Beyond major and minor: Approaches to exploring the continuum of relative mode
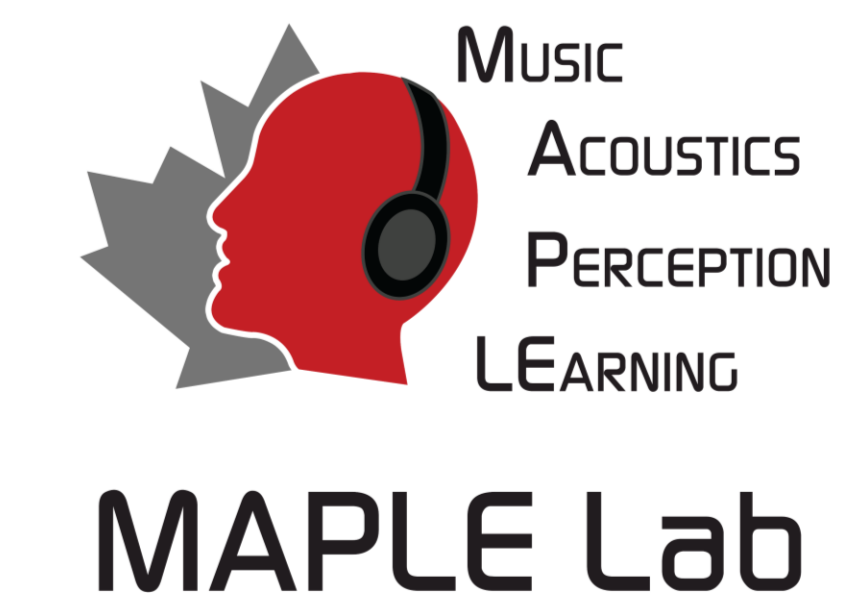
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Music Acoustics Perception LEarning — MAPLE Lab

Background

- Modality in Western music is a structural 'super cue' of musical emotion.
- The major and minor modes are traditionally dichotomized in the current music perception literature (Carraturo et al., 2023). However, it is not clear whether the dichotomous use of these labels captures how it is functionally used in many musical works.
- Here, we explore the concept of a relative mode evaluation by looking at three different approaches of quantifying relative mode: Perceptual, Analyzed, and Computed, exploring the alignment/discrepancies and the variation of perspectives within each approach.
- The concept of a relative mode offers a mode flexible, continuous spectrum between major and minor, reflecting the fluid transitions in modality.
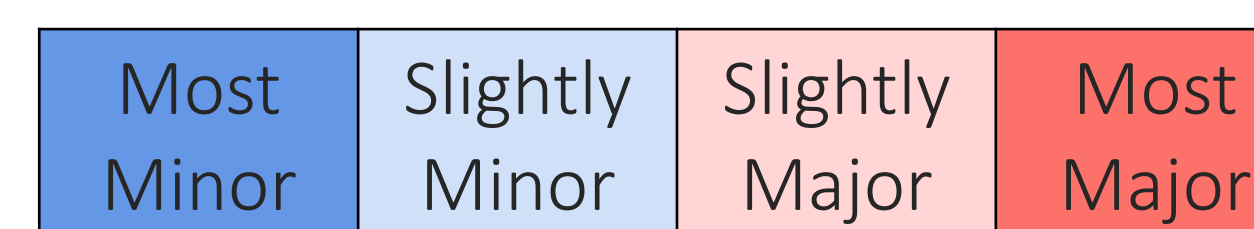
Methods

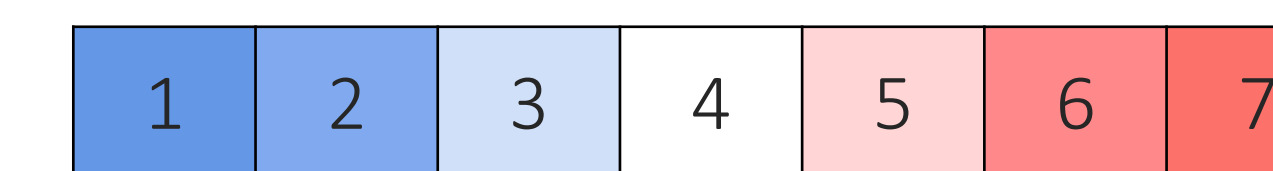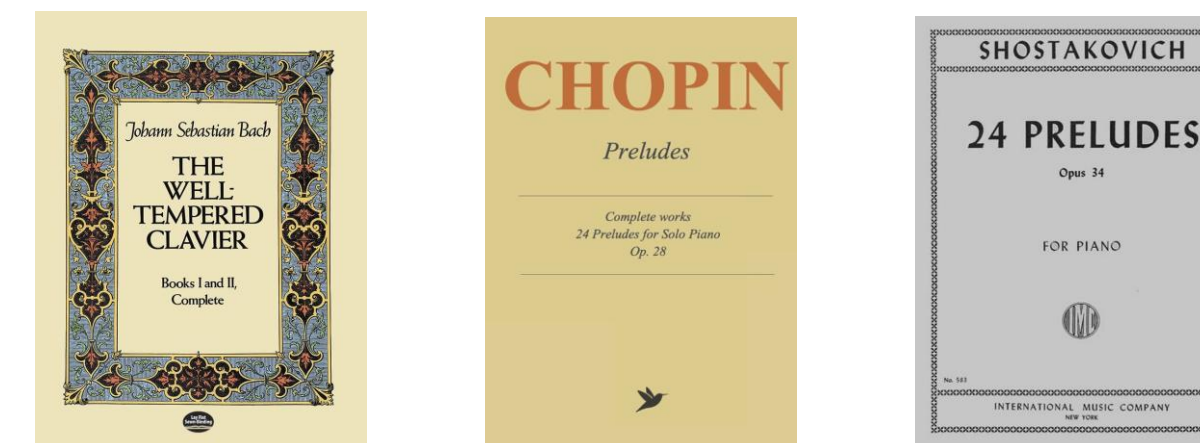**Perceptual Mode Evaluation (PM)**

J. S. Bach   F. Chopin   D. Shostakovich

| Most Minor | Slightly Minor | Slightly Major | Most Major |

Expert Theorists' Mode Analyses (AM)
Delle Grazie et al. (under review)
Western Music — Don Wright Faculty of Music

THE WELL TEMPERED CLAVIER — CHOPIN Preludes — SHOSTAKOVICH 24 PRELUDES
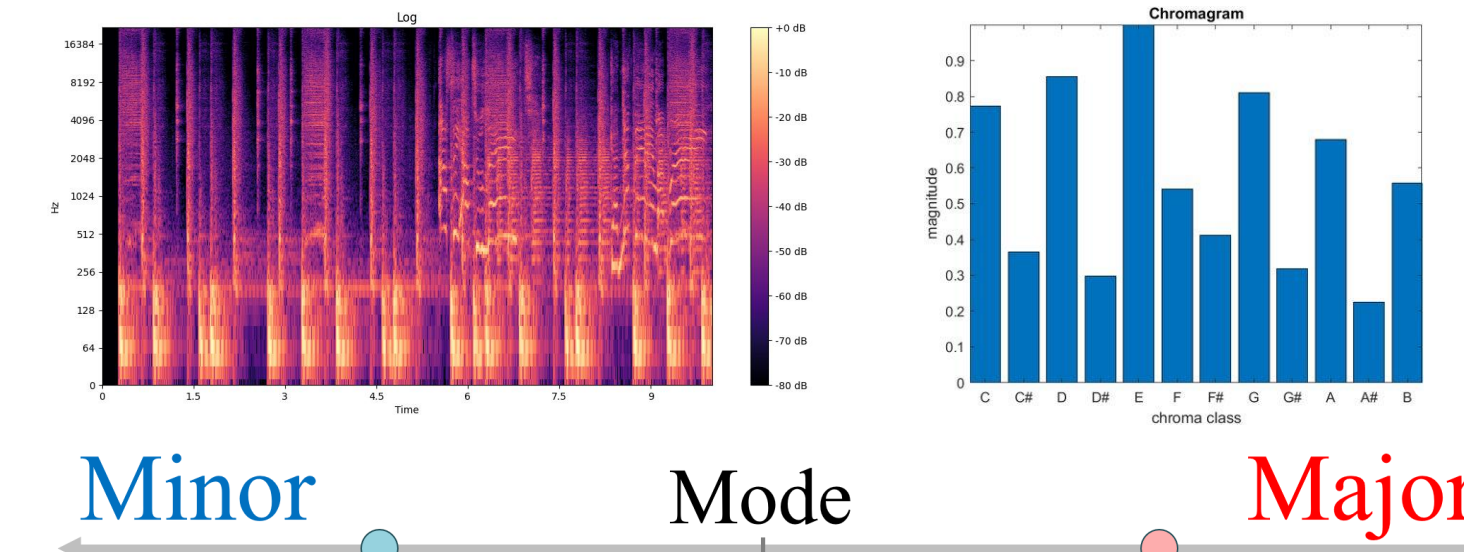
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

MIR Computed Mode (CM)

28 Computational Perspectives
- 4 Audio Fourier Transforms (changes in spectrogram)
- 7 Key Profiles (changes in mode calculation)
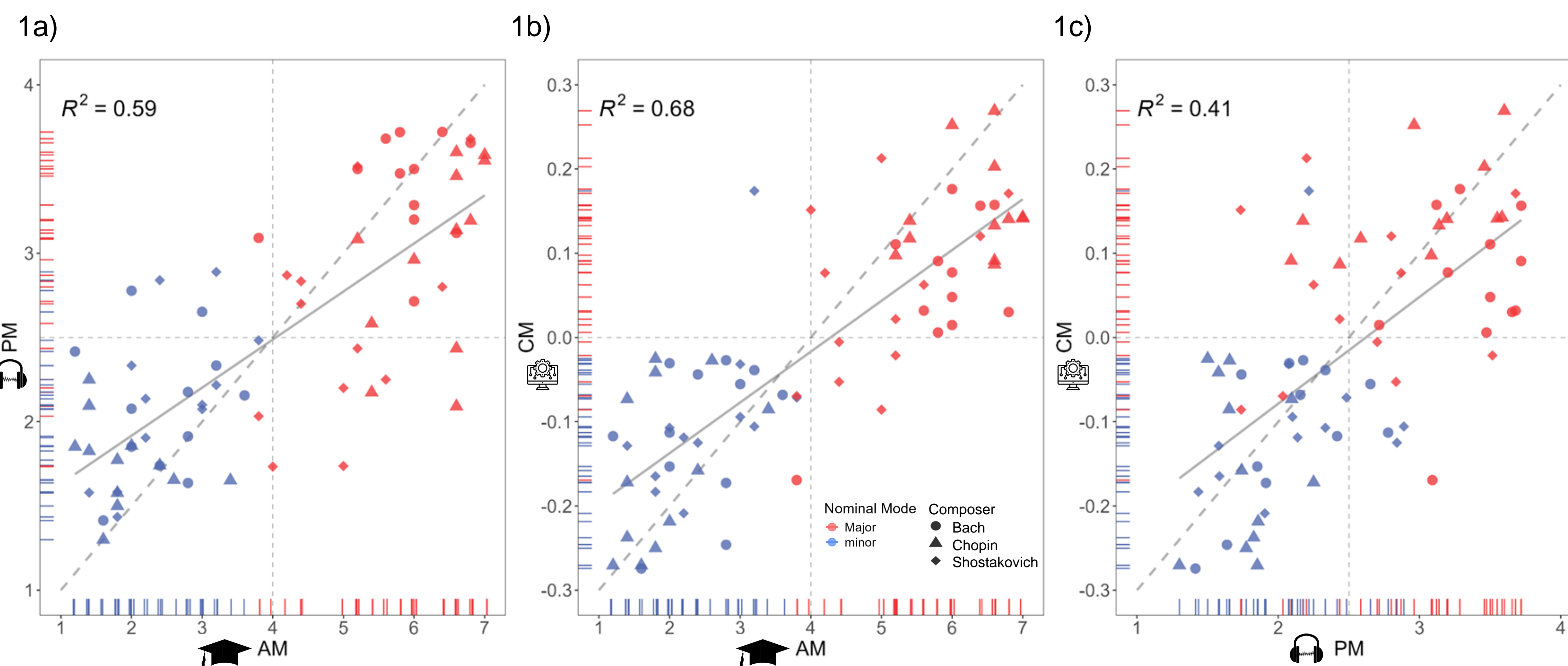
Minor — Mode — Major

Results

Figure 1: Summary pairwise comparisons of the relationships of the three approaches of relative mode between: **a)** expert analyzed (AM) and listener perceived (PM) modes, **b)** expert analyzed (AM) and computed (CM) modes, and **c)** computed (CM) and listener perceived (PM) modes. Identity line (dashed gray line) represents 1:1 relationship, serving as a reference to assess the relative strength of each approach. The colors in all graphs represent the nominal mode of each piece. The shapes represent the composers. A rug plot at the margins of each axis visually represents the distribution of the data points. Rug plots for AM values are jittered to differentiate the number of observations on that AM value.
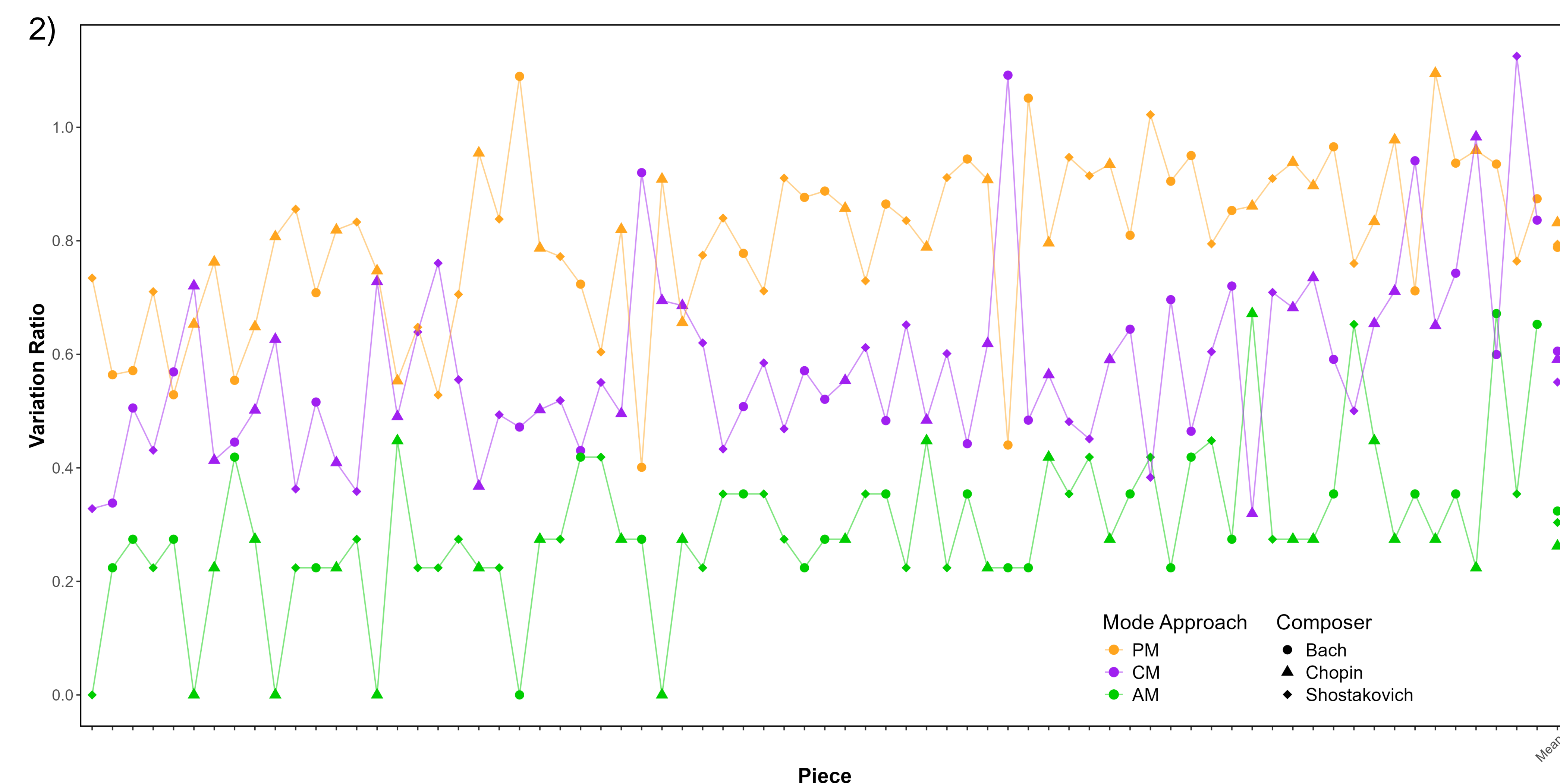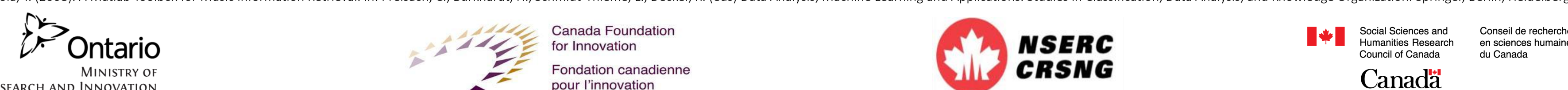
Figure 2: Variation of different perspectives within each relative mode approach. Each tick on the x-axis represents individual pieces in the corpus and is ranked by the mean average variation across all approaches for each piece, and variability ratios are plotted on the y-axis. Colors represent the mode approaches, with orange for PM (participant perceptual mode), purple for CM (computationally derived mode), and green for AM (expert analyzed mode). Shapes indicate the composers: circles for Bach, triangles for Chopin, and diamonds for Shostakovich. Mean VVR by composer is shown on the right-most index, separated by approach.

Acknowledgments & Selected References

Carraturo, G., Pando-Naude, V., Costa, M., Vuust, P., Bonetti, L., & Brattico, E. (2023). The Major-Minor mode Dichotomy in Music Perception: A Systematic Review and Meta-Analysis on its Behavioural, Physiological, and Clinical Correlates. bioRxiv, 2023-03.
Delle Grazie, M., Anderson, C. J., De Souza, J., & Schutz, M. (under review). Analysis from Multiple Perspectives (AMP): Applying decision hygiene to analysis of musical structure. Musicae Scientiae.
Eerola, T., & Schutz, M. (2023, November 8). Major-minorness in Tonal music – Evaluation of Relative Mode Estimation using Expert Ratings and Audio-Based Key-Finding Principles.
Lartillot, O., Toiviainen, P., Eerola, T. (2008). A Matlab Toolbox for Music Information Retrieval. In: Preisach, C., Burkhardt, H., Schmidt-Thieme, L., Decker, R. (eds) Data Analysis, Machine Learning and Applications. Studies in Classification, Data Analysis, and Knowledge Organization. Springer, Berlin, Heidelberg.

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Summary

- Although distinct, each approach of looking at relative mode evaluations correlate with one another, with a clear difference between nominal modes. This suggests that regardless of the method, assessments of relative mode are likely to be similar and interrelated.
- This provides support that a continuum-based understanding of mode can be evaluated by score, perceived internally, and modelled computationally.
- Variability analyses shed light on how individual piece differences affect the variability of the different approaches of mode, with experts being the least variable and participant perceptual being the most variable. It also highlights that composer differences pale in comparison to differences in approaches.
- Overall, using a continuous mode scale provides a more nuanced understanding of musical modes, effectively capturing the subtleties of mode that the traditional dichotomous labels may overlook.