

The Hidden Modes: A computer-assisted approach to tonality analysis of Swedish Folk Music

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1. INTRODUCTION

The term tonality is used in numerous ways with different significations in ethnomusicological, musicological and music cognition literature, and in its most general sense it refers to a cognitively and/or culturally significant hierarchical system of relationship between pitches in a piece of music, in a repertoire or music culture (Bengtsson 1977). Tonality in this general sense corresponds to the concept of tonal hierarchy, representing relative prominence, stability and structural significance of musical tones in a musical context, a concept which has been frequently addressed in empirical studies within the field of music cognition over the past 40 years (Krumhansl & Cuddy 2010). The empirical research in tonal hierarchy, involving both psychological studies and computer modelling, show that listeners cognition of tonal hierarchy can be related to statistical distribution of tones in musical contexts, a correlation which is also shown to be cross-culturally valid (e.g. Eerola 2004, Krumhansl & Cuddy 2010, Stevens 2004).

In the present study computer-assisted modelling of tonal hierarchy by means of analysis of statistical distribution of tones, is applied on traditional Swedish folk music in order to examine idiomatic features of tonality in this music corpus. The aim is to explore whether this approach can provide new insights regarding stylistic unity and diversity within this musical repertoire. More specifically, the concept of key-profile is applied, representing the structural prominence of chromatic tones within a mode and key.

This is not trivial for a number of reasons, such as the frequent use of micro-tonal variation of intonation within the style, observed by scholars as early as in the beginning of the 19th century as a significant trait of Swedish folk music (Boström, Lundberg & Ramsten 2010, Ahlbäck 2010). Some previous studies of tonal hierarchy are problematic with regards to this issue, assuming a chromatic pitch category set as a fundament, an underlying, invariant scale structure and not taking musical context into consideration in the estimation of structural prominence of tones.

Moreover, studying stylistic features of traditional folk music in Sweden we are faced with the problem of a diverse source material, encompassing contemporary commercial recordings, contemporary & historical field recordings as well as transcriptions and collections of music notations made under a period of over 200 years, under very different conditions, for different purposes and of varying quality regarding e.g. detail.

A purpose of the present study is to develop methodology in order to be able to make comparisons between source material with different level of musical detail.

In order to compare different source material and obtain comparable musical representations, a model for automatic musical structure analysis developed by the author is used

2. THE PRESENT STUDY

The source material used in the study is a combination of recordings and notated material of Swedish traditional folk music digitized into the same digital music representation (Ahlbäck 2004, ScoreCloud 2013). This system automatically transcribes sound or MIDI input into standard western staff notation, including quantization, metrical analysis, pitch categorization, ornamentation analysis and segmentation of melodies, which makes it possible to compare sounding and symbolic input on different level of detail.

The source material includes vocal and instrumental herding music (vallåtar), related to the traditional herding culture in Scandinavia and Fiddle music, mainly from the same geographic area, consisting of notations/transcriptions from the 20th century and field recordings. Handwritten manuscripts, so called “fiddlers books” with instrumental popular fiddle tunes from the 18th century and 19th century from the same geographic area as the recordings and collected notations was used as a reference material. The historical handwritten manuscripts shared a number of tunes (melodic themes) with the recorded material. A total of 2100 melodies were used in the study.

The method used for obtaining the key profiles was developed from methods used in previous studies, based on mainly relative duration and frequency of appearance of chromatic pitch categories, assuming octave-equivalence by Krumhansl and others (Krumhansl 1990). In the present study, other statistical features, mentioned in ethnomusicological literature (Nettle 1964), were also included in the measure of structural prominence, such as metrical prominence and melody structural prominence, as well as features motivated by psycho-acoustical research (Parncutt 1994). Moreover, melodic context was also included in the measure of structural prominence in terms of connectivity between pitch categories within a musical context. This was motivated by the significance of melodic structure in relation to intonation of scale degrees typical for many modal systems, including western major-minor tonality.

From the total dataset an initial categorization was made based on the correspondence with major or minor mode profile respectively. It was only possible to obtain a balanced subset of the data for the three different data sets (herding calls, fiddle music transcriptions and historical manuscripts) for match with the minor mode profile (Krumhansl 1990). This particular subset consists of 450 melodies, 150 melodies from each source corpus and constitutes the comparative material for this study. The analysis was performed automatically by the system.

In order to make comparison possible micro-tonal alterations of pitch were automatically assigned to closest chromatic pitch category.

3. RESULTS

The results show that the obtained mode-profiles (key-profiles transposed to the same “key”) differ between the different repertoires in the study, showing interesting features for different repertoires. These differences were most significant when using the more elaborate feature set for measuring structural prominence of tones.

However, also when using simple statistical measures such as relative duration and frequency of appearance of tones, differences and connections between repertoires show.

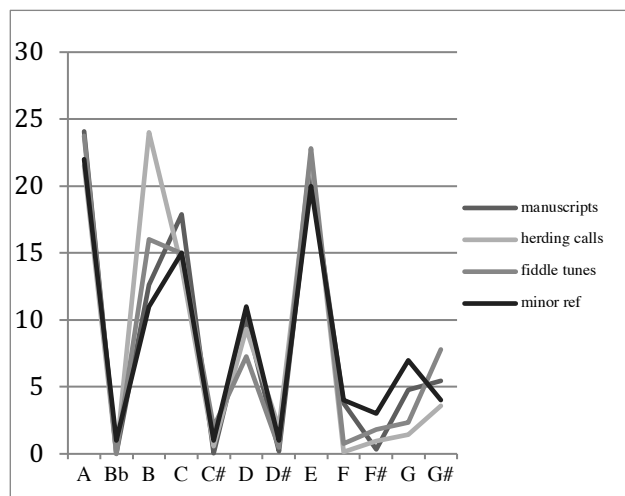


Figure 1. Relative prominence of chromatic pitch categories (percentage) for different repertoires in the study within category “minor mode” key profiles, in comparison with minor key profile (Krumhansl 1990). The neg. correlation between herding call and manuscript and herding call - minor reference are significant $p > 0.05$ (Pearson linear), as well as the pos. correlation between manuscript and minor

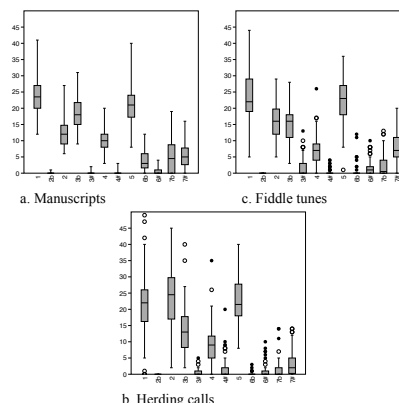


Figure 2. Data distribution for each chromatic category within the three data sets. Mean standard error for a 0.40, for b 0.58 and for c 0.52. $N=150$ for each set.

As can be seen in figure 1 and 2, the herding music and the fiddle repertoire share certain structural features such as the relatively higher prominences of the second scale degree in relation to the third scale degree in comparison with the manuscript and minor mode profiles. It might be interpreted as an influence of the herding call music in the fiddle music repertoire. The study indicates that sub-modes can be found within what is traditionally in a Swedish context categorized in terms of major and minor mode, but actually challenges this categorization, even when compensating for micro-tonal variation of intonation.

Furthermore, the study indicates that taking melodic contextual factors into account in statistical measurement of mode profile, can reveal structural stylistically significant features of tonal hierarchy.

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