Sorting Musical Expression: Characterization of Descriptions of Expressive Piano Performances

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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

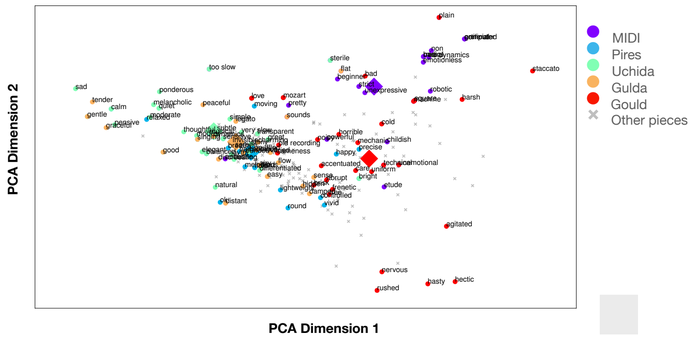
- Web based questionnaire: verbal descriptors of expressive performance.
- Different performances of 9 classical piano pieces (45 performances)
- Dataset enriched with score-to-performance alignments

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

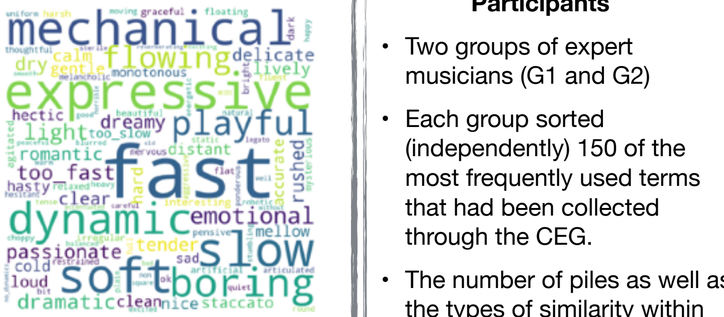
Dimension 1				Dimension 2			
positive correlation		negative correlation		positive correlation		negative correlation	
hectic	0.17	sad	-0.20	rushed	0.22	hard	-0.19
staccato	0.15	gentle	-0.18	nervous	0.20	stumbling	-0.18
hasty	0.15	tender	-0.18	too fast	0.17	staccato	-0.17
agitated	0.14	calm	-0.16	bit	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

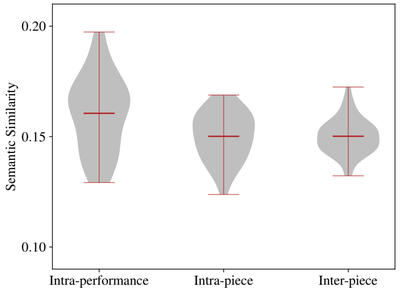


How similarly do listeners describe the performance of a piece?

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

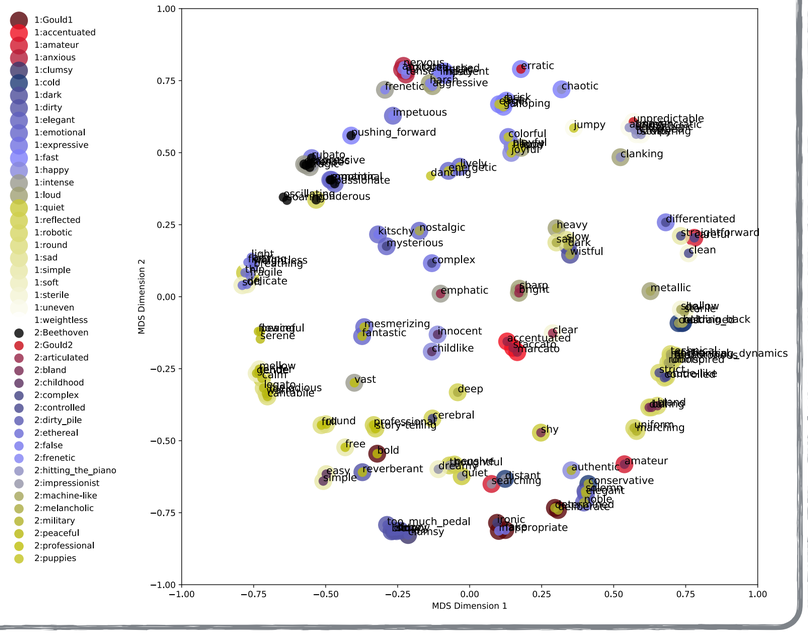
Participants

- 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.

Explore the interactive visualization!

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



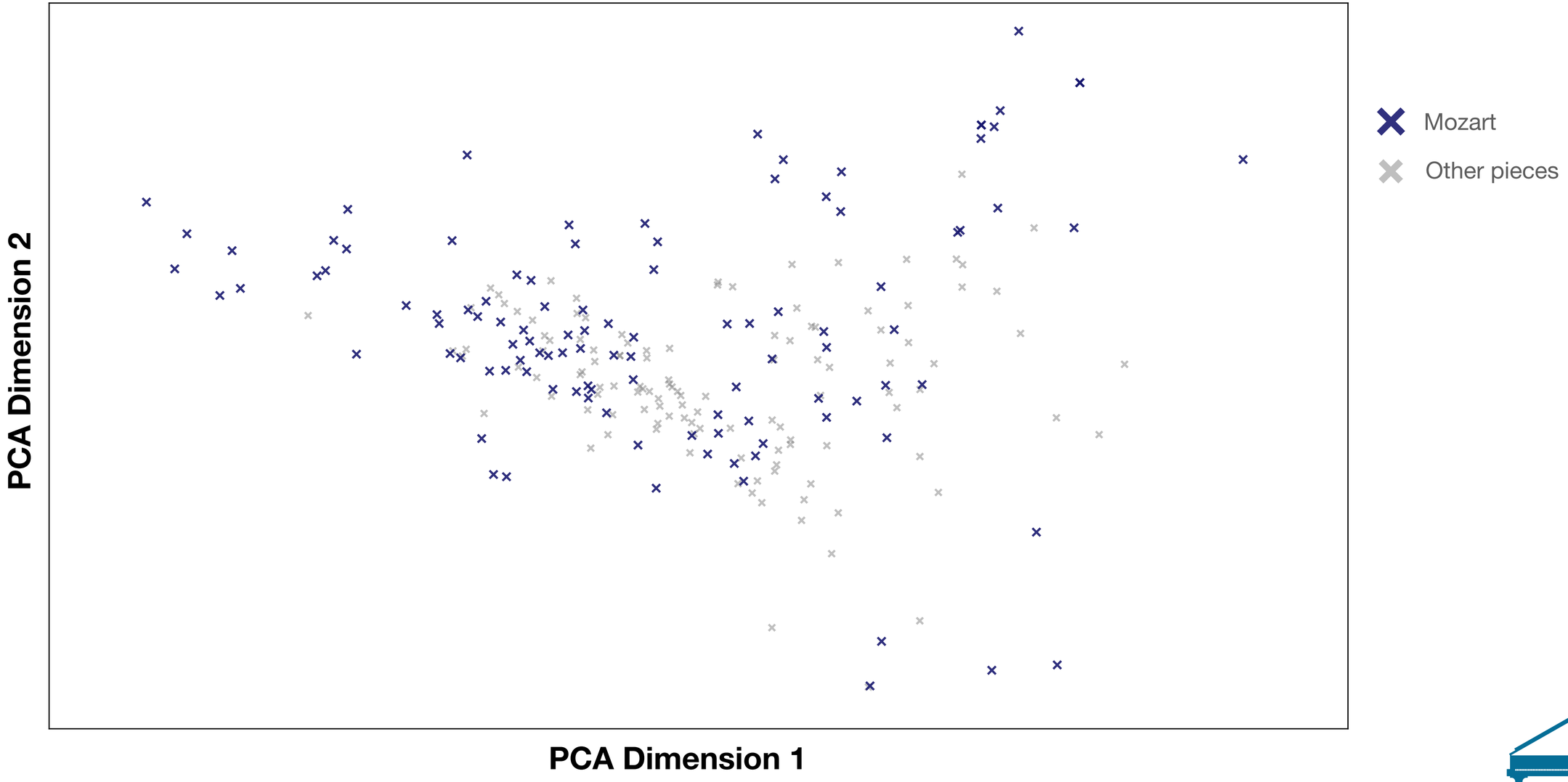
Get the Dataset!

Acknowledgements

This research has received support from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme under grant agreement No. 670035 (project "**Con Espressione**") and by the Research Council of Norway through its Centers of Excellence scheme, project number 262762 and the **MIRAGE** project, grant number 287152.

Introduction

What are the Main Dimensions for Expressive Character?



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

What are the Main Dimensions for Expressive Character?

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Results

- Number of piles
  - Group 1 (G1): 25 piles
  - Group 2 (G2): 19 piles
- Average maximal overlap (Szymkiewicz-Simpson coefficient):
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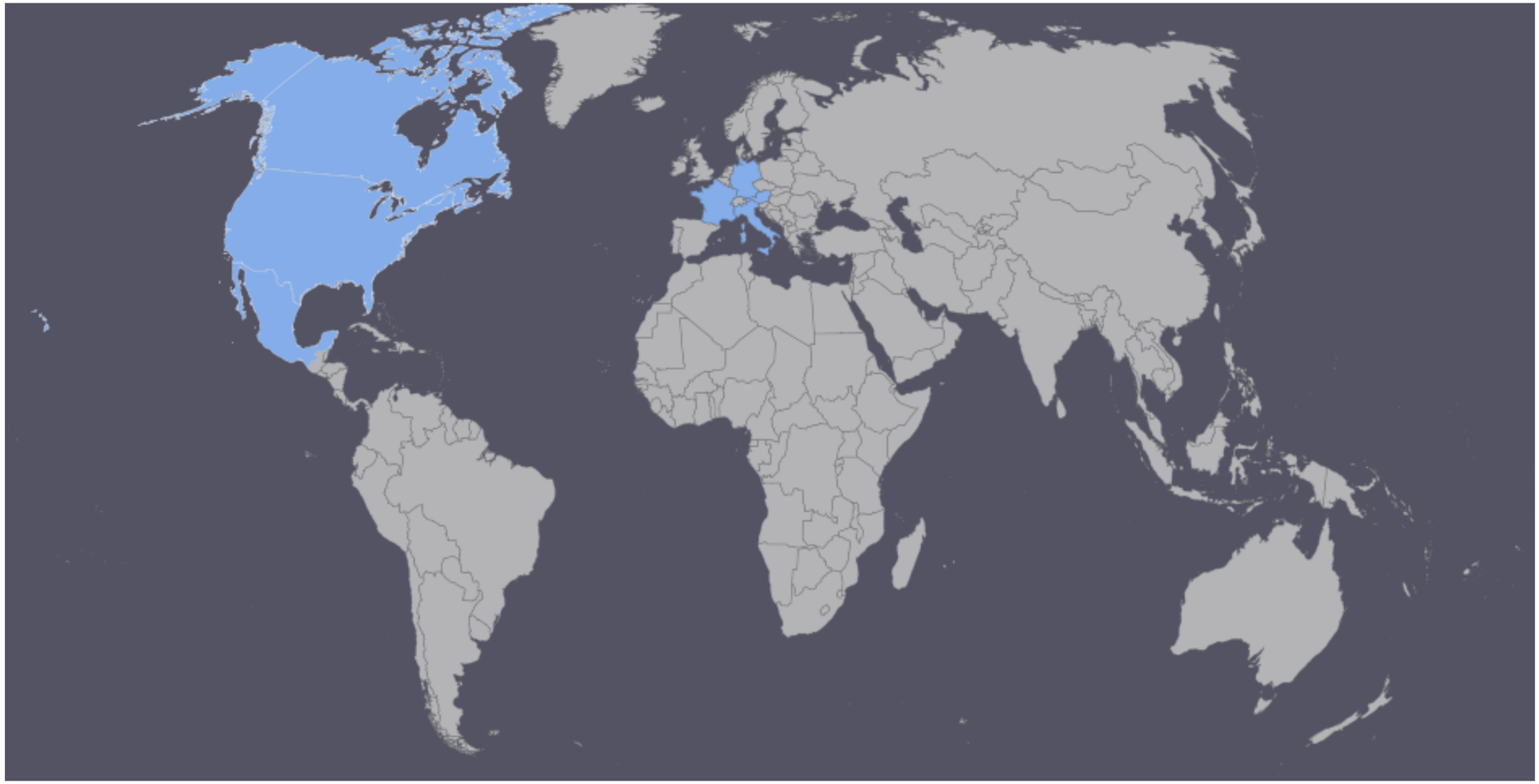
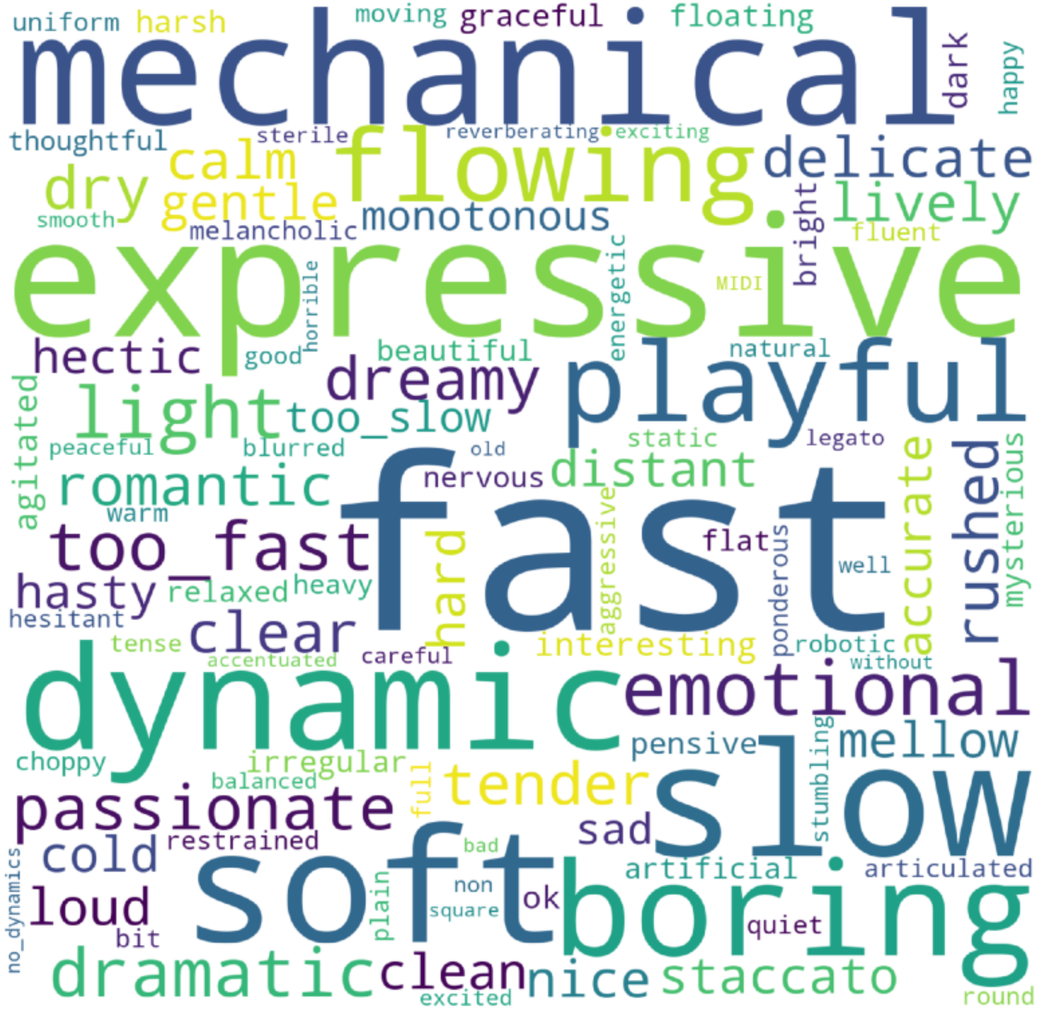
Pile Sorters Assemble!



How similarly do listeners describe the performance of a piece?

- >1,500 individual descriptions
  - >3,100 terms
  - >1,400 are unique (around 45%)



The *Con Espressione* Game

- Online questionnaire where participants listened to several performances of the same classical piano piece.
- <1500 descriptions (by 190 participants)
- 45 piano performances (9 pieces, 4-7 performances per piece)

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Semantic Similarity

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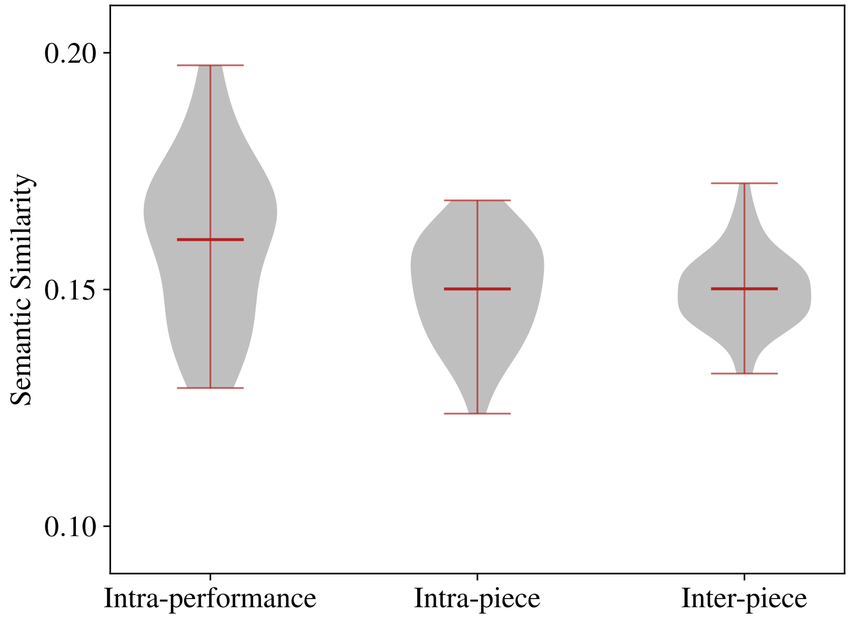
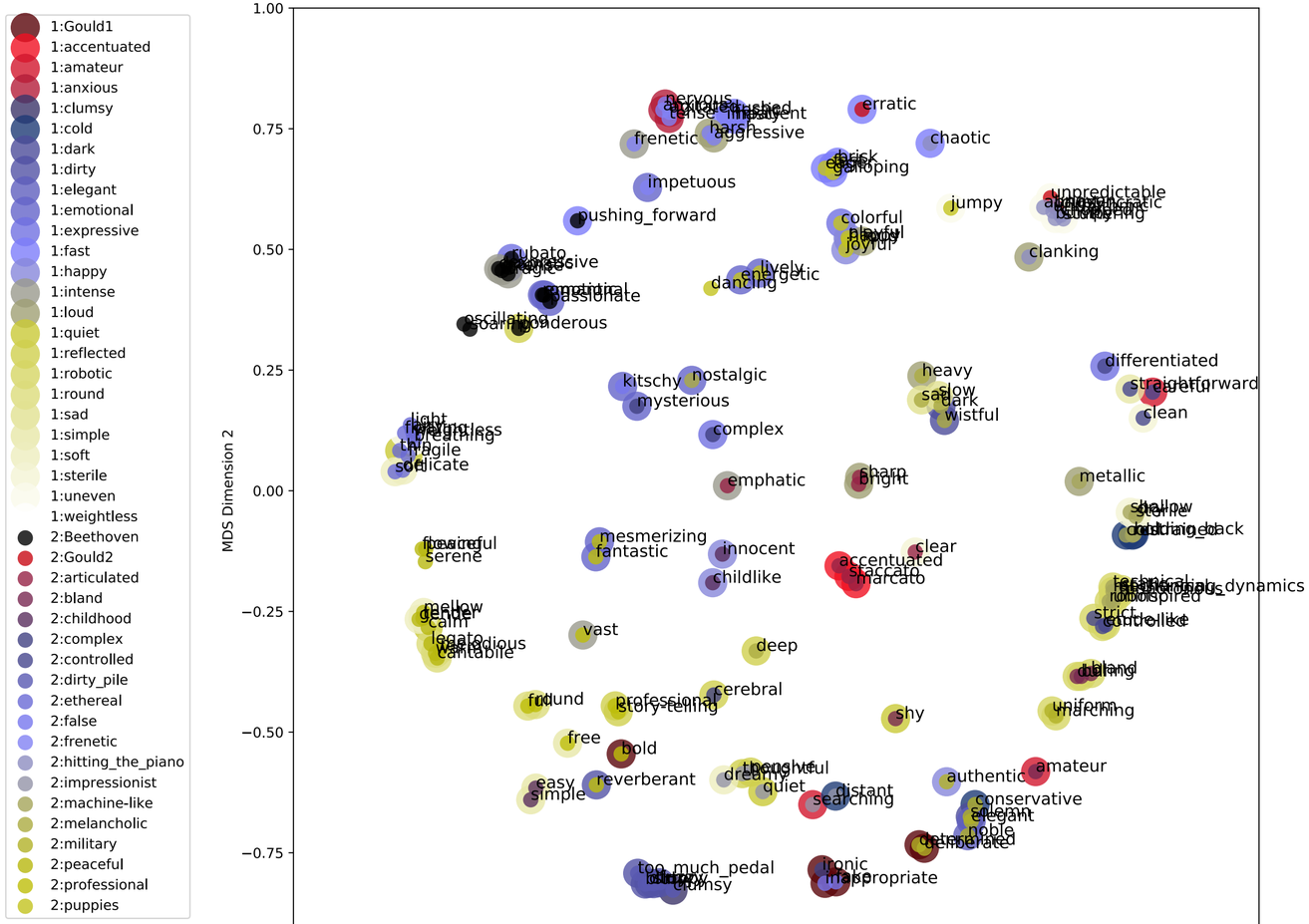
- **Intra-piece**: same piece, other pianists
- **Inter-piece**: other pieces
- Average **intra-performance** similarity is larger than both **intra-piece** or **inter-piece** similarities
- **Intra-piece** similarity is not statistically different from **inter-piece** similarity
- Evidence that listeners use a limited vocabulary to distinguish the difference in expressive character?



Multidimensional Scaling of the Piles



What are the Main Dimensions for Expressive Character?

- Principal component analysis (PCA) on the occurrence matrix of the dataset.
  - each row corresponds to a term in the dataset and each column to a performance
  - We find 4 principal dimensions