How do Performance Features relate to Expressive Dimensions?

Dimension 1	Dimension 2	Dimension 3	Dimension 4
PP ($R^2 = 0.24$)	PP ($R^2 = 0.18$)	PP ($R^2 = 0.26$)	PP ($R^2 = 0.24$)
loudness avg 0.51***	loudness sk 0.45**	loudness std −0.53**	beat period k −0.34*
			loudness std −0.44*
MF ($R^2 = 0.39$)	MF ($R^2 = 0.00$)	MF ($R^2 = 0.00$)	MF ($R^2 = 0.29$)
rhythmic complexity −0.74*	minorness 0.15	articulation −0.15	rhythmic complexity 0.52*
tonal stability −0.94**			tonal stability 0.84***
articulation 0.46*			
HF ($R^2 = 0.22$)	HF ($R^2 = 0.00$)	HF ($R^2 = 0.36$)	HF ($R^2 = 0.09$)
valence sk 0.48**	valence avg 0.14	valence k 0.42**	valence k −0.33*
		arousal avg −1.24***	
		valence std 0.27*	
		valence avg −0.82*	

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Sorting Musical Expression: Characterization of Descriptions of Expressive Piano Performances

Carlos Cancino-Chacón[1,4], Silvan Peter[1], Shreyan Chowdhury[1], Anna Aljanaki[2] and Gerhard Widmer[1,3]

[1]Institute of Computational Perception, Johannes Kepler University Linz, Austria
[2]Institute of Computer Science, University of Tartu, Estonia
[2]LIT AI Lab, Linz Institute of Technology, Linz, Austria
[4]RITMO Centre for Interdisciplinary Studies in Rhythm, Time and Motion, University of Oslo, Norway

The *Con Espressione* Game

Research Aims: Find the dimensions of musical expression that can be attributed to a performance, as perceived and described in natural language by listeners
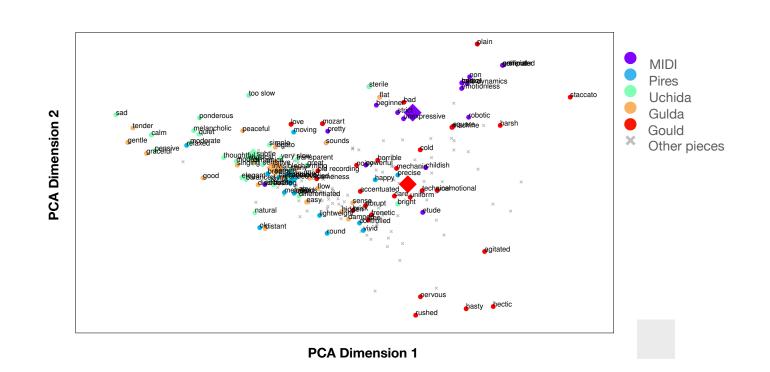
- Web based questionnaire: verbal descriptors of expressive performance.
- Different performances of 9 classical piano pieces (45 performances)
- Dataset enriched with score-to-performance alignments

Composer	Piece	#	Pianists
Bach	Prelude No.1 in C, BWV 846 (WTC I)	7	Gieseking, Gould, Grimaud, Kempff, Richter, Stadtfeld, MIDI
Mozart	Piano Sonata K.545 C major, 2nd mvt.	5	Gould, Gulda, Pires, Uchida, MIDI deadpan
Beethoven	Piano Sonata Op.27 No.2 C# minor, 1st mvt.	6	Casadesus, Lazić, Lim, Gulda, Schiff, Schirmer
Schumann	Arabeske Op.18 C major (excerpt 1)	4	Rubinstein, Schiff, Vorraber, Horowitz
Schumann	Arabeske Op.18 C major (excerpt 2)	4	Rubinstein, Schiff, Vorraber, Horowitz
Schumann	Kreisleriana Op.16; 3. Sehr aufgeregt (ex 1)	5	Argerich, Brendel, Horowitz, Vogt, Vorraber
Schumann	Kreisleriana Op.16; 3. Sehr aufgeregt (ex 2)	5	Argerich, Brendel, Horowitz, Vogt, Vorraber
Liszt	Bagatelle sans tonalité, S.216a	4	Bavouzet, Brendel, Katsaris, Gardon
Brahms	4 Klavierstücke Op.119, 2. Intermezzo E minor	5	Angelich, Ax, Serkin, Kempff, Vogt

What are the main dimensions for expressive character?

Principal component analysis (PCA) on the occurrence matrix of the terms and find 4 principal dimensions
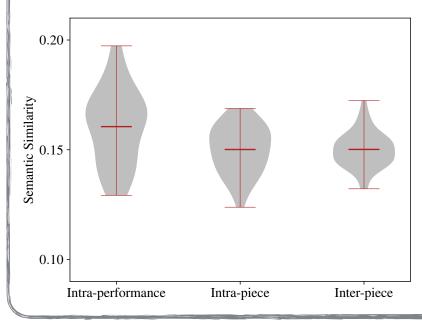
	Dimension 1			Dimension 2	
positive correlation		negative correlation	positive correlation		negative correlation
hectic	0.17	sad	-0.20	rushed	0.22	hard	-0.19
staccato	0.15	gentle	-0.18	nervous	0.20	stumbling	-0.18
hasty	0.15	tender	-0.18	too fast	0.17	staccato	-0.17
agitated	0.14	calm	-0.16	bit	0.16	ponderous	-0.14
irregular	0.14	graceful	-0.16	hasty	0.15	monotonous	-0.13

	Dimension 3			Dimension 4	
positive correlation		negative correlation	positive correlation		negative correlation
monotonous	0.22	heavy	-0.14	ok	0.24	cold	-0.15
bad	0.17	graceful	-0.13	happy	0.21	warm	-0.14
warm	0.16	smooth	-0.12	joyful	0.19	floating	-0.14
peaceful	0.16	ponderous	-0.12	free	0.15	blurred	-0.14
beautiful	0.15	soaring	-0.10	breathy	0.14	mysterious	-0.13

MIDI
Pires
Uchida
Gulda
Gould
Other pieces
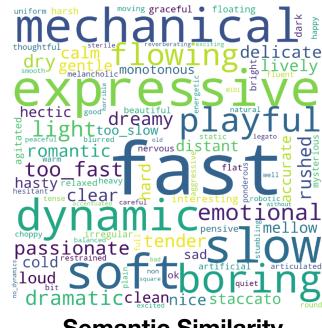
PCA Dimension 2
PCA Dimension 1

How similarly do listeners describe the performance of a piece?

Distribution of Terms

- 94 participants (on average listened to 4.5 out of 9 pieces)
- 88% had some musical training
- 1,515 individual descriptions, 3,166 terms (45% unique)

Semantic Similarity

- Semantic similarity for short sentences by [Li et al., 2007]
- **Intra-performance**: same piece, same pianist
- **Intra-piece**: same piece, other pianists
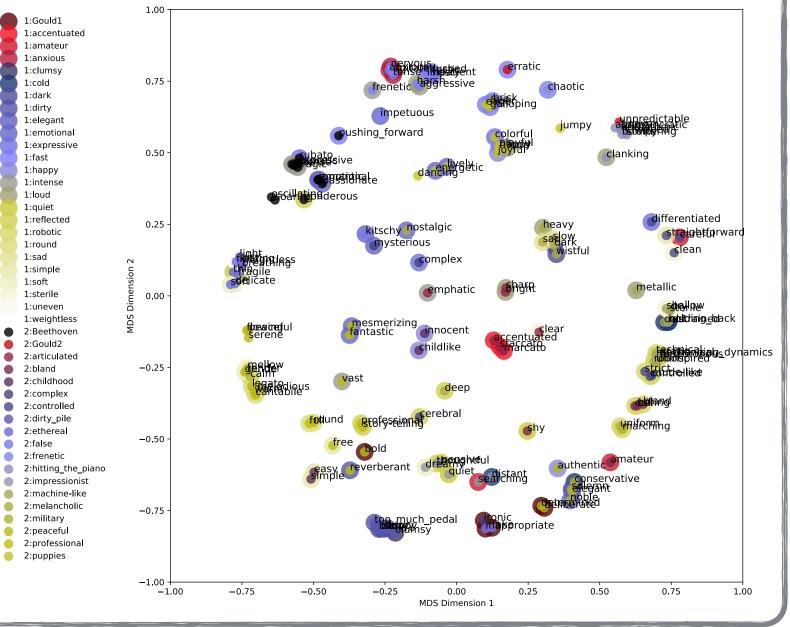- **inter-piece**: other pieces

Pile Sorting Experiment

Participants

- Two groups of expert musicians (G1 and G2)
- Each group sorted (independently) 150 of the most frequently used terms that had been collected through the CEG.
- The number of piles as well as the types of similarity within the piles were left open.

Results

- G1 (25 piles), G2 (19 piles)
- Average maximal overlap (Szymkiewicz-Simpson coefficient):
  - 62 % piles G1 with piles G2
  - 65% piles G2 with piles G1
- Multidimensional Scaling (MDS) to explore the structure of the terms

Explore the interactive visualization!

Get the Dataset!

Pile Sorting Experiment

- We want to see how expert listeners (i.e., classically trained musicians) categorize the descriptions of the terms in the Con Espressione Game
  - We selected 150 of the most representative terms
- **Pile Sorting**: Participants sort each term into categories (piles) in a collaborative fashion