From Sound to Input and Output

MUSIC 253/CS 275A

STANFORD UNIVERSITY

Experimental MIDI controllers

Yamaha *Tenori-on* controller
for "drawing" music input

MIDI controller
with iPhone cradle

Haken Audio Continuum:
High-end audio

Linnstrument
(expression)

Roli Seaboard Rise:
gesture

Note locations in 4ths tuning. Click to expand.

Alternative MIDI instruments

MIDI horn: Gary Lee Nelson

MIDI trumpet: Dexter Morrell

MIDI chelletto ("little cello"): Chris Chafe Chafe
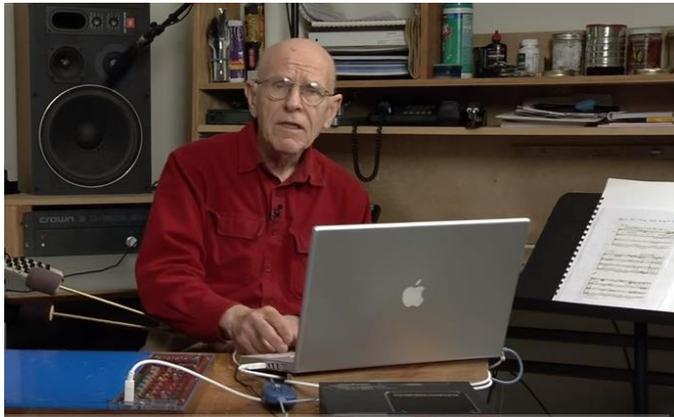
MIDI violin: Yamaha

MIDI guitar: Zeta Music/Gibson

Akai wind Controller (2016)

MIDI as an adjunct to other sound tech
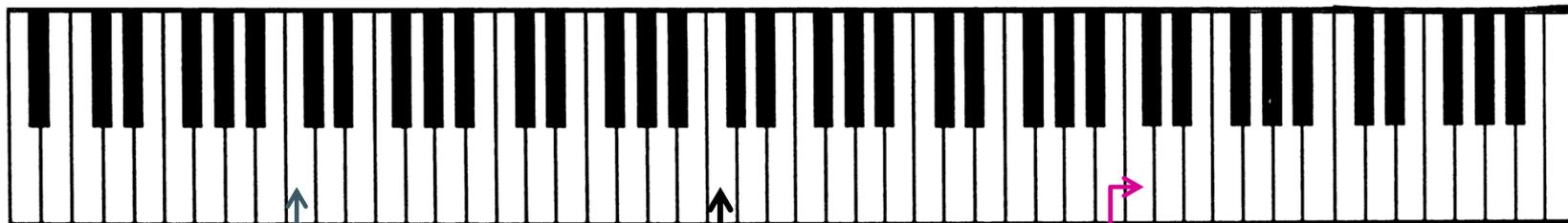
MIDI data can be synchronized with other kinds of data
- Video, animations
- Electronic instruments
- Software routines

Max Mathews' Radio Baton

https://www.youtube.com/watch?v=3ZOzUVD4oLg
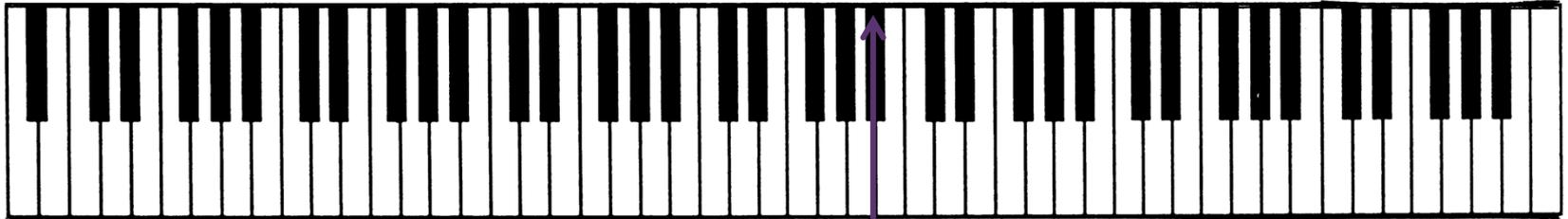
"Pitch" in MIDI = key number

□ Absolute (MIDI C's)

- **36 etc**.

- 48 C 8ve below Middle C

- **60 Middle C**

- 72 C 8ve above Middle C

- **84 etc.**

Manufacturing
variations:
Middle C = 60
Middle C = 48

Key-number pitch is *absolute;*
Tonal music notation pitch is *relative*

Absolute key number

- 36 etc.
- 48 C 8ve below Middle C
- 60 Middle C
- 72 C 8ve above Middle C
- 84 etc.

Absolute pitch = "70"

Single factor

Tonal pitch names are **contextual**

A#/Bb

Guido: separation of

name *and* ***inflection***

- CC
- C
- c (Middle C)
- c'
- c"

Data divergence (sound/notation)

Event-based system

Sounding pitch captured

in MIDI

Transposing instruments

Enharmonic notation in MIDI transcription

"Black notes" only representation means **no distinction** between A#/Bb

MIDI transcription

Debussy: "Clair de lune"
- Via MIDI transcription
- Via print

Duration: Implied vs. real (MIDI)

Truncation

Anticipation
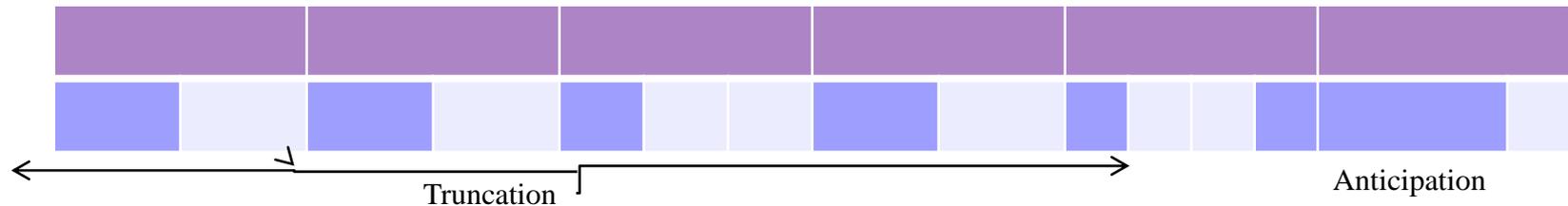
Upper row: The first six notes of this piece are written in notes of equal duration. == **Quantized**

Lower row: The actual sounding durations are variable. ==**Unquantized**

Tempo and quantization

Software may have tempo controls; MIDI hardware does not

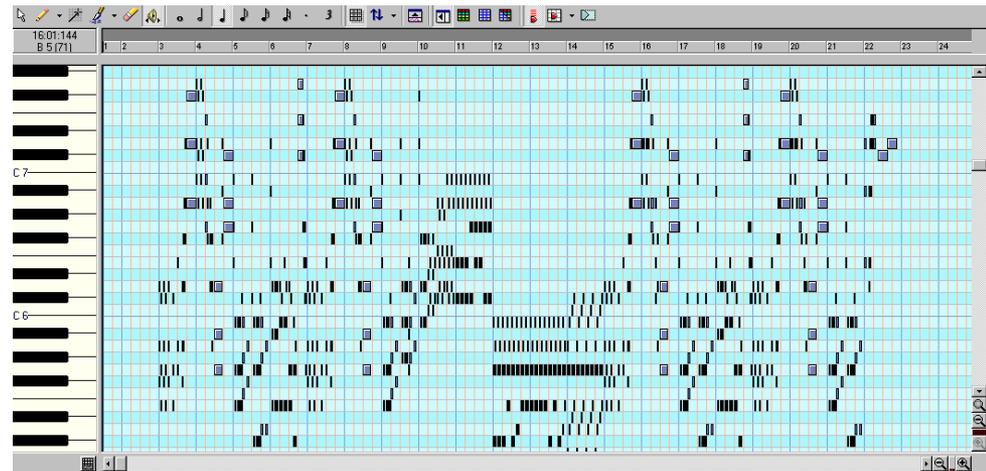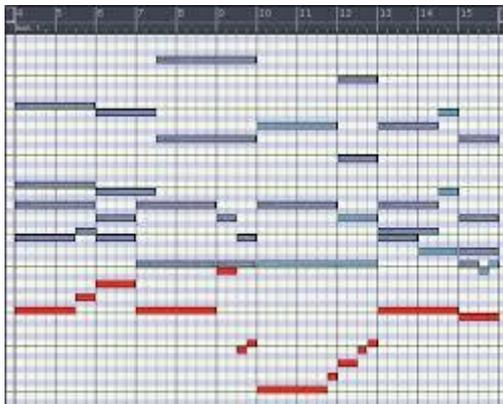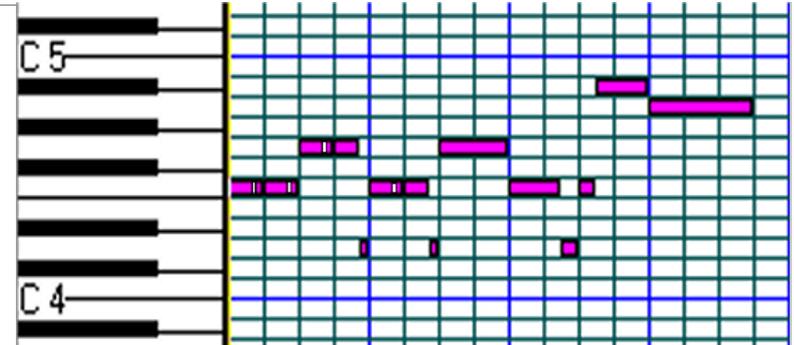**Quantized MIDI files** suited to transcription

Unquantized MIDI files: expressive, not suited to transcription

Sequencers

- Piano roll
- Event list
- Staff notation
- Virtual keyboard

Online sequencer:

https://onlinesequencer.net/

MIDI data organization

Event-based system

Part- major systems

Affects *Finale, Sibelius*

Early MIDI file types

Vertically organized

◦ 0 = monophonic music [merged single track]

◦ 1 = polyphonic music [multiple tracks]

Horizontally organized

◦ 2 = accommodates rhythmically independent tracks

See MMA file: http://www.midi.org/aboutmidi/tut_midifiles.php

MIDI data for notation

"Pitch" < **Key number**

"Duration" = **Clock time**
◦ Articulation
  ◦ But pizzicato = Gen. MIDI 45
◦ Staccato

Dynamic range < velocity

"Tempo"
◦ < ratio of quarter to whole12345

Meta-events
◦ Key signature
◦ Meter signature
◦ Lyrics
◦ Copyright notice

Example 1.1 Second trio from the Mozart Clarinet Quintet, K. 581 ("Mozart trio").

Standard MIDI File Format (SMFF)

"Chunks" (**file sections**)
- **Header chunks** (MThd): what to expect in the data
  - Byte segments address
    - Chunk type
    - Header length
    - Number of tracks
    - Meaning of *delta* times
    - Time code
  - Slight differences by format type (0, 1, 2)
- Track chunks (MTrk):

Standard MIDI File Format (SMFF)

"Chunks" (**file sections**)
◦ Header chunks (MThd)
◦ **Track chunks** (MTrk): sequential data
  ◦ Iterative process
    ◦ Delta [*difference*] time [elapsed time since last even]
    ◦ Event
  ◦ Event types
    ◦ **MIDI events** (note on, note off et al.)
    ◦ **Meta-event**s (see above; often textual)
    ◦ **System-exclusive event**s (hardware-specific, proprietary)

General MIDI "instruments"

<table>
<tr><td>TIMBRE</td><td>GENERAL MIDI</td></tr>
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TIMBRE

String

Woodwind

Brass

Percussion

Voice

**Standard MIDI file format
Level 1 1988
Level II—1999**

GENERAL MIDI

256 slots (extended set)
- 128 standard
- 128 proprietary

Many synthetic slots

Quality varies by category
- Strings
- Woodwind
- Brass
- Percussion
- Tuned and/or "dry" percussion
- Voice (try MIDI Oohs and aahs)