A new tool for measuring musical sophistication: The Goldsmiths Musical Sophistication Index

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What is the Gold-MSI?

- A new self-report inventory
- A new battery of musical tests
- A lot of data
- A novel concept
The Concept

Motivation:

• No standardised questionnaire instrument to assess skilled musical behaviours
• Over-reliance on formal (classical?) music training as proxy for musical abilities and understanding
• Recognising multiple facets of musical expertise
• Joining self-report questionnaire and ability tests into one research tool and make it freely available
A New Definition

- **Musical Sophistication:**
  - Psychometric construct comprising musical skills, expertise, achievements and related behaviours across a range of facets measured on different subscales.

- **Assumptions:**
  - Facets of musical sophistication can develop through active engagement with music in its many different forms.
  - Individuals vary in their level of sophistication on the different facets.
  - High levels of musical sophistication are generally characterised by:
    - higher frequencies for exerting the musical skills or behaviours
    - greater ease, accuracy or effect of the musical behaviour when executed,
    - a greater and more varied repertoire of behaviour patterns associated with it.
  - Differences in observable behaviour are related to levels of differentiation in cognitive systems for categorising and processing music.
Really a New Concept?

- **Self-report questionnaires:**

- **Musical ability tests:**
  Seashore, Lewis, & Saetveit (1960), Wing (1962), Bentley (1966), Gordon (1989), Wallentin et al. (2010)

- **Conceptual suggestions:**

**Missing:**
(Focus on musical expertise) x (Covering wide range of skills) x (Combining self-report and objective testing)
Components of the Gold-MSI v1.0

- 38-item Self-report Inventory covering 5 different facets of musical expertise
- 13-item Melodic Memory test:
  - AB comparison
  - novel folk tunes
- 17-item Beat Perception test:
  - correct/incorrect judgement
  - unknown instrumental tunes from rock, jazz, popular classical
  - variant of Iversen & Patel’s (2008) Beat Alignment Test
- 16-item Sound Similarity test:
  - 800ms audio excerpts from typical rock, pop, hiphop, jazz songs
  - Sorting paradigm similar to Gingras et al. (2011)
- (Beat Production test)
A Lot of Data

- Pilot study self-report inventory with BBC LabUK (n=488)
- BBC LabUK online implementation How Musical Are You? (n~148,000)
- 5 extended lab studies for optimisation of listening tests (together: n~600)
- 2 Questionnaire studies for external validity of self-report inventory (n=214, n=144)
- Online implementation for Channel 4’s Hidden Talent Show (n= 3,793)
- Lab study testing reliability and correlation with cognitive abilities (n=51)
Development of the Self-report Inventory

- Literature review
  - 5 hypothetical facets
  - 153 items

- Concept development

- Pilot study
  - 111 items

- How Musical Are You?
  - 7 dimensions
  - 70 items

- Gold-MSI v1.0
  - 5 dimensions
  - + 1 general factor
  - 38 items
The Dimensions of Musical Sophistication

- Data: 147,633 participants responding to 70 question items;

- Analysis goals:
  1. Identify latent factor structure and ‘cluster’ items into subscales
  2. Refine and shorten subscales

- Techniques: Factor analysis, item response models, structural equation modelling; data split into training and testset
Result 1: There is a strong general factor of musical sophistication
- Evidence: High eigenvalue of 1st factor, high inter-factor correlations, high $\omega_{\text{hierarchical}}$

Result 2: There are 5 distinct dimensions of musical sophistication
- Evidence: Agreement of criteria (screeplot, MAP, VSS, eigenvalues >1); content validity
Result 3: Each dimension can be measured by a shortened subscale (6 - 9 items)
- Evidence: High internal reliabilities ($\alpha > .79$)

Result 4: The 5+1 model holds true on a fresh dataset
- Evidence: Good model fit of SEM: adjusted Goodness of fit: .85, RMSEA: .064
Reliability and Validity

- Very good **test-rest reliability** (n=53, mean time lag= 64 days):
  - Active Engagement: .90
  - Perceptual Abilities: .89
  - Musical Training: .97
  - Singing Abilities: .94
  - Emotions: .86
  - General Musical Sophistication: .97

- Very good **external validity** with Gordon’s AMMA (total score, n=44):
  - Active Engagement: .46
  - Perceptual Abilities: .59
  - Musical Training: .56
  - Singing Abilities: .52
  - Emotions: .43
  - General Musical Sophistication: .60
**Reliability and Validity**

- **Good external validity** with relevant factor from Musical Experience Questionnaire (Werner et al., 2006), n=141:

<table>
<thead>
<tr>
<th></th>
<th>Active Engagement</th>
<th>Perceptual Abilities</th>
<th>Musical Training</th>
<th>Singing Abilities</th>
<th>Emotions</th>
<th>General Sophistication</th>
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<tr>
<td>Commitment to Music</td>
<td>.241**</td>
<td>.206*</td>
<td>.223*</td>
<td>.292**</td>
<td>.255**</td>
<td>.309**</td>
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<td>Social Uplift</td>
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<td>.200*</td>
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<td>.222*</td>
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<td>.312**</td>
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<td>.264**</td>
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Interim summary

- Gold M S self-report inventory is a valid and reliable measure of different facets of musical sophistication
- It comprises 5 factors and 1 general factor
- It is based on self-assessed skills and self-reported behaviours

⇒ How does self-reported sophistication compare to performance in listening tests?
Result 1: Musical Training benefits melodic memory and beat perception performance
• Evidence: $\beta = .22$ and $.17$

Result 2: Active (listening) Engagement (but not Musical Training) benefits sound similarity judgements
• Evidence: $\beta = .11$ and $.03$

Result 3: Similar (but weaker) relationships between self-report and test scores compared to lab studies.

$=>\text{uncontrolled test conditions add noise to test scores(?) }$
• Evidence: Low $\beta$’s between self-reported perceptual abilities and test scores ($.15, .17, .05$)
Result 4: General Musical Sophistication indexes all three test scores best
- Evidence: $\beta = 0.27, 0.29$ and $0.13$

Result 5: The three listening tests measure different abilities
- Evidence: Low inter-test correlations ($< 0.15$)
Conditions of Musical Sophistication

Question:

How does self-reported musical sophistication relate to socio-economic variables?

Analysis:

• 90,474 Brits from How Musical Are You? and split sample
• Sub-sample 1: Identify most important socio-economic variables via random forest regression and permutation tests
• Sub-sample 2: Relate General Musical Sophistication to socio-economic variables using a conditional inference tree model
Result 1: Occupation, Age, and Occupational status are most important variables influencing General Musical Sophistication.
  - Evidence: Highest variable importance values from random forest

Result 2: ‘Creative’ professions (media, music) and people still in education, younger and non-retired people report higher levels of Musical Sophistication:
  - Evidence: Significant splits in regression tree and significant differences in permutation tests.

Result 3: Socio-economic variables account only for small proportion of variance in Musical sophistication:
  - Evidence: 4.56% of variance explained by random forest
Conditions of Musical Sophistication 2

- Question:

*How do test scores relate to socio-economic variables and musical training?*

- Analysis:
  - 90,474 Brits from *How Musical Are You?* and split sample
  - Combine z-transformed test scores into single score
  - Sub-sample 1: Identify most important variables with random forest for each test
  - Sub-sample 2: Significance testing of variables with permutation tests
Result 1: Musical Training, Age, Occupational Status, Gender, and expected education level are most important variables.
- Evidence: Variable Importance according to random forest and significance in linear permutation tests.

Result 2: Only small amounts of variance in test scores explained by socio-economic variables:
- Evidence: $R^2$ from random forests: .03 (excluding musical training) .11 (including musical training)

Result 3: Musical Training necessary condition for perfect listening skills?
- Evidence: Only 85 Brits with no musical training among 7902 Top10 test takers.
Summary

- Gold-MSI inventory is valid and reliable self-report measure for musical skills and expertise.
- It helps to identify relationships between facets of musical behaviour (Musical Training, Active Engagement etc.) and a range of listening skills.
- Influence of socio-economic variables on sophisticated musical behaviour and listening skills is very small.
- All components of the Gold-MSI:
  - Are freely available for research purposes
  - Are fully documented
  - Have data norms derived from an adult population

Go to: http://www.gold.ac.uk/music-mind-brain/gold-msi/
... to get self-report inventory v1.0 and v0.9 of audio materials
Thank you!

- Amit Avron
- Thenille Braun
- Monika Ruscynski
- Naoko Skiada