

The Mazurka Project

Craig Stuart Sapp
Centre for the History and Analysis of Recorded Music
Royal Holloway, Univ. of London

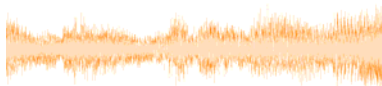
Universiteit van Amsterdam
12 october 2006

Performance Data Extraction

1. Timings of beats.
 2. Timings of all event onsets (beats + off-beats).
 3. Timings of note onsets of individual notes in chord.
LH & RH do not always play together, for example.
 4. Loudness of individual notes at onsets.
- Not trying to extract note-off information.
Would be interesting for articulation, slurring and pedalling studies.
 - Only working with piano music (Chopin mazurkas)
Nice percussive attack to all notes & note pitch does not change.

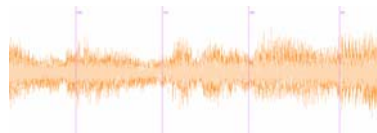
Data Entry (1)

- Using audio editor called Sonic Visualiser:
<http://sonicvisualiser.org>
- Load soundfile, which will display waveform on screen:



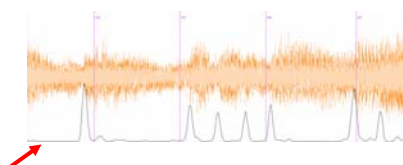
Data Entry (2)

- Next, tap to beats in music, following score.
- The taps are recorded in Sonic Visualiser as lines:





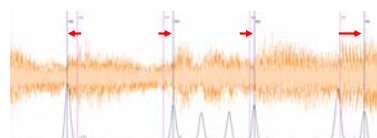
Data Entry (3)

- Then add audio analyses from plugin(s) to help identify note attacks.
- In this example, the MzAttack plugin was used:
<http://sv.mazurka.org.uk/MzAttack>



Data Entry (4)

- Adjust the tap times to events in the audio file.
-  = tapped times
 = corrected tap times
- Sonic Visualiser allows you to move tapped lines around:



Data Entry (5)

time	label
170.825	295
171.219	296
171.661	297
172.164	298
172.707	299
173.122	300
173.685	301
173.913	302
174.331	303
174.818	304
175.329	305
175.747	306
176.188	307
176.606	308
177.048	309
177.489	310
177.976	311

- Save corrected tap data to a text file.

- Data is in two columns:

1. Time in seconds
2. Tap label

Data Entry (6)

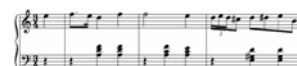
beat times	left hand	right hand
1912	4r	4ee
=1	=1	=1
2558	4r	8ff
.	.	16ee
3175	4A 4d 4f	4dd
3778	4A 4d 4f	4ff
=2	=2	=2
4430	4r	2ff
4914	4A 4c 4f	.
5541	4A 4c 4e	4ee
=3	=3	=3
6289	4r	24dd
.	.	24ee
.	.	24dd
.	.	8cc#
6805	4E 4G# 4d	8dd
.	.	8dd#
7219	4E 4G# 4d	8ee
.	.	8b
=4	=4	=4

- Beat times are aligned with score data.

- Score data is in the Humdrum format:

<http://humdrum.org>

Encoded music:



Data Entry (7)

- Timings of off-beats are then estimated from the rhythms in the score.



1912	4r	4ee
=1	=1	=1
2558	4r	8ff
3021	.	16ee
3175	4A 4d 4f	4dd
3778	4A 4d 4f	4ff
=2	=2	=2
4430	4r	2ff
4914	4A 4c 4f	.
5541	4A 4c 4e	4ee
=3	=3	=3
6289	4r	24dd
6375	.	24ee
6461	.	24dd
6547	.	8cc#
6805	4E 4G# 4d	8dd
7012	.	8dd#
7219	4E 4G# 4d	8ee
7516	.	8b
=4	=4	=4

Data Entry (8)

- Data is translated to a Matlab-friendly format.

	note onset	notated duration	pitch (MIDI)	metric level	measure	absbeat	hand
1912	646	76	1	0	0	2	
2558	463	77	0	1	1	2	
=1	154	76	-1	1	1.75	2	
2558	603	57	0	1	2	1	
3021	603	62	0	1	2	1	
3175	603	65	0	1	2	1	
3778	603	74	0	1	2	2	
=2	652	57	1	1	3	1	
3175	603	62	1	1	3	1	
3778	652	65	1	1	3	1	
3778	652	77	1	1	3	2	

- Automatic alignment and extraction of note timings and loudnesses with a program being developed by Andrew Earis.

Performance Simulations with MIDI files



Original Recording

MIDI files generated from performance data:



Straight tempo (dynamics from score) – i.e., no performance data.



Performance tempo (dynamics from score).

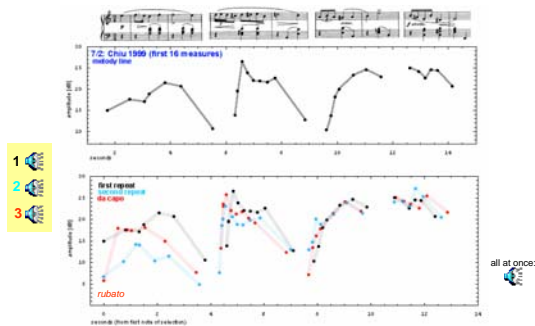
External file

Performance tempo (with automatic errors) plus performance dynamics (exaggerated slightly).

Extracted Performance Data

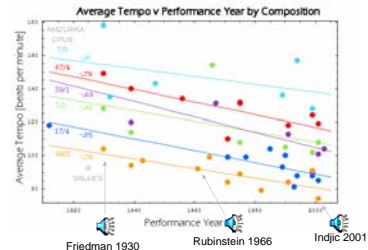
- What do you do with the data once you have it?
- How to compare different performances of the same piece?
- How to compare performances of different pieces?
- Currently examining beat tempos, starting to work with dynamics.

Dynamics & Phrasing



Average tempo over time

- Performances of mazurkas slowing down over time:



- Slowing down at about 3 BPM/decade

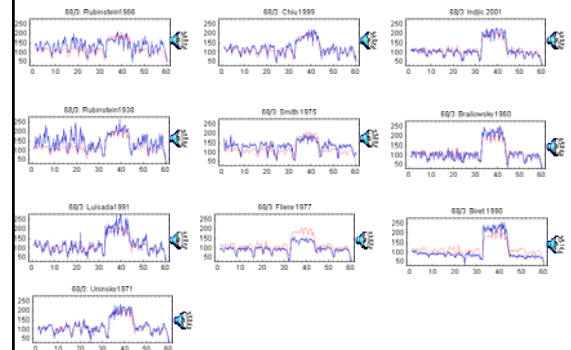
Laurence Picken, 1967: "Central Asian tunes in the Gagaku tradition" in *Festschrift für Walter Wiora*. Kassel: Bärenreiter, 545-51.

Tempo Curves

- Beat-by-beat plot of the tempo throughout the performance

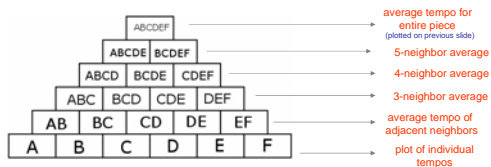


Tempo Graphs

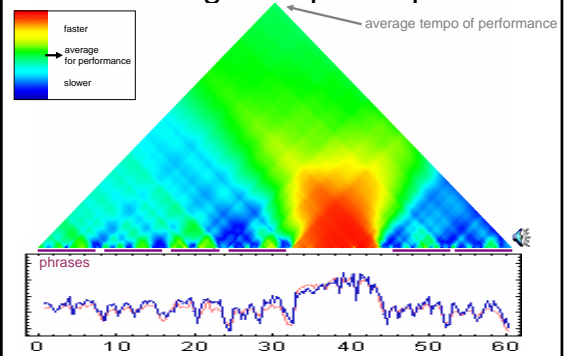


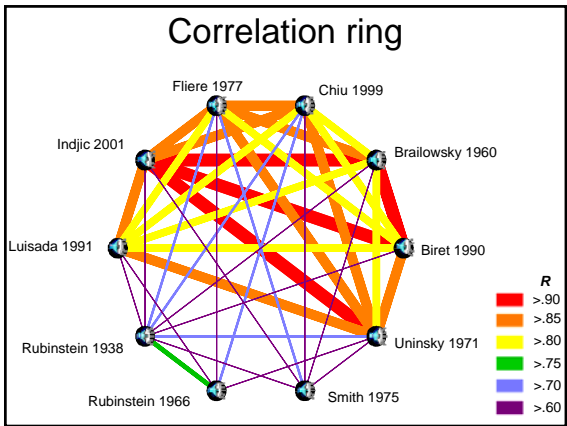
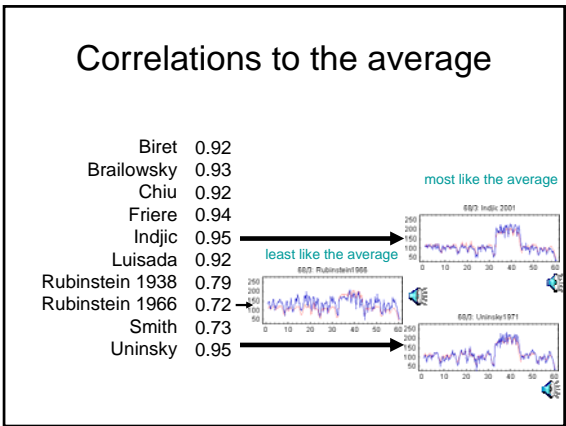
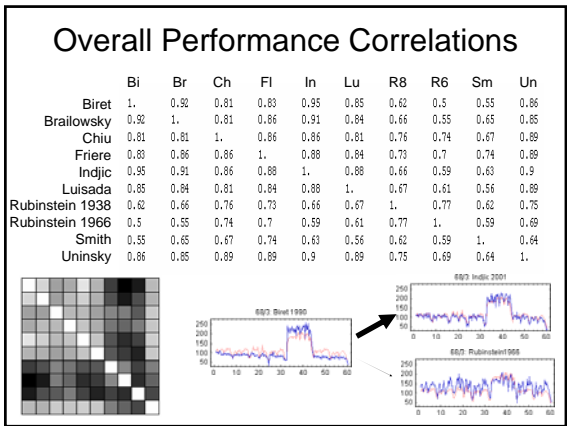
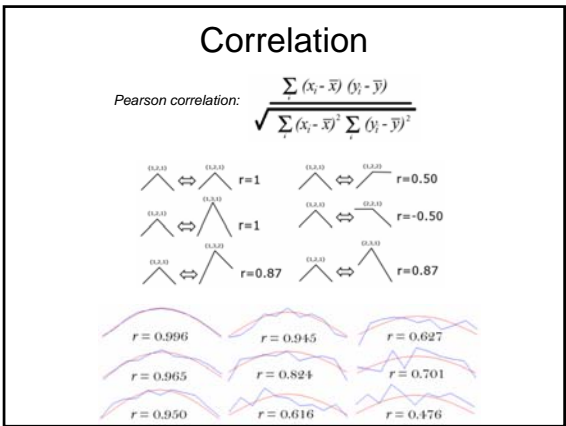
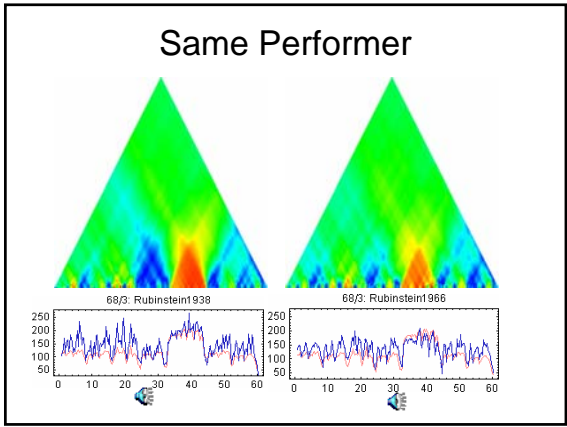
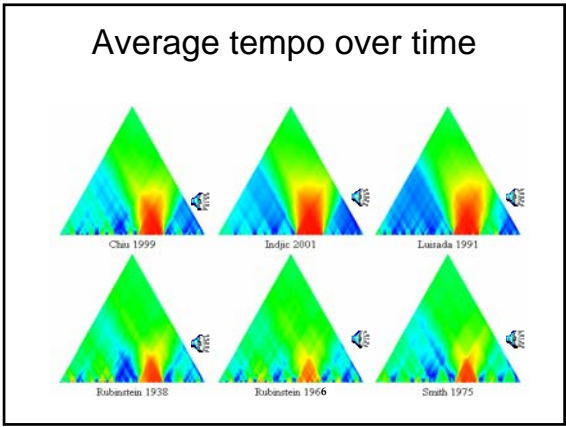
Timescapes

- Examine the internal tempo structure of a performances
- Plot average tempos over various time-spans in the piece
- Example of a piece with 6 beats at tempos A, B, C, D, E, and F:

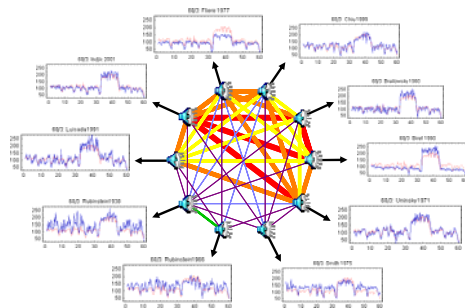


Average-tempo scape

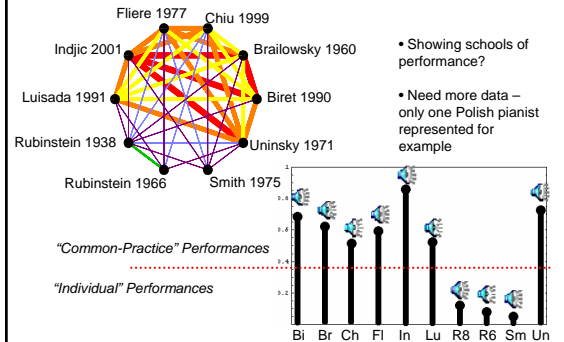




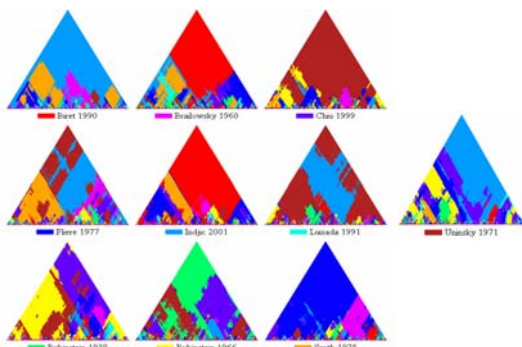
Correlation Ring (2)



Individual v Common Practice



Tempo-correlation scapes



For Further Information

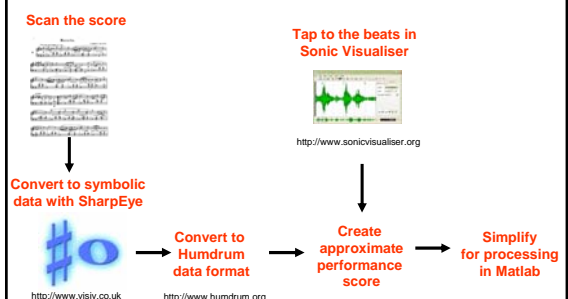


<http://www.charm.rhul.ac.uk/>

<http://mazurka.org.uk>

Extra Slides

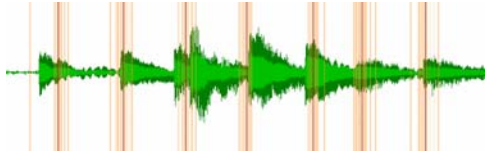
Input to Andrew's System



Reverse Conducting

- Orange = individual taps (multiple sessions) which create bands of time about 100 ms wide.

- Red = average time of individual taps for a particular beat



MIDI Performance Reconstructions

"straight" performance



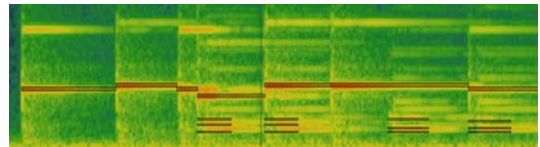
tempo = avg. of performance

matching performers tempo
beat-by-beat:



(pause at beginning)

MIDI file imported as a note layer in Sonic Visualiser:



- Superimposed on spectrogram
- Easy to distinguish pitch/harmonics
- Legato; LH/RH time offsets