

Encoding Mensural Notation with MEI

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Germany [online] (January 25th, 2021)

MUSIC ENCODING

Short Introduction to MEI

INITIATIVE

Music Encoding Initiative (MEI)

- A community and a format
- The format:
 - XML based
 - Hierarchical structure (tree structure)
 - Tags (elements)
 - Attributes to define the properties of elements
- Goal: encode a wide variety of music documents

```
<measure n="1">
  <staff n="1">
    <layer>
      <note pname="c" oct="4" dur="2"/>
    </layer>
  </staff>
  <staff n="2">
    <layer>
      <note pname="c" oct="4" dur="2"/>
    </layer>
  </staff>
  <staff n="3">
    <layer>
      <note pname="c" oct="3" dur="2"/>
    </layer>
  </staff>
</measure>
```

Example: Elements, Attributes, and Values

- Elements
 - <note> and <rest>
- Attributes
 - Pitch name (@pname)
 - Octave (@oct)
 - Duration (@dur)

```
<note pname="c" oct="4" dur="1"/>
```

```
<rest dur="1"/>
```

@dur values

1: whole note

2: half note

4: quarter note

8: eighth note

16: sixteenth note

...

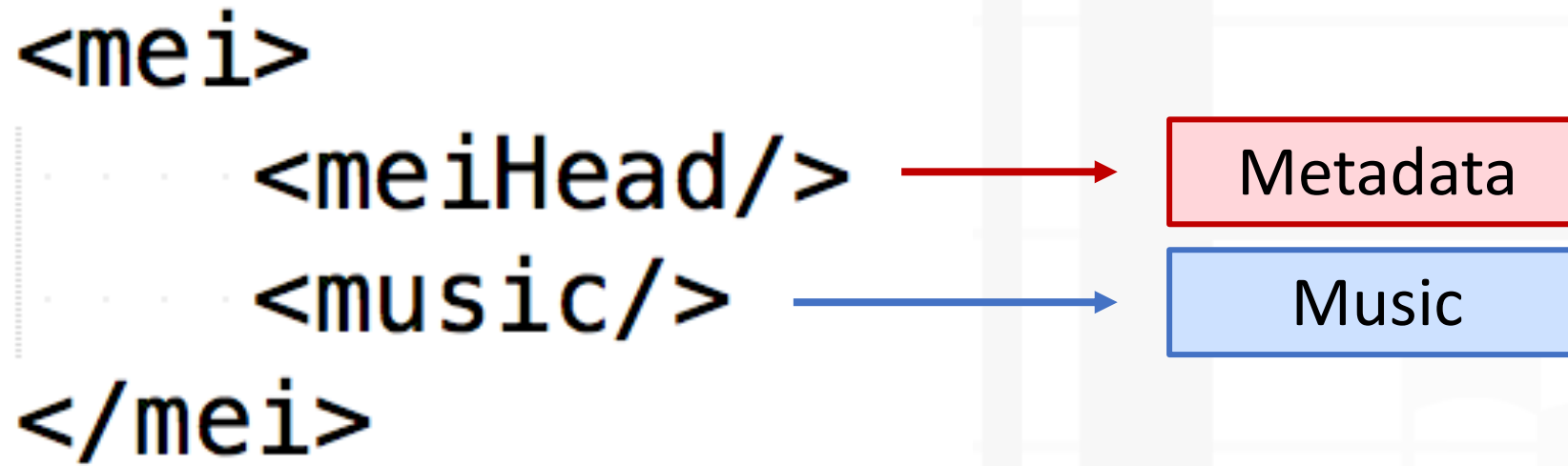
2048: 2048th note

TUTORIAL: <https://music-encoding.org/tutorials/101-quickstart.html>

Basic Structure of an MEI File

MUSIC ENCODING

Basic Structure of an MEI File



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Basic Structure of an MEI File

```
<mei>
```

```
  . . . . . <meiHead/>
```

```
  . . . . . <music/>
```

```
</mei>
```



Metadata

INITIATIVE

<meiHead> basic elements

```
<mei> ← @xmlns
  <meiHead>
    <fileDesc>
      <titleStmt>
        <title></title>
      </titleStmt>
      <pubStmt/>
    </fileDesc>
  </meiHead>
  <music/>
</mei>
```

TUTORIALS
[https://music-encoding.org/
resources/tutorials.html](https://music-encoding.org/resources/tutorials.html)

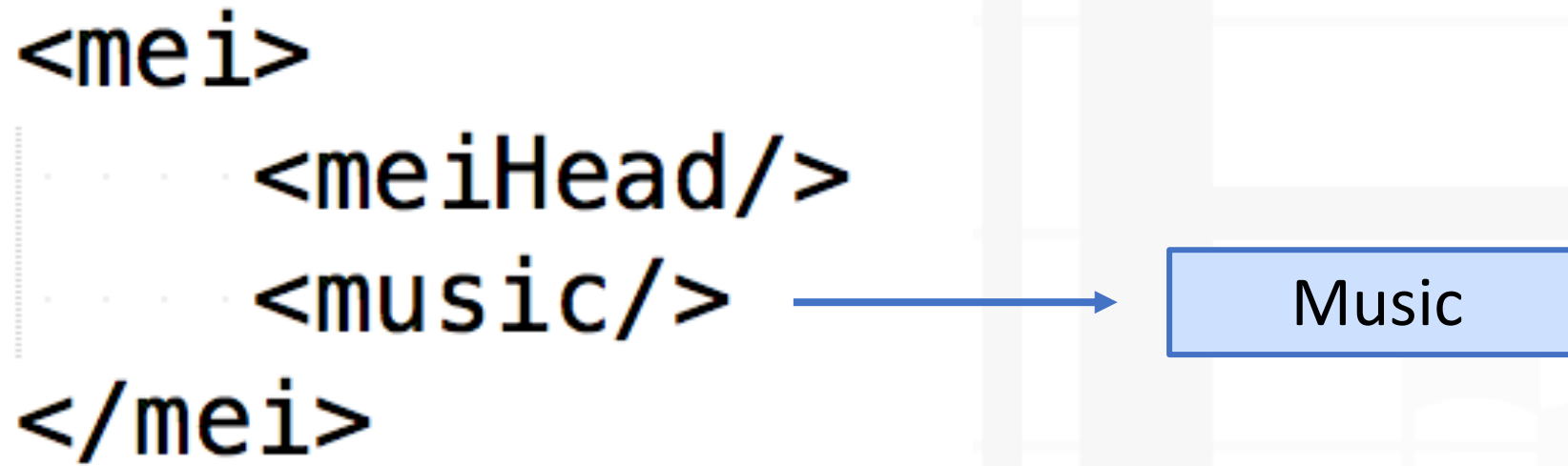
XML Basics and Minimal MEI File Structure

Outermost basic structure of
an **MEI-conformant** document
(conforms to the **schema** of MEI)

Basic structure
of a “valid” MEI file

MUSIC ENCODING

Basic Structure of an MEI File



<music> basic elements

```
<mei>
  <meiHead/>
  <music>
    <body>
      <mdiv>
        <score>
          <scoreDef/>
          <section/>
        </score>
      </mdiv>
    </body>
  </music>
</mei>
```

“Metadata,” but for the voices

Example

Violin	
Viola	
Cello	

Actual music content

<music> basic elements

```
<mei>
  <meiHead/>
  <music>
    <body>
      <mdiv>
        <score>
          <scoreDef/>
          <section/>
        </score>
      </mdiv>
    </body>
  </music>
</mei>
```

“Metadata,” but
for the voices

Example

Violin

Viola

Cello

The example shows three staves of music for Violin, Viola, and Cello. Each staff begins with a treble clef (Violin), an alto clef (Viola), and a bass clef (Cello). The key signature is one sharp (F#) and the time signature is 2/4. The first measure of each staff contains a single quarter note.

<scoreDef> - General Information for Voices

```
<score>
  <scoreDef>
    <staffGrp>
      <staffDef n="1"/>
      <staffDef n="2"/>
      <staffDef n="3"/>
    </staffGrp>
  </scoreDef>
  <section/>
</score>
```

General information for **ALL** voices

- Meter
- Key

Specific information for **EACH** voice

- Clef
- Label
- **Number of staff-lines (@lines)**
- **@n**

required for validation

Example

The example shows three staves of music. The top staff is labeled 'Violin' and uses a treble clef. The middle staff is labeled 'Viola' and uses an alto clef. The bottom staff is labeled 'Cello' and uses a bass clef. All three staves share the same key signature (two sharps) and time signature (2/4). A dashed box highlights the first measure of music on all three staves.

<https://music-encoding.org/guidelines/v4/content/shared.html>

<music> basic elements

```
<mei>
  <meiHead/>
  <music>
    <body>
      <mdiv>
        <score>
          <scoreDef/>
          <section/>
        </score>
      </mdiv>
    </body>
  </music>
</mei>
```

Example

Violin

Viola

Cello

Actual music content

<section> - Actual Music

```
<score>
  <scoreDef/>
  <section>
    <measure n="1">
      <staff n="1">
        <layer>
          <!-- MUSIC WITHIN THE STAFF -->
        </layer>
      </staff>
      <staff n="2"/>
      <staff n="3"/>
    </measure>
    ...
    <measure n="20"/>
  </section>
</score>
```

<https://music-encoding.org/guidelines/v4/content/shared.html>

<section> - Actual Music

```
<score>
  <scoreDef/>
  <section>
    <measure n="1">
      <staff n="1">
        <layer>
          <!-- MUSIC WITHIN THE STAFF -->
        </layer>
      </staff>
      <staff n="2"/>
      <staff n="3"/>
    </measure>
    ...
    <measure n="20"/>
  </section>
</score>
```

The diagram illustrates the structure of a music section in XML. A code block shows a <score> element containing a <scoreDef/> element and a <section> element. The <section> element contains a <measure n="1"> element, which in turn contains a <staff n="1"> element. Inside the <staff n="1"> element is a <layer> element containing a comment: <!-- MUSIC WITHIN THE STAFF -->. An orange arrow points from this comment to two boxes: <note/> and <rest/>, indicating that the music within the staff is represented by these elements.

<https://music-encoding.org/guidelines/v4/content/shared.html>

Notes and Rests

- Pitch name (@pname)
- Octave (@oct)
- Duration (@dur)

```
<note pname="c" oct="4" dur="1"/>
```

```
<rest dur="1"/>
```

@dur values

1: whole note

2: half note

4: quarter note

8: eighth note

16: sixteenth note

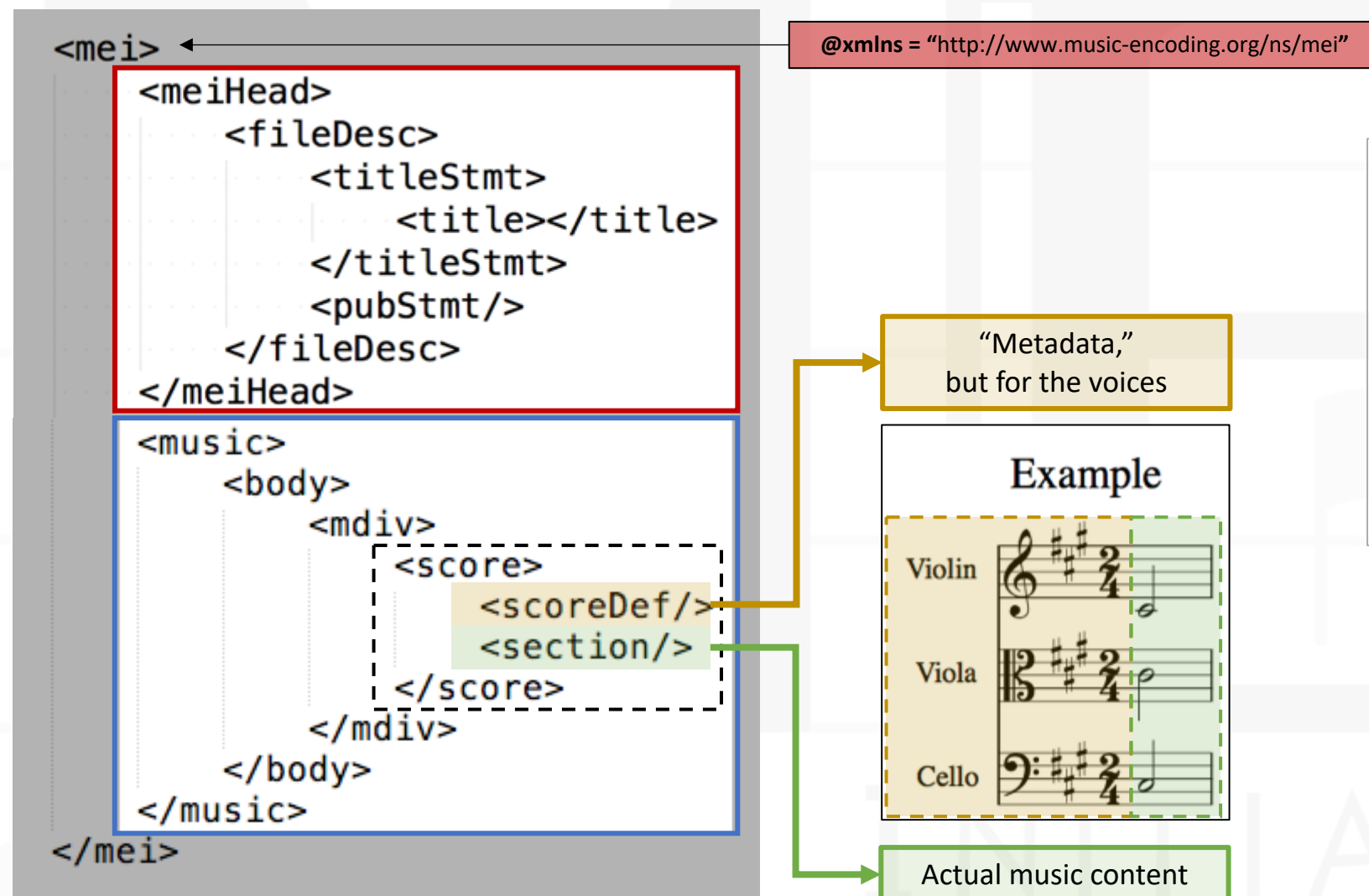
...:

2048: 2048th note

TUTORIAL: <https://music-encoding.org/tutorials/101-quickstart.html>

Example

Common Structure & Example of a Score



In general, this is the common structure for most MEI files.

The content **specific to the piece** is located within the <score> tags (example in next slide)

```

<score>
  <scoreDef meter.count="2" meter.unit="4" key.sig="3s">
    <staffGrp symbol="line">
      <staffDef n="1" label="Violin" lines="5" clef.shape="G" clef.line="2"/>
      <staffDef n="2" label="Viola" lines="5" clef.shape="C" clef.line="3"/>
      <staffDef n="3" label="Cello" lines="5" clef.shape="F" clef.line="4"/>
    </staffGrp>
  </scoreDef>
  <section>
    <measure n="1">
      <staff n="1">
        <layer>
          <note pname="c" oct="4" dur="2"/>
        </layer>
      </staff>
      <staff n="2">
        <layer>
          <note pname="c" oct="4" dur="2"/>
        </layer>
      </staff>
      <staff n="3">
        <layer>
          <note pname="c" oct="3" dur="2"/>
        </layer>
      </staff>
    </measure>
  </section>
</score>

```

Verovio PDF

Example

Violin

Viola

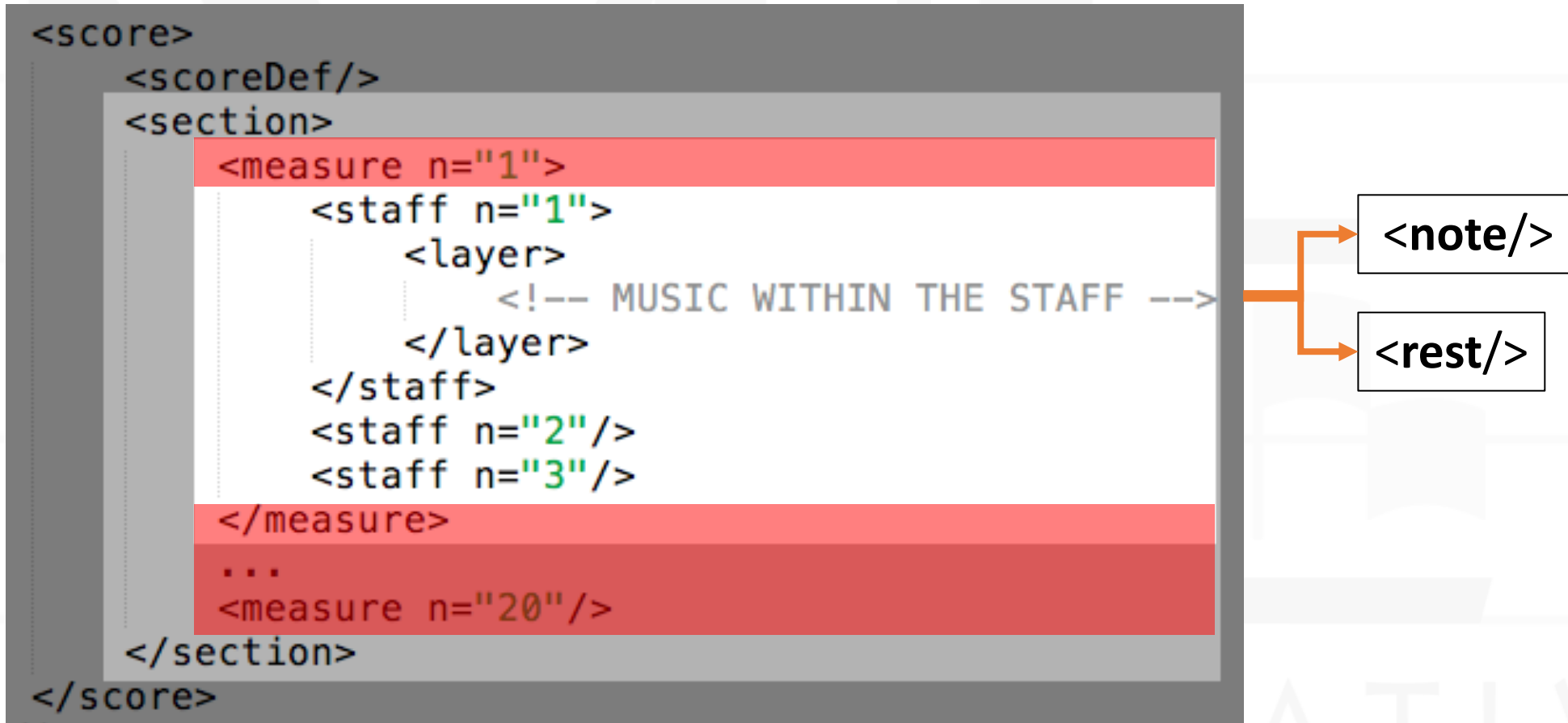
Cello

MUSIC ENCODING

Notes on Early Music

INITIATIVE

Early Music has No Measures!



MUSIC ENCODING

MEI Technologies

Editors and Viewers

Editors and Viewers

- **Editors**

- Oxygen
- Visual Studio Code

- **Viewer** (rendering system)

- *Verovio* (<https://www.verovio.org>)

It has an MEI Viewer (<https://www.verovio.org/mei-viewer.xhtml>)

Verovio Editor

<https://editor.verovio.org/>

The best of both worlds: **Editor & Viewer**

Can be used in Chrome and Firefox (not Safari)

Editors

- Has support for validation
- Auto-completion
- Show a list of valid elements / attributes / values you can use while typing

Need to include these three lines before the <mei> root element. These are known as the XML Processing Instructions:

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <?xml-model href="https://music-encoding.org/schema/4.0.1/mei-all.rng"
  type="application/xml" schematypens="http://relaxng.org/ns/structure/1.0"?>
3 <?xml-model href="https://music-encoding.org/schema/4.0.1/mei-all.rng"
  type="application/xml" schematypens="http://purl.oclc.org/dsdl/schematron"?>
```

MEI Schemas (for different notations): <https://music-encoding.org/resources/schemas.html>

Mensural Notation in MEI

Quick Reminder

Basics of Mensural Notation

Mensural Notation's Issue (in Triple Meter)

longest

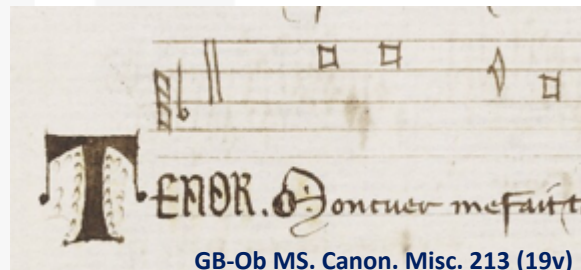


shortest

Notes		Values				
Name	Shape	Perfect (3)			Imperfect (2)	
Maxima						
Long						
Breve						
Semibreve						

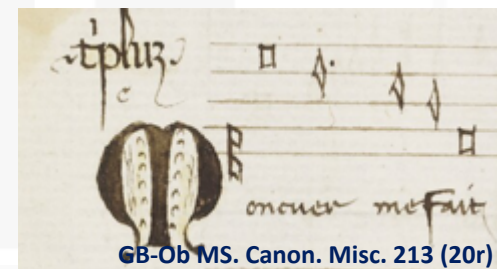
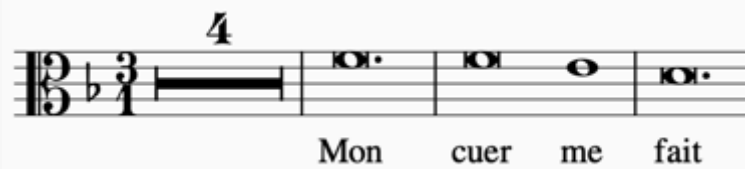
Mensuration

Context



GB-Ob MS. Canon. Misc. 213 (19v)

→ Imperfection



GB-Ob MS. Canon. Misc. 213 (20r)

→ Alteration



MUSIC ENCODING

MEI for Mensural Notation

INITIATIVE

Encoding Notes and Rests

- <note> and <rest>
- With same attributes as in CMN
 - Pitch
 - ❖ @pname
 - ❖ @oct
 - Note shape
 - ❖ @dur
 - ❖ **But with different values**

maxima: Two or three times as long as a longa

longa: Two or three times as long as a brevis

brevis: Two or three times as long as a semibrevis

semibrevis: Half or one-third as long as a brevis

minima: Half or one-third as long as a semibrevis

semiminima: Half as long as a minima

fusa: Half as long as a semiminima

semifusa: Half as long as a fusa

The image shows two staves of musical notation. The top staff is labeled 'notes' and contains a sequence of notes: a square note, a square note with a vertical line extending downwards, a square note with a vertical line extending downwards, a diamond-shaped note, and four diamond-shaped notes. The bottom staff is labeled 'rests' and contains a sequence of rests: a vertical line, a vertical line, a vertical line, a vertical line, and four small horizontal lines.

Note Quality

- @dur.quality (MEI version 5.0)

perfecta: Three times the duration of the note in the next smaller degree

imperfecta: Two times the duration of the note in the next smaller degree

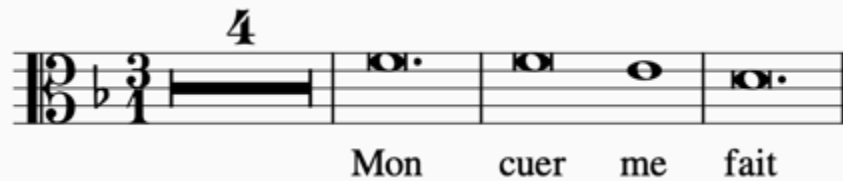
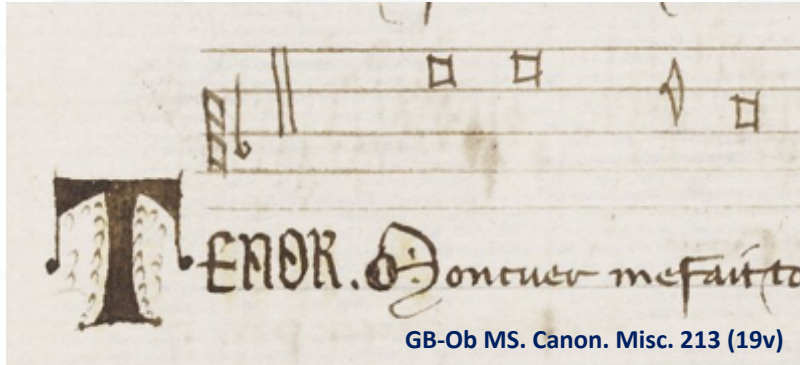
altera: Twice the original duration of the note (only usable in perfect mensurations)

minor: Category of a regular semibrevis in Ars antiqua, equivalent to a third of a brevis

maior: Category of an altered semibrevis in Ars antiqua, equivalent to two minor semibrevis

duplex: One of the three categories of a longa in Ars antiqua ('duplex', 'perfecta', and 'imperfecta')

Note Quality - Imperfection



```
<note dur="brevis" pname="f" oct="4"/>
```

```
<note dur="brevis" pname="f" oct="4" dur.quality="imperfecta"/>
```

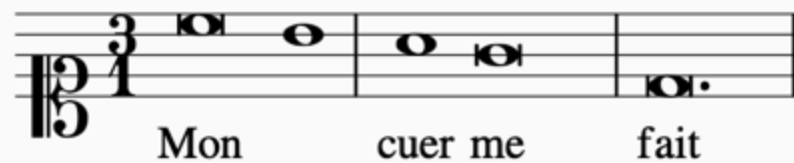
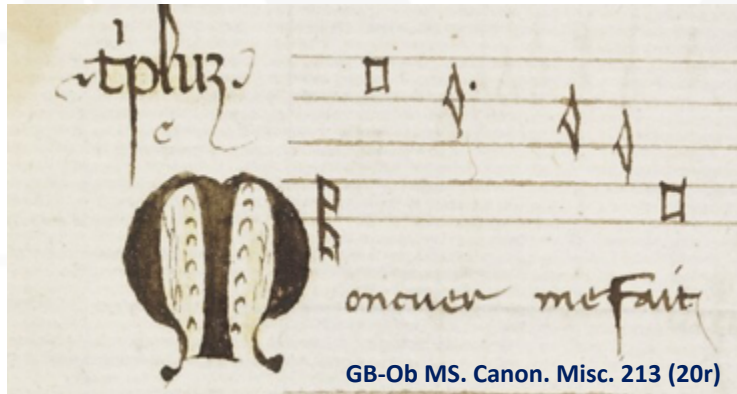
```
<note dur="semibrevis" pname="e" oct="4"/>
```

```
<note dur="brevis" pname="d" oct="4"/>
```

Current version (4.0.1)

- num = "3"
- numbase = "2"

Note Quality - Alteration



```
<note dur="brevis" pname="c" oct="5" dur.quality="imperfecta"/>  
<note dur="semibrevis" pname="b" oct="4"/>  
<dot form="div"/>  
<note dur="semibrevis" pname="a" oct="4"/>  
<note dur="semibrevis" pname="g" oct="4" dur.quality="altera"/>  
<note dur="brevis" pname="d" oct="4"/>
```

Current version (4.0.1)

- num = "1"
- numbase = "2"

Dots (@form)

- Dot of division
 - `<dot form="div"/>`
- Dot of augmentation (or addition)
 - `<dot form="aug"/>`
- `<dot>` is a **sibling** of the `<note>` and `<rest>` elements

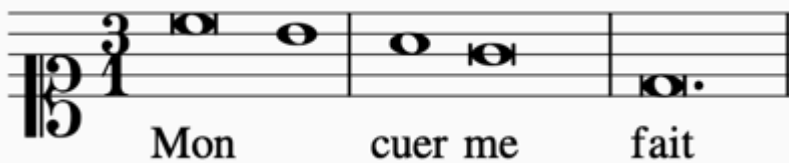
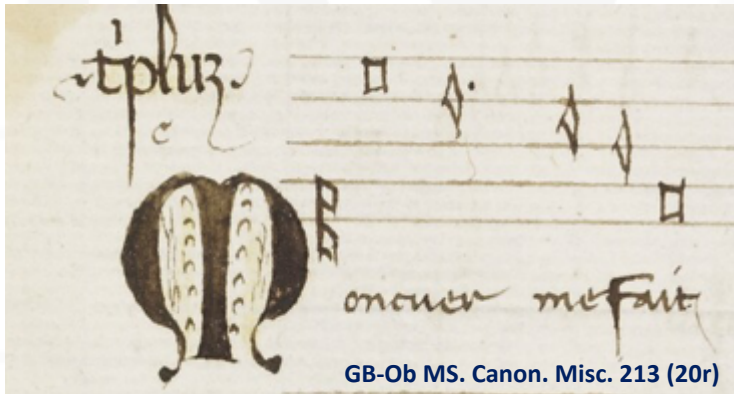
Dots (@form)

- **Dot of division**

- `<dot form="div"/>`

- **Dot of augmentation (or addition)**

- `<dot form="aug"/>`



```
<note dur="brevis" pname="c" oct="5" dur.quality="imperfecta"/>
```

```
<note dur="semibrevis" pname="b" oct="4"/>
```

```
<dot form="div"/>
```

```
<note dur="semibrevis" pname="a" oct="4"/>
```

```
<note dur="semibrevis" pname="g" oct="4" dur.quality="altera"/>
```

```
<note dur="brevis" pname="d" oct="4"/>
```

Dots (@form)

- Dot of division
 - `<dot form="div"/>`
- **Dot of augmentation (or addition)**
 - `<dot form="aug"/>`



```
<note dur="semibrevis" dur.quality="perfecta"/>
```

```
<dot form="aug"/>
```

```
<note dur="minima"/>
```

Current version (4.0.1)

- num = "2"
- numbase = "3"

Coloration (@colored = true)

```
<note colored="true"/>
```

- Additionally, use @dur.quality (or @num and @numbase) to encode the effect of the coloration



```
<note dur="brevis"/>
```

```
<note dur="semibrevis" colored="true" dur.quality="imperfecta"/>
```

```
<note dur="semibrevis" colored="true" dur.quality="imperfecta"/>
```

```
<note dur="minima" colored="true"/>
```

```
<note dur="minima" colored="true"/>
```

```
<note dur="brevis"/>
```

Mensuration = Meter (in CMN)

- Using the mensural module, mensuration signs can be indicated with the attributes available on the [<scoreDef>](#) and [<staffDef>](#) elements.

The division levels corresponding to *modus maior*, *modus minor*, *tempus*, and *prolatio* can be encoded in the **@modusmaior**, **@modusminor**, **@tempus**, and **@prolatio** attributes respectively. Their value must be 3 (perfect) or 2 (imperfect).

- <>** **@modusmaior** —————
Describes the maxima-long relationship.
- <>** **@modusminor** —————
Describes the long-breve relationship.
- <>** **@tempus** —————
Describes the breve-semibreve relationship.
- <>** **@prolatio** —————
Describes the semibreve-minim relationship.

Notes		Values			
Name	Shape	Perfect (3)		Imperfect (2)	
Maxima	☐	☐	☐	☐	☐
Long	☐	◻	◻	◻	◻
Breve	◻	◊	◊	◊	◊
Semibreve	◊	⋮	⋮	⋮	⋮

@notationtype

- Provide a **@notationtype** in `<staffDef>` → **Verovio** renders the right notation
- If you are using the Verovio Editor and you don't provide a **@notationtype**, the Verovio Editor will stop working

Context	@notationtype Values
Mensural notation	"mensural"
	"mensural.black"
	"mensural.white"
Neume notation	"neume"
Common Western music notation	"cmn"



Ligatures

- <ligature> element as parent of the <note> elements that are part of the ligature
- <ligature> is a child of <layer>

```
<ligature>  
  <note dur="brevis" pname="c" oct="5"/>  
  <note dur="longa" pname="g" oct="4"/>  
</ligature>
```



- Based on the note values, Verovio will render the right ligature form

Ligatures

- <ligature> element as parent of the <note> elements that are part of the ligature
- <ligature> is a child of <layer>

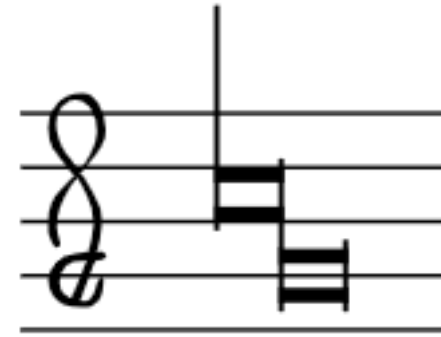
```
<ligature>  
  <note dur="brevis" pname="c" oct="5"/>  
  <note dur="brevis" pname="g" oct="4"/>  
</ligature>
```



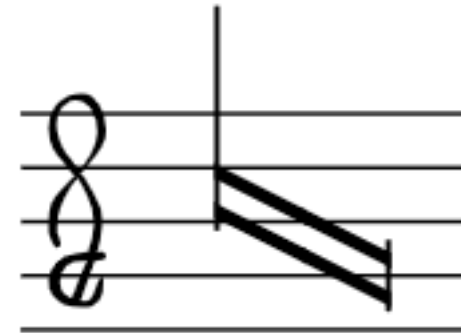
- Based on the note values, Verovio will render the right ligature form

Ligatures with Semibreves (@form)

```
<ligature form="recta">  
  <note dur="semibrevis" pname="c" oct="5"/>  
  <note dur="semibrevis" pname="g" oct="4"/>  
</ligature>
```



```
<ligature form="obliqua">  
  <note dur="semibrevis" pname="c" oct="5"/>  
  <note dur="semibrevis" pname="g" oct="4"/>  
</ligature>
```



Ligatures of More than Two Notes

<ligature>

<note dur="semibrevis" pname="g" oct="4"/>

<note dur="semibrevis" pname="e" oct="4"/>

<note dur="brevis" pname="a" oct="4"/>

<note dur="brevis" pname="e" oct="4"/>

<note dur="brevis" pname="a" oct="4"/>

<note dur="longa" pname="c" oct="5"/>

</ligature>



Ligatures of More than Two Notes

<ligature>

<note dur="semibrevis" pname="g" oct="4"/>

<note dur="semibrevis" pname="e" oct="4"/>

<note dur="brevis" pname="a" oct="4" lig="obliqua"/>

<note dur="brevis" pname="e" oct="4"/>

<note dur="brevis" pname="a" oct="4"/>

<note dur="longa" pname="c" oct="5"/>

</ligature>

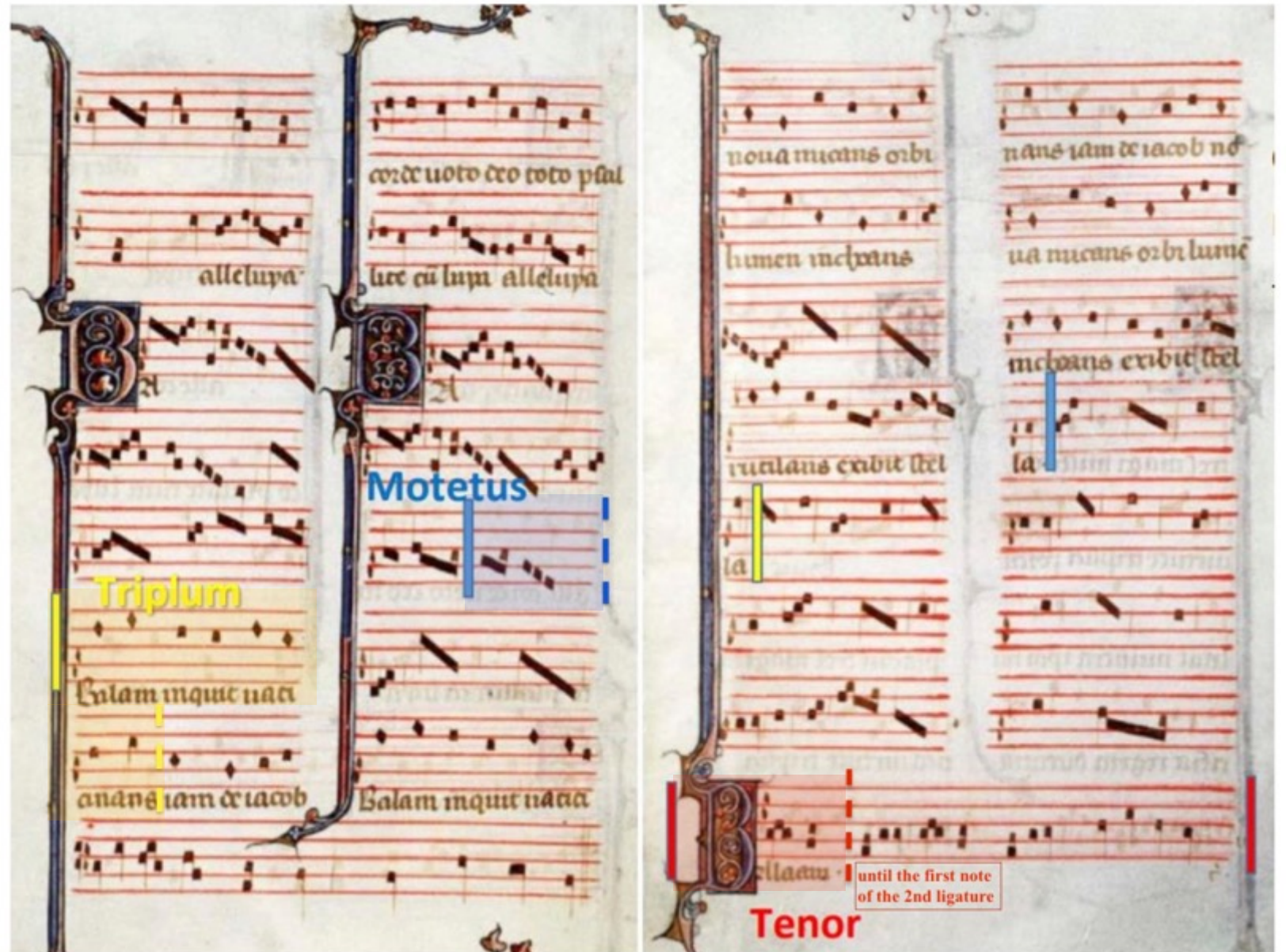


In-Class Exercise

Balam inquit vaticinans
(from Montpellier)

Steps:

- Open the Verovio Editor
- Import the file "ReadyToGo_mensural.mei"
 - File → Import MEI file
- Enter title
- In staffDef
 - Enter voice label
 - Enter clefs
 - Enter mensuration
- In layer
 - Transcribe the notes
 - Add the perfect / imperfect / altered values to the notes (using @num and @numbase)



Thank you!

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SIMSSA | Single Interface for Music
| Score Searching and Analysis



Social Sciences and Humanities
Research Council of Canada

Conseil de recherches en
sciences humaines du Canada

Canada 