

Codes for data archiving, interchange, and analysis

Music 253/CS 275A
Stanford University

Distinguishing features

- 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

- 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*)

All ASCII

EsAC network model (1982-1994)

Folk music research

Developed in Essen, DE, by Helmut Schaffrath from the [Kiel/DVA archive](#) and other sources

esac-data.org

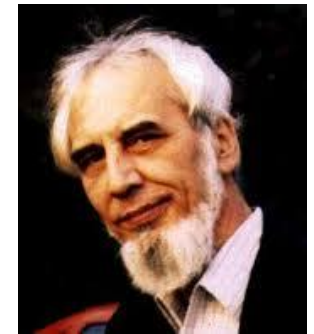
Often transcribed
by hand

Sound
apps

EsAC

Analytical
apps

Mainly assigned to students



Above: H. Schaffrath,
L: Ewa Dahlig

Notation
apps

Often simplified,
No text underlay

EsAC code vs other codes

Pitch relative to a “tonic”



ESAC: +1 +3 +5 +3 ++1_ +5 +3 +2 +1 +6_ +1 +2 +1 7 +3 +2 +5 +4 +2#_+3_

a JIANPU: 1 3 5 3 1 5 3 2 4 6 4 2 1 7 3 2 5 4 #2 3

b DARMS1: 26E 28E 30E 28E 33Q 30E 28E (etc.)

c DARMS2: 6E 8E 10E 8E 13Q 10E 8E (etc.)

d SCORE: c5/e/w/ g/e/c6/g5/e/w/ d/f/ a/ f/ d/ w (etc.)
ex4/ q/ex4/

e MTeX: \a 5\a 7 : \a9\a7\v12\a9\a7\% (etc.)

Duration relative to a stated value

Octave relative to central 8ve

Mozart trio (EsAC with 5 data translations

<http://esac-data.org/>

<http://kern.humdrum.org/search?s=t&keyword=essen&type=Text>

EsAC: Essen Folksong Collection

□ Monophonic music (8500 songs)

□ Purposes

- Archiving
- Comparing versions
- Teaching
- Sound output

Three staves of musical notation with numerical annotations below them. The first staff has a box around '+1 +3 +5 +3 ++1_' and other numbers. The second and third staves have boxes around '1_ 3_ 5_ 3_ +1_'. Arrows point from the 'Purposes' list to these staves.

□ Contributions

- Earliest model of analysis (Leppig, 1987)

Analytical recoding

Pitch and duration uncoupled

Code-recode comparison

R: nearest matches for Mozart trio

Three staves of musical notation labeled 'Mozart', 'B0397', and 'E0699A'. Above the first staff is the text 'First lines Mozart'. Arrows point from the 'Code-recode comparison' box to each staff.

MuseData : overview

- ❑ Name of online repository
- ❑ Name of encoding language
- ❑ Developed by **Walter Hewlett**
(from 1982)
- ❑ Served by **CCARH**
- ❑ Many implementations,
extensions, refinements by **Craig Sapp**
- ❑ Largest **verified** dataset online

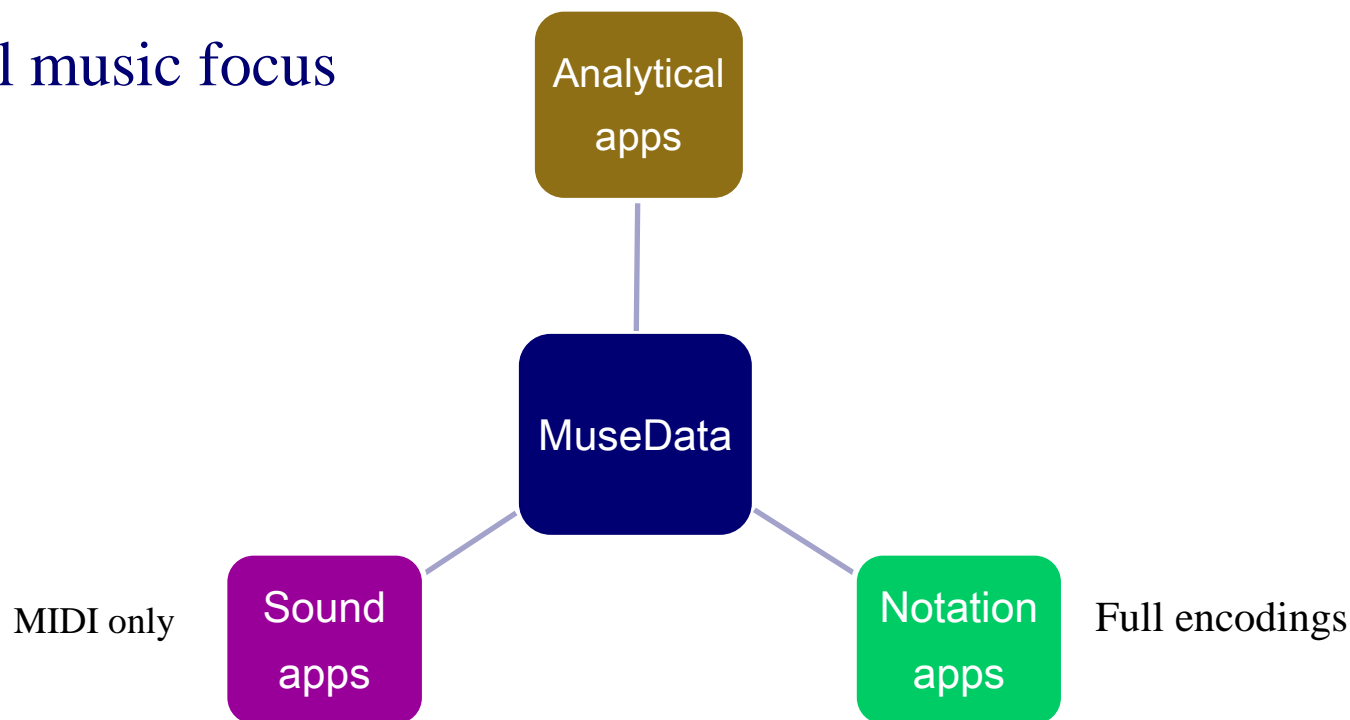


<http://www.musedata.org>

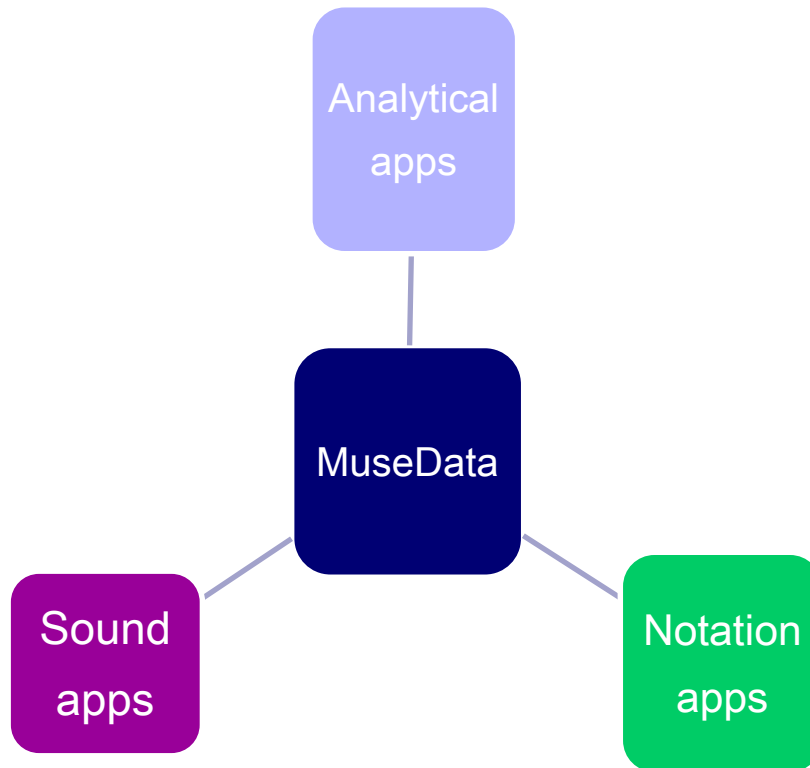
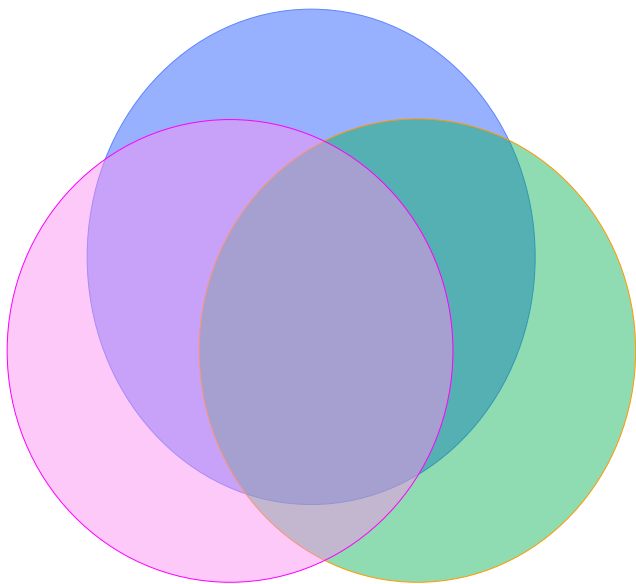


MuseData's “solar” network models

Classical music focus

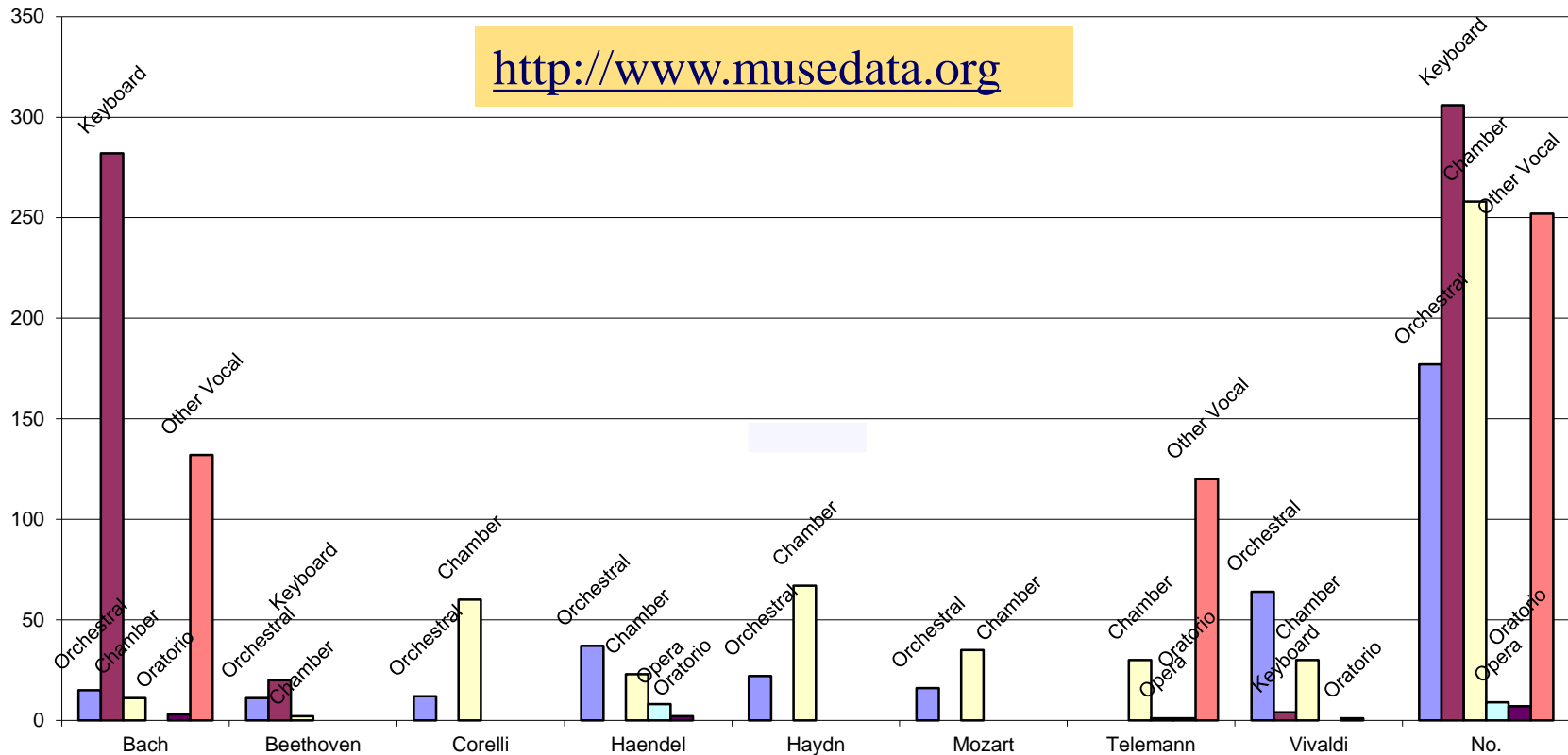


Comparison of models



MuseData encodings (2012)

c. 1250 works



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

The image displays two musical score excerpts. The top excerpt shows a system of five staves: 'clarinet in A' (top), 'violino I', 'violino II', 'viola', and 'violoncello' (bottom). The 'clarinet in A' staff is highlighted with a light blue background. The bottom excerpt shows a system of five staves with a 'S' above the first staff. The first staff is highlighted with a light blue background. The second staff has a 'p' dynamic marking, and the third, fourth, and fifth staves have 'pi' dynamic markings.

MuseData: encoding

- Two-step process
 - MIDI-level data
 - Non-sounding data
- Serial processes
- Storage formats
 - Stage 1 (pitch, duration)
 - Stage 2 (stems, lyrics, etc)
 - Internal format (notation)

The screenshot shows the MuseData website interface. At the top, there are navigation links: About *MuseData*, Repertoires, Works and Title Numbers, Sources, Data Formats [*MuseData* | Humdrum | MIDI1 | MIDI+], and Legal Considerations. Below the links is a search bar with the text "Search:" and a text input field. Underneath the search bar are two links: "[Printable Scores/Parts | MIDI1 files for listening]". The main content is a table with the following data:

<i>composer's name</i>	<i>number of encoded compositions</i>	<i>movements (approx.)</i>	<i>PDF files (by work)</i>
Johann Sebastian Bach	417	1534	51 (418 pages)
Ludwig van Beethoven	10	58	9 (1339 pages)
Arcangelo Corelli	72	363	0
Antonin Dvorák	1	0	0
George Frederick Handel	80	904	0
Franz Josef Haydn	87	352	12 (693 pages)
Benedetto Marcello	1	3	0
Wolfgang Amadeus Mozart	47	171	0
Giovanni Rovetta	1	9	0
Georg Philipp Telemann	109	553	0
Antonio Vivaldi	56	168	12

MuseData: Turkish march



Distinguishes written from logical durational value

Print suggestions

Sound suggestions

chord

Print suggestion

```
WK#:331 MV#:3
Breitkopf & H3artel
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
A5 4 q d1
E5 4 q d1
C#5 4 q d1
back 4
gA2 4 t u2 [[[ [
P C33:o
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 == .
```

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 Werkverzeichnis (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

Encoding in multiple domains: samples



From PDF list

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

From MIDI file list

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

Work Information

Composer Haydn, Franz Joseph
Title Symphony in E-flat Major
Popular title Drumroll
Scholarly catalogue 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 Thematic-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 1312e141e151617 e11 e12 e13 e14 e15 e16 e17 e18 e19 e10 e11 e12
2. Andante	02	02	02	02	02	01 02 03 04 05 06 07 08 09 10 11 121314151617 e11 e12 e13 e14 e15 e16 e17 e18 e19 e10 e11
3. Menuetto and Trio	03	03	03	03	03	01 02 03 04 05 06 07 08 09 10 11 121314151617 e11 e12 e13 e14 e15 e16 e17 e18 e19 e10 e11
4. Finale	04	04	04	04	04	01 02 03 04 05 06 07 08 09 10 11 12131415161718 e11 e12 e13 e14 e15 e16 e17 e18 e19 e10 e11