MusiX\TeX, even more beautiful than Music\TeX for music typesetting

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Abstract
MusiX\TeX is a new music typesetting package derived from Music\TeX, but it provides more beautiful scores than Music\TeX did. While Music\TeX was a single pass package, MusiX\TeX is a three pass system: the first pass performs a rough \TeXing which reports the spacings of each music section, the second pass is a computation of the best note spacings, and the third one is the final \TeXing process.

The beauty of single notes does not significantly differ from Music\TeX, but slurs are much more beautiful, and notes are regularly spaced instead of being irregularly spaced with glue.

1 History
Music\TeX is now well known and widely spread over the world for music typesetting. It is mostly used by highly skilled amateurs, but even sometimes by music typesetting professionals.

Nevertheless, most connoisseurs actually regretted the questionable aesthetic of its slurs and ties; this ugliness was due to the fact that only horizontal lines (\texttt{\textbackslash hrule}) would resist the glue inserted by \TeX to achieve line\textsuperscript{1} justification. This would lead to something like:

\begin{verbatim}
\begin{VerbatimBox}[xsep=2pt]
\hline \\
\hline \\
\hline \\
\hline \\
\hline \\
\hline \\
\hline \\
\end{VerbatimBox}
\end{verbatim}

\textsuperscript{1} We use the word 'line' to meet \TeXiKs' way of thinking, but the correct musical word describing a synchronous set of staffs tied together with braces or bar rules, is 'system'.
Various suggestions were proposed, all of them resulting in a several pass system, for example inserting `\specials` in the DVI, analyzing this DVI byte after byte to compute the accurate size of needed slurs, and eventually invoking metafont when needed to generate the final text with the slurs/ties of the exact required length.

In 1992, Ross Mitchell\textsuperscript{2} proposed another package (initially called 'Muflex') in which \TeX explicitly writes in a file the spacings consumed – regardless of an arbitrary unique scale factor – by each group of notes.

At the next pass, this file read by a small program – `musixflx` initially in Fortran, now in C – which determines the optimal value of the elementary spacing (`\elemskip`) so that each score line exactly fits in a \TeX line (i.e. one `\hsize`) without any additional glue to be inserted.

Then, at final pass, \TeX reads the brainstorming results of this small Fortran or C program, and it readily knows which spacing it must assign to the various notes in order to avoid any glue inclusion to fill the line. Thus, if the unit length `\elemskip` is known to be 14.25 pt, while a given slur is 13 units long\textsuperscript{3}, it is then easy to choose the convenient sequence of symbols to build a smart curve of the right length, with an accuracy of one point.

Thus, using MusiX\TeX the previous sequence becomes:

\begin{equation*}
\includegraphics[width=\textwidth]{sequence1}
\end{equation*}

and when the spacings are increased, one obtains:

\begin{equation*}
\includegraphics[width=\textwidth]{sequence2}
\end{equation*}

After this preliminary trial MusiX\TeX was created by Andreas Egler\textsuperscript{4} and Daniel Taupin, tuning the Muflex by Ross Mitchell and `negotiating' some features of Music\TeX.

\begin{itemize}
\item[2.] CSIRO Division of Atmospheric Research, Monialloc, Victoria – Australia.
\item[3.] In fact this is seldom an integer, due to additional spaces for bars and special insertions.
\item[4.] Ruhr-Uni-Bochum, D-44780 Bochum.
\end{itemize}
2 The characteristics of MusiX\TeX

Most commands are taken from Music\TeX, sometimes with name changes such as debutmorceau becoming startpiece. Some people may smile about this point, but as a matter of fact the existence of keywords taken from the French language sometimes triggers allergy reactions\(^5\). In addition, MusiX\TeX provides specific macros to achieve slurs whose final altitude is different from the initial, for example:

![Musical notation example](image1)

Here is another example — Intermezzo op. 117.1 by Brahms — according to data provided by Miguel Filgueiras

![Musical notation example](image2)

3 MusiX\TeX's advantages and difficulties

3.1 The glue problem

Obviously, the glue notion is essential to \TeX, since it enables justifications equally spread over the text lines. Music\TeX also reasonably uses this feature, in order to approximately

\(^5\) Werner Icking humoristically suggested that German people use something like \texttt{HierbeginntmeinePartitur} instead of \texttt{debutmorceau}. 
justify the lines of music scores, with that specific difficulty that music 'paragraphs' may not finish with partial lines.

However, the Music\TeX{} experience was that glue imposed slurs and ties with a wide horizontal section, in order to enable overlappings or extensions of the \texttt{\textbackslash hrule} form. Moreover, if the user was poorly careful, glue would introduce wide empty spaces between compact sequences of notes.\footnote{This the unfortunate experience of most Music\TeX{} beginners.}

Mus\TeX{} solves all these problems, but the unfortunate counterpart is that the least parasitic space:

- forgotten $\%$ at end of line when not ended with a keyword,
- boxes containing text (lyrics) spilling out of the horizontal length allocated to the group of notes,

results in, at best some Underfull boxes filled \textit{in extremis} with glue, at worst catastrophic Overfull boxes.

As a consequence, when getting these messages, hunting spilling boxes or parasitic spaces becomes sophisticated operation, of the competences of a skilled \TeX{}pert only.

\subsection*{3.2 Compatibility with Musi\TeX{}\\textsc{X}}

Our idea – as well as of another musician, Werner Icking – was to build a new package using the same commands as Music\TeX{} except hard impossibility, and offering in addition a more automatic page layout, and an aesthetic slur generation by means of a set of additional commands.

But later, one of the co-authors – Andreas Egler – wanted to do the other way, namely a distinct new package, obviously taking advantage of the bases of Music\TeX{} but providing different internal and external commands:

- unification of certain distinct commands whose choice could have been automated... with deletion of the old ones;
- compilation speed enhancement replacing many \texttt{\def} by \texttt{\let}, admittedly faster but badly encapsulated;
- replacement of command names taken from French and Italian with English looking keywords;\footnote{However Andreas Egler is German, and I would have definitely preferred that he replace \texttt{\barre} with the German word \texttt{Takt} rather than \texttt{bar} which is confusing with basic \TeX{}/\LaTeX{}.}
- locking some internal identifiers by inserting $\&$
- ambiguous shortening of command names, which were really long but self-explanatory, probably due to memory problems in his computer.

Nevertheless, although he claimed that music typesetters should give up using Music\TeX{} to definitely move to Musi\TeX{}\textsc{X}, with no possible backstepping, he accepted
to develop an optional set of macros, \texttt{musixcpt}, which superposes the fundamental \texttt{MusiXT\TeX} most of the commands commonly used by the 'old-fashioned' \texttt{Music\TeX}-ers. And all this works... except some details presently under revision.

Thus, it is presently possible to have a unique source file which can be compiled with both \texttt{Music\TeX} or \texttt{MusiXT\TeX}. To do that it suffices changing the \texttt{\textbackslash inputs} at the beginning or, even better, creating two formats:

1. a format with Plain \TeX+musicnt+music\texttt{tex},
2. a format with Plain \TeX+musixtex+musixcpt.

### 3.3 The remaining problems

1. A persisting controversy between A. Egler on one side, and D. Taupin and W. Icking on the other, about the developing strategy for \texttt{MusiXT\TeX}.
2. Clean lyrics insertion, since \texttt{musixflx/Muflex} is unable to handle and shrink text lengths to meet zero glue justification.

### 4 Availability

- Original version (presently T.396) supported by D. Taupin at \texttt{ftp://resovax.lps.u-psud.fr/\texttt{[anonymou}\texttt{smusixtex]}\texttt{]} and at \texttt{ftp://hprlib.lps.u-psud.fr/pub/musixtex});
- Copies in the various CTANs (directory macros/musixtex/taupin);
- Andreas Egler's version is also available now in the various CTANs (directory macros/musixtex/egler). Note that Egler's version is not compatible with sources designed for \texttt{Music\TeX}.

### 5 Two examples

On page 356 is the beginning of Charles Gounod's 'Ave Maria', transcribed for organ and soloist (violin and/or singer), typeset with format \texttt{music\texttt{tex}.fmt} (\texttt{Music\TeX}); in page 357 is the output of the same source file using format \texttt{musixtex.fmt} (\texttt{MusiXT\TeX}). Note the different slur shapes, and the unfortunate exceeding glue at bars 10-12 with \texttt{Music\TeX}.
Méditation – Ave Maria

G.O.: flûte 8' [+]4]
Positif : flûtes 8' + 4' [+]2]
Pédale : 16', arc, positif

Charles Gounod & J.-S. Bach
Transcription Orgue soliste Daniel Taupin
& Markus Viettes

Ave Maria (C. Gounod, J.-S. Bach, D. Taupin) ©
Méditation – Ave Maria

G.O.: flûte 8′ [4]
Positif : flûtes 8′ + 4′ [2]
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Charles Gounod & J.-S. Bach
Transcription Orgue+solete Daniel Toupin
& Markus Veitges

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