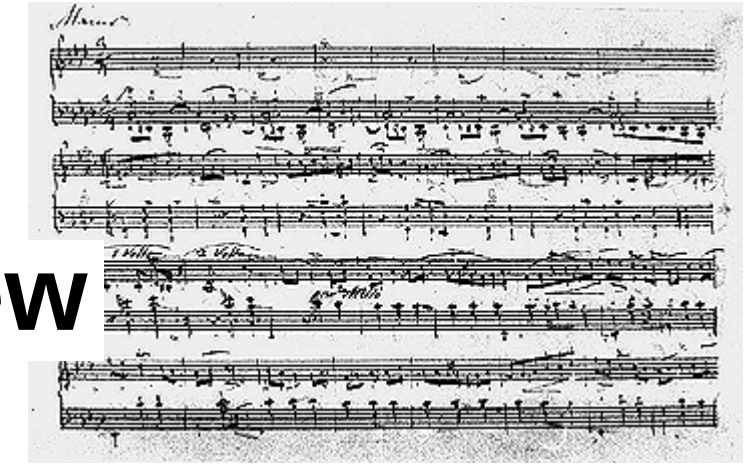
The Mazurka Project Overview



Craig Stuart Sapp
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Royal Holloway, University of London

CHARM Advisory Board Meeting

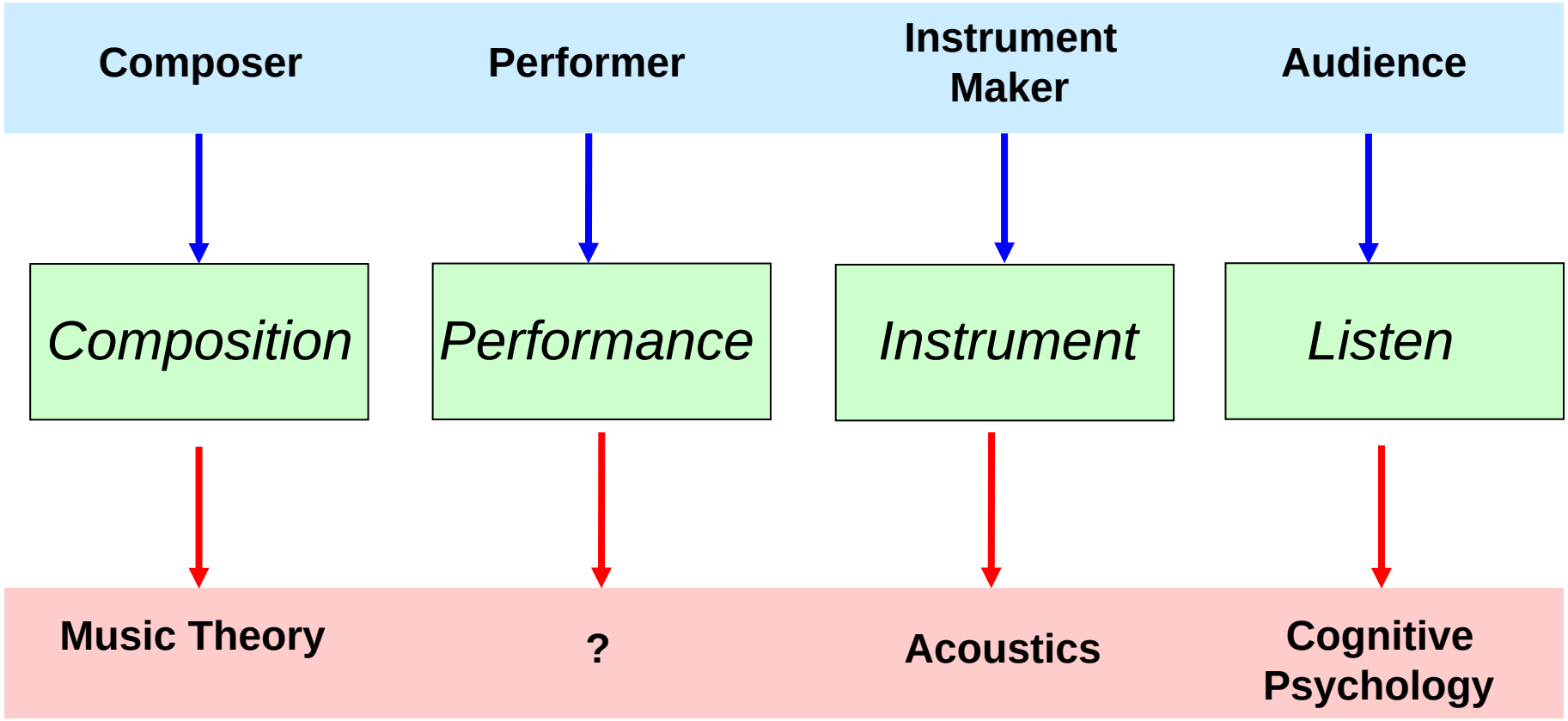
Institute for Historical Research,
School of Advanced Study,

UL Senate House, London

12 Dec 2006

Some facets of music

fields of generation



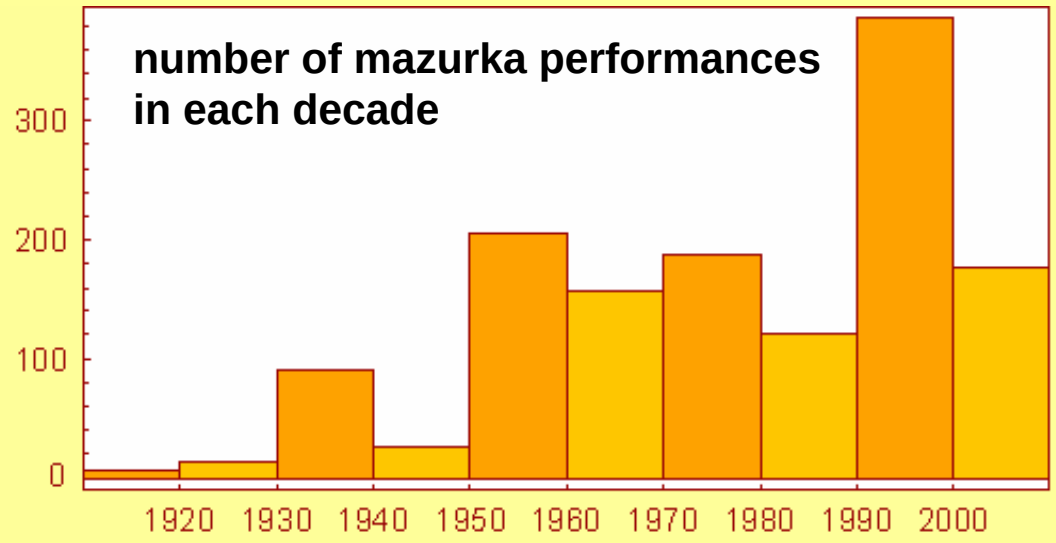
fields of analysis

Source Material: Mazurka Recordings

- **1,374 recordings of 49 mazurkas**

  = 28 performances/mazurka on average

- **65 performers, 73 CDs**

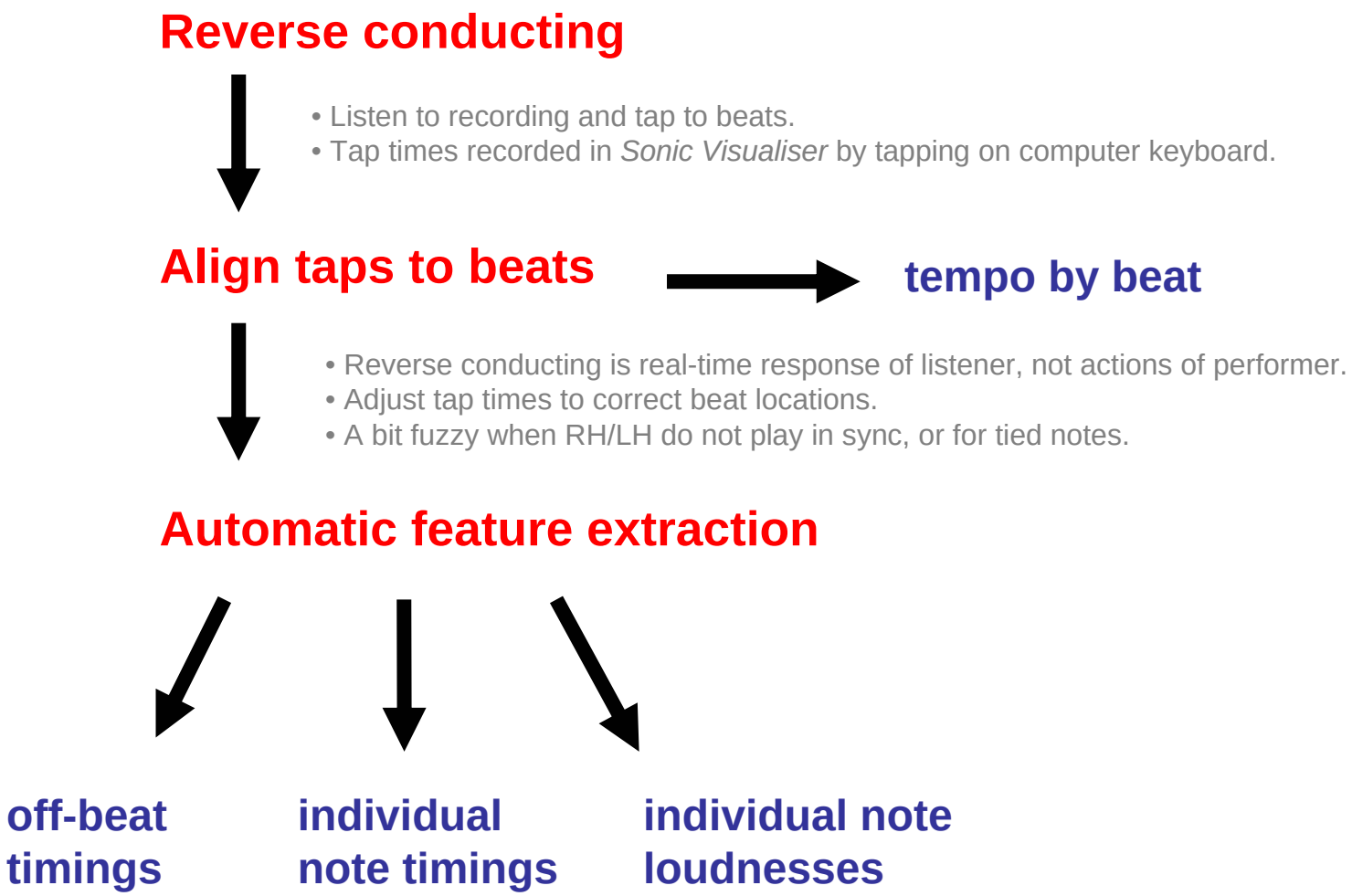


Mazurka in G minor Op. 24, No. 1

29 performances:

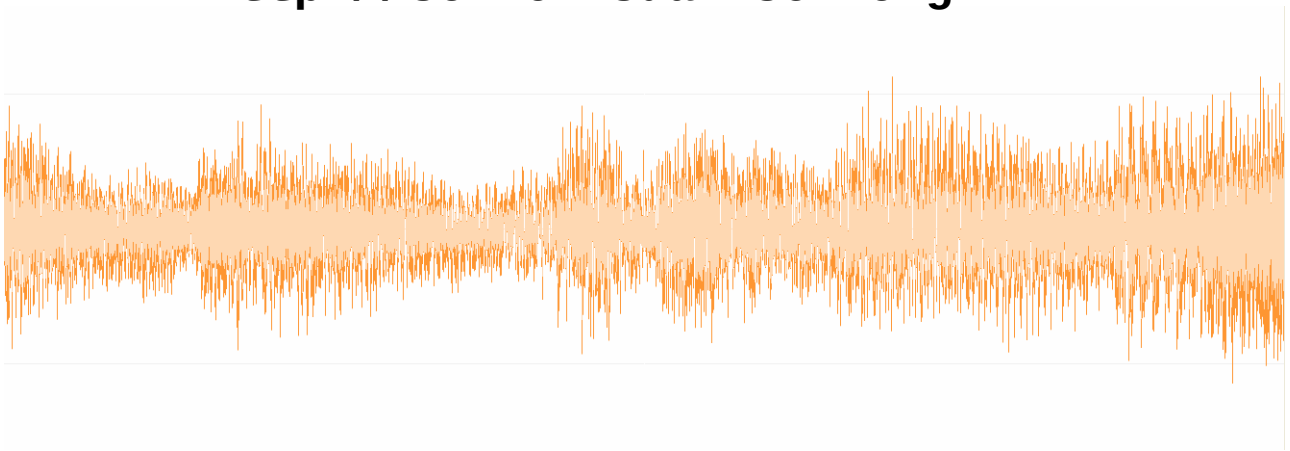
2:48	Ashkenazy (1981)	Decca 448 086-2
3:06	Biret (1990)	Naxos 8.550359
2:39	Block (1995)	ProPiano PPR224507
2:04	Brailowsky (1960)	Sony SB2K 63237
2:49	Chiu (1999)	HMX 2907352.53
2:30	Clidat (1994)	Forlane UCD16729
2:50	Cortot (1951)	Concert Artist 9180/12
2:44	Falvay (1989)	Naxos 8.550256
3:06	Fiorentino (1962)	Concert Artist 9200-2
3:01	Flière (1977)	Melodia 10 00439
1:41	François (1956)	EMI CZS 7 67413 2
3:12	Hatto (1997)	Concert Artist 9270/12
3:12	Indjic (2001)	Calliope 3321
2:37	Kapell (1951)	RCA 09026-68990-2
2:52	Luisada (1990)	DG 463054-2
3:11	Lushtak (2004)	Centaur CRC 2707
3:12	Magaloff (1977)	Phillips 426 817/29-2
2:45	Nezu (2005)	DUX KCh15-10
2:47	Pobłolcka (1999)	BeArTon CDB012/13
3:08	Rosen (1989)	Globe 5028
2:03	Rubinstein (1939)	Naxos 8.110656-57
3:32	Rubinstein (1952)	BMG 09026 63027-2
2:48	Rubinstein (1966)	BMG 09026-63050-2
2:57	Shebanova (2002)	DUX 0350/0351
3:45	Smith (1975)	EMI 724358576726
3:04	Ts'ong (1993)	Sony SB2K 53 246
2:59	Ts'ong (2005)	NIFC CD001
2:41	Tsujii (2005)	DUX KCh15-7
1:50	Uninsky (1959)	Philips 442 574-2

Performance data extraction

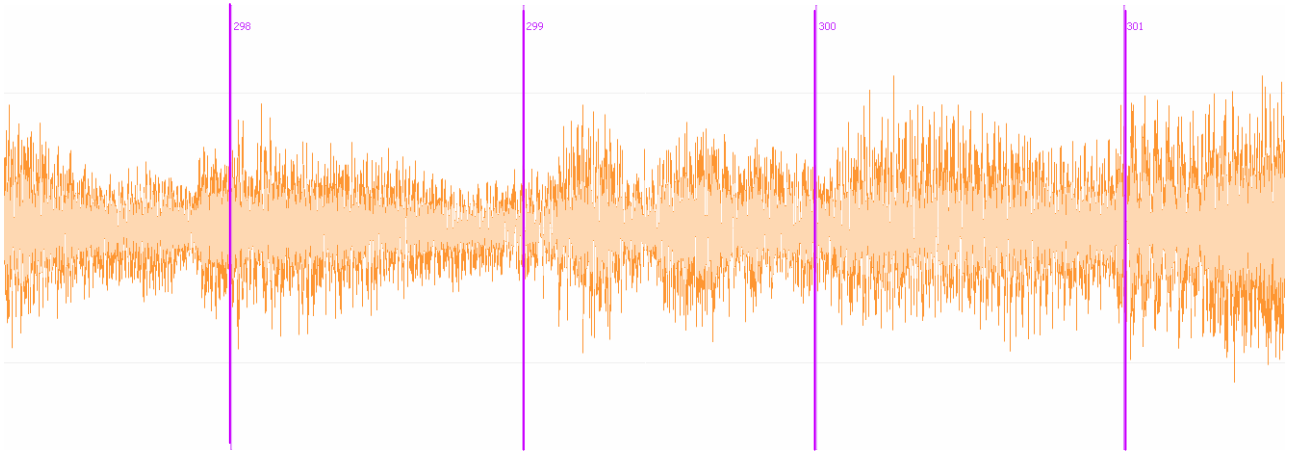


Reverse conducting

- Mazurka project using an audio editor called Sonic Visualiser (SV):
  `http://sonicvisualiser.org`



- In SV, you can mark points in time while the audio is playing:



Beat alignment

- Taps from reverse conducting are not exactly aligned with the performance.

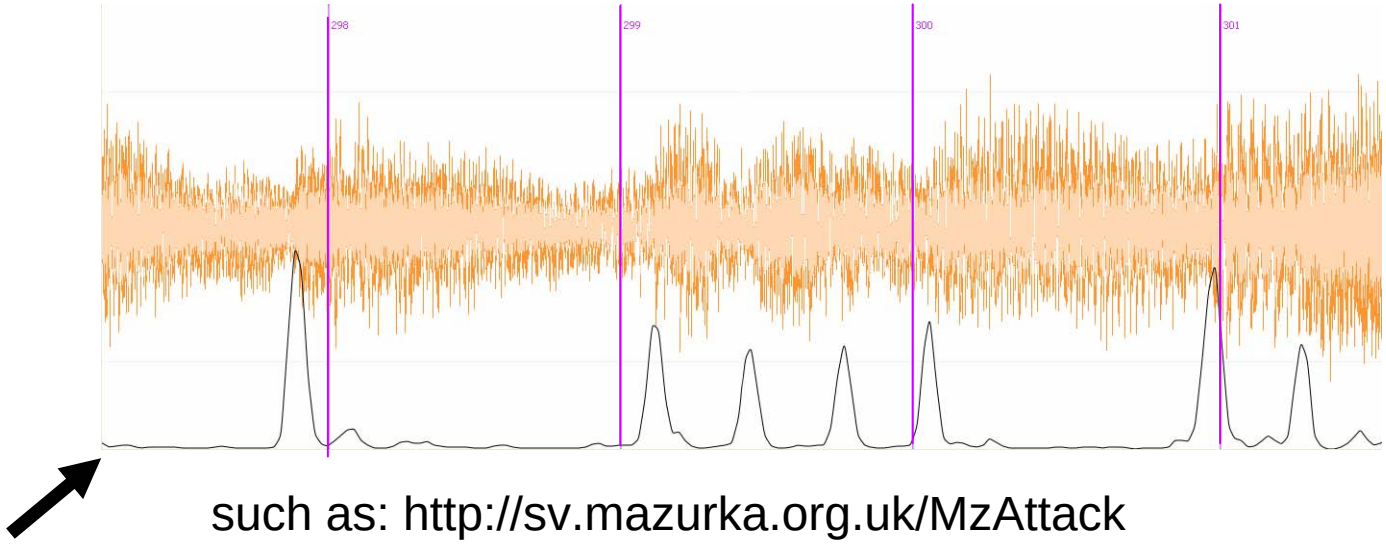
  primarily due to constant changes in tempo

- How to adjust to actual note attacks?

- Can be difficult to do by eye in audio editor.

- Very time-consuming to do by ear.

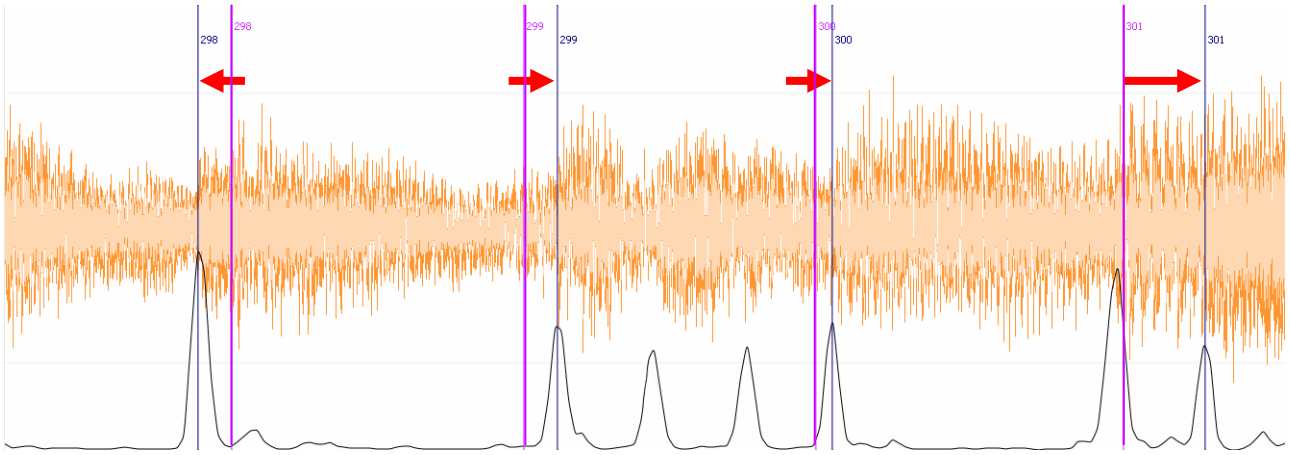
- Solution: audio markup plugins in SV to help locate note attacks:



such as: http://sv.mazurka.org.uk/MzAttack
and http://sv.mazurka.org.uk/PowerCurve

Beat alignment (2)

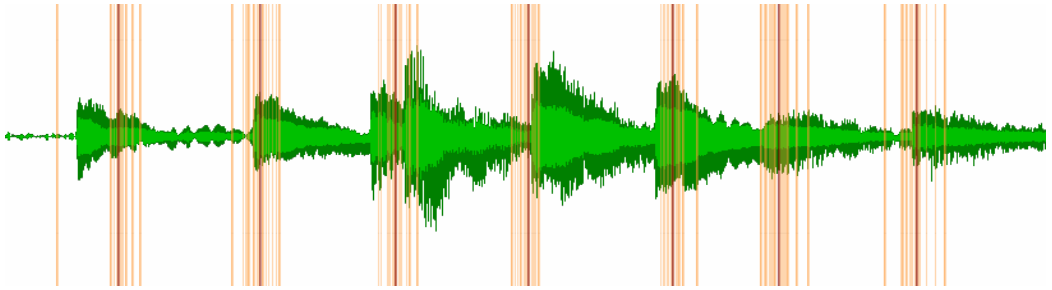
- With visual aid of markup, correction becomes easy to do by eye:



Example:

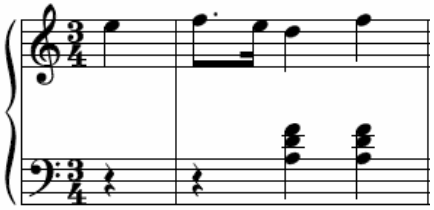
= tapped times

= aligned to beats



Automatic feature extraction

- Tapped beats linked score:



1912	4r	4ee
=1	=1	=1
2558	4r	8.ff
3021	.	16ee
3175	4A 4d 4f	4dd
3778	4A 4d 4f	4ff
=2	=2	=2

- Estimate times of notes in recording

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
3021	154	76	-1	1	1.75	2
3175	603	57	0	1	2	1
3175	603	62	0	1	2	1
3175	603	65	0	1	2	1
3175	603	74	0	1	2	2
3778	652	57	1	1	3	1
3778	652	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 onsets and loudnesses with program being developed by Andrew Earis.

MIDI Performance Reconstructions

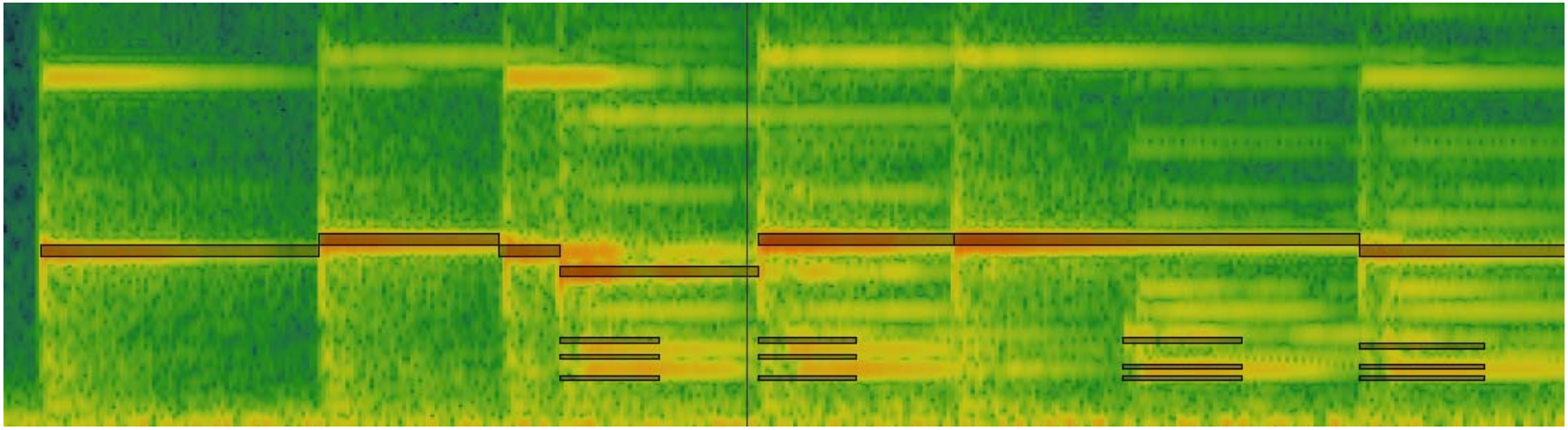
“straight” performance

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

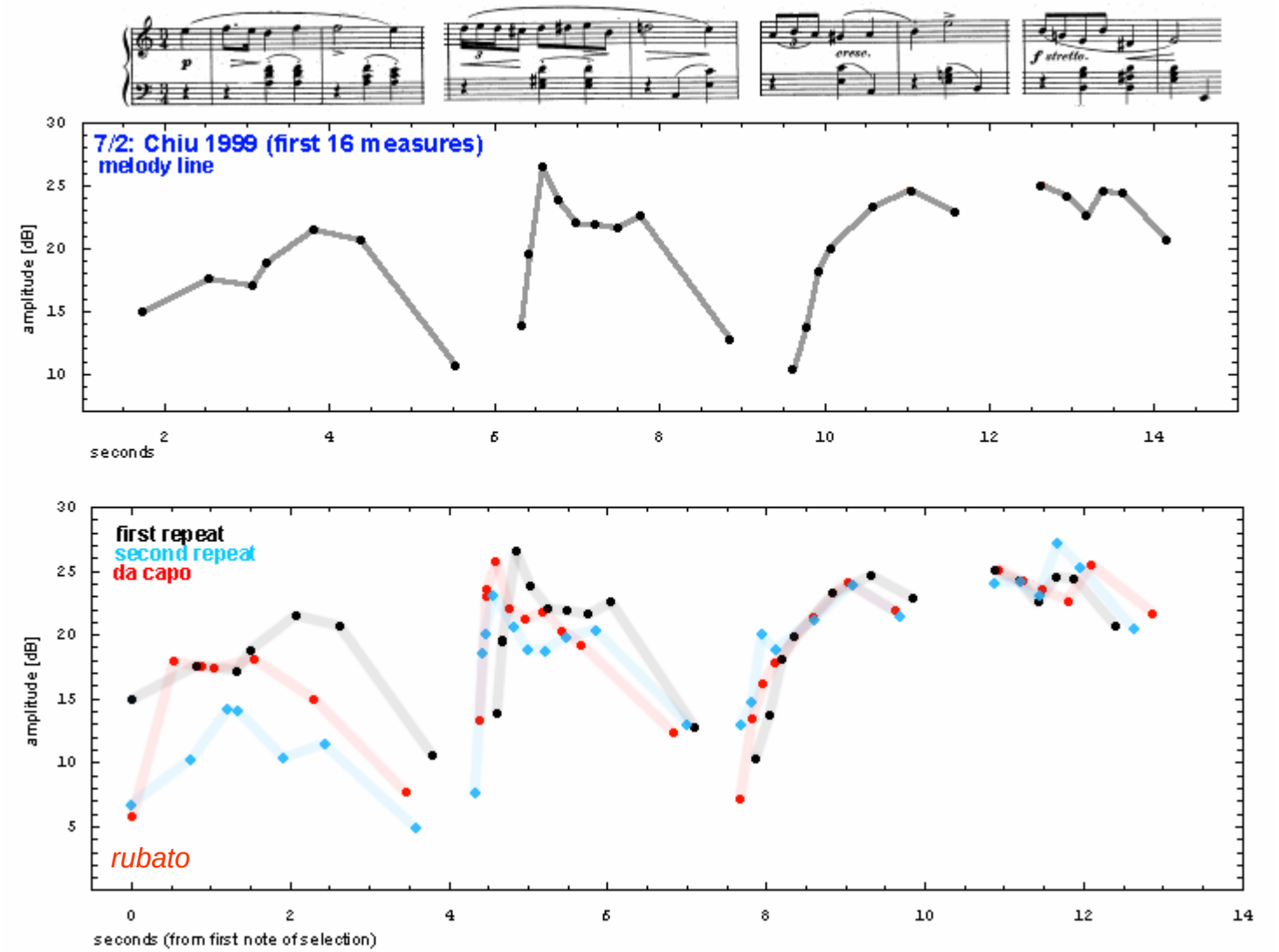
original recording

Dynamics & Phrasing

1 

2 

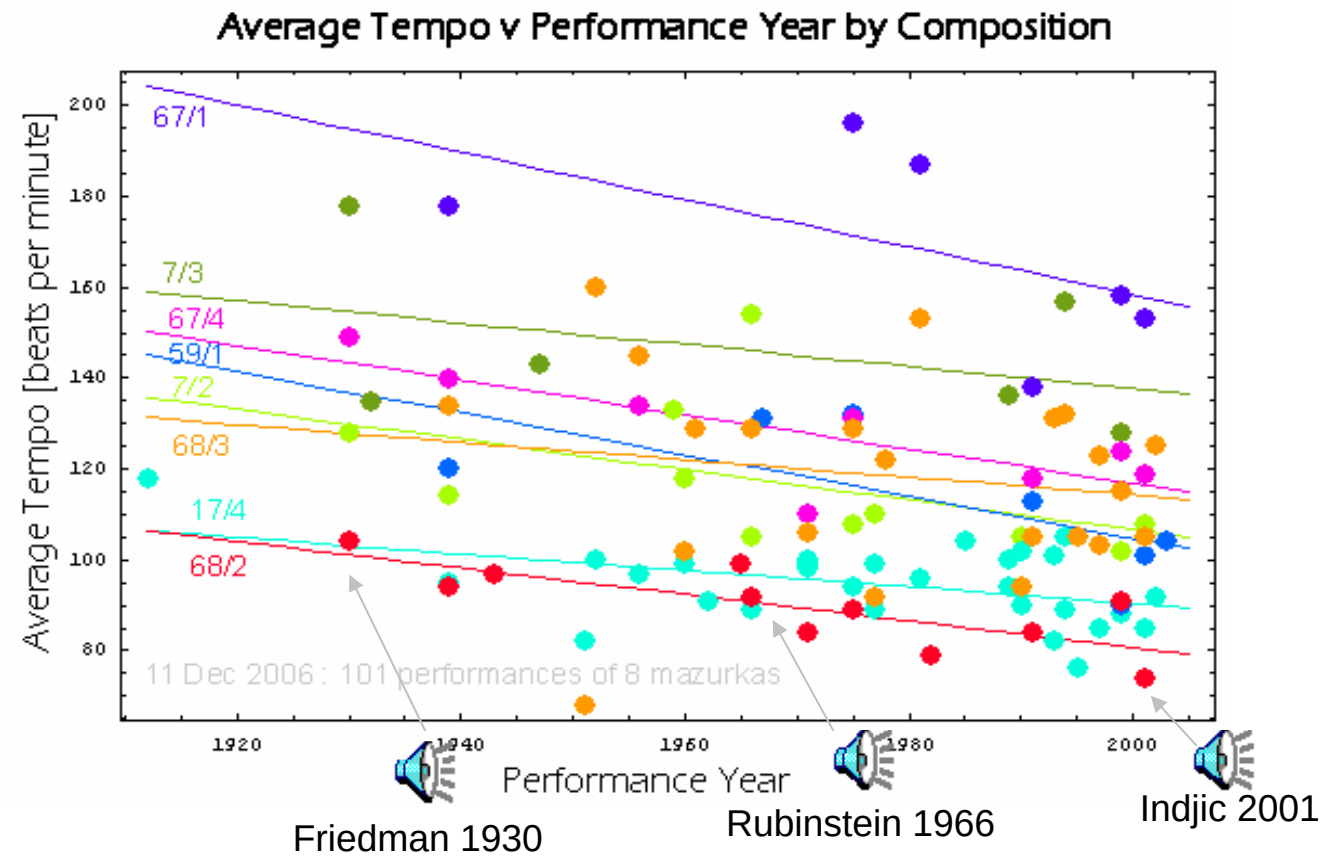
3 



all at once:

Average tempo over time

- Performances of mazurkas slowing down over time:

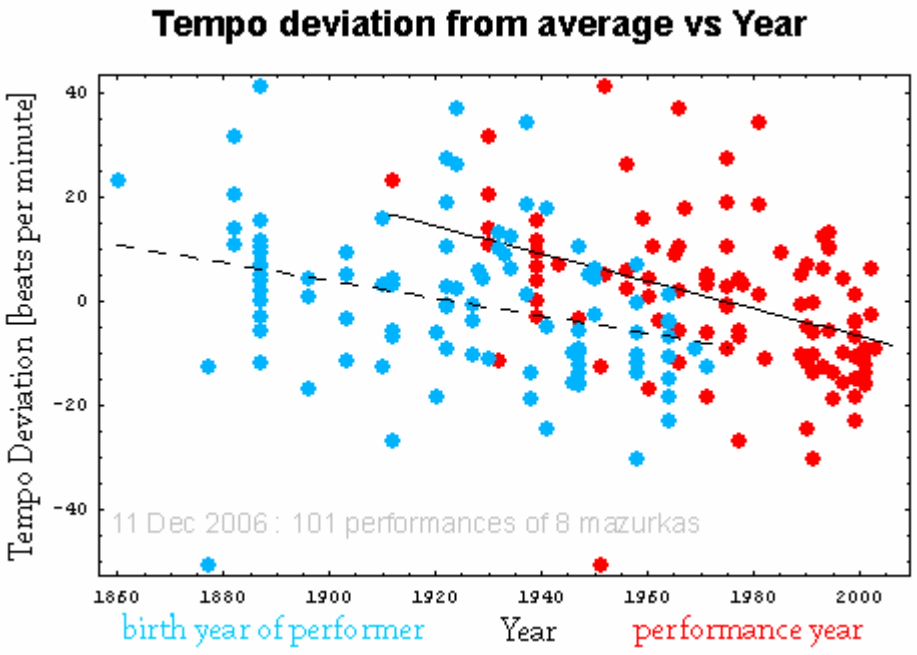


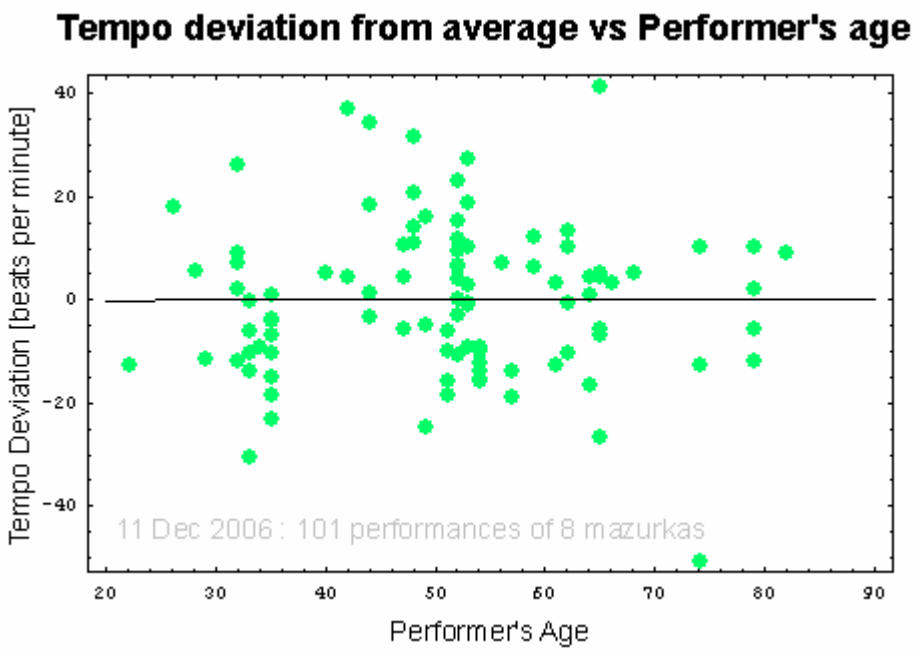
- Slowing down at about 3 BPM/decade

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

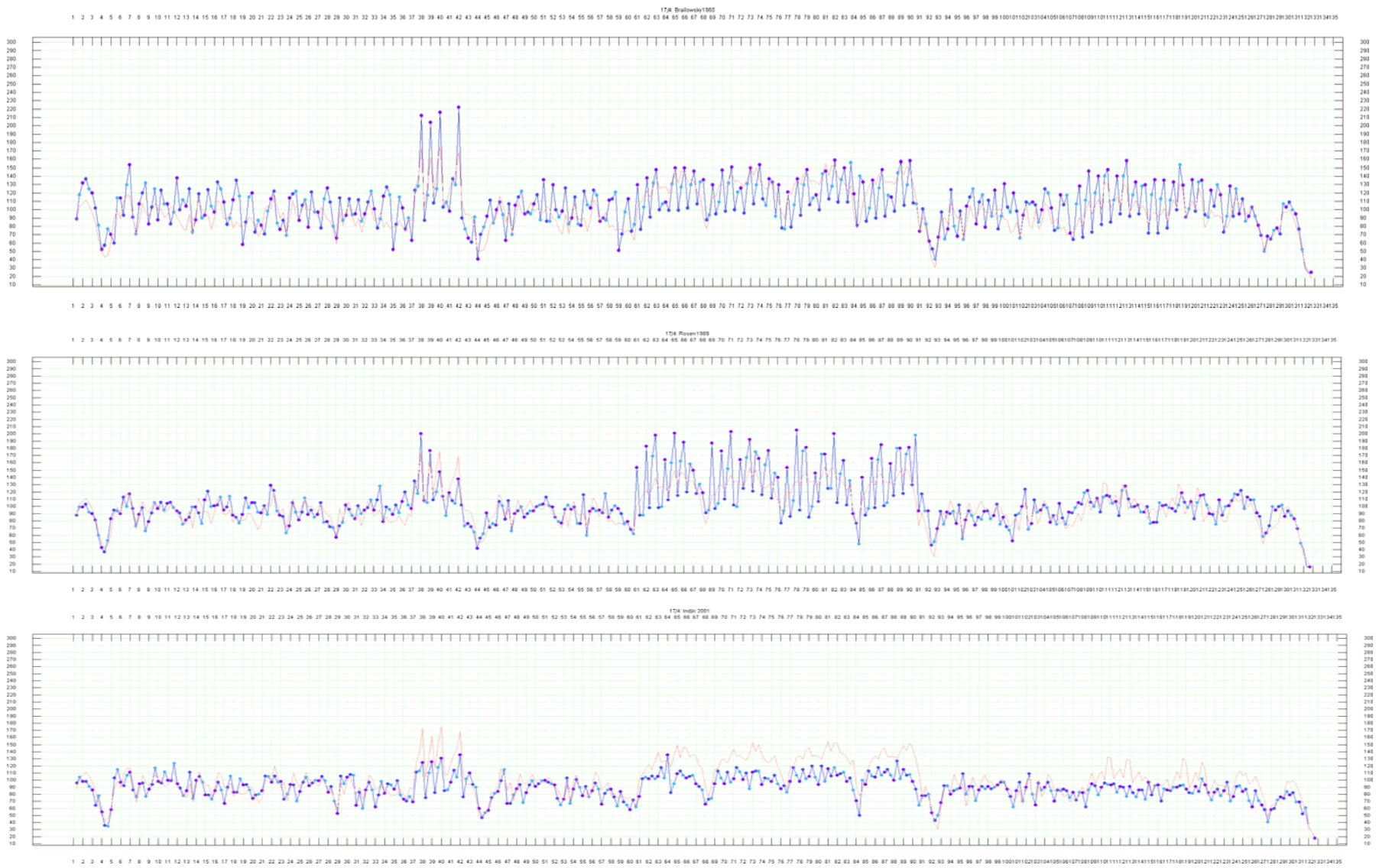
Average Tempo over time (2)

- **The slow-down in performance tempos is unrelated to the age of the performer**





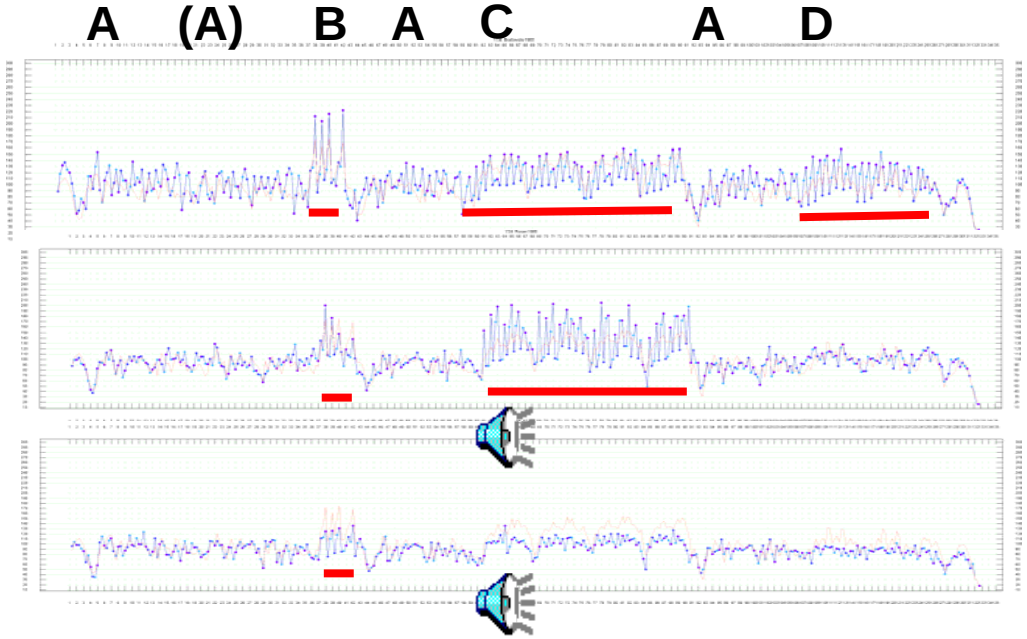
Tempo graphs

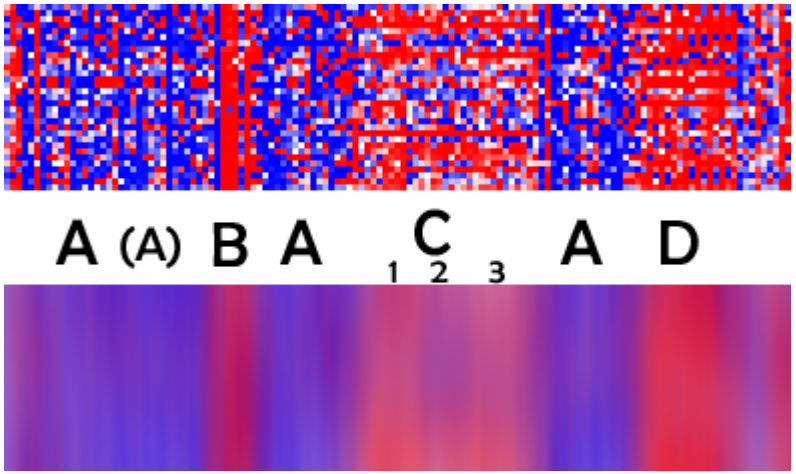


Mazurka Meter

- **Stereotypical mazurka rhythm:**
  - **First beat short**
  - **Second beat long**

Mazurka in A minor
Op. 17, No. 4



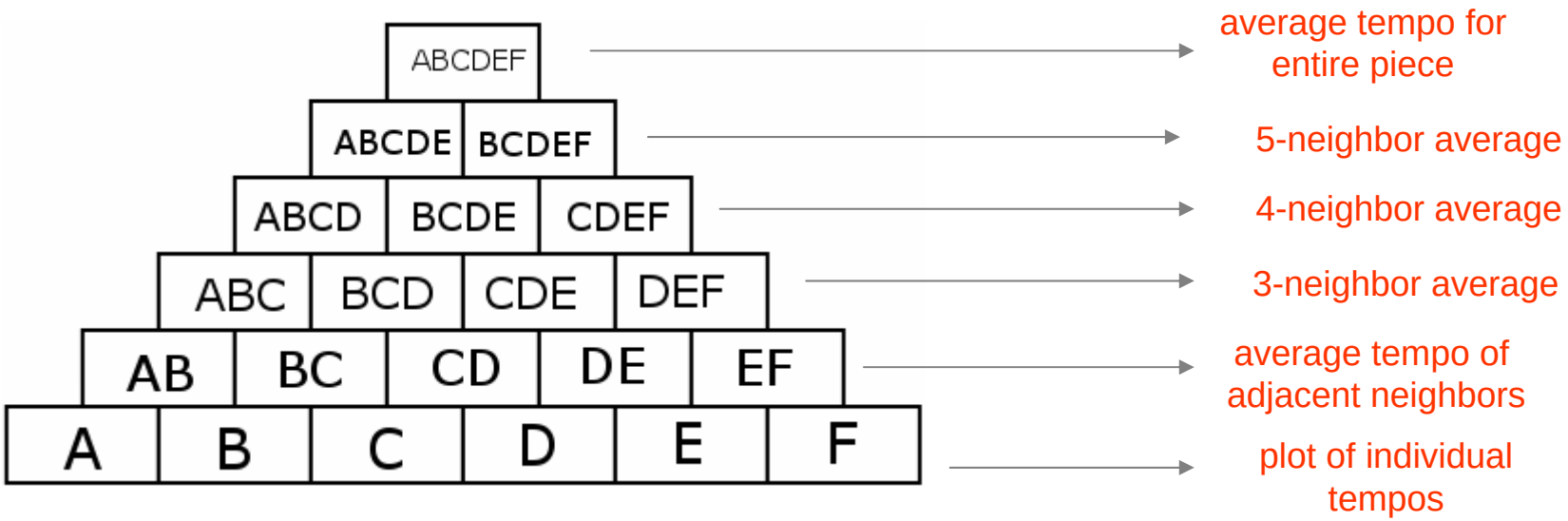


measure with longer second beat
measure with longer first beat

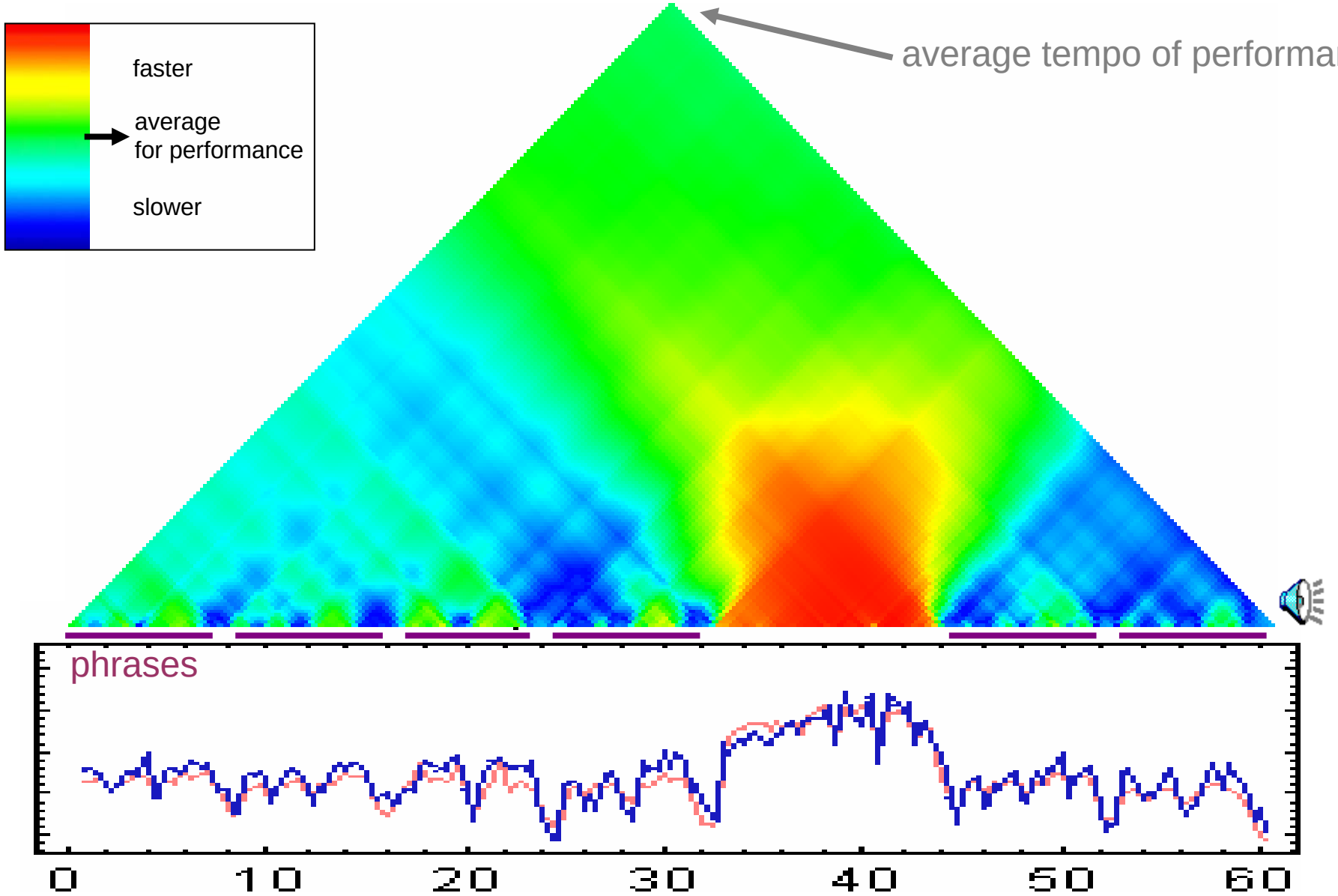
- blurred image to show overall structure

Timescapes

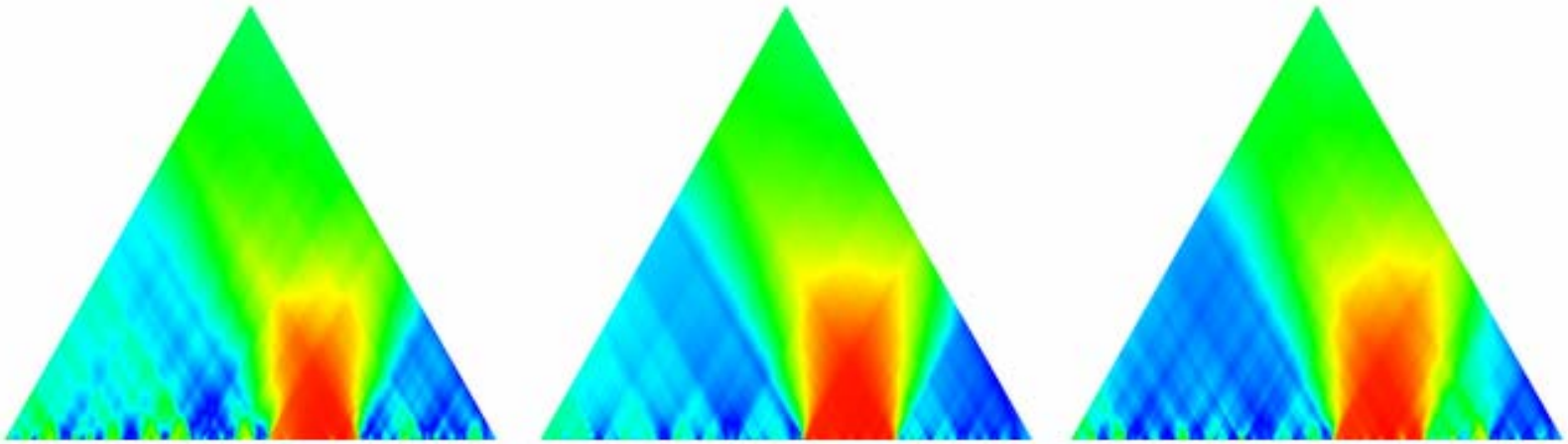
- Examine the internal tempo structure of a performances
- Plot average tempos over various time-spans in the piece
- Example of a piece with 6 beats at tempos A, B, C, D, E, and F:



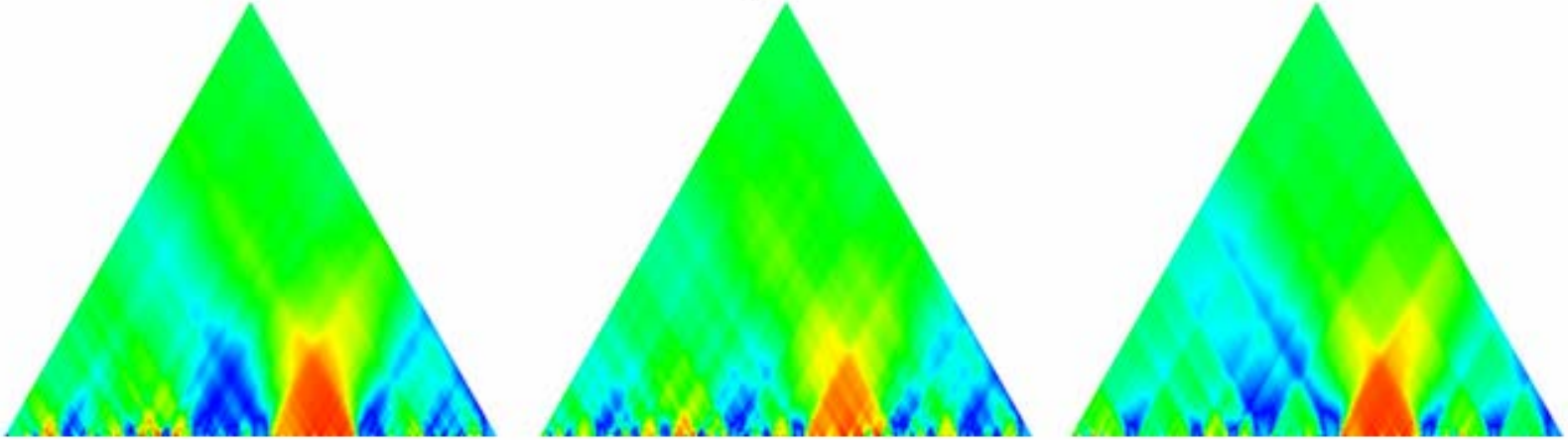
Timescapes (2)



Comparison of performers

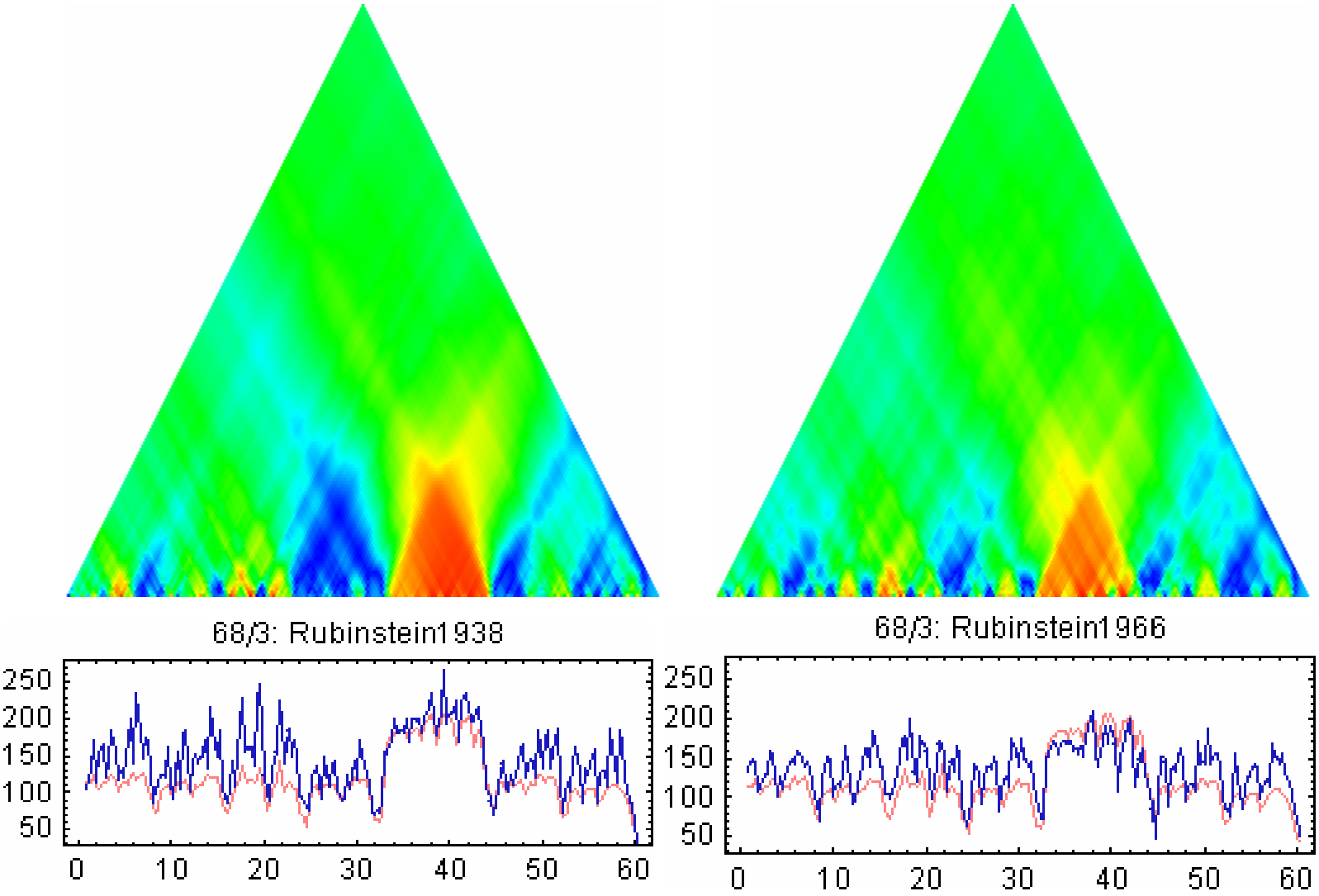


Chiu 1999 | Indjic 2001 | Luisada 1991



Rubinstein 1938 | Rubinstein 1966 | Smith 1975

Same performer



Correlation

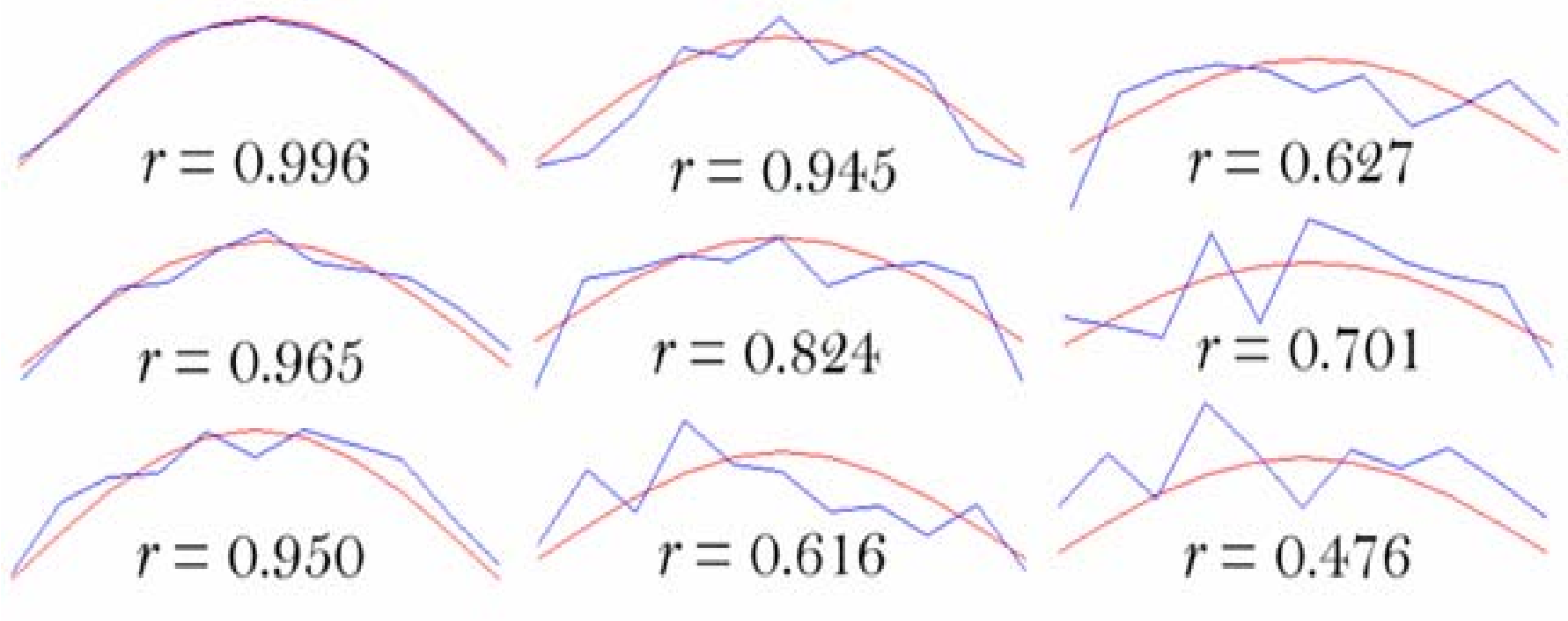
Pearson correlation:

$$\frac{\sum_i (x_i - \bar{x})\,(y_i - \bar{y})}{\sqrt{\sum_i (x_i - \bar{x})^2 \sum_i (y_i - \bar{y})^2}}$$

- **Measures how well two shapes match:**

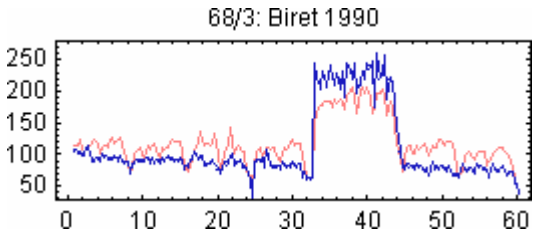
  r = 1.0 is an exact match.
  r = 0.0 means no relation at all.

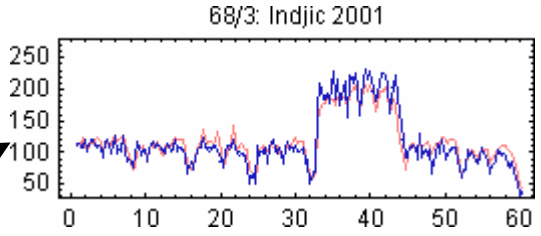
- **What does correlation "mean"?**
- **What does it mean "musically"?**

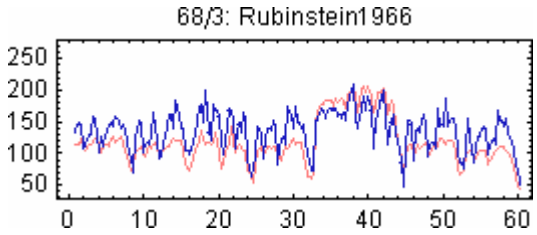


Overall performance correlations

	Bi	Br	Ch	Fl	In	Lu	R8	R6	Sm	Un
Biret	1.	0.92	0.81	0.83	0.95	0.85	0.62	0.5	0.55	0.86
Brailowsky	0.92	1.	0.81	0.86	0.91	0.84	0.66	0.55	0.65	0.85
Chiu	0.81	0.81	1.	0.86	0.86	0.81	0.76	0.74	0.67	0.89
Friere	0.83	0.86	0.86	1.	0.88	0.84	0.73	0.7	0.74	0.89
Indjic	0.95	0.91	0.86	0.88	1.	0.88	0.66	0.59	0.63	0.9
Luisada	0.85	0.84	0.81	0.84	0.88	1.	0.67	0.61	0.56	0.89
Rubinstein 1938	0.62	0.66	0.76	0.73	0.66	0.67	1.	0.77	0.62	0.75
Rubinstein 1966	0.5	0.55	0.74	0.7	0.59	0.61	0.77	1.	0.59	0.69
Smith	0.55	0.65	0.67	0.74	0.63	0.56	0.62	0.59	1.	0.64
Uninsky	0.86	0.85	0.89	0.89	0.9	0.89	0.75	0.69	0.64	1.







Highest correlation to Biret 1990

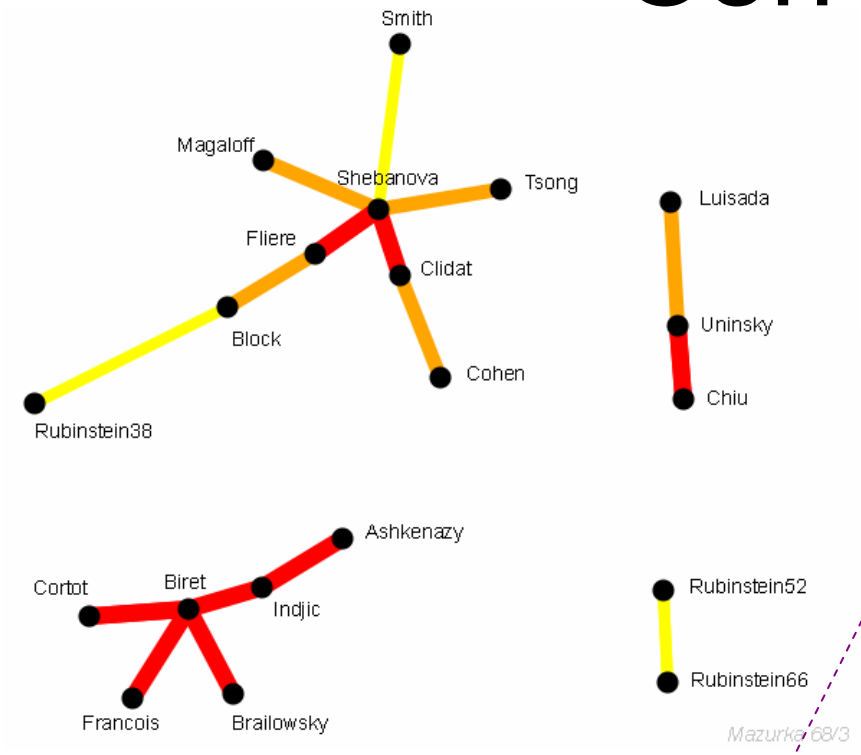
Lowest correlation to Biret 1990

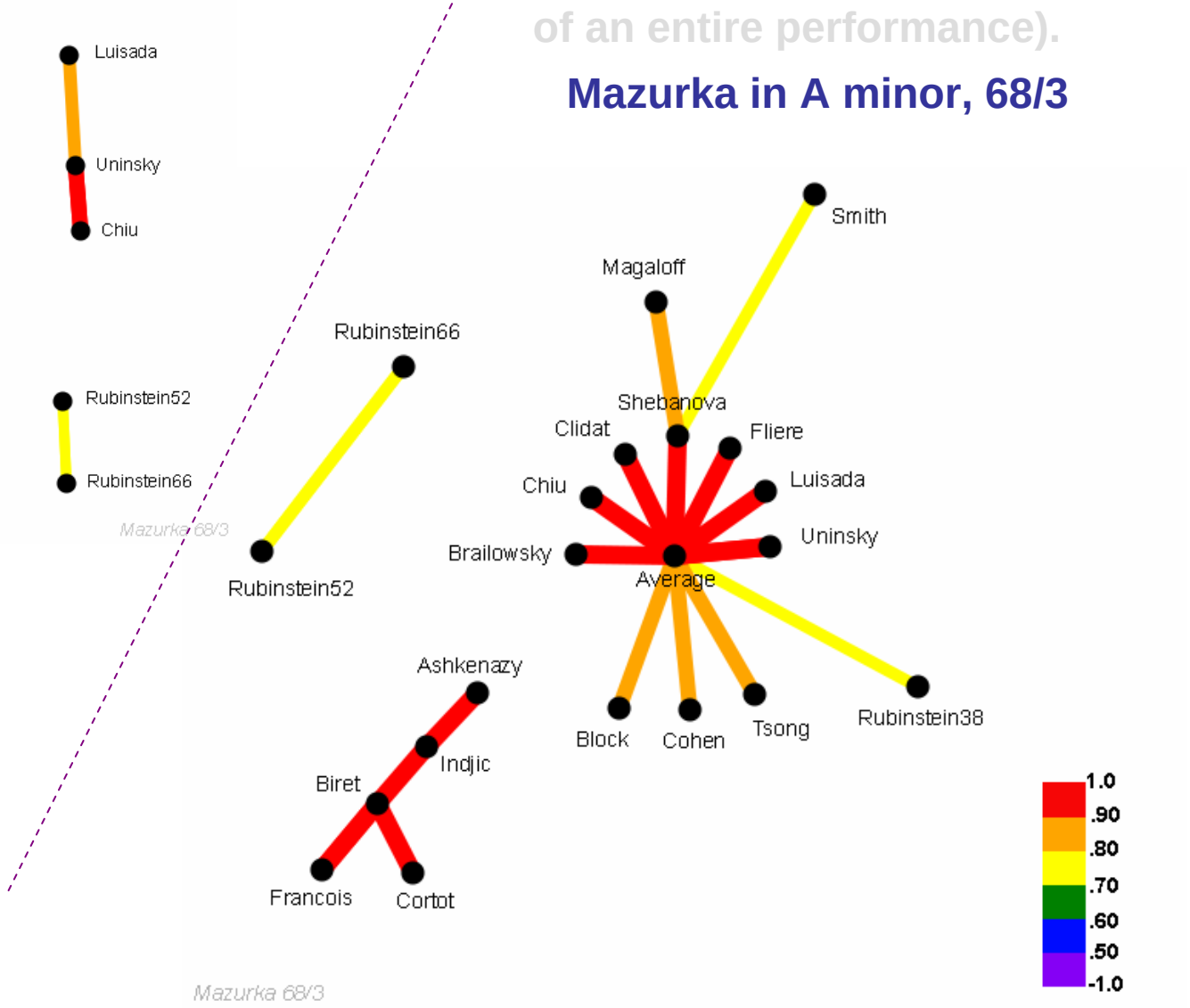
Correlation tree

- **Who is closest to whom?**

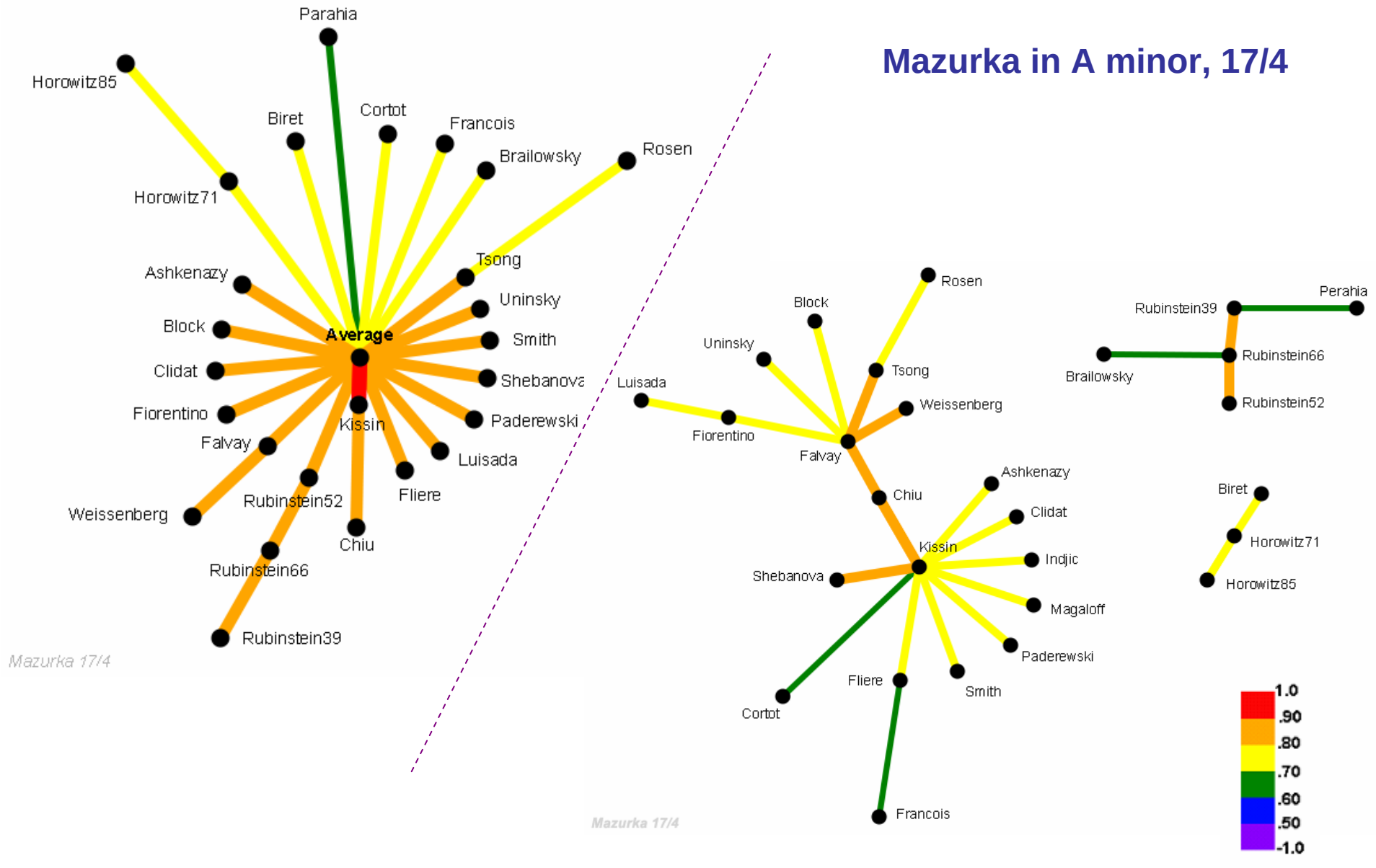
(with respect to beat tempos of an entire performance).

Mazurka in A minor, 68/3



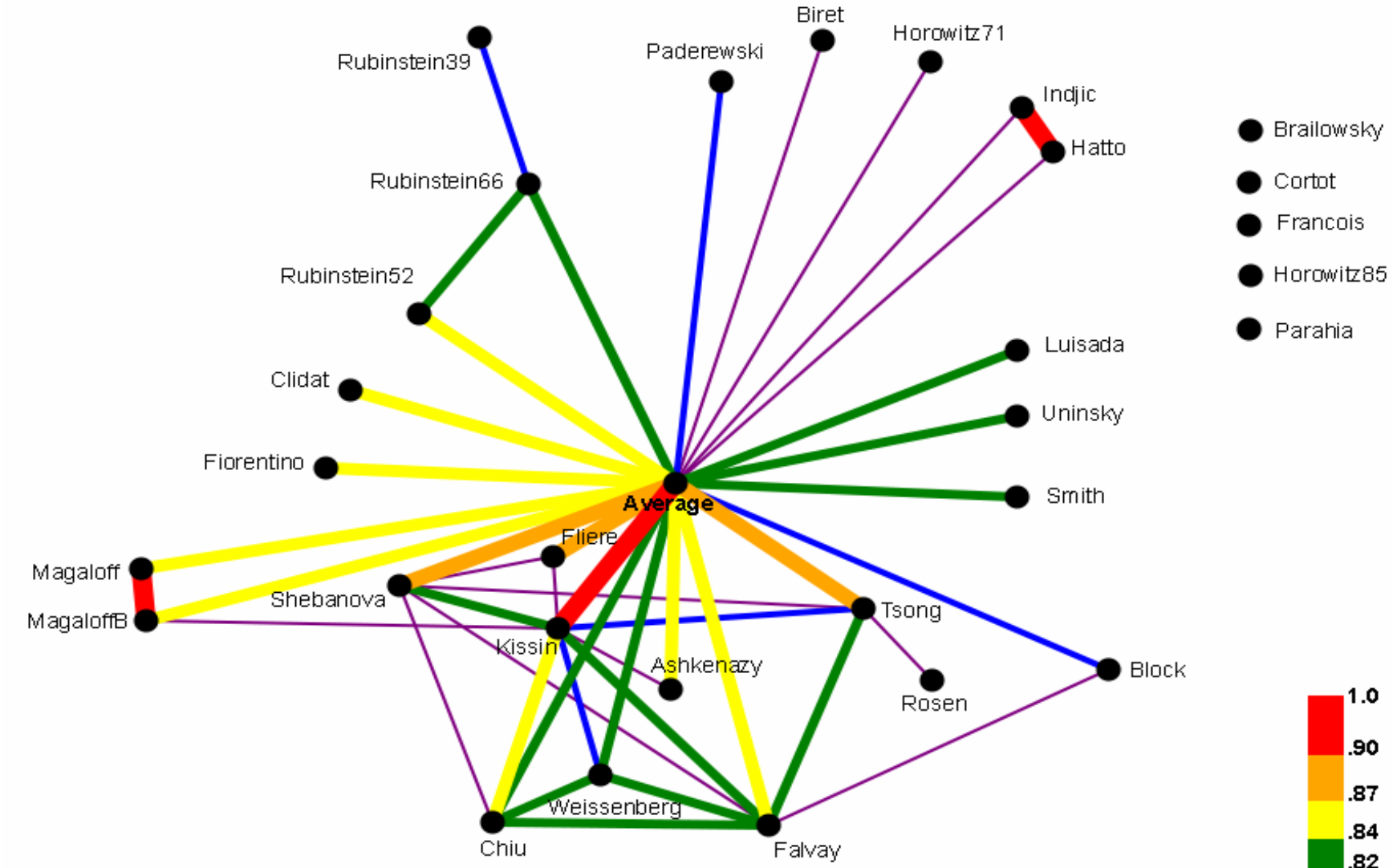


Correlation tree (2)



Correlation network

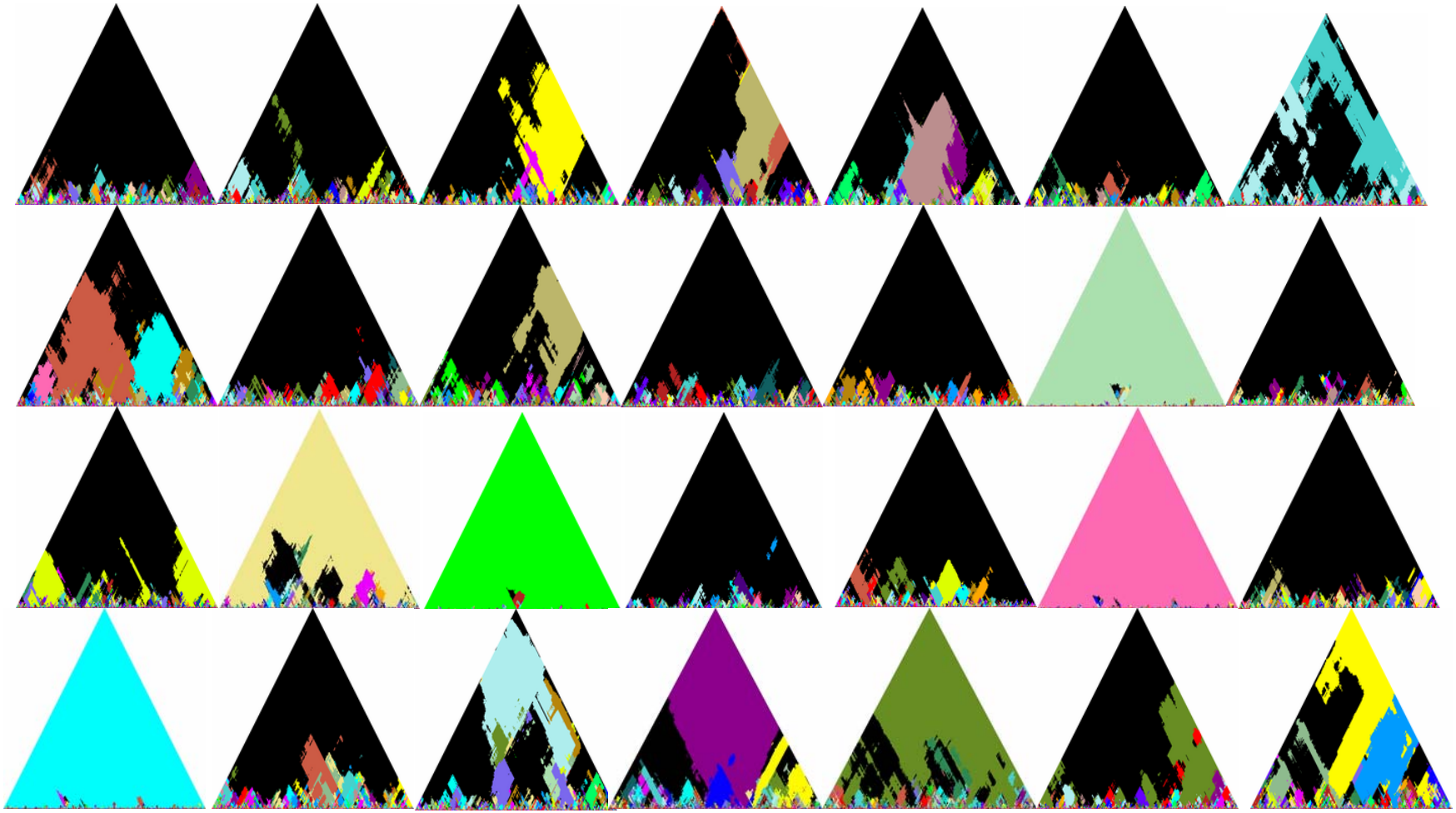
- **How close is everyone to everyone else?**



Mazurka in A minor, 17/4

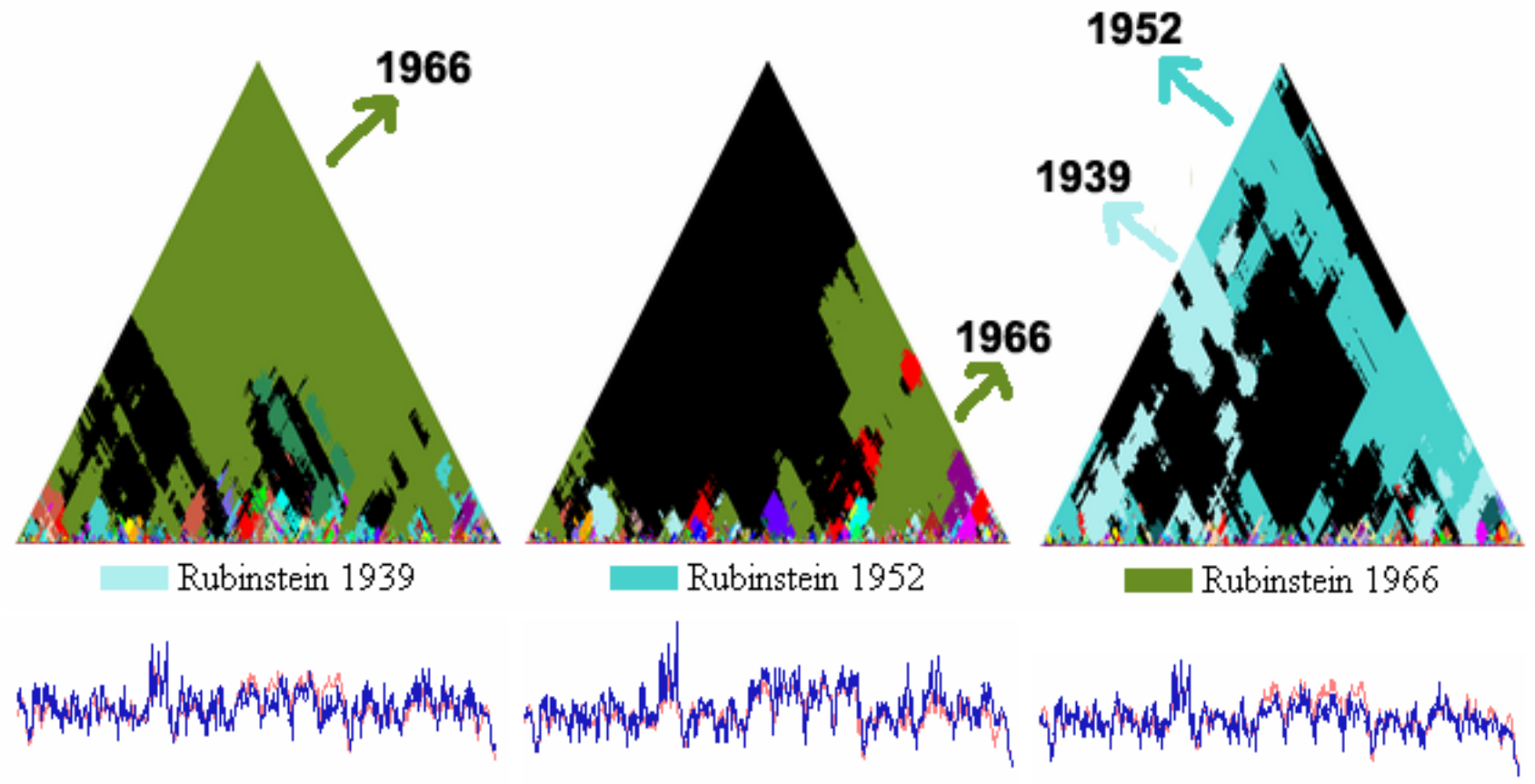
Correlation scapes

- **Who is most similar to a particular performer at any given region in the music?**



Same performer over time

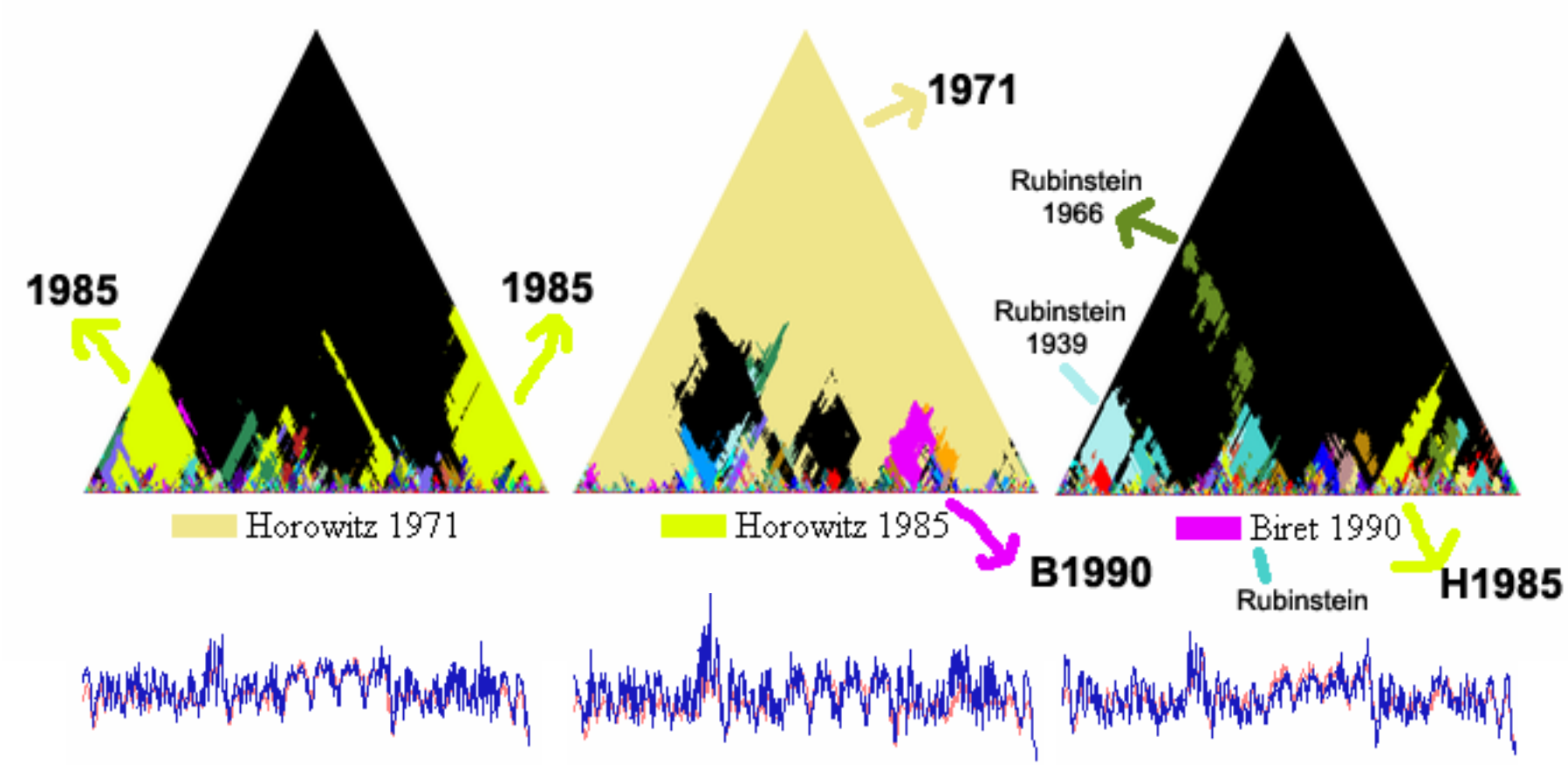
3 performances by Rubinstein of mazurka 17/4 in A minor



(30 performances compared)

Same performer (2)

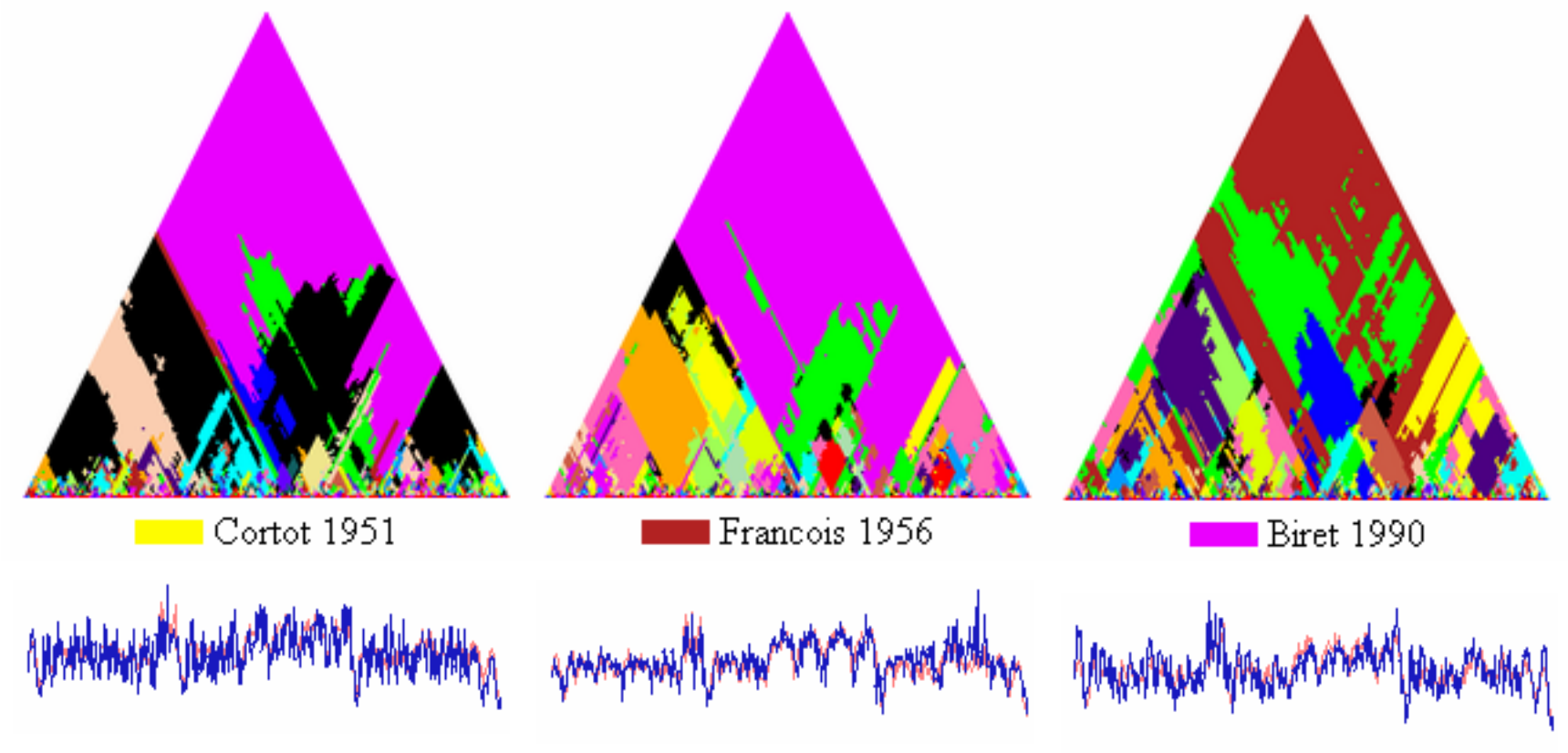
2 performances by Horowitz of mazurka 17/4 in A minor
plus Biret 1990 performance.



(30 performances compared)

Student/Teacher

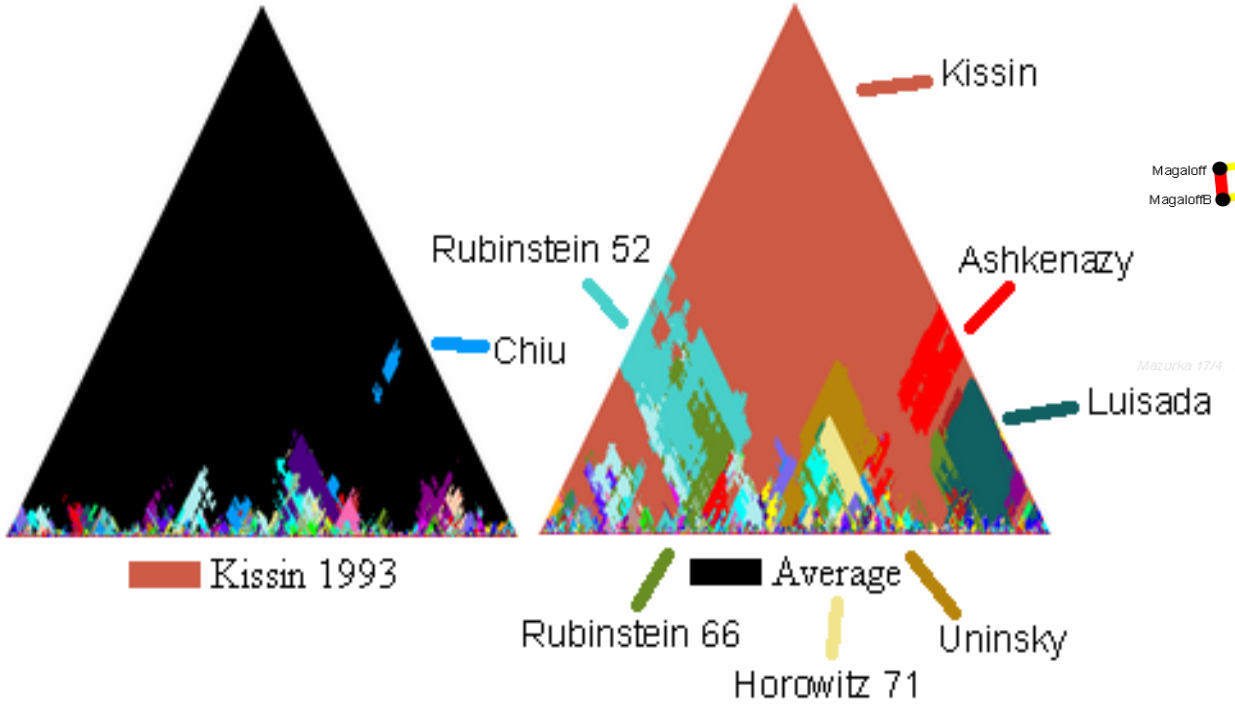
Mazurka in F major 68/3

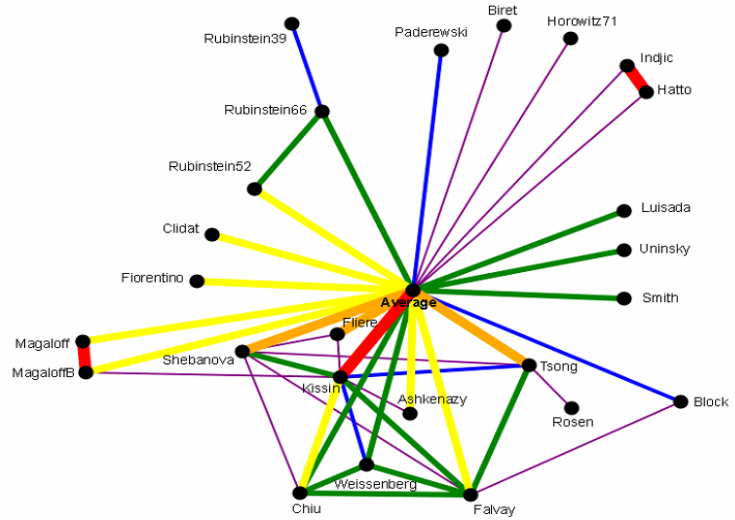


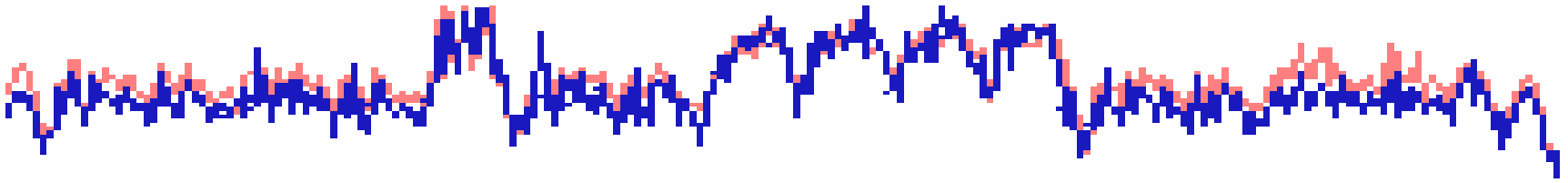
- Francois and Biret both studied with Cortot,

(20 performances compared)

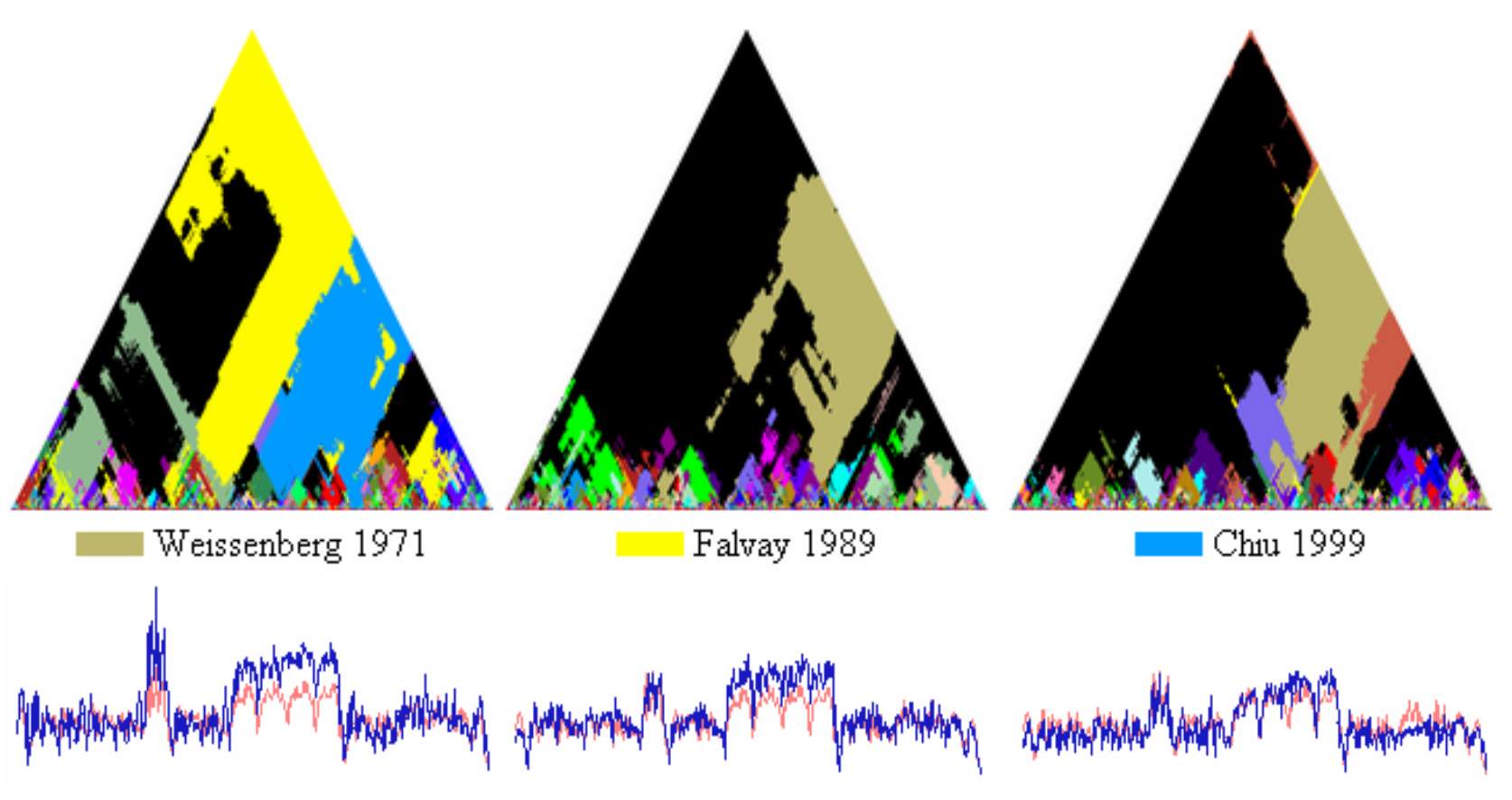
Correlation to average







Possible influences



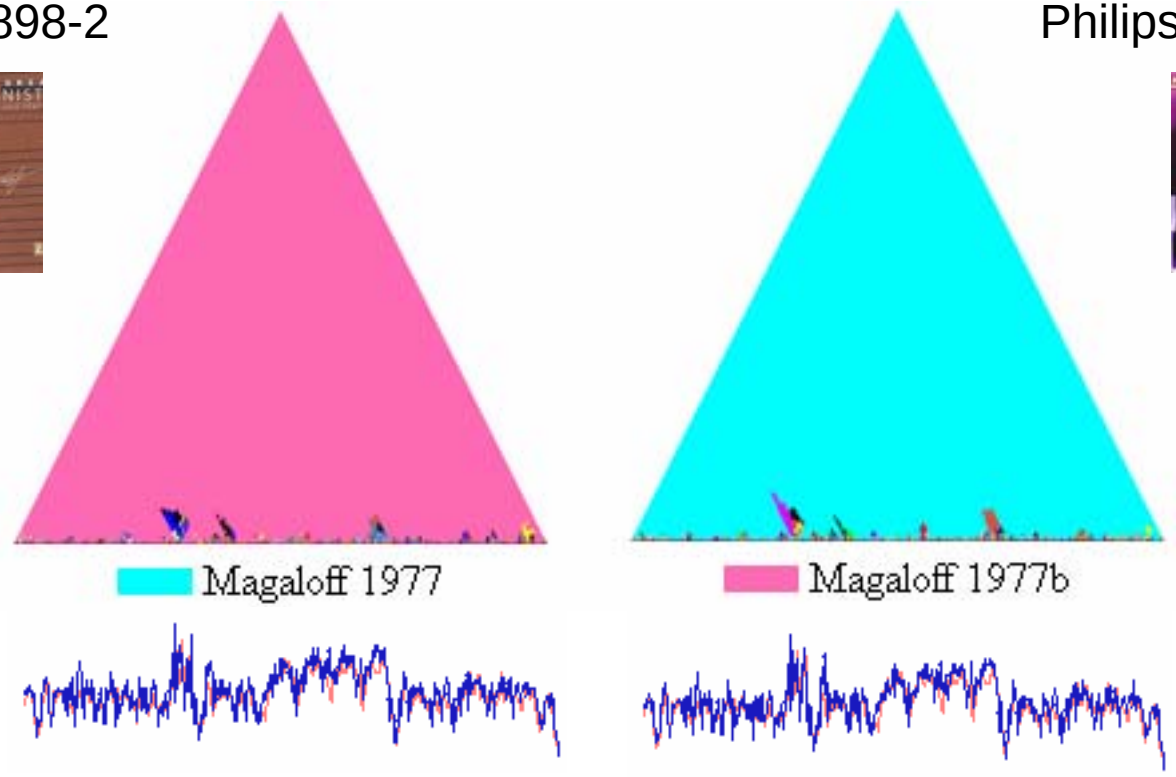
Same source recording

The same performance by Magaloff on two different CD releases

mazurka 17/4 in A minor

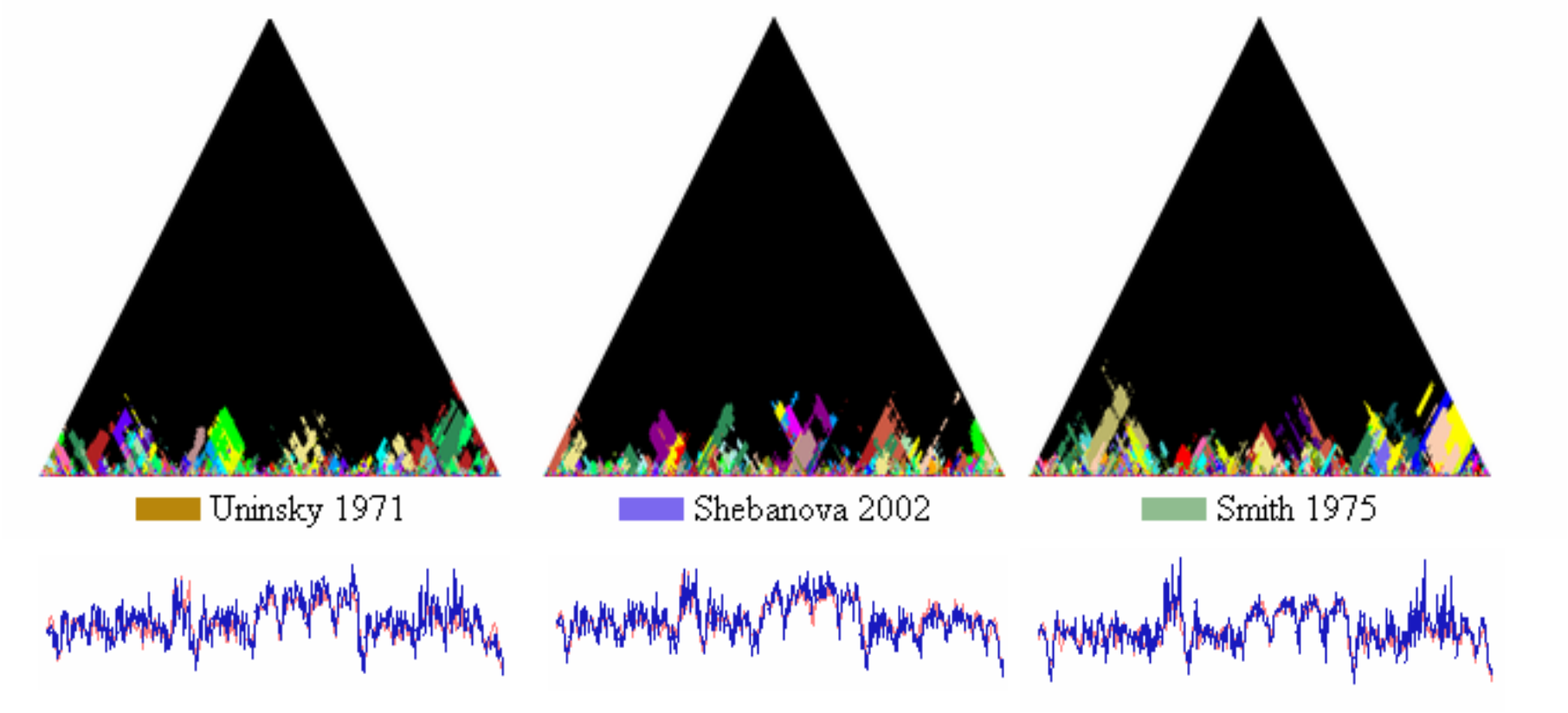
Philips 456 898-2

Philips 426 817/29-2



• Structures at bottoms due to errors in beat extraction or interpreted beat locations (no notes on the beat).

Individual interpretations

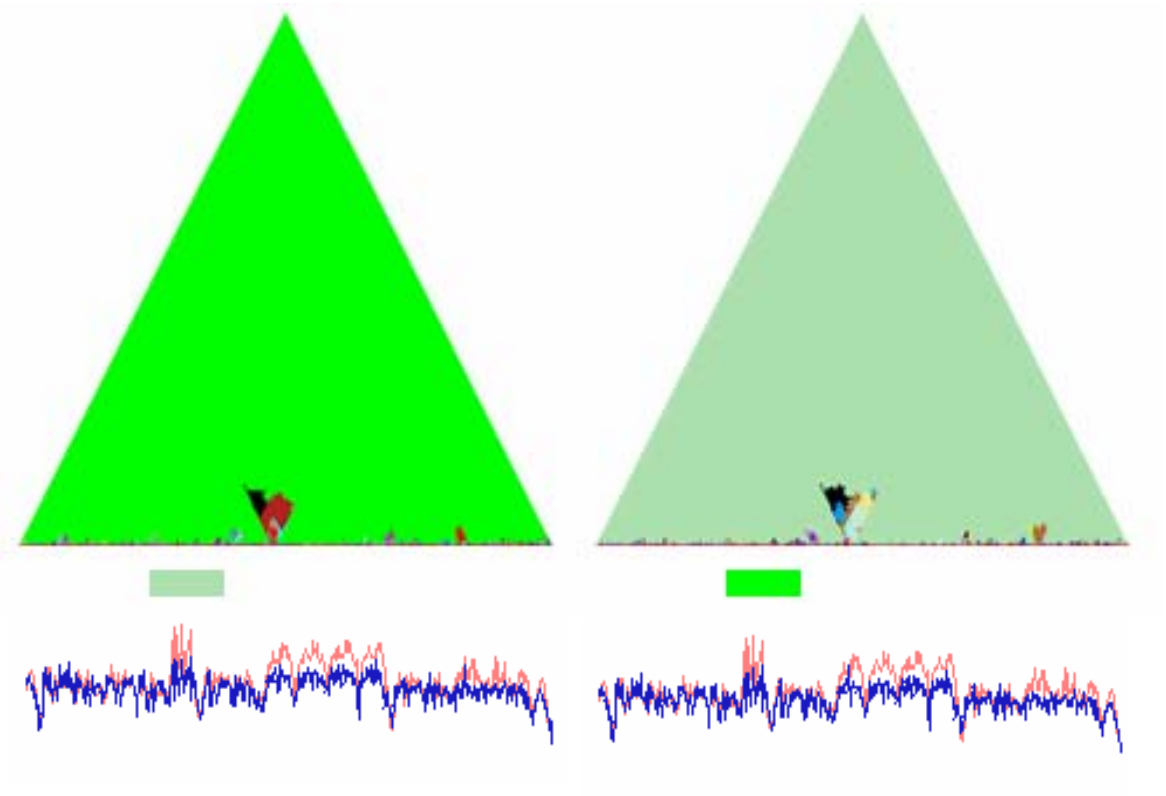


- Idiosyncratic performances which are not emulated by other performers.

(or I don’t have performances that influenced them or they influence)

Purely coincidental

Two difference performances from two different performers on two different record labels from two different countries.



For further information

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

http://mazurka.org.uk