What to expect from music psychology?

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Music psychology

- Psychological investigation of musical behaviour and experiences
- Linked to real-world behaviours:
  - Aesthetic appreciation, preference judgements
  - Musical involvement
  - Musical creation
  - Patterns of listening behavior
  - …
As fundamental research: highly relevant for understanding of human mind

- Complex non-verbal processing
- Music listening and music making among most complex cognitive and psycho-motor tasks
- Familiar and personally relevant to general population
- ‘Highest form of art’ (F. Nietzsche)
- Uniquely human faculty and ‘most profound description of the human existence’ (A. Schopenhauer)
As applied research: highly visible in popular media
What to expect from music psychology?

Scientific understanding of

Foundations underlying commercial and legal handling of music

Nature of uniquely human faculty (Question: ‘What does it mean to be human?’)

Basis: Rigorous empirical, data-driven approach
Two examples

- Similarity perception and music plagiarism
- The development of musicality
Huge public interest:

Grand-Prix-Betrug?
Sće Carla Cordalis (51) ist von ihr geklaut.
Bild, 11.05.1998

Grand-Prix-Siegerin
Charlotte ist nur geklaut.
Bild, 31.05.1999

STEFAN RAAB – da haust ihr geklaut
Bild, 9.3.2000

Michelles Siegerlied –
alles nur geklaut?
Bild am Sonntag, 4.3.2001

Das Siegerlied beim Grand
Prix ist geklaut! Der deutsche Latino-Sänger
Lou Bega (26).
Bild am Sonntag, 28.5.2002

Alles nur geklaut? Wirbel
um Grand-Prix-Hit von
Texas Lightning.
Bild, 21.3.2006

“No Angels” unter Verdacht:
Haben sie ihren Grand-Prix-
Song “Disappear” nur geklaut?
Bild, 11.3.2008
Hard and fast rules for music plagiarism?

- The 2-second rule
- The 1-bar rule
- The 5-notes rule

It is more complicated than that!

*Two songs or song parts must be similar and share unique musical components*
Example: Bright Tunes VS. Harrisongs (1976)

- The Chiffons He’s So Fine, 1963
  - No. 1 in US

- George Harrison, My Sweet Lord, 1971
  - No. 1 Hit in US, UK & (West-)Germany

Plagiarism! Cost: $1 Million

- Ronald Selle, “Let It End”

- Bee Gees, “Is Your Love” (1977)
Questions

- How can we measure the similarity between melodies?
- What do we mean by melodies *sharing unique features*?
- When is similarity dangerous?
Possible approach: Measuring similarity in context of music corpus

1. Break melodies up into short motives (types)

2. Use statistics on types in representative corpus as context

3. Compute similarity based on types shared between melodies

4. Evaluate computational model against human judgements
1. Break up melodies into types

Melody types: similar to words in language

Count occurrence of types in melody

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<th>Melodic Type $\tau$ (pitch interval, length 2)</th>
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m-type of length 2: “s1e_u5e”

m-type of length 3: “s1e_d2e_s1e”

Twinkle Twinkle - Little star
How I wonder what you are
2. Consider pop music history as context

Count melody-types in database of 14,000 pop songs:

- Common melody-types => low weight
- Rare and unique melody-types => high weight
3. Compute similarity from types shared between two melodies

Tversky (1977): Ratio model of similarity perception

\[ \sigma(s,t) = \frac{f(s_n \cap t_n)}{f(s_n \cap t_n) + \alpha f(s_n \setminus t_n) + \beta f(t_n \setminus s_n)}, \alpha, \beta \geq 0 \]

- Ratio of shared to non-shared types
- Degree of uniqueness of types: weighting function \( f() \)
4. Evaluate model against human judgements

- Ratings of music experts (Müllensiefen & Frieler, 2004, 2007): Correlation ~ 0.95

- Court decisions (Müllensiefen & Pendzich, 2009): Prediction accuracy: 90%

- Memory confusions by lay listeners (Müllensiefen & Wolf, in prep.): Correlation ~ 0.5
Similarity between tunes can be measured through perceptual models

Personal listening history can be approximated via corpus statistics

Court decisions are related to perceptual judgements of lay audiences and can be modelled computationally

=> Empirical research can provide foundation for commercial and legal handling of alleged infringement cases
Do listeners always hear the same thing when they hear music?

Different people might rightfully disagree in their perception of the same music. (‘de gustibus non disputandum esse’)

- How loud does this sound?
- Does this sound sad?
- Would you recommend this to a friend?

Different ‘correct’ responses to same stimulus possible!
‘If a phenomenon is strong enough to get in the way of something that you are trying to study, then perhaps it is worth studying in itself’
(advice to Albert Bregman)
Where do individual differences come from?

- Cultural background
- Education
- Familiarity with style/genre/composer
- Intelligence, working memory, perceptual acuity, …
- Musical sophistication
The Goldsmiths Musical Sophistication Index (Gold-MSI)

- Promoted on the BBC network in 2011
- 148,037 participants
- Self-report inventory on musical background, self-assessed skills
- Four ‘objective’ listening tests
Maps of Musical Sophistication

UK Amount Musical Training  UK General Musical Sophistication  UK Weekly Median Income

[Three maps showing geographic distribution]
Correlations with wealth

Musical Training ~ Annual Income ($r = .31$)

Active Engagement ~ Annual Income ($r = .01$)
Correlations with wealth

Self-reported general sophistication ~ Annual Income ($r = .14$)

Combined test score ~ Annual Income ($r = .40$)
Individual differences in musical sophistication exist and correlate with socio-demographic variables
Well-documented associations between musical abilities and
cognitive abilities, e.g. intelligence, memory (e.g. Chan et al., 1998; Schellenberg, 2011)
personality (e.g. Greenberg et al., 2015)
pro-social behaviour (e.g. Kirschner and Tomasello, 2010; Williams et al., 2015)
academic performance (Hille & Schupp, 2014)

But where do musical abilities come from?

How do musical abilities, intelligence, social skills, and personality develop together over adolescence?

=> Lack of longitudinal studies on musical development across teenage years
Proposed longitudinal study
(with Reinhard Kopiez and Hanover Music Lab)

Track development of musical abilities, intelligence, personality, and social skills in longitudinal study over 7 years

=> How do musical abilities develop?

=> Who will take up music seriously?
   (and who will give up again?)

=> Can we measure subsequent effects on intelligence, social skills and academic performance? (and how does it compare to sports and other leisure activities?)
Proposed longitudinal study

- To be implemented in secondary schools in Germany and the UK
- Online testing in computer classes under supervision of researchers
- Comprehensive testing using Gold-MSI listening tests (Müllensiefen et al., 2014) and other test batteries
Example: Melodic Discrimination
(Harrison, Collins & Müllensiefen, 2016)

- Psychological construct to be assessed:
  - short-term melodic memory

- Generic item format:
  - Three-alternative forced-choice (3AFC) / “odd one out”

1. [Musical notation]
2. [Musical notation]
3. [Musical notation]
Melody Item Construction

- Features manipulated according to cognitive literature:
  - length of melody
  - contour violation
  - tonality violation
- Features varied:
  - underlying base melodies
- Automatic Item generation:
  - Compositional model Racchman-Oct2010 (Collins et al., 2015)
  - Generates new base melodies in style of the source corpus (Irish folk songs)
Calibration Experiment

- **Aim**
  - Develop accurate predictive model of item difficulty for later implementation as computerized adaptive test

- **Method**
  - 425 participants
  - Produce **20 item families** by factorially combining:
    - **melody length** (5 levels)
    - **contour violation** (2 levels)
    - **tonality violation** (2 levels)
  - Generate 60 items for each item family (1,200 items)
  - Each participant takes 20 items, one from each item family, with no repetition of base melodies
Results

1. Findings from cognitive psychology confirmed

2. Link between cognitive difficulty and musical features identified

3. Scale for individual differences in melodic discrimination ability developed

=> Basis for computerized adaptive test using automatic item generation
The broader picture

=> Use melodic discrimination test as part of test battery for measuring musical development across adolescence (longitudinal study)
Girls school, UK
- 312 girls, 10 to 18 years
- Test: individually via online interface and headphones in computer rooms

Aims:
- Proof-of-concept
- Baseline measures for all tests
- Identify correlational relationships
Tests and data collected

Cognitive:
- Non-verbal Intelligence

Musical Listening:
- Melodic Memory
- Beat Perception
- Sound Similarity
- Musical Preferences

Musical background (self-report):
- Goldsmiths Musical Sophistication Index
- Concurrent musical activities

Self-theories and self-concept:
- Social self-concept
- Academic self-concept
- Theory of Intelligence
- Theory of Musicality

Personality:
- Big 5 inventory (TIPI)
- Social Desirability Scale

Academic performance:
- Academic achievement (5 subject categories)
- Academic effort

Parents:
- Musical home questionnaire
### Correlation Matrix

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*Image specifications per type. Two-tailed significance levels are calculated on the basis of all available observations on a pair-wise basis and are not corrected for multiple comparisons. Significance levels are indicated as follows: *p* < 0.05, **p* < 0.01, ***p* < 0.001. For the sake of easier interpretation, the signs of the four self-theory scales (Musical Goals, Theory of Musicality, Academic Goals, Theory of Intelligence) have been reversed, where high values indicate strong beliefs in the incremental and changeable nature of musicality and intelligence as well as the importance of learning opportunities for setting musical and academic goals.*
Network model from PC algorithm (Spirtes et al., 2000) based on partial correlation tests
Intelligence and musical abilities connected

Intelligence connected to academic performance

Self-theories of intelligence and musicality closely connected

Chain from self-theories to conscientiousness to academic performance
If chain from self-theories to conscientiousness to academic performance is causal …

then changing the self-belief about one’s own musicality can have positive effect on academic performance.

Size of effect under causal assumption: ~0.1 SD
(comparable to Hille & Schupp, 2014; also: Blackwell et al., 2007)

=> Experience with music learning can change self-beliefs about cognitive abilities and promote positive academic outcomes
Next steps

- Start longitudinal study in 2016-17
- Test more schools including mixed schools, boys schools, German schools
- Compare musical activity to sports and drama
- Include measures on mental well-being and school belonging
- Setup reporting system for participating schools
- Collect genetic data of participants?
Aspects of human musicality can be meaningfully measured

Individual differences in musicality are linked to other psychological factors

Longitudinal studies may reveal how unique musicality develops (in western societies)
What to expect from music psychology?

Scientific models and empirical underpinnings for generating real-world (e.g. commercial, legal) impact and advancing human knowledge (e.g. on music, the human mind).
Any challenges?

- Weak institutional structure - *no army of music psychologists out there working in a coordinated fashion*

- Patchy research funding - *rewarding spectacular findings rather than sustainable research*

- The interdisciplinary crack between ‘proper’ psychology and ‘proper’ musicology – *apparent with funding applications, high-impact journals, job applications*
Story-telling around a leisure activity or science that society really needs?
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