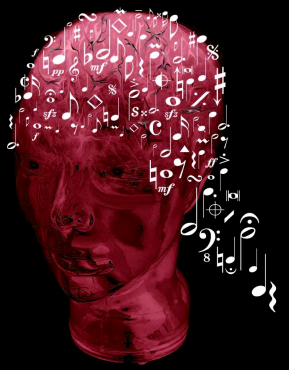


What emotions and free associations characterize different musical styles?

Florian Eckl, Erica Bisesi & Richard Parncutt

ICME3 2013

Jyväskylä, Finland, 11-15 June 2013

An accent-based approach to music analysis

Q: What do listeners perceive in the *structure* of a piece of music (i.e. not timbre, meaning)?

A: Two aspects of relationships between structural elements:

a) **segmentation** (hierarchical)

b) **accents** (salient events)

Our analysis produces :

- **SEGMENTATION**
  - ✓ start and end of phrases
  - ✓ hierarchical level of phrasing
  - ✓ climax of each phrase and sub-phrase

- **ACCENTS**
  - ✓ accent position
  - ✓ their kind (grouping, metrical, dynamical, melodic, harmonic)
  - ✓ their salience
  - ✓ their range of action

What is an "accent"?

What accents do :

- attract attention of listener
- give a feel for what is important
- clarify structure
- facilitate musical communication

A broad definition

- **immanent** (in the score):
  - ✓ grouping, metrical, melodic, harmonic
- **performed** (in the sound):
  - ✓ dynamic, durational, articulatory, timbral

What is an "accent"?

What accents do :

- attract attention of listener
- give a feel for what is important
- clarify structure
- facilitate musical communication

A broad d

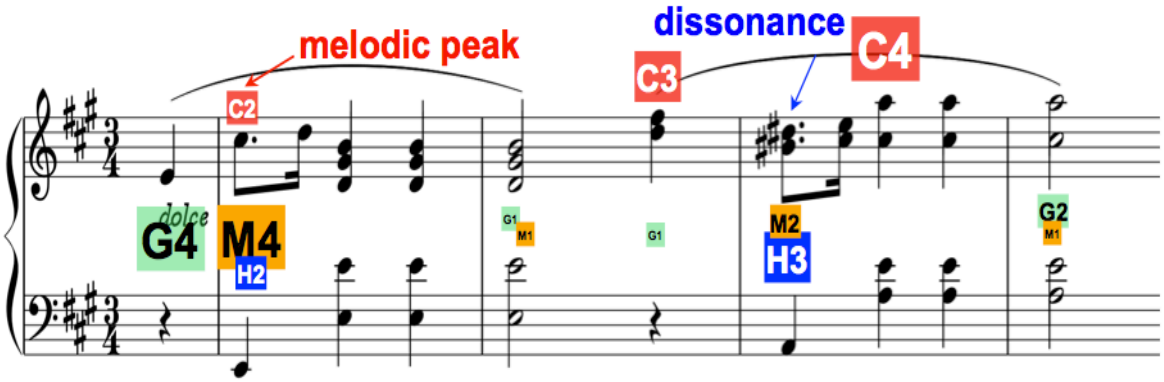
- immaner
  - ✓ groupi
- performe
  - ✓ dynam

ACCENTS	IMMANENT	PERFORMED
time	grouping metrical	agogic (onset time) articulatory (duration)
pitch	melodic harmonic	intonation
loudness	dynamic	stress
timbre	instrument orchestration	coloration

Table 1: Parncutt's (2003) taxonomy of musical accents.

Model for accents

Chopin – Prelude op. 28 no. 7



salience 5 C melodic contour

salience 4 H harmonic accent

salience 3 M metrical accent

salience 2 / salience 1 G grouping accent

A computer model of immanent accent salience in tonal music

Parncutt, Bisesi & Friberg (2013)

Director Musices (DM) is a computer program that enables a musical score to be performed automatically. The result of a long-term research project at the KTH, Stockholm, it comprises performance rules that change specific note properties, including timing, duration, intensity, and frequency *(Friberg, Bresin & Sundberg, 2006)*.

Input: musical score → Output: "musical" performance

Method: adjust timing, loudness, etc. by music-structural "rules"

Director Musices :
new formulation

- not only global or intermediate structural properties, but also local events
- analysis-by-synthesis method
- automatic analysis of the score and application of rules
- focus on different historical periods and stylistic conventions

a toolbox in which the performer decide which tool to use depending on the musical intention, style, personal preferences

Mathematical model
salience

- **Metrical accents:**
  - each pulse or metrical level is marked on the score
  - the function of pulse salience against period is a Gaussian function relative to a logarithmic scale of period *(Parncutt, 1994)*

$$Salience_i = e^{-0.5*\left(\frac{\log X - \log M}{\log S}\right)^2}$$

  - the metrical accent salience of each point in time in the score is the sum of the salience of all metrical levels including that note

Mathematical model
salience

- **Metrical accents:**
  - each pulse or metrical level is marked on the score
  - the fu… a Gaussian functi… od *(Parncutt, 1994)*
  - the me… in the score is the …cluding that note

	Metrical level			
Time signature	**Level 0**	**Level 1 (beat)**	**Level 2**	**Level 3**
4/4	1/8	1/4	2/4	4/4
2/2	1/4	1/2	2/2	4/2
4/2	1/4	1/2	2/2	4/2
2/4	1/8	1/4	2/4	4/4
¾	1/8	1/4	¾	6/4
3/8	1/16	1/8	3/8	6/8
6/8	1/8	3/8	6/8	12/8
9/8	1/8	3/8	9/8	18/8

Table 1. The period of each metrical level expressed as note values for different time signatures.

Mathematical model
salience

- **Melodic contour accents:**
  - the salience of the accent is due to a combination of two factors: the **size of the leap preceding** the accent, and **the distance of the accent from the centre** of the melody's range or ambitus
  - the mean pitch is calculated for each track individually:
    - each tone is assigned a salience S_1 for the pitch deviation from the mean
    - each tone is assigned a salience S_2 is according to the size of the preceding interval
    - the final value for melodic salience = $(S_1 + S_2) / 15$

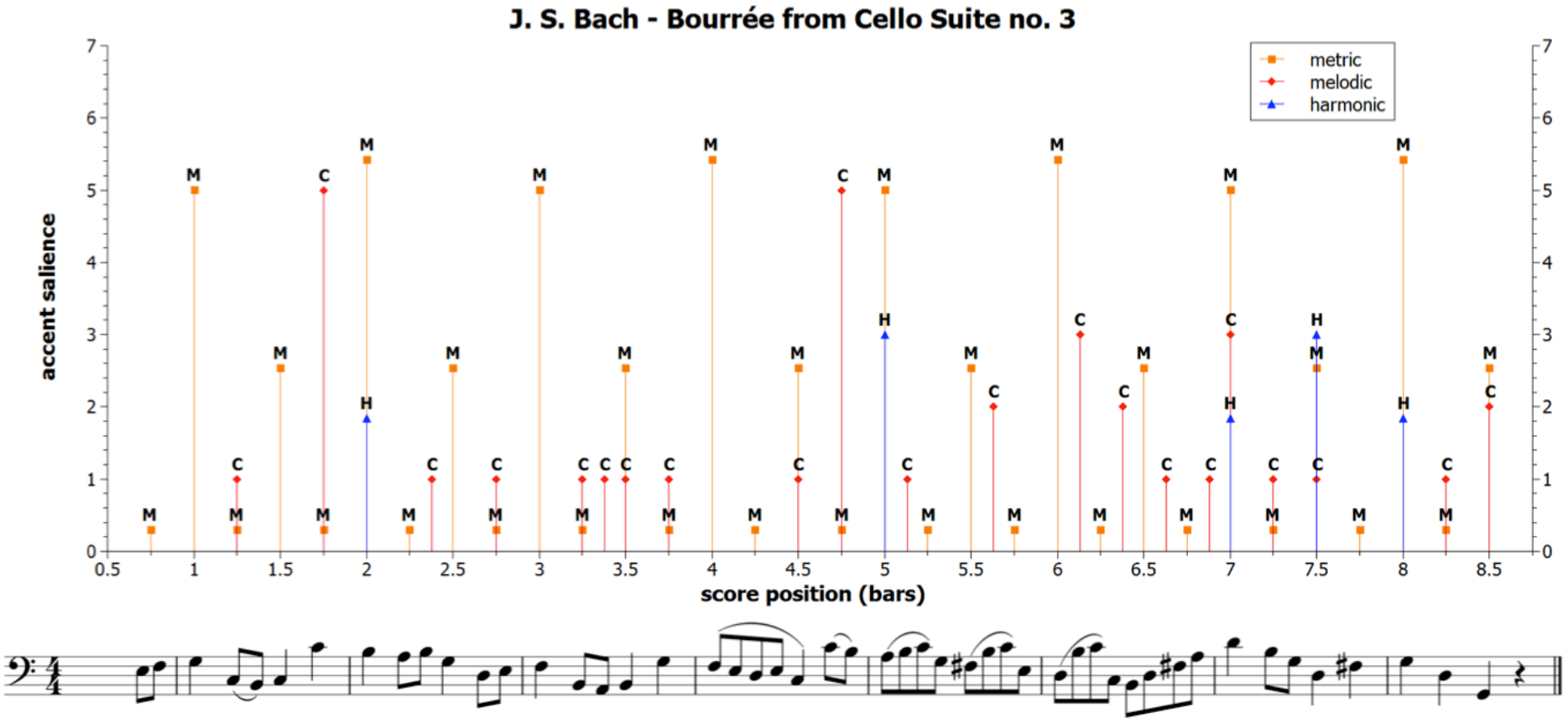
Mathematical model
salience

- **Harmonic accents:**
  - a functional harmonic analysis is manually provided in the score *(Friberg, 1991)*
  - the salience of a harmonic accent is computed at each chord change

$$Salience = 1.5 * \sqrt{Harmonic\ Charge}$$

  - an alternative possibility is to consider Krumhansl profiles (*Krumhansl & Kessler, 1982*)

Results


J. S. Bach - Bourrée from Cello Suite no. 3
metric
melodic
harmonic
accent salience
score position (bars)

Our project

Aim. We are searching for a relationship between structural parameters involved in our new model for musical expression (based on accents), and emotions and free associations.

Research Questions:

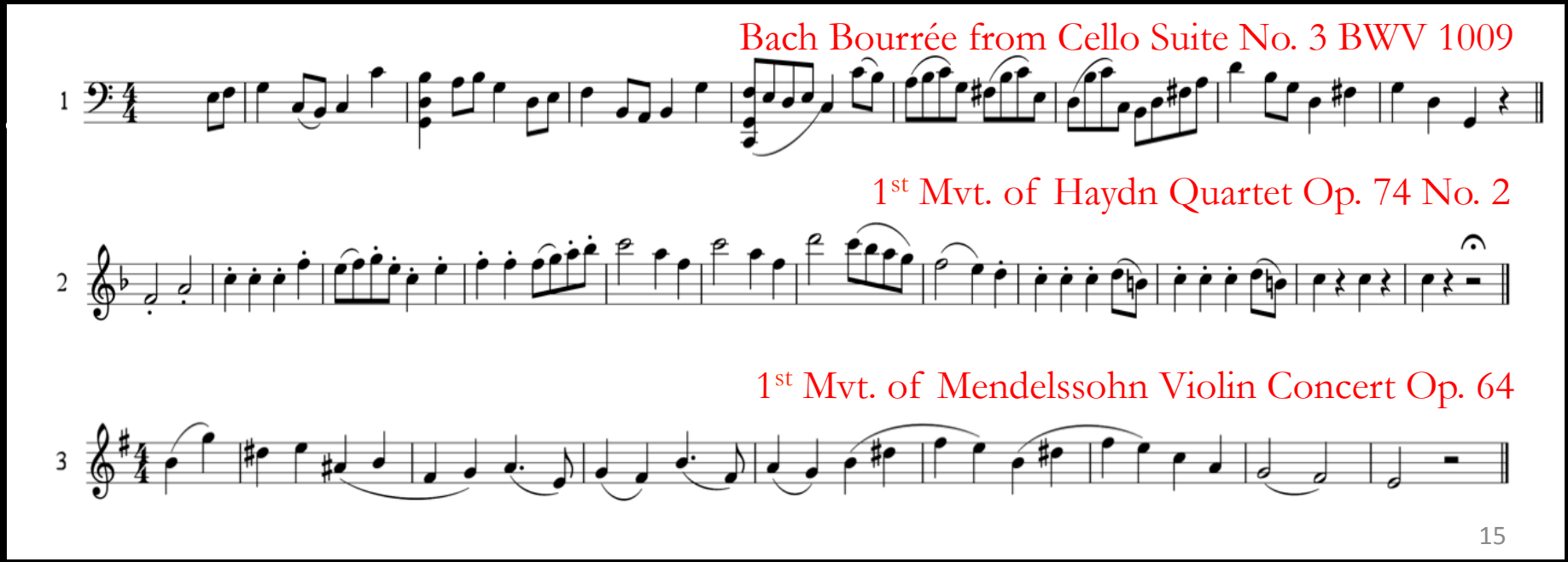
1. How do musically acceptable performances fit with possible ranges of parameter values?
2. Which parameter ranges correspond to particular qualities of performance such as emotions and free associations?
3. How do all these findings depend on stylistic context?

Our project

Participants. 14 participants (7 musicians and 7 non-musicians)

Stimuli.

- 3 piano pieces in different ”classical” styles and with different structure (meter, modality)



Stimuli.

Table 1. Stimuli provided to participants in tasks 1, 2, and 3. Acronyms' explanation: "1": Bach; "2": Haydn; "3": Mendelssohn; "N": nominal (or dead-pan) performance; "M": expressive performance based on metrical accents; "CH": expressive performance based on melodic and harmonic accents; "T": local deviations in the tempo; "D": local deviations in the dynamics; "W1": steep curve profile; "W2": smooth curve profile.

TASK 1, TASK 3		TASK 2	
#	performance	#	performance
1	1N		
2	1MTW1	1	1N – 1MTW1
3	1MTW2	2	1N – 1MTW2
4	1MDW1	3	1N – 1MDW1
5	1MDW2	4	1N – 1MDW2
6	1CHTW1	5	1N – 1CHTW1
7	1CHTW2	6	1N – 1CHTW2
8	1CHDW1	7	1N – 1CHDW1
9	1CHDW2	8	1N – 1CHDW2
10	2N		
11	2MTW1	9	2N – 2MTW1
12	2MTW2	10	2N – 2MTW2
13	2MDW1	11	2N – 2MDW1
14	2MDW2	12	2N – 2MDW2
15	2CHTW1	13	2N – 2CHTW1
16	2CHTW2	14	2N – 2CHTW2
17	2CHDW1	15	2N – 2CHDW1
18	2CHDW2	16	2N – 2CHDW2
19	3N		
20	3MTW1	17	3N – 3MTW1
21	3MTW2	18	3N – 3MTW2
22	3MDW1	19	3N – 3MDW1
23	3MDW2	20	3N – 3MDW2
24	3CHTW1	21	3N – 3CHTW1
25	3CHTW2	22	3N – 3CHTW2
26	3CHDW1	23	3N – 3CHDW1
27	3CHDW2	24	3N – 3CHDW2

Our project

Procedure.

Stage 1:

Aim: quantify the musical acceptability of the pieces

Method: rate on a scale from 1 (not at all) to 10 (a lot)

Stage 2

Aim: quantify the degree of expressivity of different renditions as compared with deadpan performances

Method: rate on a scale from 1 (small) to 10 (big)

Our project

Procedure.

Stage 3

Aim: describe automatic performance renditions from the viewpoint of the listeners (feelings, images, or other descriptions)

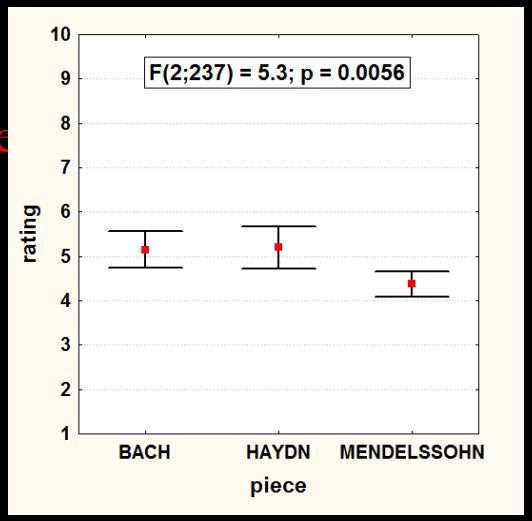
- Stage 1 and 3: each of the 27 performances was provided to participants separately
- Stage 2: each stimulus consisted of a combination of a deadpan performance and an expressive performance
- In all stages, stimuli were presented in a random order

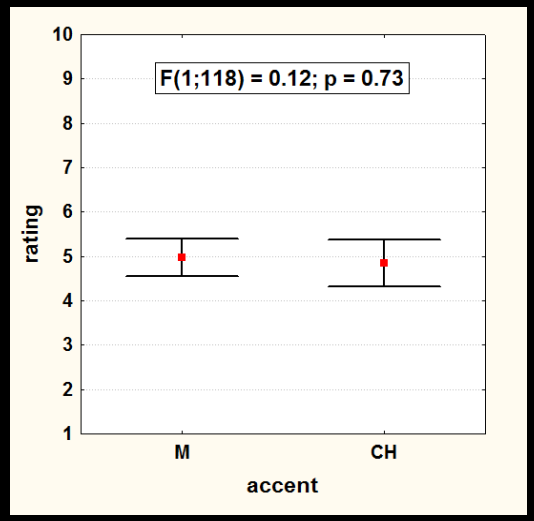
Preliminary results

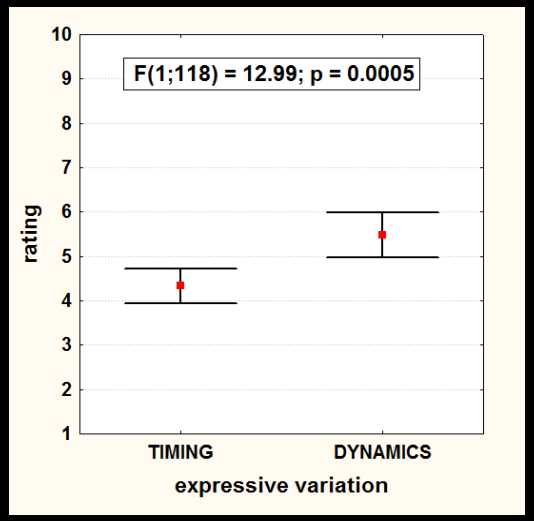
task 1: goodness of stimuli

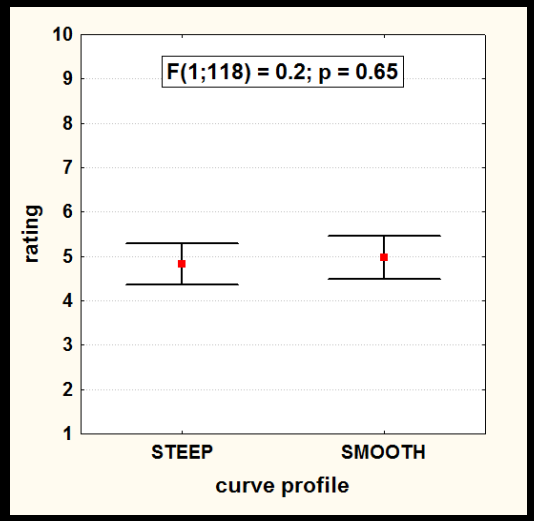
Preliminary results

task 1: goodne









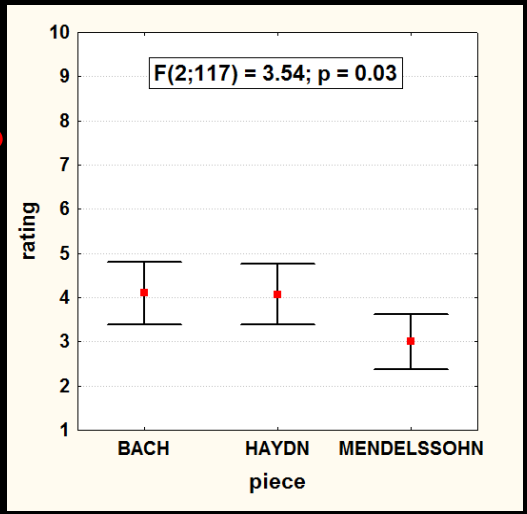
Eckl, Bisesi & Parncutt (2013)

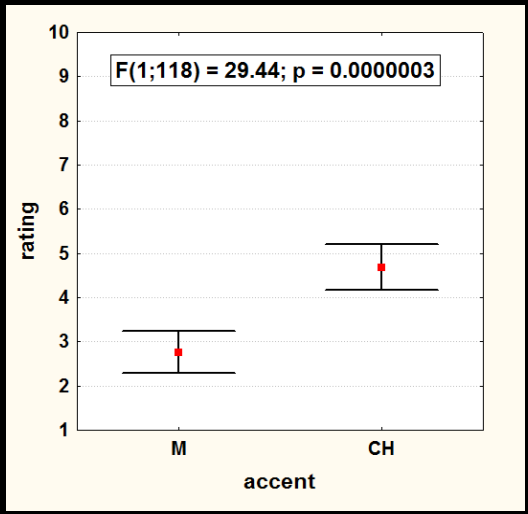
Preliminary results

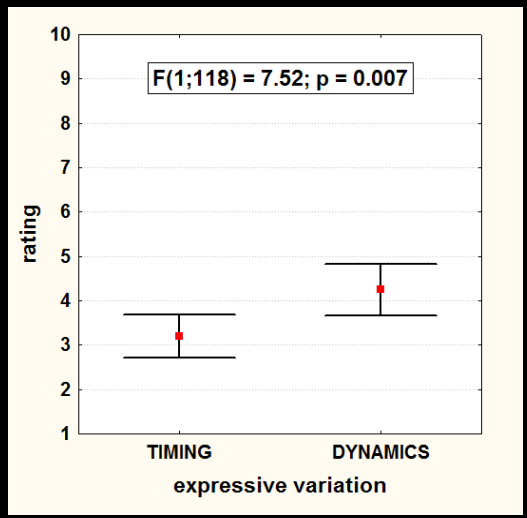
task 2: level of expressivity

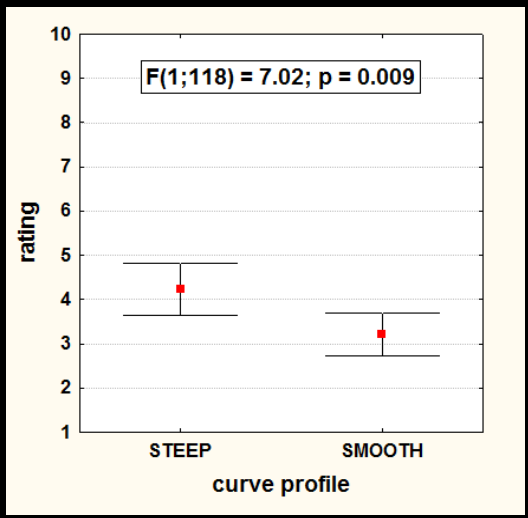
Preliminary results

task 2: level o









Eckl, Bisesi & Parncutt (2013)

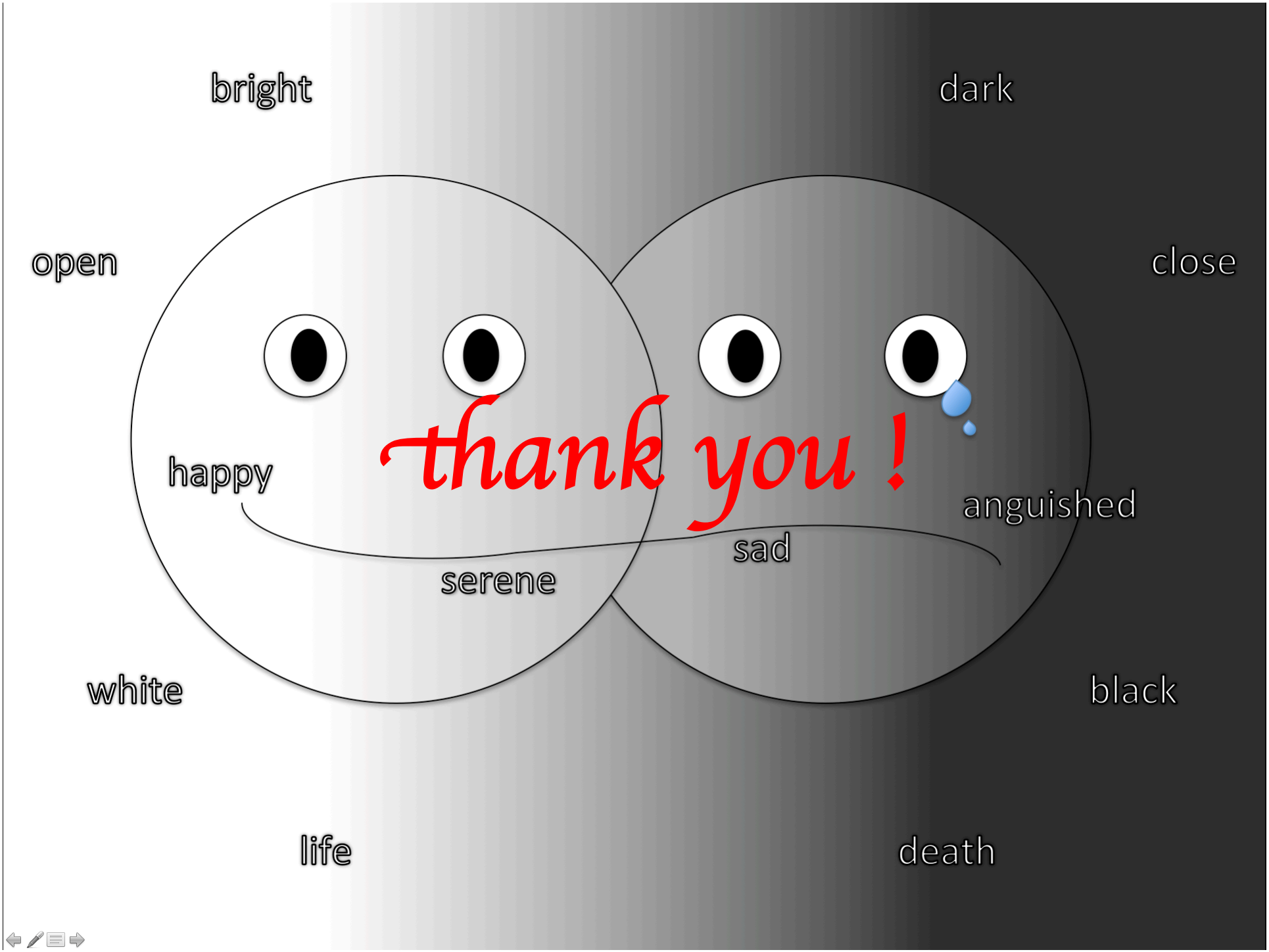
Conclusions

- Baroque- and classical-style performances are preferred with respect to romantic-style performances
- Expressive variations in the dynamics are preferred

- Baroque- and classical-style performances were rated as more different from deadpan performances than romantic performances
- Ratings were higher when differences were due to changes in the dynamics than in the timing
- Emphasis on melodic and harmonic accents modeled by mean of steep curve profiles were perceived as more different from deadpan performances than renditions based on metrical accents and/or smooth curve profiles

Implications

- Second stage of the experiment: to relate parameters' pre-sets to specific words describing emotions and free associations
- Results will be used to develop new gestural interfaces in pDM - a *pure data* system for real-time expressive control of music performance


bright
dark
open
close
thank you !
happy
anguished
sad
serene
white
black
life
death