

# Codes for data archiving, interchange, and analysis

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Music 253/CS 275A  
Stanford University

# Distinguishing features

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- Neither *time* nor *space* is a dominant consideration
- Focus is on **repurposable data**, interoperability
- Examples
  - *Archiving*: canonical format that facilitates interoperability
  - *Interchange*: canonical format that is easily interpreted by sending and receiving systems whose formats may be unknown
  - *Analysis*: flexible format that can be modified to suit a range of needs (can sometimes be distilled from richer format)

# Distinguishing features

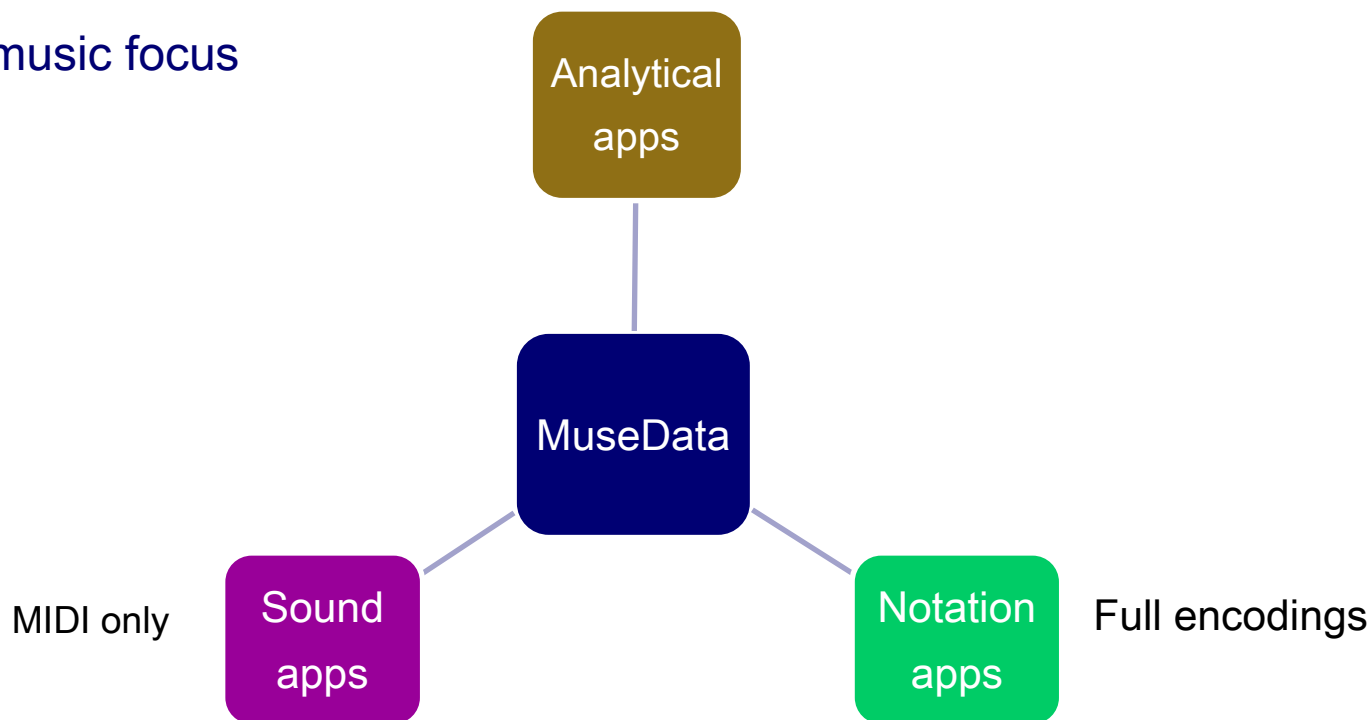
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- Neither *time* nor *space* is a dominant consideration
- *Environment* may be extensive; focus on interoperability
- Examples
  - *Archiving*: EsAC (monophonic), MuseData (polyphonic)
  - *Interchange*: MusicXML, MEI
  - *Analysis*: Humdrum Toolkit (main format = *kern*)

# *MuseData's* “solar” network model

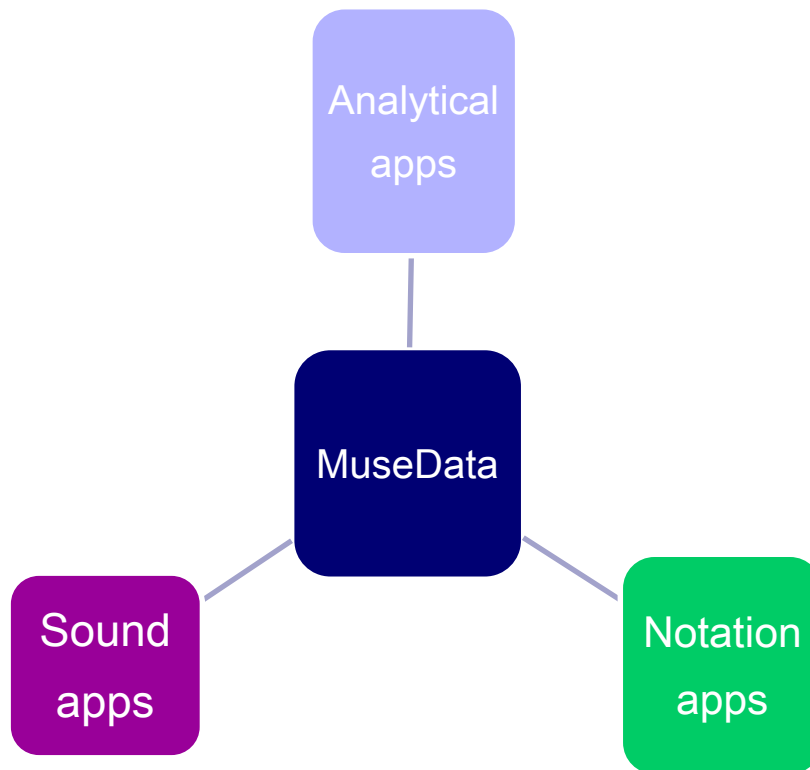
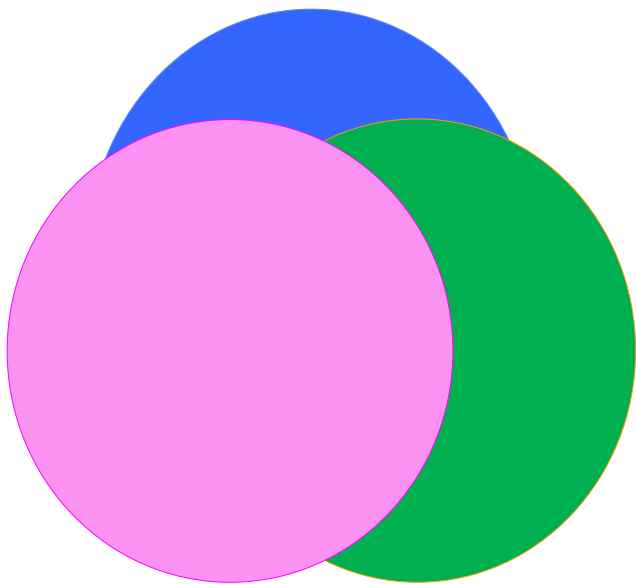
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Classical music focus



# Comparison of models

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# MuseData: Turkish march



Print suggestions

Sound suggestions

chord


Print  
suggestion

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WK#:331 MV#:3
Breitkopf & H\u00e4rtel
Piano Sonata

1 0
Group memberships: sound, score
sound: part 1 of 1
score: part 1 of 1
&
Initial conversion from stage 1 to
stage 2
&
$ K:3 Q:4 T:2/4 C1:4 C2:22
C#6 8 h u1 S
back 8 1
d1
d1
d1
back 4
gA2 4 t u2 [[[ [
gC#3 4 t u2 ===
gE3 4 t u2 ]]]
A3 2 e d2 [ ]
A3 2 e d2 =
A3 2 e d2 =
A3 2 e d2 ]
measure 2
D6 1 s d1 [( (
C#6 1 s d1 == )
B5 1 s d1 == .
C#6 1 s d1 ]] .
D6 1 s d1 [( (
C#6 1 s d1 == )
B5 1 s d1 == .
```

# Part/score orientation in *MuseData*

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



A musical score for four instruments: violino I, violino II, viola, and violoncello. The score is presented in a vertical orientation, with each instrument's part on a separate staff. The staves are labeled on the left. The music is in 2/4 time and features various rhythmic patterns and dynamics, including a forte (f) marking. A light blue rounded rectangle is positioned above the score.



A musical score for voice and piano accompaniment. The score is presented in a vertical orientation, with the voice part on the top staff and the piano accompaniment on the bottom three staves. The piano part includes dynamic markings such as piano (p) and piano fortissimo (p<sup>ff</sup>). A light blue rounded rectangle is positioned above the score.

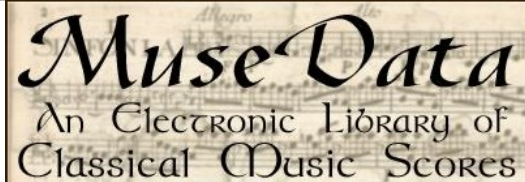
# Part/score orientation in Humdrum

1. Encode event by event for full movement
2. Add lyrics, other refinements
3. Repeat until all movements are encoded

The image displays a musical score for a string quartet, featuring five staves: clarinet in A, violino I, violino II, viola, and violoncello. A vertical yellow bar highlights a specific section of the score, spanning across all five staves. The score is written in a key signature of two sharps (F# and C#) and a 2/4 time signature. The highlighted section is located in the middle of the first system and continues into the second system. The notation includes various musical symbols such as notes, rests, and dynamic markings.



# Encoding in multiple domains: Actualities



## Work Information

<i>Composer</i>	Haydn, Franz Joseph
<i>Title</i>	Symphony in E-flat Major
<i>Popular Title</i>	Drumroll
<i>Scholarly catalog num.</i>	H I 103
<i>Copyright notice</i>	Copyright (c) 1994, 2000 Center for Computer Assisted Music Studies
<i>Copyright message</i>	Rights to all derivative editions reserved.
<i>Copyright message</i>	Refer to licensing agreement for further details.
<i>Scholarly catalogue</i>	Thematisch-bibliographisches Werkeverzeichniss (A. Henkel)
<i>Derived from</i>	Dover Edition, reprint of Eulenburg Edition
<i>Encoding state</i>	stage2
<i>Error reports</i>	None [Submit error report]

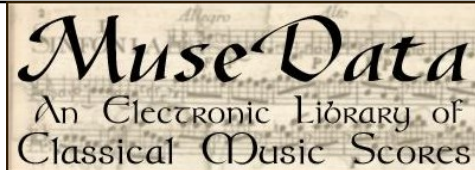
## Musical Data

	<i>kern</i>	<i>MIDI</i>	<i>PDF</i>	<i>SCORE</i>	<i>stage2</i>	<i>parts</i>
<i>Entire work</i>	all	all	all	all	all	
<i>By movement:</i>						
1. Adagio -- Allegro con spirito	01	01	01	01	01	01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 s01 s02 s03 s04 s05 s06 s07 s08 s09 s10 s11 s12
2. Andante	02	02	02	02	02	01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 s01 s02 s03 s04 s05 s06 s07 s08 s09 s10 s11
3. Menuetto and Trio	03	03	03	03	03	01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 s01 s02 s03 s04 s05 s06 s07 s08 s09 s10 s11
4. Finale	04	04	04	04	04	01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 s01 s02 s03 s04 s05 s06 s07 s08 s09 s10 s11

Adagio

[musedata.org](http://musedata.org)

# Encoding in multiple domains: samples



## From PDF list

Haydn, Franz Joseph	<a href="#">Symphony in E-flat Major, H I:99</a> <a href="#">Symphony in G Major ("Military"), H I:100</a> <a href="#">Symphony in D Major ("The Clock"), H I:101</a> <a href="#">Symphony in B-flat Major, H I:102</a> <a href="#">Symphony in E-flat Major ("Drumroll"), H I:103</a>
Vivaldi, Antonio	<a href="#">Concerto in E Major ("La Primavera"), Op. 8, No. 1</a> <a href="#">Concerto in G Minor ("L'Estate"), Op. 8, No. 2</a> <a href="#">Concerto in F Major ("L'Autunno"), Op. 8, No. 3</a> <a href="#">Concerto in F Minor ("L'Inverno"), Op. 8, No. 4</a> <a href="#">Concerto in E-flat Major ("La Tempesta di Mare"), Op. 8, No. 5</a> <a href="#">Concerto in C Major ("Il Piacere"), Op. 8, No. 6</a> <a href="#">Concerto in D Minor, Op. 8, No. 7</a> <a href="#">Concerto in G Minor, Op. 8, No. 8</a> <a href="#">Concerto in D Minor, Op. 8, No. 9</a> <a href="#">Concerto in B-flat Major ("La Caccia"), Op. 8, No. 10</a> <a href="#">Concerto in D Major, Op. 8, No. 11</a> <a href="#">Concerto in C Major, Op. 8, No. 12</a>

## From MIDI file list

Beethoven, Ludwig van	<a href="#">Piano Concerto No. 2 in B-flat Major, Op. 19</a> <a href="#">Violin Concerto in D Major, Op. 61</a> <a href="#">Symphony No. 5 in C Minor, Op. 67</a>
Haydn, Franz Joseph	<a href="#">Symphony in D Major, H I:1</a> <a href="#">String Quartet in C Major, H III:57</a> <a href="#">Symphony in E-flat Major, H I:99</a> <a href="#">Symphony in G Major ("Military"), H I:100</a> <a href="#">Symphony in D Major ("The Clock"), H I:101</a> <a href="#">Symphony in B-flat Major, H I:102</a> <a href="#">Symphony in E-flat Major ("Drumroll"), H I:103</a> <a href="#">Symphony in D Major ("London"), H I:104</a>

## Work Information

*Composer* Haydn, Franz Joseph  
*Title* Symphony in E-flat Major  
*Popular title* Drumroll  
*Scholarly catalog num.* H I:103  
*Copyright notice* Copyright (c) 1994, 2000 Center for Computer Assisted Research in the Humanities  
*Copyright message* Rights to all derivative editions reserved  
*Copyright message* Refer to licensing agreement for further details  
*Scholarly catalogue* Thematik-bibliographisches Werkeverzeichnis (A. van Hoboken)  
*Derived from* Dover Edition, reprint of Eulenburg Edition  
*Encoding state* page2  
*Error reports* None [Submit error report]

## Musical Data

	kern	MIDI	PDF	SCORE	stage2	parts
<i>Entire work</i>	all	all	all	all	all	
<i>By movement:</i>						
1. Adagio -- Allegro con spirito	01	01	01	01	01	01 02 03 04 05 06 07 08 09 10 11 12 1312e1414e151617 401 402 403 404 405 406 407 408 409 410 411 412
2. Andante	02	02	02	02	02	01 02 03 04 05 06 07 08 09 10 11 121314151617 401 402 403 404 405 406 407 408 409 410 411
3. Menuetto and Trio	03	03	03	03	03	01 02 03 04 05 06 07 08 09 10 11 121314151617 401 402 403 404 405 406 407 408 409 410 411
4. Finale	04	04	04	04	04	01 02 03 04 05 06 07 08 09 10 11 12131415161718 401 402 403 404 405 406 407 408 409 410 411