Składaj nuty! — Typeset scores!

Songbook in LaTeX

Andrzej Odyniec

Macrologic SA

BachoTEX 2016

Outline

Outline

Outline

Outline

- typesetting scores in TEX is freak, isn't it?
- notes are generally used less frequently than mathematics
- about typesetting (engraving?) of scores in BachoTEX there was presentation in ancient times by Bogusław Jackowski and Marek Ryćko
- after it was almost all about notes but not in TEX
- but by this time we were doing the music, we screened and sang „Miała baba koguta" and „Płonie ognisko i szumią knieje"
- why not in TEX?

- typesetting scores in TEX is freak, isn't it?
- notes are generally used less frequently than mathematics
- about typesetting (engraving?) of scores in BachoTEX there was presentation in ancient times by Bogusław Jackowski and Marek Ryćko
- after it was almost all about notes but not in TEX
- but by this time we were doing the music, we screened and sang „Miała baba koguta" and „Płonie ognisko i szumią knieje"
- why not in TEX?

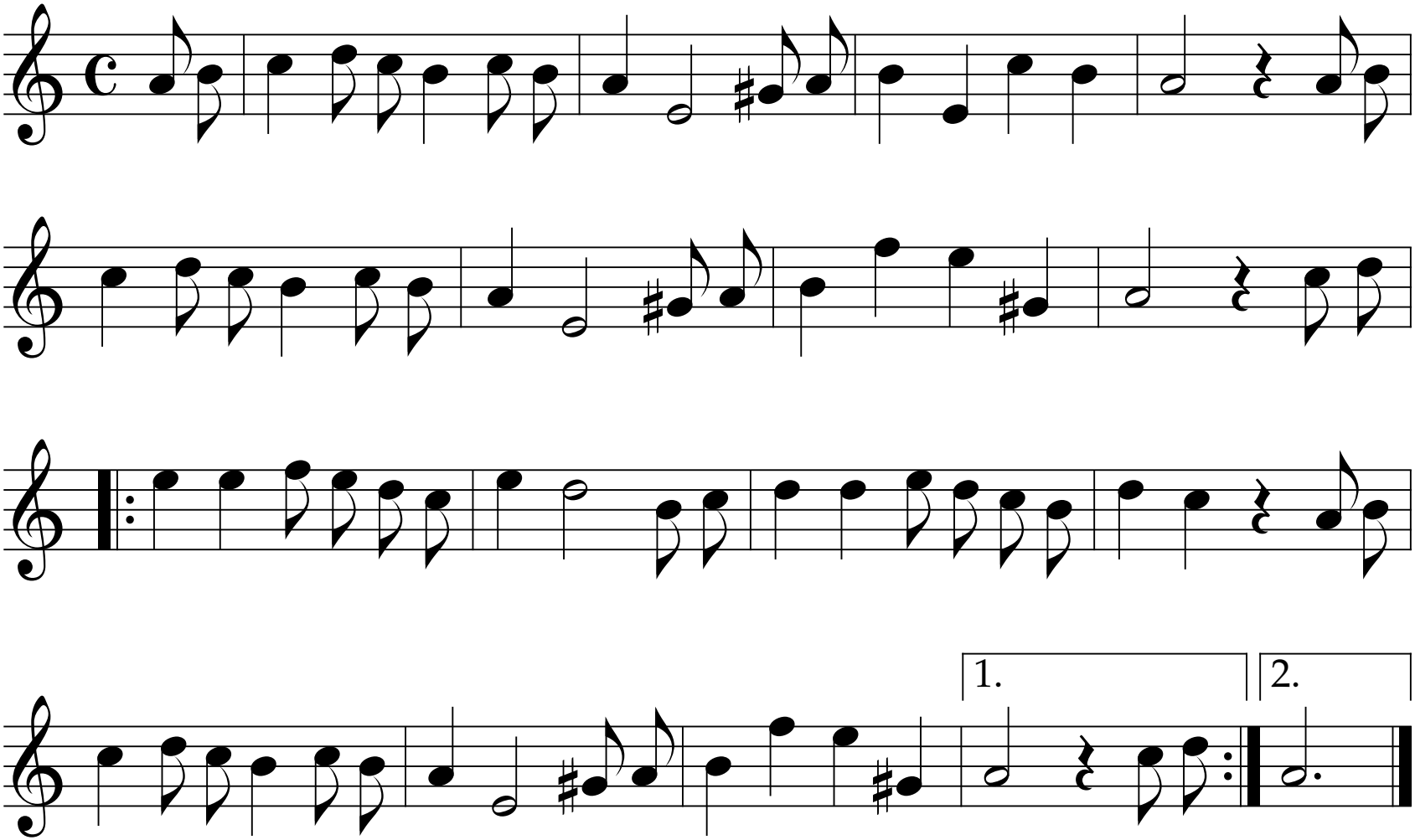
- typesetting scores in TEX is freak, isn't it?
- notes are generally used less frequently than mathematics
- about typesetting (engraving?) of scores in BachoTEX there was presentation in ancient times by Bogusław Jackowski and Marek Ryćko
- after it was almost all about notes but not in TEX
- but by this time we were doing the music, we screened and sang „Miała baba koguta" and „Płonie ognisko i szumią knieje"
- why not in TEX?

- typesetting scores in TEX is freak, isn't it?
- notes are generally used less frequently than mathematics
- about typesetting (engraving?) of scores in BachoTEX there was presentation in ancient times by Bogusław Jackowski and Marek Ryćko
- after it was almost all about notes but not in TEX
- but by this time we were doing the music, we screened and sang „Miała baba koguta" and „Płonie ognisko i szumią knieje"
- why not in TEX?

- typesetting scores in TEX is freak, isn't it?
- notes are generally used less frequently than mathematics
- about typesetting (engraving?) of scores in BachoTEX there was presentation in ancient times by Bogusław Jackowski and Marek Ryćko
- after it was almost all about notes but not in TEX
- but by this time we were doing the music, we screened and sang „Miała baba koguta" and „Płonie ognisko i szumią knieje"
- why not in TEX?

- typesetting scores in TEX is freak, isn't it?
- notes are generally used less frequently than mathematics
- about typesetting (engraving?) of scores in BachoTEX there was presentation in ancient times by Bogusław Jackowski and Marek Ryćko
- after it was almost all about notes but not in TEX
- but by this time we were doing the music, we screened and sang „Miała baba koguta" and „Płonie ognisko i szumią knieje"
- why not in TEX?

Why this melody was not typeset in TEX?



Typesetting of notes in TEX is not simple

- the problem is a common belief that it is so difficult that even impossible
- the notes does not have a baseline
- notes can not be spaced by glue
- the space between notes depends nonlinearly on their value
- notes are connected by ties and slurs
- are preceded by sharps and flats
- needs ornaments
- special signs (repetitions, voltas, segno, coda etc.)
- and for example: guitar chords

Typesetting of notes in TEX is not simple

- the problem is a common belief that it is so difficult that even impossible
- the notes does not have a baseline
- notes can not be spaced by glue
- the space between notes depends nonlinearly on their value
- notes are connected by ties and slurs
- are preceded by sharps and flats
- needs ornaments
- special signs (repetitions, voltas, segno, coda etc.)
- and for example: guitar chords

Typesetting of notes in TEX is not simple

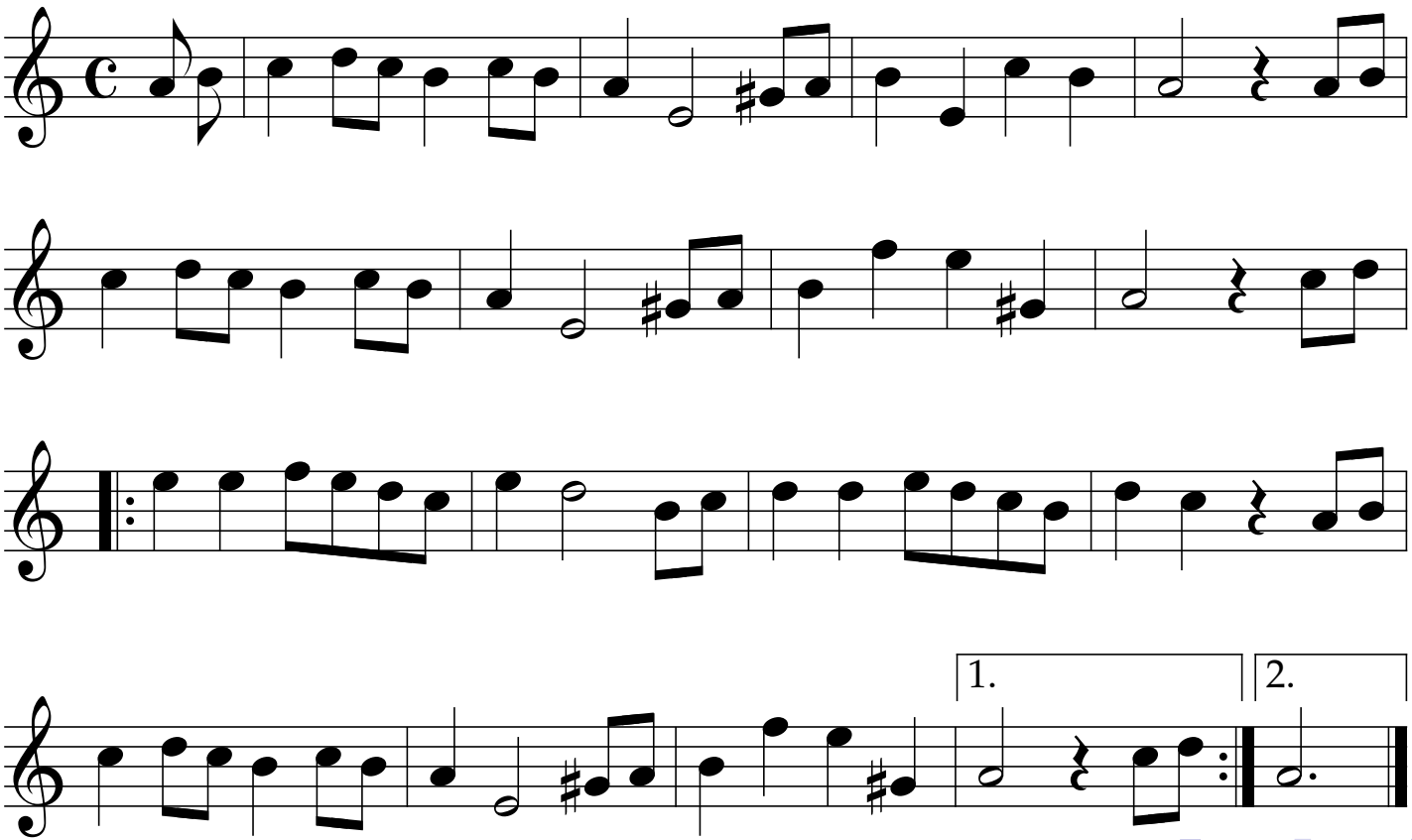
- the problem is a common belief that it is so difficult that even impossible
- the notes does not have a baseline
- notes can not be spaced by glue
- the space between notes depends nonlinearly on their value
- notes are connected by ties and slurs
- are preceded by sharps and flats
- needs ornaments
- special signs (repetitions, voltas, segno, coda etc.)
- and for example: guitar chords

Requires knowledge about music, notation and practice

- scales and keys, circle of fifths, basics of musical transposition
- relations between the value of the notes, rhythm, bar, meter
- style of notation (example):

Requires knowledge about music, notation and practice

- scales and keys, circle of fifths, basics of musical transposition
- relations between the value of the notes, rhythm, bar, meter
- style of notation (example):



Scores in TEX are engraved using preprocessors

- rich TEX code is difficult to write for human
  — we need code generator
- space calculating code in TEX is ineffective and unsatisfactory
  — we need external program
- convenient typesetting words under notes is not trivia
  — we need program support
- preprocessors were shaped by historical reasons

Scores in TEX are engraved using preprocessors

- rich TEX code is difficult to write for human
  — we need code generator
- space calculating code in TEX is ineffective and unsatisfactory
  — we need external program
- convenient typesetting words under notes is not trivia
  — we need program support
- preprocessors were shaped by historical reasons

Main processor — MusiXTEX

- by Daniel Taupin twenty five years ago (1991)
- improved by external positioning (space calculating) program in 1997
- two(three) pass model
  1. first TEX pass writes information about notes to log
  2. external program `musixflx` writes calculated spacings to another log
  3. second TEX pass uses calculated data and typesets notes properly
- TEX command `\startmuflex` starts spacing logs
- `\endmuflex` stops
- in LATEX implicit with `\begin` and `\end{document}`
- MusiXTEX code is hard to write, understand, maintenance, transpose to another key etc. but...
- MusiXTEX is successfully typesetting notes

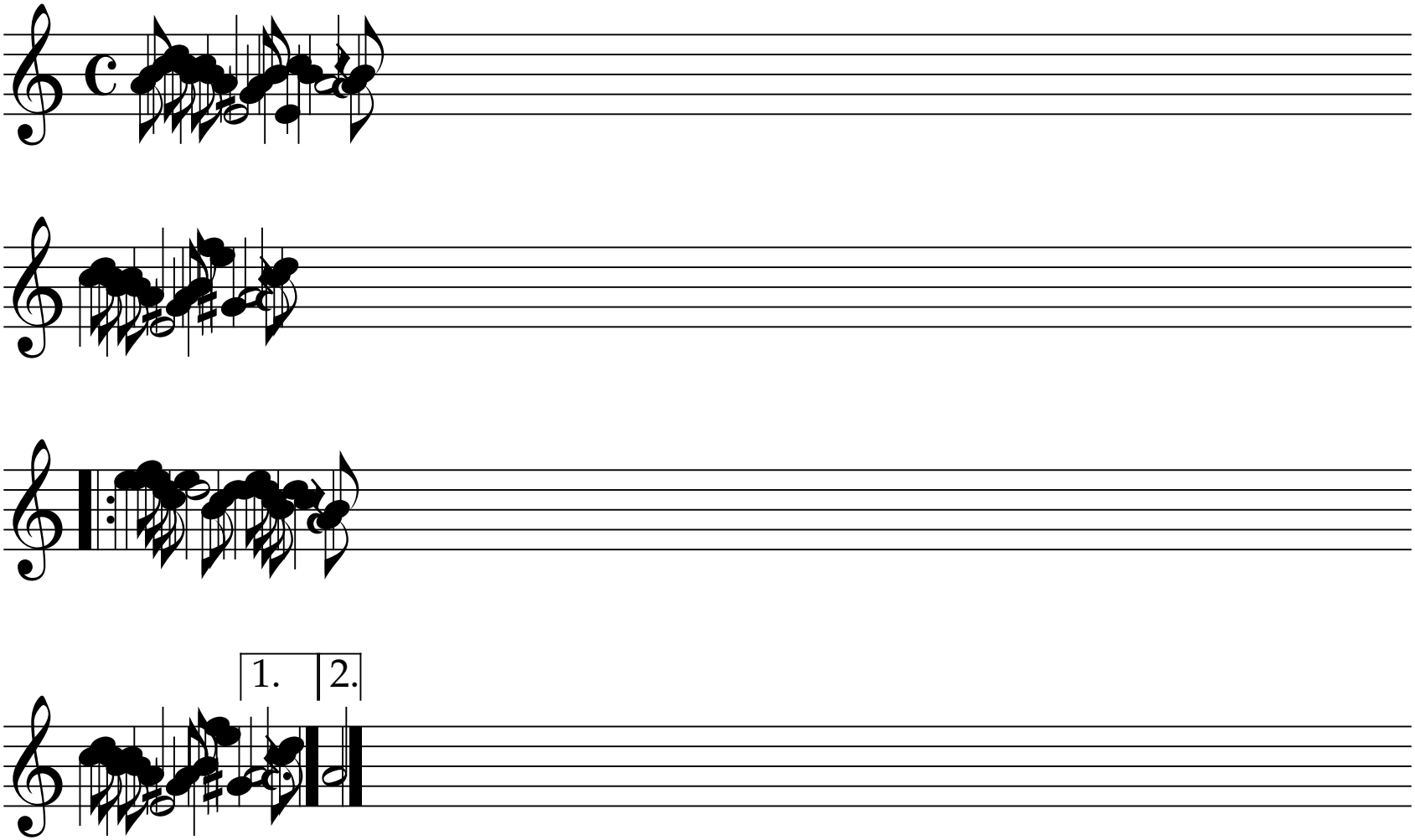
Main processor — MusiXTEX

- by Daniel Taupin twenty five years ago (1991)
- improved by external positioning (space calculating) program in 1997
- two(three) pass model
  1. first TEX pass writes information about notes to log
  2. external program `musixflx` writes calculated spacings to another log
  3. second TEX pass uses calculated data and typesets notes properly
- TEX command `\startmuflex` starts spacing logs
- `\endmuflex` stops
- in LATEX implicit with `\begin` and `\end{document}`
- MusiXTEX code is hard to write, understand, maintenance, transpose to another key etc. but...
- MusiXTEX is successfully typesetting notes

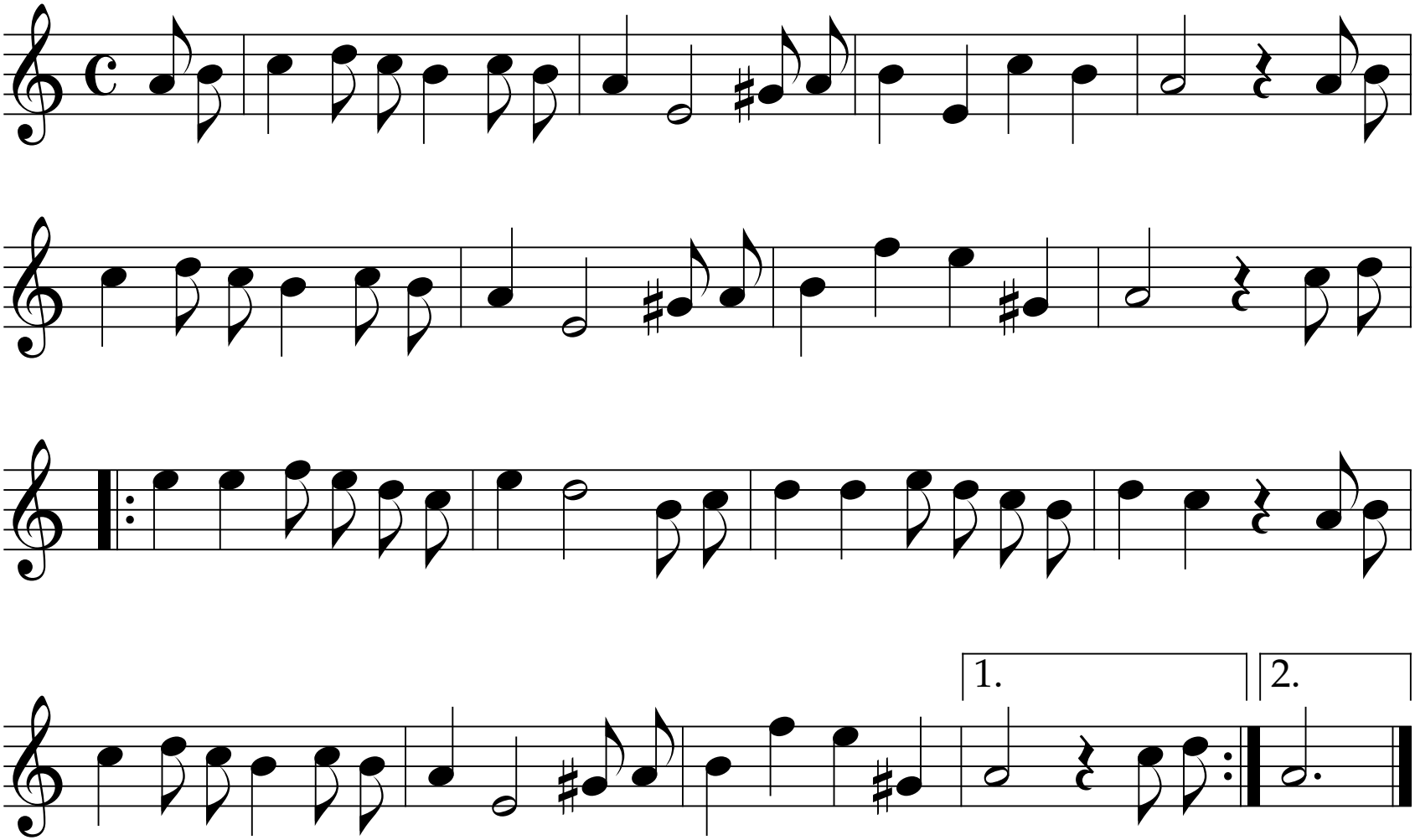
Main processor — MusiXTEX

- by Daniel Taupin twenty five years ago (1991)
- improved by external positioning (space calculating) program in 1997
- two(three) pass model
  1. first TEX pass writes information about notes to log
  2. external program `musixflx` writes calculated spacings to another log
  3. second TEX pass uses calculated data and typesets notes properly
- TEX command `\startmuflex` starts spacing logs
- `\endmuflex` stops
- in LATEX implicit with `\begin` and `\end{document}`
- MusiXTEX code is hard to write, understand, maintenance, transpose to another key etc. but...
- MusiXTEX is successfully typesetting notes

Before `musixflx` (after first pass)



After `musixflx` (after last pass)



ABC notation

- musicians, while reading note from i.e. third line or second field between lines are not naming sounds by numbering or lettering places of note (MusiXTEX does)
- they call sounds using letters of alphabet, according to scale, tradition etc. but regardless of the octave
  - Polish tradition for major scale: *c*, *d*, *e*, *f*, *g*, *a* and *h*
  - English tradition for major scale: *c*, *d*, *e*, *f*, *g*, *a* and *b*
  - sol-fa (solfeggio) tradition *do*, *re*, *mi*, *fa*, *sol*, *la* and *si*
  - sound can be modified using sharp (♯) or flat (♭)
  - Polish tradition gives for chroma separate naming using suffix *is* or *es*, eg. *cis* or *des*; exception is *es*, *as* and *b* (= English $b_\flat$)

ABC notation preprocessor — PMX

- by Don Simons (1997)
- after letter (English tradition, `r`=rest) is coded length of note: 0 — whole, 2 — half, 4 — quarter, 8 — eight, 1 — sixteen etc.
- after this can be coded octave: „+" — one up, „-" — one down and explicite 4 — one-line octave
- after can be coded `s` — sharp and `f` — flat and much more (triplets, graces, up/down ...)
- there are another spells ie. slurs `( )` or ties `{ }`, voltas etc.
- `\command\` goes directly to the TEX code as `\command`
- our melody in PMX abc notation:

```
a84 b8 c4 d8 c8 b4 c8 b8 / a4 e2 g8s a8 / b4 e4- c4+ b4 /
a2 r4 a8 b8 / c4 d8 c8 b4 c8 b8 / a4 e2 g8s a8 /
b4 f4+ e4 g4-s / a2 r4 c8 d8 / Rl e4 e4 f8 e8 d8 c8 /
e4 d2 b8 c8 / d4 d4 e8 d8 c8 b8 / d4 c4 r4 a8 b8 /
c4 d8 c8 b4 c8 b8 / a4 e2 g8s a8 / b4 f4+ e4 g4-s /
V1 a2 r4 c8 d8 / Rr m3/4/0/0 V2b a2d /
```

- preprocessor name is `pmxab` and extension is `.pmx`

ABC notation preprocessor — PMX

- by Don Simons (1997)
- after letter (English tradition, `r`=rest) is coded length of note: 0 — whole, 2 — half, 4 — quarter, 8 — eight, 1 — sixteen etc.
- after this can be coded octave: „+" — one up, „-" — one down and explicite 4 — one-line octave
- after can be coded `s` — sharp and `f` — flat and much more (triplets, graces, up/down ...)
- there are another spells ie. slurs `( )` or ties `{ }`, voltas etc.
- `\command\` goes directly to the TEX code as `\command`
- our melody in PMX abc notation:

```
a84 b8 c4 d8 c8 b4 c8 b8 / a4 e2 g8s a8 / b4 e4- c4+ b4 /
a2 r4 a8 b8 / c4 d8 c8 b4 c8 b8 / a4 e2 g8s a8 /
b4 f4+ e4 g4-s / a2 r4 c8 d8 / Rl e4 e4 f8 e8 d8 c8 /
e4 d2 b8 c8 / d4 d4 e8 d8 c8 b8 / d4 c4 r4 a8 b8 /
c4 d8 c8 b4 c8 b8 / a4 e2 g8s a8 / b4 f4+ e4 g4-s /
V1 a2 r4 c8 d8 / Rr m3/4/0/0 V2b a2d /
```

- preprocessor name is `pmxab` and extension is `.pmx`

Weakness of PMX abc notation

- unnatural polyphonic record
- descriptions over the stave
- PMX header is a sequence of numbers (ugly)
- lyrics under (over) notes

Weakness of PMX abc notation

- unnatural polyphonic record
- descriptions over the stave
- PMX header is a sequence of numbers (ugly)
- lyrics under (over) notes

Music with text preprocessor — M-Tx

- by Dirk Laurie from 1998
- organizes record by introducing stanzas of form:

```
U: code for text over staves
   extended pmx code for voice
   extended pmx code for other voice
L: ly-rics for voi-ce
L: a-no-ther ly-rics
```

- header has form:

```
Keyword: value
Keyword2: value2
```

- line preceded by double comment (%%) is injected into PMX
- styles are defined in file `mtxstyle.txt`, i.e.

```
SINGER: Voices S; Vocal; Clefs G
```

- preprocessor name is `prepmx` and extension is `.mtx`

Music with text preprocessor — M-Tx

- by Dirk Laurie from 1998
- organizes record by introducing stanzas of form:

```
U: code for text over staves
   extended pmx code for voice
   extended pmx code for other voice
L: ly-rics for voi-ce
L: a-no-ther ly-rics
```

- header has form:

```
Keyword: value
Keyword2: value2
```

- line preceded by double comment (%%) is injected into PMX
- styles are defined in file `mtxstyle.txt`, i.e.

```
SINGER: Voices S; Vocal; Clefs G
```

- preprocessor name is `prepmx` and extension is `.mtx`

Script prepc.bat for typesetting in TEX:

```
if EXIST %1.mtx (
  del %1.log
  del %1.mx1
  del %1.mx2
  del %1.pml
  del %1.pmx
  del %1.tex
  prepmx %1
  pmxab %1
  luatex %1.tex
  musixflx.exe %1.mx1
  luatex %1.tex
)
```

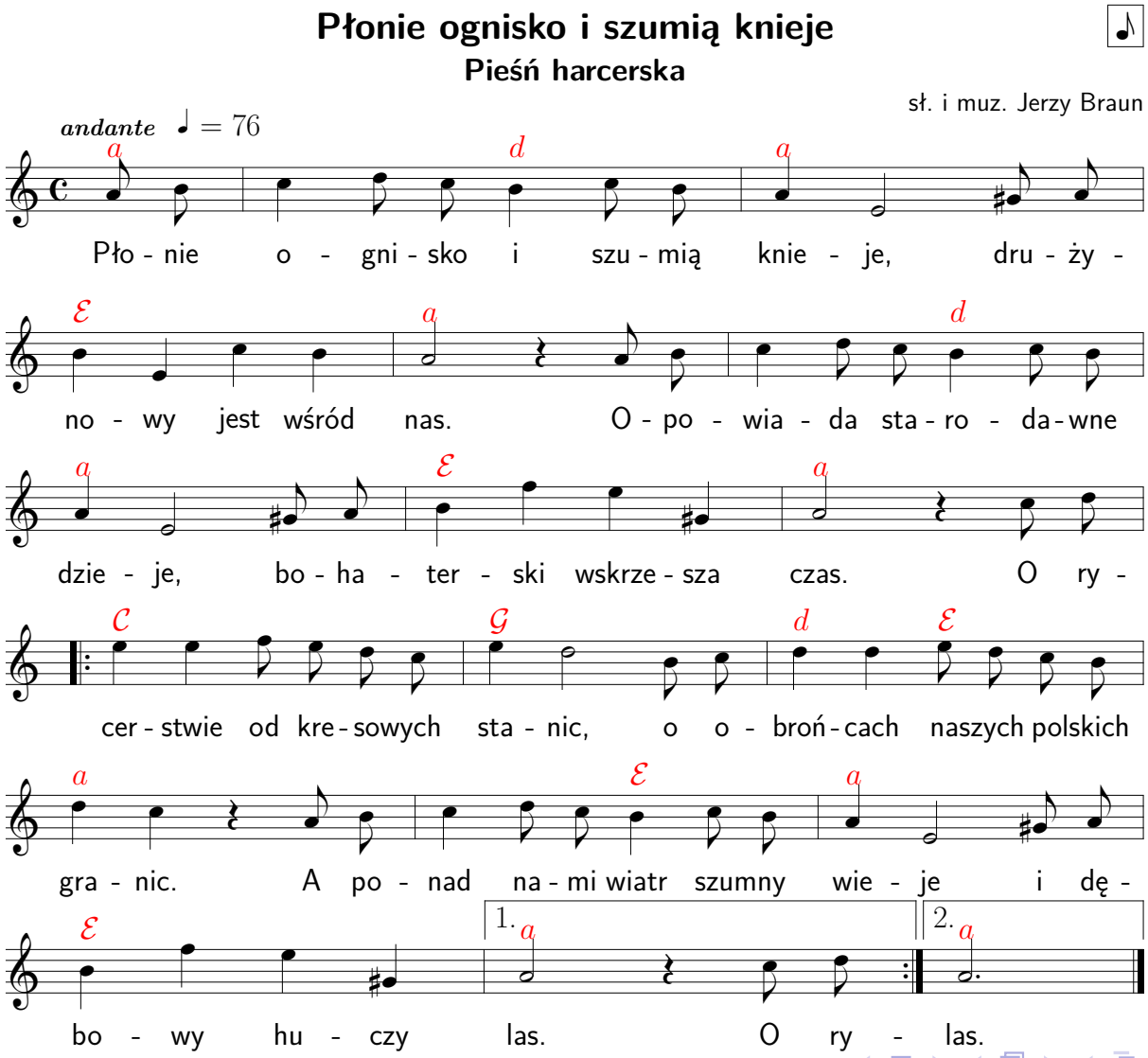
TEXstudio configuration

- in TEXstudio options we define custom build command: `<full-path>prepc.bat % | txs:///view-pdf-internal`
- we connect this command to Alt-X; preview will be refreshed at every hotkey press
- another script, starting generated `.mid`, is connected to Alt-Z

So we write our song...

- System: Microsoft Windows
- Framework: TEXstudio
- Scripts connected to left Alt-X and Alt-Z
- Compiler: LuaTEX

Our goal


Płonie ognisko i szumią knieje
Pieśń harcerska
sł. i muz. Jerzy Braun
andante ♩ = 76
Pło - nie o - gni - sko i szu - mią knie - je, dru - ży -
no - wy jest wśród nas. O - po - wia - da sta - ro - da - wne
dzie - je, bo - ha - ter - ski wskrze - sza czas. O ry -
cer - stwie od kre - sowych sta - nic, o o - broń - cach naszych polskich
gra - nic. A po - nad na - mi wiatr szumny wie - je i dę -
bo - wy hu - czy las. O ry - las.

Header of the song in M-Tx

```
Part: Pieśń harcerska
Title: Płonie ognisko i szumią knieje
Composer: sł. i muz. Jerzy Braun
Meter: C
%Sharps: 1
%Flats: 1
Space: 3 10 20
PMX: w185m Ar Iiclg0t76
%Pages: 1
%Systems: 6
Bars/line: 4
Size: 20
Style: Singer
```

Body of the song in M-Tx

```
   \Scribesh{-2em}{andante\quad\metr{\qu}{76}}\ a8 b | c4 d8 c b4 c8 b a4 e2 g8s a
L: Pło-nie o-gni-sko i szu-mią knie-je, dru-ży-

   b4 e- c+ b a2 r4 a8 b
L: no-wy jest wśród nas. O-po-

   c4 d8 c b4 c8 b a4 e2 g8s a
L: wia-da sta-ro-da-wne dzie-je, bo-ha-

   b4 f+ e gs- a2 r4 c8 d
L: ter-ski wskrze-sza czas. O ry-

   |: e4 e f8 e d c e4 d2 b8 c
L: cer-stwie od kre-so-wych sta-nic, o o-

   d4 d e8 d c b d4 c r a8 b
L: broń-cach na-szych pol-skich gra-nic. A po-

   c4 d8 c b4 c8 b a4 e2 g8s a
L: nad na-mi wiatr szu-mny wie-je i dę-

   b4 f+ e gs-
L: bo-wy hu-czy

   V1 a2 r4 c8 d :|
L: las. O ry-

   V2b a2d
L: las.
```

Body of the song in M-Tx with chords by chords.sty

```
U: \a ~ ~ ~ ~ \d ~ ~ \a
   \Scribesh{-2em}{andante\quad\metr{\qu}{76}}\ a8 b | c4 d8 c b4 c8 b a4 e2 g8s a
L: Pło-nie o-gni-sko i szu-mią knie-je, dru-ży-

U: \E ~ ~ ~ \a
   b4 e- c+ b a2 r4 a8 b
L: no-wy jest wśród nas. O-po-

U: ~ ~ ~ \d ~ ~ \a
   c4 d8 c b4 c8 b a4 e2 g8s a
L: wia-da sta-ro-da-wne dzie-je, bo-ha-

U: \E ~ ~ ~ \a
   b4 f+ e gs- a2 r4 c8 d
L: ter-ski wskrze-sza czas. O ry-

U: \C ~ ~ ~ ~ ~ \G
   |: e4 e f8 e d c e4 d2 b8 c
L: cer-stwie od kre-so-wych sta-nic, o o-

U: \d ~ \E ~ ~ ~ \a
   d4 d e8 d c b d4 c r a8 b
L: broń-cach na-szych pol-skich gra-nic. A po-
```

Key tranposition

- PMX transposition:
  command `K`±<shift>±<key>
- chords transposition:
  count `\transposeQ`=±<fifths>

Macro recording

- MIDI macros:

IMR*n*	starts recording
IM	stops recording
IMP*n*	play macro

- text macros:

MR*n*	starts recording
MS*n*	starts saving
M	stops recording/saving
MP*n*	play macro

Cleaning TEX code for LATEX

- LATEX don't need standalone prologue
- unnecessary commands:

```
\input mtx
\input pmx
\input musixtex

\startmuflex
\endmuflex

\setmaxslurs{24}\setmaxinstruments{24}
\nopagenumbers
\vfill\eject\bye
```

Cleaning scripts pre.bat

```
if EXIST %1.mtx (
  del %1.pml
  del %1.pmx
  del %1.mid
  del %1.tex
  del %1.ex
  prepmx %1
  pmxab %1
  awk -vf=%1 -f clean.awk %1.tex >%1.ex
  call rrr.bat
  del rrr.bat )

BEGIN{n=f".mtx";
while(getline < n > 0)
  {if($0 ~ /MIDIFILE/)
   {m=$2;print("copy "f".mid "m".mid")>"rrr.bat"}}}
$0!~/\\eject\\endmuflex/&&
$0!~/\\bye/&&
$0!~/\\input/&&
$0!~/\\nopagenumbers/
  {gsub("\\\\startmuflex","");
   gsub("\\\\setmaxslurs{24}","");
   gsub("\\\\setmaxinstruments{24}","");
   print $0}
/\\input *mtx/
  {print "\\def\\mtxmidi{"m"}"}
```

MHB in LATEX prologue

- equivalents of cleaned commands
- recommended command for `\input`'ting cleaned file `.ex` in MusiXTEX `music` environment
- `\titles` command and companion for code:
```
\znotes\zcharnote{16}{%
\titles{2.0}{Pieśń harcerska}{2.0}{\mtxTitle}{2.0}%
{\mtxPoetComposer}{2.0}}\en%
```
- modification of commands defined in MusiXTEX or preprocessor packages eg. in order to neutralize
- switches, eg. `\nobarnumbers`
- definition of commands injected into TEX code

Script for build Songbook

```
for %%n in (B*.mtx) do call pre.bat %%~nn
del BachoTex2016.aux
del BachoTex2016.log
del BachoTex2016.mx1
del BachoTex2016.mx2
del BachoTex2016.out
del BachoTex2016.pdf
del BachoTex2016.toc
lualatex.exe -synctex=1 -interaction=nonstopmode
BachoTex2016.tex musixflx.exe BachoTex2016.mx1
lualatex.exe -synctex=1 BachoTex2016.tex
```

Big sheet music project

- almost 500 pages of scores
- almost all heard from recordings on compact cassetes and written by ear
- some recorded about 50 years ago, poor quality
- many of these songs were monodies (without rhythm)
- songs of Neocatechumenal Way, religious communities formation in the Catholic Church
- refresh and restore the original — direct transfer pauperized melodies
- GNU Open Source and Free Documentation licences
- files in `http://andrzej.odyniec.info/sp`

Important things when typesetting songbook scores

good source

- reach out to existing scores, even when the melody is widely known
- it is worth trying to get to the original edition
- you must also have a good text and master, good, or at least correct harmonization
- meter, rhythm, division into bars and distribution of accents is important

author fidelity

- it is good to get author's writing and/or author recording
- own human memory is insufficient, unless it is widespread

Important things when typesetting songbook scores

good source

- reach out to existing scores, even when the melody is widely known
- it is worth trying to get to the original edition
- you must also have a good text and master, good, or at least correct harmonization
- meter, rhythm, division into bars and distribution of accents is important

author fidelity

- it is good to get author's writing and/or author recording
- own human memory is insufficient, unless it is widespread

Important things when typesetting songbook notes

readability

- in the sense that the singer or instrumentalist can easily and accurately read melody

right key choice

- it is good to take into account the typical ranges of human voices
- some keys are to difficult for amateurs especially on diatonic instruments (i.e. six sharps)

careful scores verification

- error in pitch or rhythm will always be troublesome for the reader or performer
- generated MIDI can be helpful

Important things when typesetting songbook notes

readability

- in the sense that the singer or instrumentalist can easily and accurately read melody

right key choice

- it is good to take into account the typical ranges of human voices
- some keys are to difficult for amateurs especially on diatonic instruments (i.e. six sharps)

careful scores verification

- error in pitch or rhythm will always be troublesome for the reader or performer
- generated MIDI can be helpful

Important things when typesetting songbook notes

readability

- in the sense that the singer or instrumentalist can easily and accurately read melody

right key choice

- it is good to take into account the typical ranges of human voices
- some keys are to difficult for amateurs especially on diatonic instruments (i.e. six sharps)

careful scores verification

- error in pitch or rhythm will always be troublesome for the reader or performer
- generated MIDI can be helpful

LilyPond

- by Han-Wen Nienhuys and Jan Nieuwenhuizen from 1996 after abandon MPP (MusiXTEX PreProcessor)
- by LilyPond Development Team from 2003
- created to achieve the beauty and balance of a handengraved score
- output is improved gradually over time, and it continues to improve by comparing its output to hand-engraved scores
- sophisticated enough to write complex notes of classical works
- unified non-hybrid solution, in contrast to MusiXTEX and preprocessors
- a serious competitor to the preprocessing+TEX solution

LilyPond pro's (this is not SWAT)

- beauty of engravings
- one program, independent of vagaries of TEX
- is not WYSIWYG
- is advanced
- very good for restore classics to electronic form
- creates pdf

LilyPond contra's

- closed solution
- is not WYSIWYG
- is advanced to learn (notation reference has 825 pages)
- to difficult to use in simple songbook
- creates only pdf

M-Tx→PMX→TEX pro's

- beauty is better than in handwriting
- is not WYSIWYG
- is advanced when we need power of MusiXTEX and simple if we need write songbook
- creates pdf and TEX and LATEX and others
- allows to use whole power of TEX (including hyperlinks and other pdf tricks)

M-Tx→PMX→TEX contra's

- beauty is probably less than LilyPond
- is not WYSIWYG
- protrude from under the covers dirty feet of MusiXTEX
- do not creates handmade engravings
- TEX's full power can overwhelm
- errors sometime are hard to diagnose

Which solution is better?

There is no better solution!

Both are different solutions!

Thank You

Which solution is better?

There is no better solution!

Both are different solutions!

Thank You

Which solution is better?

There is no better solution!

Both are different solutions!

Thank You