

Introduction to Humdrum

Music 253/CS 275A
Stanford University

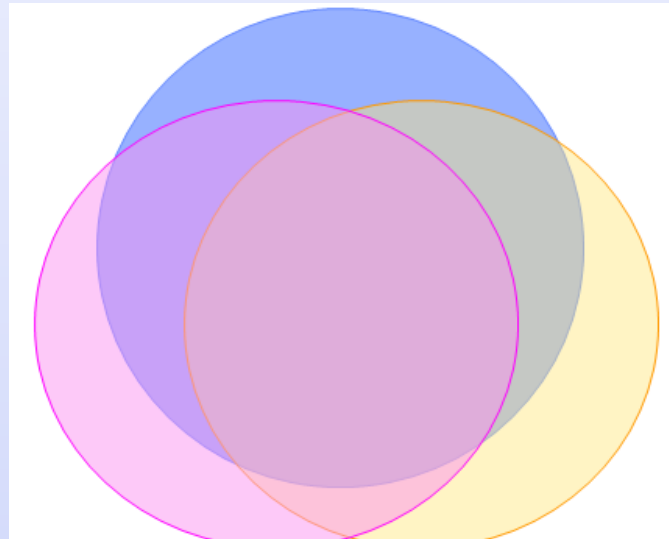
Where we've been

□ Sound apps

- Temporal or
- Sounding pitch

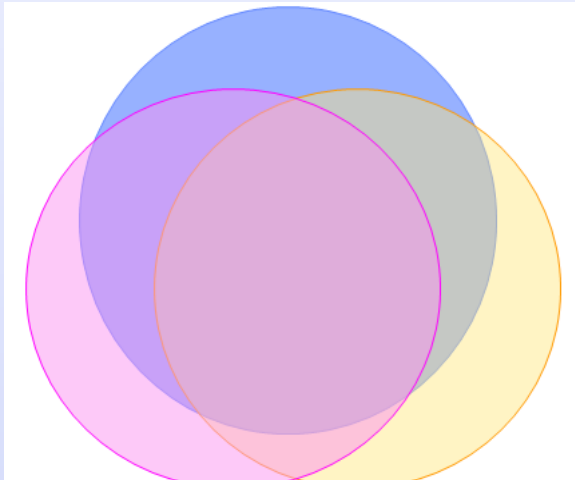
□ Score apps

- Spatial org
- Written pitch



“Logical” information (for analysis)

- No necessary requirements for
 - **Sound** description
 - **Page** description



- Possible requirements
 - **Gestural** information
 - Selective details of notation or sound
 - **Cues** to formal structure
 - **Accentual info**

Humdrum Toolkit (1985—)

- *Goal*: encoding for analysis
- *Inventor*: David Huron
- *Orientation*: Context-free grammar
 - Adaptable to many repertoires (incl. non-Western)
 - *Not directly printable* [based on Unix]
 - Offers a wide range of representations
 - Features and representations can be extended
 - Features can be minimized or excluded
- *Availability*:
 - Extensive documentation online
 - Tool set (official version) downloadable



Local resources for Humdrum

- CCARH Humdrum **Portal**: <http://humdrum.ccarh.org/>
- **Downloads** of the Toolkit:
<http://extras.humdrum.org/download/>
- Sapp **extras**: <http://extras.humdrum.org/>
- **Data** in the ****kern** form (CMN format for Humdrum TK):
<http://kern.ccarh.org/>
- Humdrum users group: ****hug**
- **Verovio** Humdrum Viewer (VHV):
<http://verovio.humdrum.org>

Overview (comparative)

- MIDI: Sound
- SCORE: Graphics
- MuseData: Core rep.
- MusicXML: interchange
- ****kern: Analysis data**
- **Event-based** →
 - Binary; time-ordered; var-length; score Types 0, 1]
- **Object-based** →
 - ASCII; score/spatially- ordered; var. no fields
- **Event-based** →
 - ASCII; fixed/expandable; part-ordered [=MIDI Type 1]
- **Attribute/element-based**
 - ASCII; fixed/expandable; time- or score-ordered
 - ASCII; score-ordered but no spatial information [=MIDI Type 0]; selective attribute encoding permitted
- **Event-based**

A Humdrum ****kern** file

!!!OTL: Frere Jacques

!!!YEC: ESF 1999

****kern**

****text**

*M4/4

*k[]

!soprano

!!First phrase

=1

4c

4d

4e

4c

=2

4c

4d

4e

4c

!lyrics

=1

Fre-

re

Jac-

ques,

=2

Fre-

re

Jac-

ques,

Spines

!!Fourth phrase

=7

4c

4G

2c

=8

4c

4G

2c

=9

*_

=7

Din,

don,

din.

=8

Din,

don,

din.

=9

*_

Decoding a Humdrum file

Comment records:

- !!! **Reference** records
- !! **Global** comments
- ! **Local** comments

Interpretation records:

- ** **Exclusive** interpretation
- * **Tandem** interpretation
- *>**x** Form marker
- *- **End-of-spine** marker

Measure markers:

- = Single bar-line
- == Double bar-line

Tandem interpretations:

- *staff<1> staff no.
- *clef<G2> clef name
- *<G:> key name
- *k[f#c#] key signature
- *M<2/4> meter signature

Semiotic aspects of Humdrum

- **Multiple understandings** of individual terms
- A sample problem of **nomenclature**: pitch
- Humdrum's answers (e.g.)
 - Notated pitch
 - Concert pitch
 - Relative pitch
 - Fundamental frequency
 - Cents
 - Interval
 - Scale degree
 - MIDI note number
 - Visual appearance.....

Humdrum in relation to music

Relies heavily on **Unix commands** and syntax

- ❑ Unix regular expressions (`grep`)
- ❑ File-manipulation commands (`assemble`, `yank`)
- ❑ Sound-management tools (`record`, `perform`)
- ❑ Pitch translation tools (`frequency`, `cents`)
- ❑ Duration and accent tools (`beat`, `accent pos.`)
- ❑ Melody tools (e.g. `melodic intervals`)
- ❑ Harmony tools (e.g. `harmonic intervals`)
- ❑ Other music-theory tools (e.g. `tone-row`, `pitch-class sets`)

Pre-defined representations (49)

- pitch-class
- semitones, cents, MIDI, critical bands, cochlear coordinates
- melodic interval, harmonic interval
- absolute time, relative time, duration, epoch, date
- tablatures: guitar, lute, banjo, sitar ...
- harmony, embellishments

Special qualities of Humdrum

Harmonic
analysis
keyscape

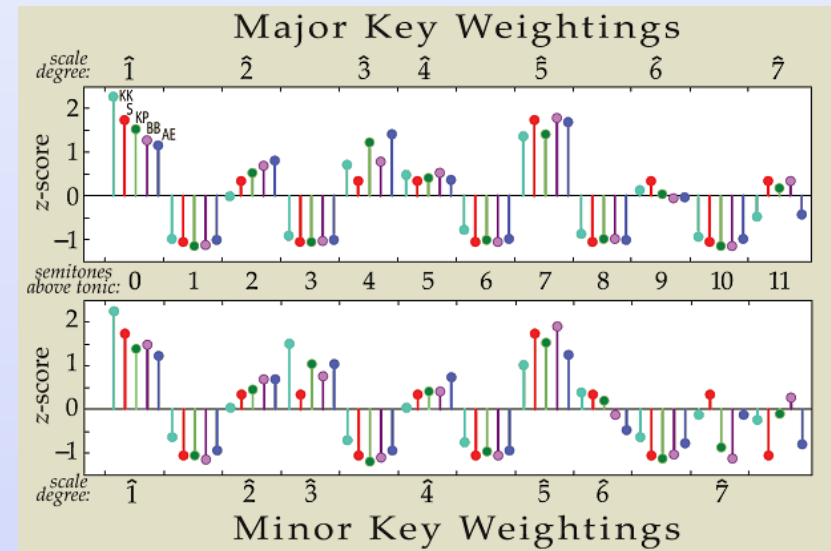
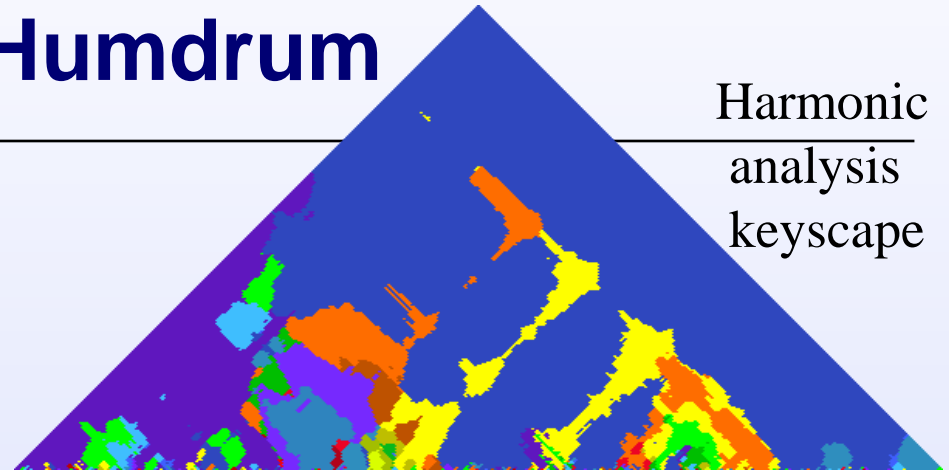
- Very elastic

Base-40 pitch numbers



A musical score in 3/4 time, consisting of four staves. The top two staves are in treble clef, and the bottom two are in bass clef. The score is annotated with base-40 pitch numbers below each note. The numbers are: 179, 174, 168, 208, 202, 197, 191 (top staff); 151, 168, 163, 151, 179, 157, 162, 168, 162 (second staff); 139, 145, 151, 139, 157, 151, 146, 134 (third staff); 128, 111, 128, 128, 134, 111 (bottom staff).

- open, documented
- extensible



What's new in Humdrum?

List view


□ **Verovio:**
verovio.humdrum.org

VerovioHumdrumViewer ?

1. Aus meines Herzens Grunde, BWV 269
2. Ich dank dir, lieber Herre, BWV 347
3. Ach Gott vom Himmel sieh darein, BWV 153/1
4. Es ist das Heil uns kommen her, BWV 86/6
5. An Wasserflüssen Babylon, BWV 267
6. Christus, der ist mein Leben, BWV 281
7. Nun lob, mein Seel, den Herren, BWV 17/7
8. Freuet euch, ihr Christen alle, BWV 40/8
9. Ermuntre dich, mein schwacher Geist, BWV 248/12
10. Aus tiefer Not schrei ich zu dir, BWV 38/6 (Phrygian)
11. Jesu, nun sei gepreiset, BWV 41/6 & 171/6

VerovioHumdrumViewer ?

```
1  **kern
2  *M4/4
3  *clefG2
4  =1-
5  (<8f^<L<@
6  8g'~N
7  8a~<N
8  8b~~JZ
9  2/ee#M<'~;>)
10 ==
11 *-
12 !!!RDF**kern: < = below
13 !!!RDF**kern: > = above
14 !!!RDF**kern: @ = marked note color="orchid"
15 !!!RDF**kern: N = marked note color="#8855ff"
16 !!!RDF**kern: Z = marked note color="yellowgreen"
17
```



Work of Laurent Pugin (notation)
Craig Sapp (Humdrum implementation)

The other end of Verovio development

<http://www.verovio.org/index.xhtml> (Laurent Pugin, Berne)

Verovio

Home How it works Tutorial MEI Viewer Other formats

A music notation engraving library

Designed for the Music Encoding Initiative - Fast - Light - Flexible - No dependencies

Verovio is a fast, portable and lightweight **open-source** library for engraving **Music Encoding Initiative (MEI)** music scores into SVG.

Verovio follows the **Standard Music Font Layout** specification, which makes it easy to change the music font for [personalizing the appearance](#).

MUSIC ENCODING INITIATIVE **SMuFL**
Standard Music Font Layout

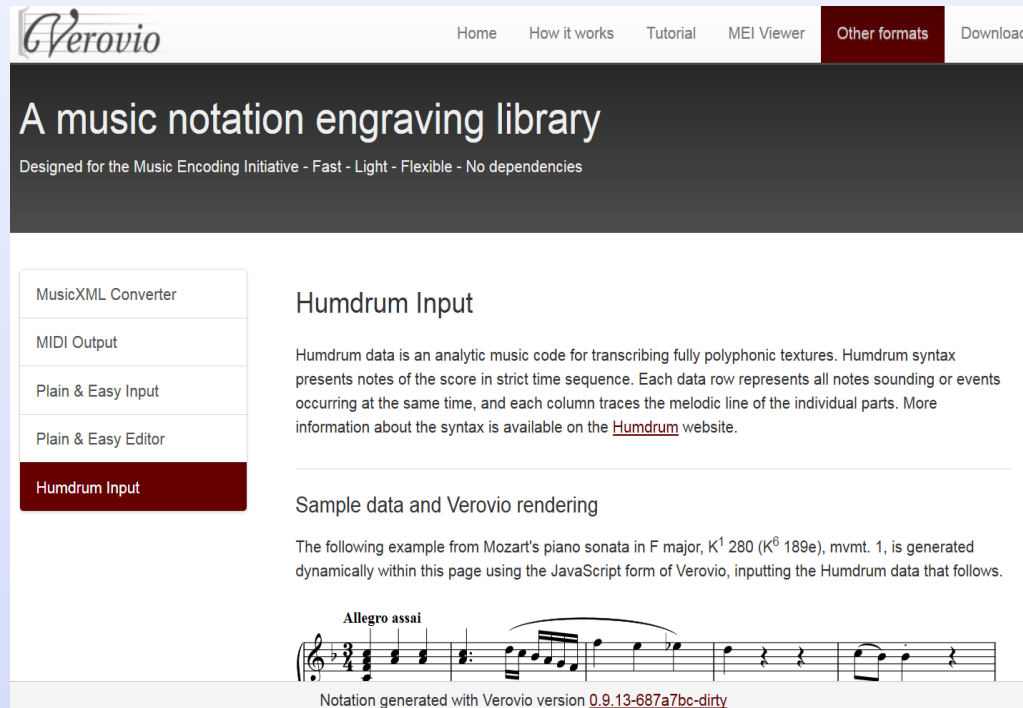
Singstimme *Mässig.*

Am Brunnen vor dem Thore, da
Ich musst' auch heute wandern vor
Die kalten Winde bliesen mir

Pianoforte *p*

Verovio for Humdrum viewing

- <http://www.verovio.org/humdrum.xhtml>



The screenshot shows the Verovio website interface. At the top, the Verovio logo is on the left, and navigation links for Home, How it works, Tutorial, MEI Viewer, Other formats, and Download are on the right. The main heading is "A music notation engraving library" with the tagline "Designed for the Music Encoding Initiative - Fast - Light - Flexible - No dependencies". A sidebar on the left contains a menu with options: MusicXML Converter, MIDI Output, Plain & Easy Input, Plain & Easy Editor, and Humdrum Input (which is highlighted in red). The main content area is titled "Humdrum Input" and contains a paragraph explaining that Humdrum data is an analytic music code for transcribing fully polyphonic textures. Below this is a section titled "Sample data and Verovio rendering" which includes a paragraph stating that the following example from Mozart's piano sonata in F major, K¹ 280 (K⁶ 189e), mvmt. 1, is generated dynamically. Below the text is a musical score snippet for "Allegro assai" in 3/4 time, showing a treble clef and a series of notes and rests. At the bottom of the snippet, it says "Notation generated with Verovio version 0.9.13-687a7bc-dirty".

File with code and notation

VerovioHumdrumViewer ◀ ▶ ▶ Bach, Chorale 5. *An Wasserflüssen Babylon*, BWV 267 ? Play

1	!!!COM:	Bach, Johann Sebastian		
2	!!!CDT:	1685/02/21/-1750/07/28/		
3	!!!OTL@DE:	An Wasserflüssen Babylon		
4	!!!SCT:	BWV 267		
5	!!!PC#:	5		
6	!!!AGN:	chorale		
7	**kern	**kern	**kern	**kern
8	*ICvox	*ICvox	*ICvox	*ICvox
9	*Ibass	*Itenor	*Ialto	*Isoprn
10	*I"Bass	*I"Tenor	*I"Alto	*I"Soprano
11	*>[A,A,B]	*>[A,A,B]	*>[A,A,B]	*>[A,A,B]
12	*>norep[A,B]	*>norep[A,B]	*>norep[A,B]	*>norep[A,B]
13	*>A	*>A	*>A	*>A
14	*	*oclefC4	*oclefC3	*oclefC1
15	*clefF4	*clefGv2	*clefG2	*clefG2
16	*k[f#]	*k[f#]	*k[f#]	*k[f#]
17	*G:	*G:	*G:	*G:
18	*M4/4	*M4/4	*M4/4	*M4/4
19	*met(c)	*met(c)	*met(c)	*met(c)
20	*MM100	*MM100	*MM100	*MM100
21	4G	4B	4g	4dd
22	=1	=1	=1	=1
23	4C	8cL	4g	4ee
24	.	8BJ	.	.
25	4D	4A	4f#	8ddL
26	.	.	.	8ccJ
27	4E	4e	4g	8bL
28	.	.	.	8ccJ
29	8F#L	8AL	4f#	4dd
30	8GJ	8BJ	.	.
31	=2	=2	=2	=2
32	4A	8cL	8eL	8ccL
33	.	8eJ	8gJ	8bJ
34	4D	4d	8gL	4cc
35	.	.	8f#J	.
36	4G;	4d;	4g;	4b;
37	4F#	4d	4a	4a

The image shows a musical score for four voices: Soprano, Alto, Tenor, and Bass. The score is written in G major (one sharp) and common time (C). The Soprano part begins with a treble clef and a G4 note. The Alto part begins with a treble clef and a G4 note. The Tenor part begins with a treble clef and a G3 note. The Bass part begins with a bass clef and a G2 note. The music consists of a series of eighth and quarter notes, with a final measure containing a half note with a fermata. The notation is presented in a standard staff format with a brace on the left side.

The Verovio <Humdrum> Viewer today

- Parallel viewing (code frame, viewing frame)
- Inter-connection allows on-the-spot changes
- Drag-and-drop upload for supported formats
- Supports proof-hearing via MIDI (same screen)
- Code frame allows filters for analytical use
- Supports Humdrum and a growing list of other codes
- Projects currently using VHV
 - Tasso in Music (Amherst)
 - Josquin Research Project (Stanford)
 - Chopin Institute (Warsaw)
 - SIMSSA (Montreal)