Bold Italic

\textit{abcdefghijklmnopqrstuvwxyz}

\textit{ABCDEFGHIJKLMNOPQRSTUVWXYZ}
Towards a calligraphic script for DejaVu

abcdefghijkl

ABCDEFGHIIJ

abcdefghijkl

ABCDEFGHIIJ
Towards a calligraphic script for DejaVu

The first stage – using a visual tool, the second and third stages – using METATYPE1; automation allows a relatively easy generating of a calligraphic script for the sans-serif variant
Towards a calligraphic script for DejaVu

Callimat Regular
abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ

Callimat Bold
abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ

Callimat Linear Regular
abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ

Callimat Linear Bold
abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ

DejaVu Sans Bold
abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ

DejaVu Sans Regular
abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ
Towards a calligraphic script for DejaVu

abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ
Towards a calligraphic script for DejaVu

In our humble opinion, the DejaVu calligraphic script passed the "diagram test" from Donald Knuth's *The \TeX*book*
Again, two obtrusive questions
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1. Is a next math font really needed?
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2. If not, what can be done in this realm?
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   - ad 1. Not really
Again, two obtrusive questions

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   - ad 1. Not really
   - ad 2. A lot
Again, two obtrusive questions

1. Is a next math font really needed?
2. If not, what can be done in this realm?

- ad 1. Not really
- ad 2. A lot
  - enhance the font making engine (open to doubt)
  - enhance the structure of the existent fonts
  - broaden the repertoire of math-oriented glyphs in the GUST e-foundry text fonts
  - broaden the repertoire of glyphs in the GUST e-foundry math fonts (open to doubt)
  - improve shapes of certain glyphs (requires extensive testing – users’ support is needed)
  - prepare non-standard math fonts (sans-serif and bold variants for, e.g., titles, monospaced variants for text editors)
The engine – to enhance or not to enhance?

We’re not enthusiastic about investing our energy into smoothing the engine which is to produce objects on which we have no actual influence.

The very idea of OTF math fonts is, in our not so humble opinion, a misconception: sticking a few completely different scripts into a single medley only because the operating systems cannot handle user-defined groups of fonts, does not seem a particularly deep idea.
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Avoiding the notches is, in practice, impossible.
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All in all, we are satisfied with our collection of modules loosely linked together which turns out to be a fairly convenient approach to meet the demands posed by the companies controlling the font market, e.g., adapting \texttt{METATYPE1} to produce math fonts with the help of FontForge was not too hard (it took a few months).
Which variant?

If not just “yet another font”, then which variant(s) and what for?
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- Presentations like this, but containing (complex) math formulas, may serve as a typical example of the use of a math sans-serif variant
- bold/heavy variant may prove itself useful for titles and banners
- bold/heavy sans-serif variant may also prove itself useful, e.g., if a sans-serif font is used as a main typeface for the publication
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There is no well-defined, unique correspondence between a standard (serif) math font and its respective variants, although guidelines are less or more obvious:

\[
\begin{align*}
abcABC & \rightarrow \quad a\ b\ c\ A\ B\ C \\
\textit{a\ b\ c\ A\ B\ C} & \rightarrow \quad a\ b\ c\ \textit{A\ B\ C} \\
\textbf{a\ b\ c\ A\ B\ C} & \rightarrow \quad \textbf{a\ b\ c\ A\ B\ C} \\
\textit{a\ b\ c\ A\ B\ C} & \rightarrow \quad \textit{abc\ A\ B\ C} \\
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\[
\int \int \int \int \int \int \int \int \int \rightarrow \int \int \int \int \int \int \int \\
(\left\{\left[\left(\left[\left[\left[\left[\right]\right]\right]\right]\right]\right]\right\}) \rightarrow \left\{\left[\left[\left[\left[\left[\right]\right]\right]\right]\right]\right\}
\]

\[
\rightarrow \equiv \equiv \equiv \equiv \rightarrow \equiv \equiv \equiv \equiv
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There is no well-defined, unique correspondence between a standard (serif) math font and its respective variants, although guidelines are less or more obvious, but not always...

\[
\begin{align*}
\text{a } b & \text{ c } A \text{ B } C & \rightarrow & \text{ a } b & \text{ c } A \text{ B } C \\
\text{a } b & \text{ c } A \text{ B } C & \rightarrow & \text{ a } b & \text{ c } A \text{ B } C \\
\text{a } b & \text{ c } A \text{ B } C & \rightarrow & \text{ a } b & \text{ c } A \text{ B } C \\
\text{a } b & \text{ c } A \text{ B } C & \rightarrow & \text{ a } b & \text{ c } A \text{ B } C
\end{align*}
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Roger Penrose, *The Road to Reality*, chapter XIII

\[ T^{12}x^2 + T^{13}x^3 \]

...standard algebraic laws

\[ A + B = B + A, \]
\[ A(B + C) = AB \]

...hold. (Each element of the vector space \( V \), we have \( x^a \rightarrow T^a \))

...preserves the vector-space symmetry of a vector and multiplication and...
A dream
A dream: typeless typography

I keep dreaming of a day when the “Gutenberg-Knuth” model of computer typesetting, i.e., the model based on stiff, dumb boxes, will become obsolete.
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Why all these pseudo-dynamic glyphs cannot be ultimately replaced by flexible, smart computer programs (modules, objects) communicating with each other?
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The idea is not new. Already in 1989, Tomasz Leszczyński received the US patent number 4,833,627 for his ingenious Computerized typesetting correction system aka Toles system.
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The Toles system offered quite subtle procedures of adjusting serifs in order to counteract collisions of certain elements of glyphs.

Nowadays computers are significantly more powerful than a quarter-century ago, there is no longer need to limit oneself to serifs: think about calligraphy, two-dimensional notations (e.g., music, chemistry, math), ornaments, etc.
A dream: typeless typography

Travestying John Lennon:
Imagine there’re no typefaces – it’s easy if you try...
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When all these pseudo-dynamic glyphs will be ultimately replaced by flexible, smart computer programs (modules, objects) communicating with each other?
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When all these pseudo-dynamic glyphs will be ultimately replaced by flexible, smart computer programs (modules, objects) communicating with each other?

You may say I’m a dreamer, but I’m not the only one. I hope some day you’ll join us…

John Lennon, Imagine
The OpenType math fonts project is supported by \TeX\ Users Groups, in particular, by the Czechoslovak \TeX\ Users Group CSTUG, 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.

Hearty thanks go to Alex Konahin from Riga, Latvia, for his generous permission to use his admirable ink drawings http://konahin.com/
THANK YOU FOR YOUR ATTENTION

and

See you at the next BachoTEX meeting

April/May 2016