

Historical Development of Tonal Syntax

Counting Pitch-Class Sets in 13th-16th Century Polyphonic Vocal Music



Richard Parncutt, Fabio Kaiser, Craig Sapp

{richard.parncutt, fabio.kaiser}@uni-graz.at, craig@ccrma.stanford.edu



Introduction

The music and music theory of the late Middle Ages and Renaissance reflect historically changing conceptions and perceptions of **sonority**. We systematically investigate that development by analyzing polyphonic scores. In this preliminary exploratory study, we count vertical pitch-class (pc) sets of cardinality three and make tentative cross-period comparisons.



Theory

In Western music until c. 1900, **consonance** was generally preferred. In a psychological approach, consonance comprises

- **fusion** (similarity to harmonic series)
- **smoothness** (lack of roughness or fast beating)
- **familiarity** (prevalence in previous music)

As composers and listeners experimented with sonorities of three pcs, they increasingly preferred major/minor triads (3-11) because of their unique combination of fusion (perfect fifths) and smoothness (no seconds). Similarly, other common sonorities tended to be relatively smooth and/or to fuse well.

Method

We analyzed available electronic scores from the 13th – 16th centuries using the **Humdrum Toolkit**. Transcription mostly from MIDI to Kern format. All pitches assigned to the 12-note chromatic scale. *Musica ficta* alternatives not yet considered.

Corpus

- 13th: Perotin (*sample too small!*)
- 14th: Machaut (*sample too small!*)
- 15th: Dufay, Dunstable, Josquin, Ockeghem
- 16th: Lassus, Palestrina



Analysis

We looked for **pitch-class sets** and **Tn-types of cardinality three**. A pc-set or Tn-type was considered to occur when either

- all 3 tones sounded simultaneously (**onset**), or
- 1 or 2 tones were held from previous sonority (**sonor**)

References

- Eberlein, R. (1994). Die Entstehung der tonalen Klangsyntax. *Frankfurt/Main: Lang*.
 Forte, A. (1977). The structure of atonal music. *Yale University Press, New Haven*.
 Parncutt, R. (2011). The tonic as a triad: Key profiles as pitch salience profiles of tonic triads. *Music Perception*, 28, 333-366.
 Parncutt, R., Hair, G. (accepted). Consonance and dissonance in theory and psychology: Disentangling dissonant dichotomies. *J. Interdisc. Music Studies*.

Results

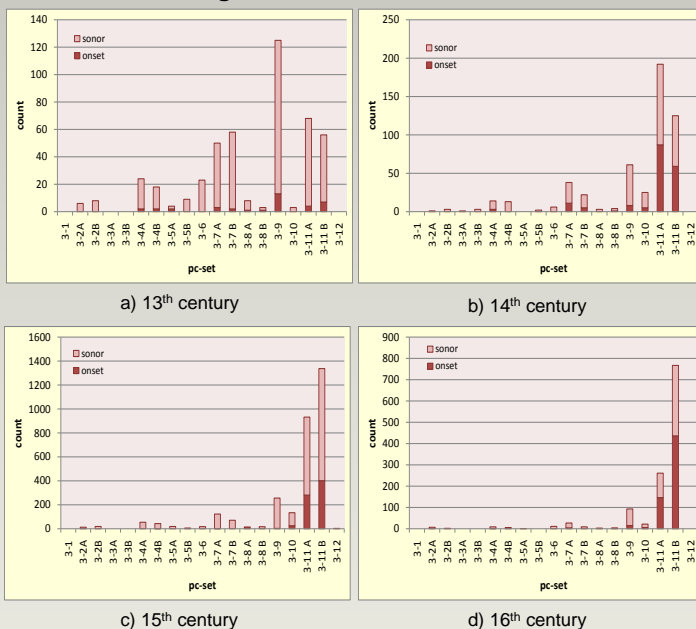
- 13th: 3-9, 3-11, 3-7 most common
- 14th: 3-11 dominates over 3-7, 3-9
- 15th-16th: increasing dominance of 3-11
- 16th: rank order of Tn-types is 3-11, 3-9, 3-7, 3-10 (consistent with psychological theory of consonance)

Table 1. All pc-sets and Tn-types of cardinality 3

Set labels (Forte, Rahn) and semitones relative to reference pitch (italics)

	3-1	3-2A	3-3A	3-4A	3-5A	3-6	3-7A	3-8A	3-9	3-10	3-11A	3-12
	012	013	014	015	016	024	025	026	027	036	037	048
Prime Form												
Inversion												
		3-2B	3-3B	3-4B	3-5B		3-7B	3-8B			3-11B	
		023	034	045	056		035	046			047	

Figure 1. Pitch-class set counts



Conclusions

- Prevalence of individual sonorities determined by consonance
- Central role of hearing and psychology in music history

3-11 (major and minor triads):

- dominated sonorities since the 14th century
- gradual increase in proportion of “onset” vs “sonor”
- aural familiarity → emergence of maj-min tonality

Discussion

In the future we will:

- more carefully study intervallic and chordal inversions
- try automatic transcription to increase corpus size and address “ficta” from a modern performance viewpoint