


Markup Languages for Music: MusicXML and MEI

Music 253/CS 275A
Stanford University



CMME (Computerized Mensural Music Encoding)

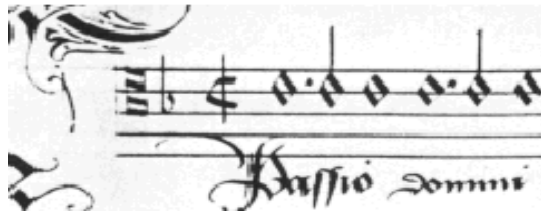
CMME: virtual editions of early music

□ *Corpus Mensurabilis Musicarum* (est. 1998)

Est. and built by Theodor Dumitrescu, Oxford-Utrecht-Berkeley)



Goal: *One encoding, multiple systems of notation for mensural notation*



cmme.org

From *The Virtual Score*. Used by permission.

CMME (2013)

Early Music Editing

Principles, Techniques, and Future Directions

about

program

pictures

3-5 July 2008

Universiteit Utrecht

The Netherlands

- ❑ *Computerized Mensural Musical Editing*
- ❑ *Based in Utrecht*
- ❑ Marnix van Berchum (director from 2012--)
- ❑ Home of “The Other Josquin” [attribution study]
- ❑ Source code publicly available (GNU license) at <https://github.com/tdumitrescu/cmme-editor>



CMME today

Content lists,
some scores, for 15th-
16th cent music

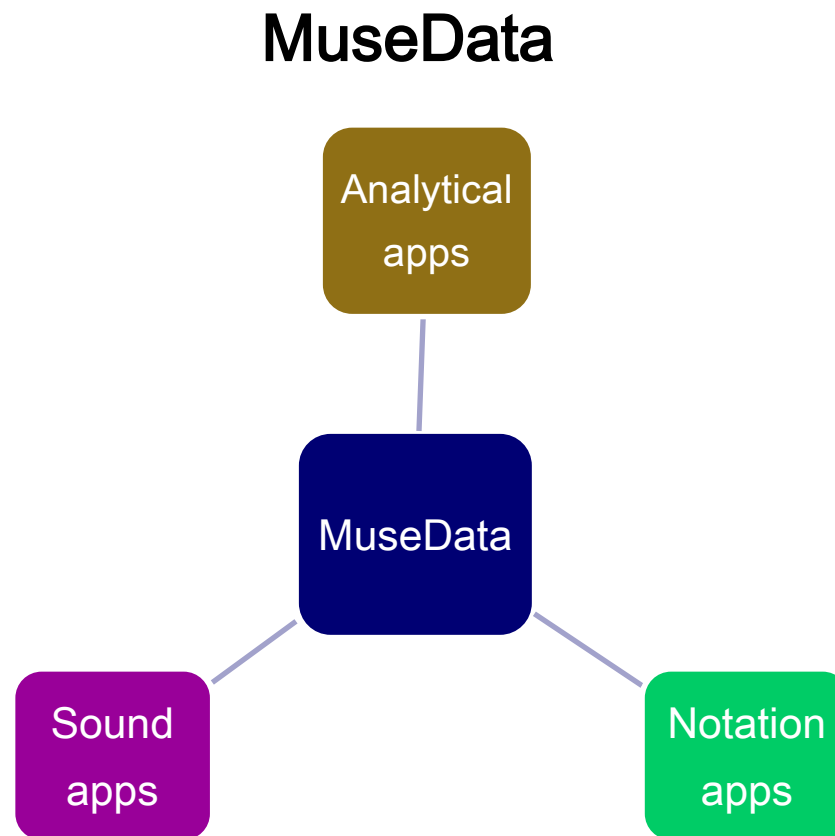
The image displays two screenshots of the CMME Viewer application. The top-left window shows a score for 'Hec est preclarum vas' by Anonymus, featuring four staves (Soprano, Alto, Tenor, Bass) with lyrics: 'Do - mi - na - no -', 'mi - na - no -', 'no -', and 'no -'. The top-right window shows a larger score for the same piece, with lyrics: 'fac nos tuis precibus consortes', 'fac nos tuis preci // bus consortes', 'fac nos tuis precibus consortes', and 'fac nos tuis precibus consortes'. The bottom-right window shows a score for 'Sancta maria clemens et pia domina nostra fac nos tuis precibus consortes celestis glorie amen.'.

<http://www.cmme.org>



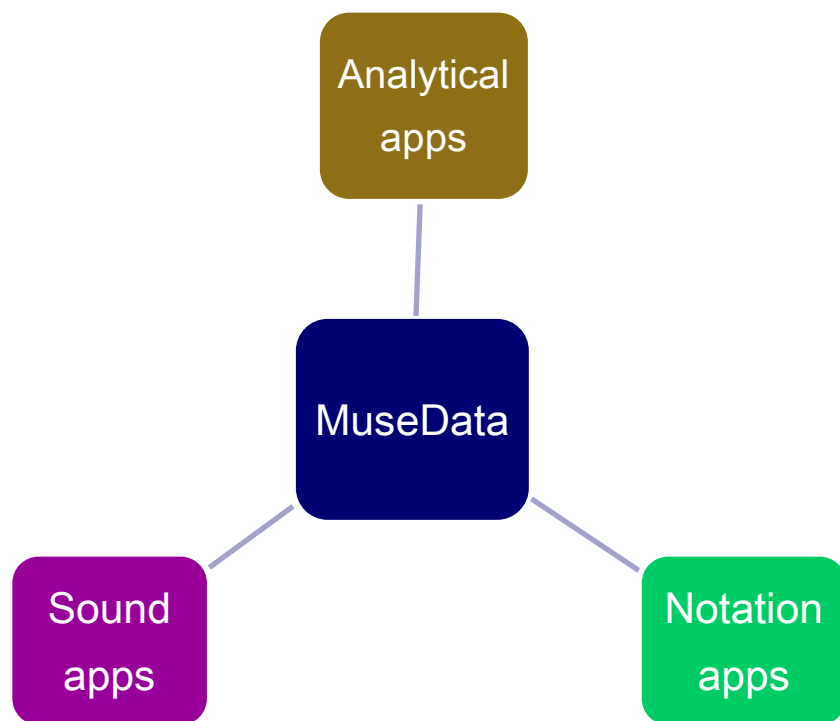
MusicXML **(Extensible Markup Language)**

From data to apps: *MuseData* Model

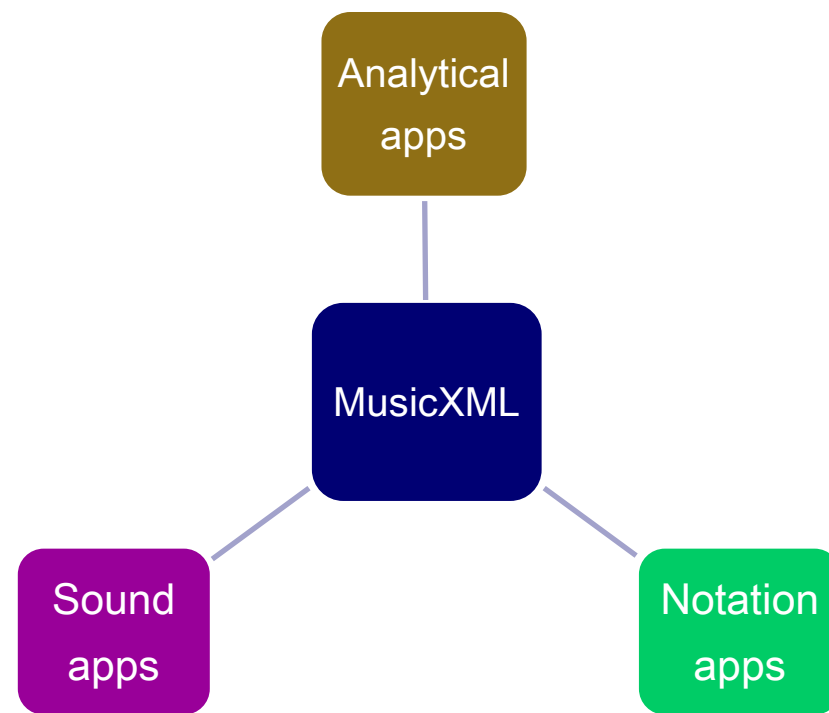


MusicXML vis-à-vis MuseData

MuseData



MusicXML



MusicXML: History

- Developed from 2000 by Michael Good
- Distrib Recordare (2002-2011)

- V. 1: platform-specific (2004)
- V. 2: Java (2007)
- V. 3: Java (2011)
- Sold as add-on to *Finale*, *Sibelius* et al.

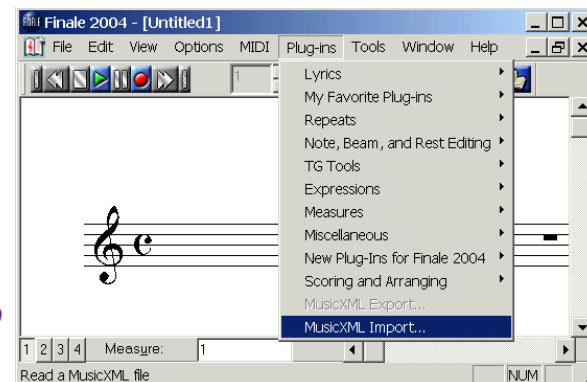


NAMM 2011

- Sold to MakeMusic (*Finale*) in 2011
- Native in *Finale*; more limited capabilities in *Sibelius*

<http://www.makemusic.com/musicxml/>

Sibelius team moved to Steinberg as *Keeping Score*



Sibelius/Steinberg side of MEI

- Sibelius sold to Avid (Santa Cruz)
- Sibelius sw team moved to new Steinberg team to develop “Keeping Score”
- Most visible part is [SMuFL](#) (standard music font layout) [version 1.18]

Long list of music glyphs (2000+)

Glyphs vs fonts *Lento* [$\text{♩} = 40$]

Bravura font



Daniel Spreadbury

MusicXML: Main Aims

- ❑ Nexus of all **commercial** notation interchange schemes
- ❑ Highest structural compatibility with MuseData and Humdrum
- ❑ Most useful tool for converting from older to newer versions of *Finale*!
- ❑ In use for over past decade by many small sw companies and a few music publishers (inc. Hal Leonard)

Part/score orientation in *MuseData*

1. Encode **voice by voice** for full movement
2. Add **lyrics**, other refinements
3. **Repeat** until all movements are encoded
4. Assemble score

The image displays two musical score examples, each with a light blue header bar. The top example shows a four-part string quartet score with staves labeled 'violino I', 'violino II', 'viola', and 'violoncello'. The bottom example shows a four-part score with staves labeled 'pt.', 'pi.', 'pi.', and 'pi.'. Both scores are written in 4/4 time and feature various musical notations including notes, rests, and dynamic markings like 'p' (piano) and 'f' (forte).

Part/score orientation in *MusicXML*

Both/and

1. Encode **voice by voice** or **bar by bar**
2. **Transform array** as needed

Part-wise (MuseData)

Time-wise (Humdrum)

The diagram illustrates two different ways to orient a musical score in MusicXML. It features a musical score with four staves: *violino I*, *violino II*, *viola*, and *violoncello*. The score is divided into two sections by a vertical yellow bar. The top section is labeled 'Part-wise (MuseData)' and shows the score oriented with the staves stacked vertically. The bottom section is labeled 'Time-wise (Humdrum)' and shows the score oriented with the staves stacked horizontally. The vertical yellow bar represents a time slice, and the horizontal yellow bar represents a part slice. The diagram demonstrates how the same musical score can be represented in different orientations to suit different encoding needs.

MusicXML: basic file structure

- Row/column rotation handled through XSLT style-sheets
(no style sheets in beginning)
- Score/part/measure elements at top of file
- Lots of metadata fields possible in score header
- DTD: <http://www.musicxml.com/for-developers/musicxml-dtd/>

MusicXML: Current status (v. 3.1, 2016)

- <http://www.makemusic.com/musicxml/specification/dtd>
- “Common” DTD (v. 3.0)
- *Sound*: timbral recognition (sounds.xml, v. 3.0)
- *MIDI*: in absolute or delta times (v. 3.0)
- *Other*: some support for recent music, no semantic support for early music
- Main current emphasis on W3C Music Notation Community (with *Noteflight* and SMuFL):
<https://www.w3.org/community/music-notation/>

MusicXML: MIDI interface

Andantino

dolce

Dans un som - meil que char-mait ton i - ma - - ge

pp

```
<attributes>
  <divisions>24</divisions>
  <key>
    <fifths>-3</fifths>
    <mode>minor</mode>
  </key>
  <time>
    <beats>3</beats>
    <beat-type>4</beat-type>
  </time>
</attributes>
```

```
<note>
  <pitch>
    <step>E</step>
    <alter>-1</alter> Accidental="alter"
    <octave>5</octave>
  </pitch>
  <duration>24</duration>
  <tie type="start"/>
  <lyric>
    <syllabic>end</syllabic>
    <text>meil</text>
    <extend/>
  </lyric>
</note>
```

```
<note>
  <pitch>
    <step>C</step>
    <octave>4</octave>
  </pitch>
  <duration>1</duration>
</note>
<note>
  <chord/>
  <pitch>
    <step>E</step>
    <alter>-1</alter>
    <octave>4</octave>
  </pitch>
  <duration>1</duration>
</note>
<note>
  <chord/>
  <pitch>
    <step>G</step>
    <octave>4</octave>
  </pitch>
  <duration>1</duration>
</note>
```


MuseScore

- ❑ Uses MusicXML as visible rep system
- ❑ Java-based
- ❑ Doc in several languages
- ❑ Open-source level
- ❑ Closed-source level
- ❑ YouTube tutorials

<http://wiki.ccarh.org/wiki/MuseScore>



Andante con moto (♩ = 120) *mp* *poco rit.*

più mosso *rit.* *più mosso*

rit. *tempo primo* *mf* *cresc.*

accel. *rit.* *f* *meno mosso* *mf*

rall. *mp* *8va*

musescore.org

Music by Marc Sabatella

Lilypond




- Shareware (GNU) engraving, own code (c. 2005)
- Dev (Han Wen Nienhuys) in Netherlands (now lives in Brazil)
- All platforms (mainly unix/linux)
- TeX-like syntax, markup
- Extensive online documentation
- *Musicxml2lp* script (Lilypond 2.12.3)
- Hosts “unofficial MusicXML test suite”
 - (no official test suite)
 - Good categorical organization

<http://wiki.ccarh.org/wiki/Lilypond>

<http://www.lilypond.org/doc/v2.16/Documentation/snippets.pdf>

<http://lilypond.org/doc/v2.12/input/regression/musicxml/collated-files.html#Test-cases>



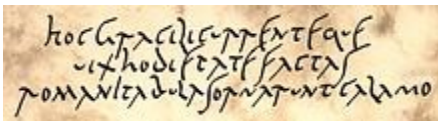
The Music Encoding Initiative (MEI)

Aims of MEI

- To support encoding of **musical sources**
 - i.e. sources underpinning modern editions
- To function synchronously with TEI (Text Encoding Initiative)
 - Sources in which textual material and music are combined
- To rely on 3rd-party software for printing and data interchange

TEI in relation to sources

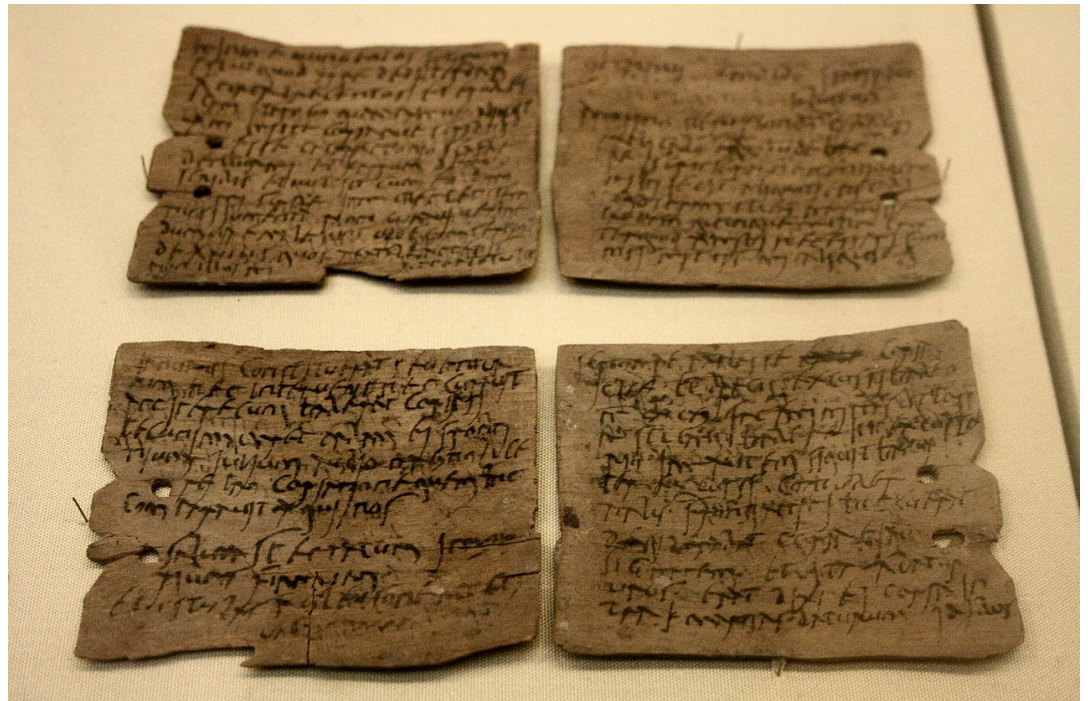
Old Roman cursive script



TEI app EpiDoc
-epigraphy (Oxford)

Other TEI tools

- Coins
- Seals



Tablets from Roman fort at Hadrian's Wall

What problems do music sources present?



The image displays a musical score for the song "Im wunderschönen Monat Mai" by Franz Schubert. The score is written for voice and piano. The voice part is in the upper staff, and the piano accompaniment is in the lower staves. The lyrics are in German. The score is annotated with XML code, likely from a music notation software like MuseScore or Sibelius, showing the underlying data structure. The XML code is overlaid on the right side of the score, and a small snippet is shown on the bottom left.

XML annotations visible in the image:

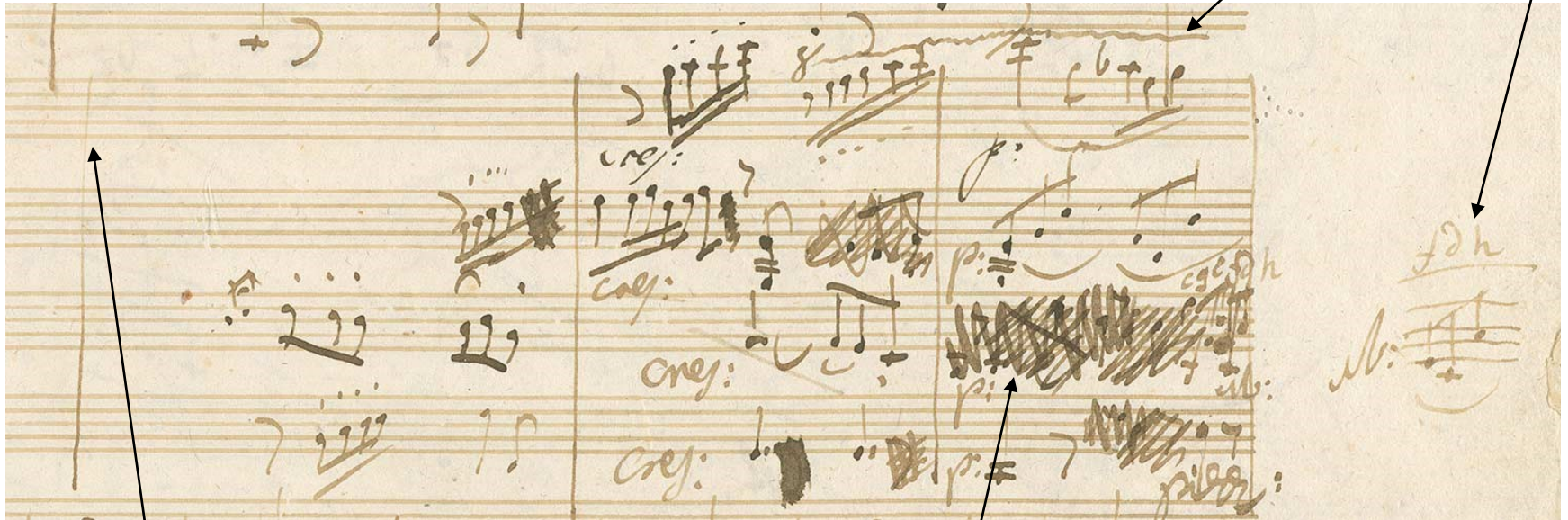
```
<measure n="5">
  <staff n="1">
    <layer n="1">
      <note pname="c" oct="5" dur="8" dots="1" stem.dir="down" accid.ges="s">
        <verse n="1">
          <syl wordpos="i" con="d">Wun</syl>
        </verse>
      </note>
      <note pname="b" oct="4" dur="16" stem.dir="down">
        <verse n="1">
          <syl wordpos="m" con="d">der</syl>
        </verse>
      </note>
      <note pname="b" oct="4" dur="16" stem.dir="up">
        <verse n="1">
          <syl wordpos="m" con="d">schö</syl>
        </verse>
      </note>
      <note pname="d" oct="5" dur="16" stem.dir="up">
        <verse n="1">
          <syl wordpos="t">nen</syl>
        </verse>
      </note>
      <note pname="f" oct="4" dur="16" stem.dir="up" accid.ges="s">

```

XML annotations visible in the image (bottom left):

```
<beam>
  <note xml:id="d1e129"
    stem.dir="up"
    pname="f"
    dur="8"
    oct="4" />
  <note xml:id="d1e130"
    stem.dir="up"
    pname="c"
    dur="8"
    oct="4" />
</beam>
```


Manuscript sources of music



Suppressed material
Added material
Imperfections
Ambiguities

Printed sources of music



First word? Zefiro [archaic vs. modern notation]

Bar lines?

Custos?

Part-book problems?