# Musical modes as statistical modes: classifying modi in Gregorian chant

Musical traditions can organize their melodic material in 'modes': musical structures occupying the middle ground between melodies and scales (Powers et al., 2001). Several recent studies investigate whether modes can be detected automatically in Turkish (see e.g. Bozkurt, Ayangil, Holzapfel, 2014), Iranian (e.g., Heydarian & Bainbridge, 2019) and Indian (e.g., Gulati et al., 2016) art music. Gregorian chant, the medieval liturgical plainchant that inspired Powers' notion of mode, has received comparatively little attention. The current study addresses that hiatus.

We study automatic mode classification in two large corpora of Gregorian chant: the Cantus database (~60.000 melodies) and the Liber Usualis (~2000). We evaluate the only prior study we are aware of (Huron & Veltman, 2006) on this much larger dataset, and address some of its criticisms (Wiering, 2006). Moreover, we quantitatively analyze several Medieval procedures for mode classification, and propose a new method using note-group frequencies (i.e., a bag-of-words model). When we apply our new approach to melodic contours rather than pitches, we can separate the melodic and scalar aspects of modes, something not possible using pitch class distributions (Huron & Veltman, 2006).

Preliminary results suggest that our new method improves mode classification, even when only using melodic contours. Still, modes seem to be fuzzy categories: some chants are perfect examples of their mode, but others have an ambiguous mode. Although this can be explained historically, it also suggests that musical modes might be thought of as modes in the statistical sense: 'clusters' of likely melodies in a given tradition. This aligns with cognitive theories proposing that melodic structure is learned statistically (Pearce, 2018).

## References

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