

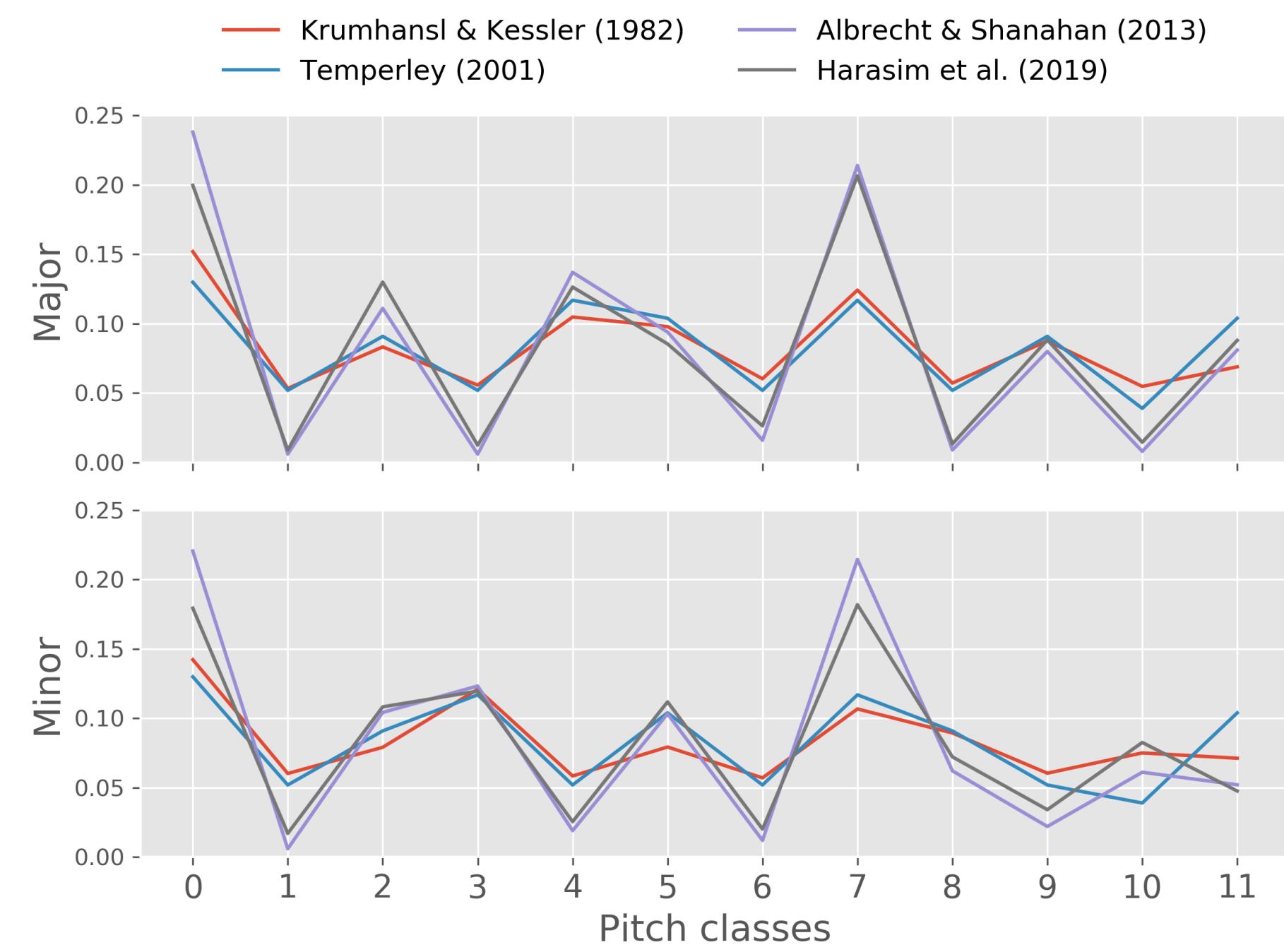
Inferring Tonality from Note Distributions: Why Models Matter

Fabian C. Moss and Martin Rohrmeier

Digital and Cognitive Musicology Lab, École Polytechnique Fédérale de Lausanne

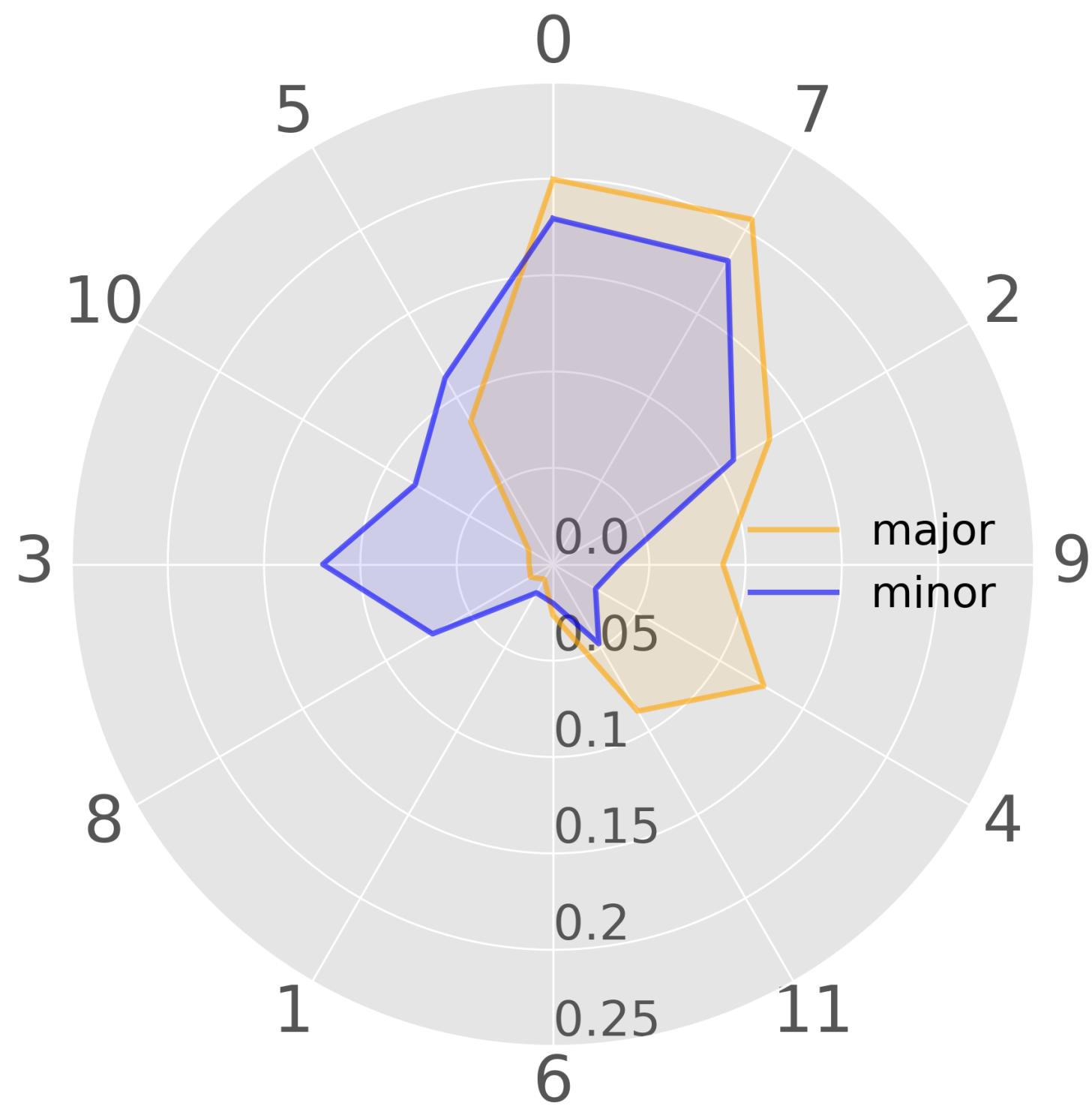
Background

Statistics of pitch classes (PCs) in musical pieces correspond to cognitive representations of tonality [1, 4, 5, 6] and assumed to constitute the basis for statistical learning.



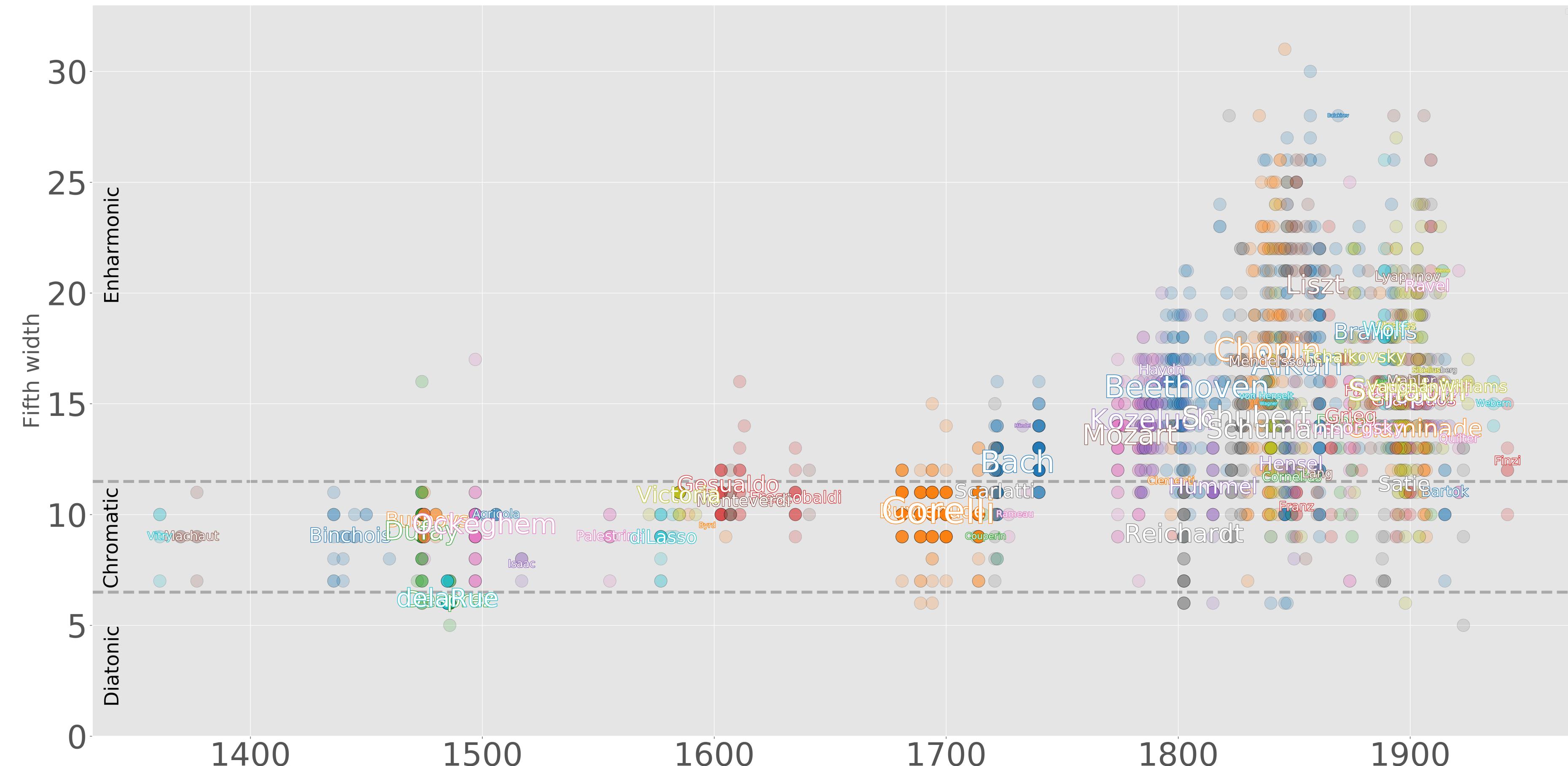
Model 1: Circle of Fifths

Reordering PCs by $x \mapsto 7x \bmod 12$ and arranging them on the **circle of fifths** emphasizes differences and similarities of the major and the minor mode [4].



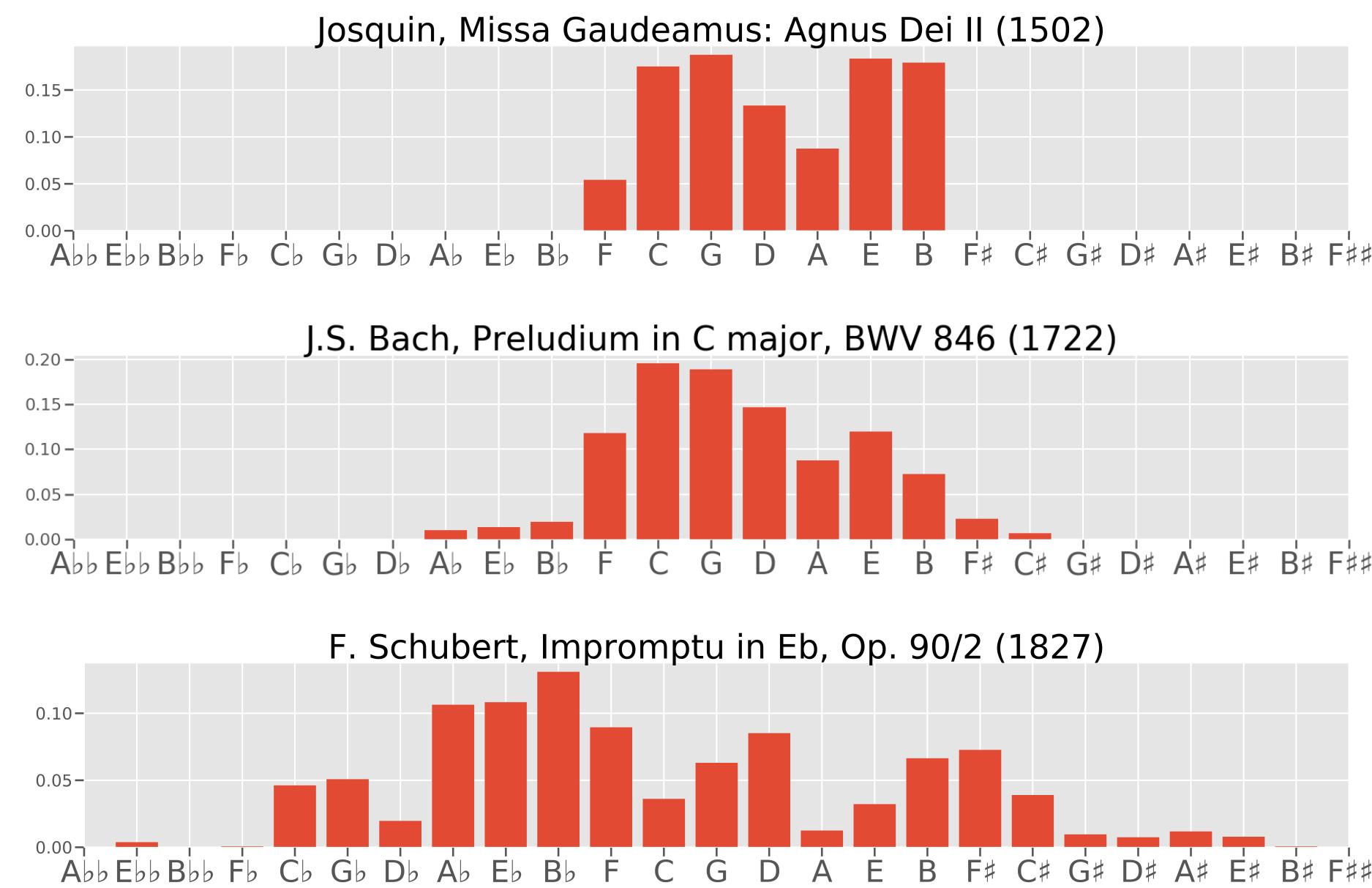
In particular, the relation between in- and out-of-scale notes becomes apparent, as well as the discrepancies between PCs 3 and 10 (minor) vs. 4 and 11 (major).

Historical Development



Model 2: Line of Fifths

Using **spelled PCs** enables the distinction between enharmonically equivalent notes that is not possible when using only 12 PCs.



Moreover, comparing pieces from different time periods indicates a historical trend towards expansion of the tonal material (see "Historical Development") and a transition from diatonicism to chromaticism and enharmonicism [3].

Conclusion

The often implicit or unconscious modeling **assumptions about tonal spaces** underlying pitch-class distributions in musical pieces as well as cognitive schemata crucially affect research outcomes.

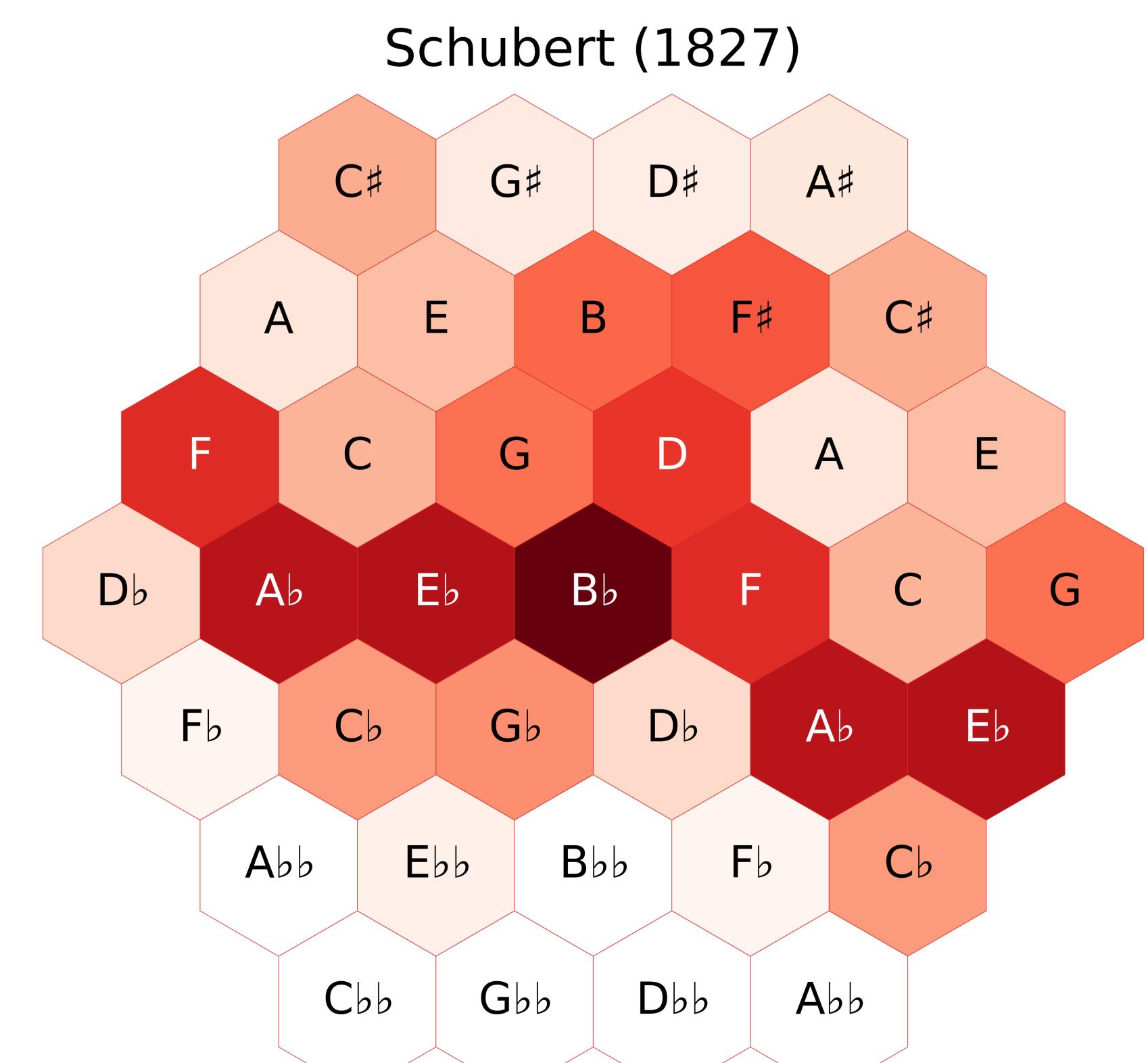
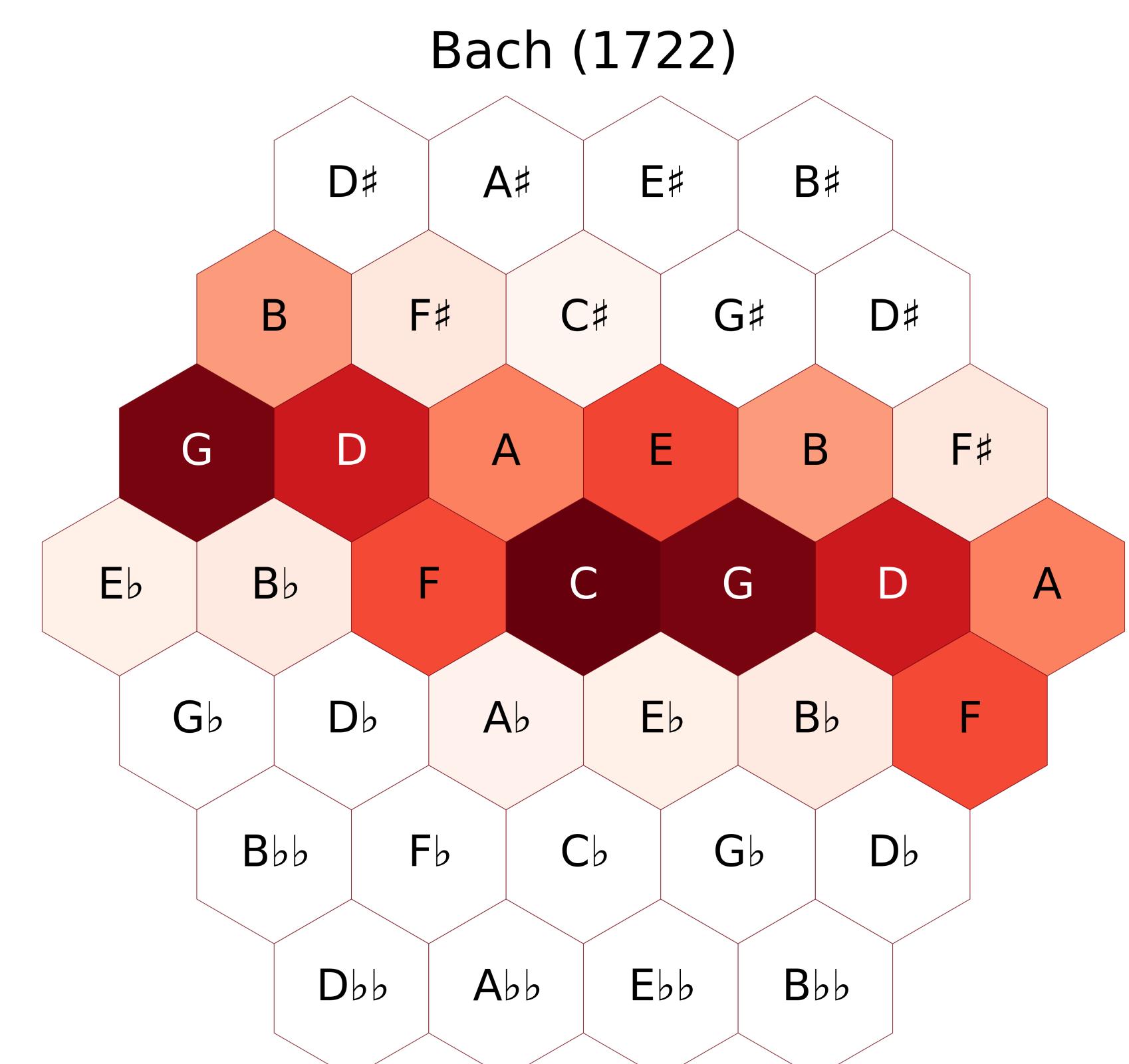
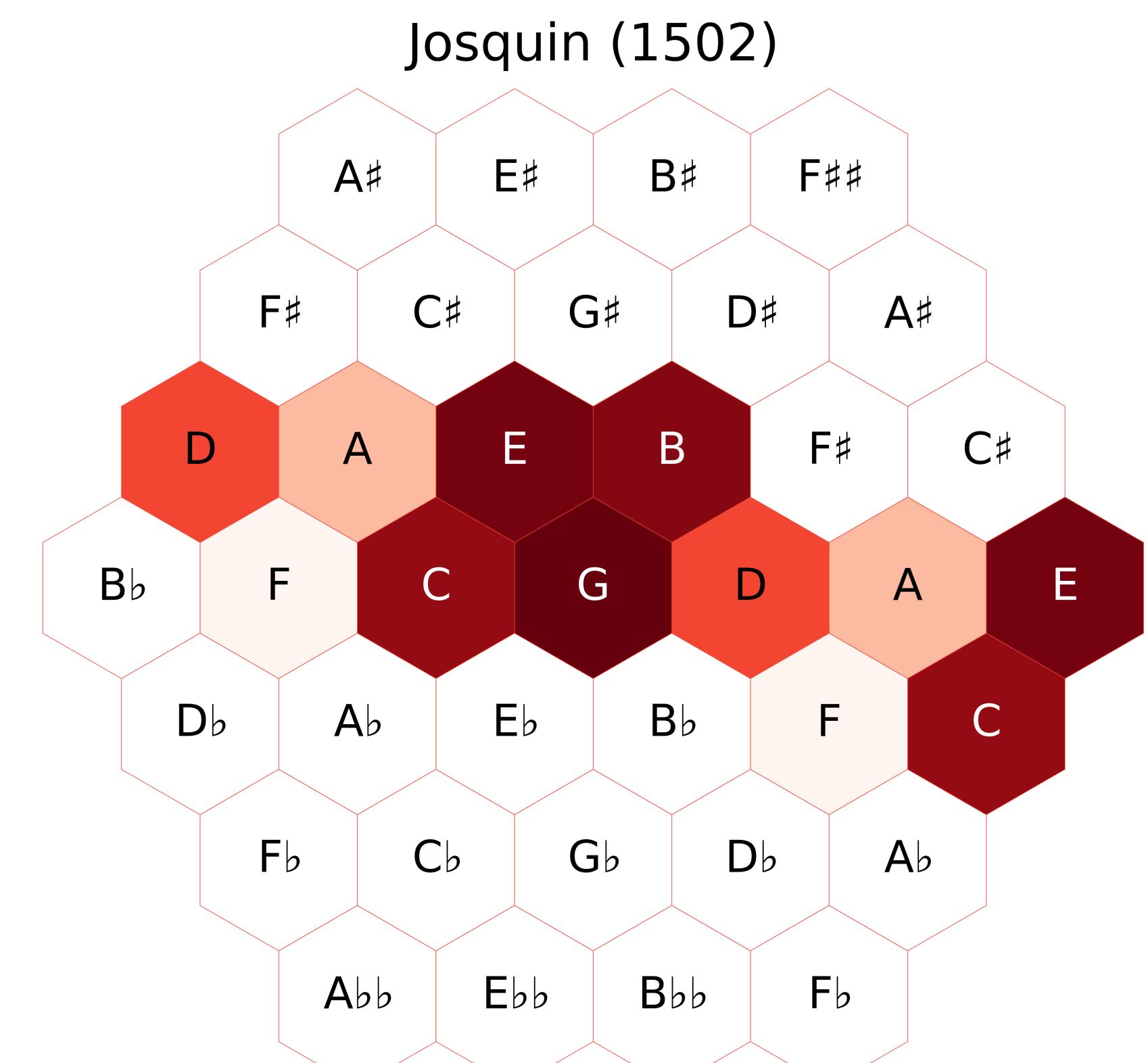
Making these assumptions explicit acknowledges **modeling** as an integral part of study design. Incorporating music-theoretical knowledge about the structure of tonal spaces furthermore allows to apply more apt models models for the research on the **history of tonality** as well as its **cognitive representations**.

References

- [1] J. Albrecht and D. Shanahan. "The Use of Large Corpora to Train a New Type of Key-Finding Algorithm: An Improved Treatment of the Minor Mode". In: *Music Perception: An Interdisciplinary Journal* 31.1 (2013), pp. 59–67.
- [2] R. Cohn. *Audacious Euphony: Chromatic Harmony and the Triad's Second Nature*. Oxford: Oxford University Press, 2012.
- [3] Z. Gárdonyi and H. Nordhoff. *Harmonik*. Wolfenbüttel: Mösele Verlag, 2002.
- [4] D. Harasim, F. C. Moss, M. Ramirez, and M. Rohrmeier. "Cognitive modeling reveals history of major and minor in Western classical music". Submitted.
- [5] C. L. Krumhansl and E. J. Kessler. "Tracing the dynamic changes in perceived tonal organization in a spatial representation of musical keys.". In: *Psycholog-*

Model 3: Tonnetz

The expansion of tonal material entails also an increase in mediantic relations. Consequently, the usage of PCs diachronically spreads out in both the fifth and the third dimensions of the Tonnetz [2].



Acknowledgements & Contact

EPFL

This research is generously supported by the Latour Chair in Digital and Cognitive Musicology at EPFL.