

Transformations of musical scales in traditional unaccompanied singing

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ABSTRACT

Because of an absence of a fixed referential tonality, musical scales can experience certain gradual changes in the course of a *capella* vocal performance. For example, the phenomenon of floating tonality or gradual transposition (usually a gradual rise of pitch up to several semitones) common in traditional, unaccompanied singing has been discussed (Niemi & Jouste, Greene, Ambrazevičius). Alexeyev studied some peculiar instances of so-called “evolving” scales in Yakut singing, i.e. the intervals between adjacent scale degrees tend to widen in the course of performance. In the present study, we aim to identify types of gradual changes of musical scales in traditional singing without accompaniment and to discuss possible causes for the changes. Praat-aided acoustical measurements of pitches in traditional unaccompanied vocal performances were carried out. The sample was composed of 20 song records exemplifying the Lithuanian vocal tradition, both monophony and homophony. Several phenomena were revealed. First, the gradual transposition (rise) from the beginning to the end of the song performances can be identified as typical case. Second, the phenomenon of “evolving” scales was found to range from negligible to striking, for different vocal performances. Third, sometimes an opposite phenomenon of gradual shrinking of the musical scales, i.e. microtonal narrowing of intervals, takes place. The rise and widening might be attributed to warming-up, timbral brightening, and mastering of range, whereas the gradual shrinking manifests as the upper scale degrees reach gradually the upper part of a vocal range not comfortable for voice production.

I. INTRODUCTION

Gradual transposition of tonality, mostly rise, seems to be quite common for unaccompanied vocal performances in various musical traditions worldwide. For instance, the gradual transposition found in Yakut, Russian, and some other traditions was mentioned by Eduard Alexeyev (1976; 1986). Paul D. Greene in his study on Tamil religious incantation found that, in the final part of the ecstatic recitation (during some 20 recited lines), tonality could rise even in the interval of twelfth (!) (Greene, 1999, p. 482). Also Jarkko Niemi and Marko Jouste noticed that tonality in the North Eurasian songs changes in the course of performances. “There are two types of changes in the tonal structures that are common in northern songs. First, the overall pitch level often rises during the performance. There are examples of Sámi yoiks in which a singer has ended the piece as much as an octave higher to the initial level. Second, the distance between various intervals can change during a single performance or between different variations of the same melody” (Niemi & Jouste, 2002, p. 257).

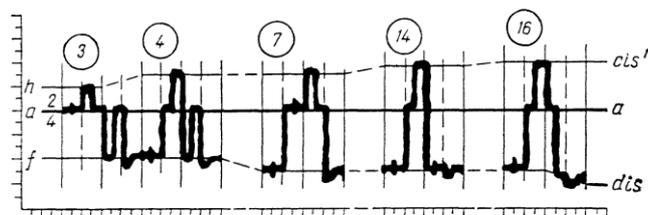


Figure 1. Example of an “evolving scale” (Alexeyev, 1976, p. 49).

We find the second type especially intriguing. Here one encounters not a simple transposition of the whole scale, but a different transposition of the different scale steps. This results in what Alexeyev has named “outspreading” or “evolving” scales (1976, pp. 48-58), an archaic phenomenon connected with the physiological and cognitive matters of singing¹ *inter alia*. Alekseev visualizes this schematically by outspreading the lines in a staff (Figure 1).

In the present paper, the dynamic transformations of scales in a set of typical Lithuanian traditional vocal performances are examined.

II. SAMPLES

Briefly, monophony (heterophony), polyphony, and homophony are/were characteristic of various Lithuanian singing dialects. Monophony in ensemble performance is traditionally attributed almost exclusively to Dzūkija and Suvalkija (Southeastern and Southwestern Lithuania; see Figure 2). Monophony was also registered in so-called Lithuania Minor², yet after the WWII only some traces of autochthonic traditional music could be found in this region as the music vanished together with the Lithuanian autochthons. Polyphony, containing counterpointal polyrhythmic singing – type of *Schwebungsdiaphonie* – among other stylistic variants, was documented in the northwestern part of Aukštaitija, yet it also has vanished in the middle of the 20th century and was finally substituted by homophony. Thus nowadays homophony is prevailing style in different Lithuanian regions. Usually one singer performs the leading part while the rest of a group add the lower “background” part making mostly dyads of thirds, fourths, or fifths with the leading part, according to the

¹ Alexeyev attributes the evolving scales in Yakut singing to dynamics of emotions: to his belief, the interval widening accompanied by increasing tempo leads to a rise of emotional tension (Alexeyev, 1976, pp. 56–57).

² Western part of Lithuania and East Prussia (present day Königsberg/Kaliningrad district) that was part of Germany for several centuries.

functional harmony. Sometimes the third, still lower part is added as well, but usually it can be considered merely as stable or heterophonic variant of the second part. The homophonic multipart singing in Žemaitija and Aukštaitija are considered to be of relatively early origin, and mostly featuring major-like mode. The homophonic style in Dzūkija is thought to be of later origin, dating from the turn of 19th and 20th centuries or somewhat earlier. Both major-like and minor-like modes are common.



Figure 1. The ethnographic regions of Lithuania and the location of the samples. The shading palette depicts the spoken dialects.

Only examples of Lithuanian monophonic and multipart homophonic performances are considered in the present paper. Phenomena of musical scales in the Lithuanian *Schwebungsdiaphonie* are definitely relevant as well, yet the peculiar psychoacoustic requirements make the sonorities relatively stable in intonation and thus the dynamic transformations of the scales are relatively negligible (refer to e.g. Ambrazevičius & Wiśniewska, 2009).

One could hypothesize that the gradual transposition as well as more sophisticated phenomena of the scalar transformations are mostly expected in the songs with narrow ambit. Presumably such cases provide “much of space” for the different transformations as they are relatively little limited by tessitura issues.

Therefore a set of recordings of the monophonic Lithuanian rye and oat harvesting songs was composed.³ All the songs exhibit minor-like scales (at first glance, they could be roughly estimated as Aeolian or Phrygian), except of the major-like *Vai aš pjaunu pjovėjėlė*. The harvesting songs are characteristic of

³ Ten recordings were applied from different published sources: rye harvesting songs *Per dziedį dvarų; Bėkit, bareliai; Oi an marių, an mėlynių; Rūta žalioj* (Kalviai, Trakai Dst.); *Verkia martela; Laiskis laiskis, saulala* (Slabada, Kaišiadorys Dst.); *Pūtė vėjas* (Verbyliškės, Prienai Dst.) (Četkauskaitė, 2007, CD 1, N. 12, 13, 16, 18, 14, 17, 15); *Gali baralio mėlyni karveliai* (Žagariai, Seinai Dst.) (Ambrazevičius, 1999a, N. 1); *Vai aš pjaunu pjovėjėlė* (Žiliniai, Varėna Dst.) (Vyčinienė, 2000, N. 1); oat harvesting song *An kalno, jan aukštojo* (Gečialaukis, Alytus Dst.) (Četkauskaitė, 2007, CD 1, N. 23).

narrow ambit usually not exceeding the interval of fourth. Figure 3 presents an example of the rye harvesting song.

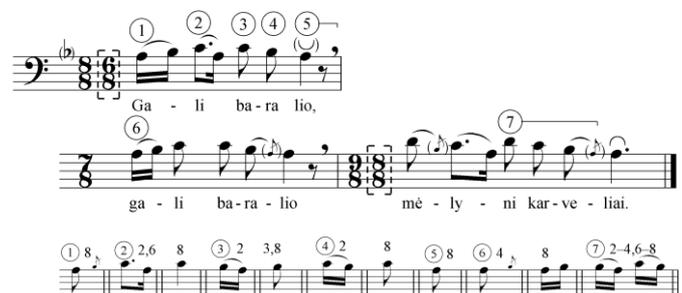


Figure 3. Schematic transcription of *Gali baralio mėlyni karveliai*.⁴ The gradual transposition not presented.

The “schematic transcription” means that only the basic features of the tune are depicted. The peculiar scalar qualities (their differences from the 12TET) are in fact neglected: thereafter we will see that the corresponding diacritic or other markings would make no sense or they would be too complicated since the scales change noticeably from the beginnings to the ends of the songs.⁵ The circled numerals denote the segments varying in the succeeding melostrophes; the variations are presented on the undermost staff, complemented with the row numbers of the melostrophes.

For the pilot-type research on the transformations of musical scales in the Lithuanian traditional vocal homophony, two typical idiolects were chosen. The first sample comes from Šeduva folklore group; this small town is situated in the Western part of Aukštaitija, Radviliškis Dst. (see the locations in Figure 2). For the second sample, group of singers from Mištūnai village (Šalčininkai Dst.; Dzūkija region) is chosen. Both groups are groups of female singers. Both samples represent major-like homophony; each of them contains five songs recorded in the turn of the last two decades of the 20th century.⁶



⁴ Translation of the first strophe: ‘Blue doves at the end of bay’.

⁵ Actually here the scale in the beginning of the song is schematized. The flat in parentheses (key accidental) denotes the neutral and floating interval of second (the second scale degree). In the course of performance, the scale undergoes certain transformations; see further.

⁶ Recordings: (Šeduva) orphan song *Auga kiemi dagilis* (Četkauskaitė, 2007, CD 3, N. 7), song to welcome the bridegroom *Oi brolio brolužėlio* (Vyčinienė, 2002, N. 3), song sung on the wedding eve at the bride’s home *Kad aš keltuį keliavo* (Vyčinienė, 2002, N. 1), ploughing song *Tėtėrvins subilda* (Četkauskaitė, 2007, CD 1, N. 7), song of leaving for the wedding ceremony *Oi sesutėla, ko verki* (Četkauskaitė, 2007, CD 2, N. 16); (Mištūnai; all songs from Ambrazevičius, 1999b) love song *Arškėtėli garbuonėli* (N. 20), song to welcome the bridegroom *Kad šeriau žirgelį* (N. 13), oat harvesting song *Lėkė sakalėlis* (N. 8), emigrants’ song *Oi tu sakalėli* (N. 19), and (wedding) guests mocking song *Tai kieno gražus kaimas* (N. 1).

Figure 4: Schematic transcription of *Auga kiemi dagilis*⁷.



Figure 5: Schematic transcription of *Arškėtėli garbuonėli*⁸.

Examples of two song transcriptions are presented in Figures 4 and 5. The tonalities are normalized: the tunes are transposed so that the tonics are equalized to G4. Other songs in the two samples actually follow the same schemes of the structures and the same rules of combinations of vocal parts (differing slightly for the two dialects).

III. MONOPHONIC PERFORMANCES

A. Gradual Transposition: General Remarks

Quasistable segments of the occurrences containing tonics were cut from the recordings of first melostrophes of all ten songs. Then software Praat was applied, LTAS spectra for each set of the segments were composed, and averaged pitches of the tonics were obtained. For example, the corresponding notes were left in the recording of the first melostrophe of *Gali baralio mėlyni karveliai* (Figure 3): *ga-* (first measure, first note of the syllable), *-li* (first measure, second note of the syllable), *-lio* (first measure), *ga-* (second measure, first note of the syllable), *-lio* (second measure), *-ly-* (third measure, second note of the syllable), and *-liai* (third measure). This technique of averaging weights automatically longer and more intense occurrences. Then the procedure was repeated with the last melostrophe and the differences between the readings for the first and last melostrophes were obtained (Figure 6).

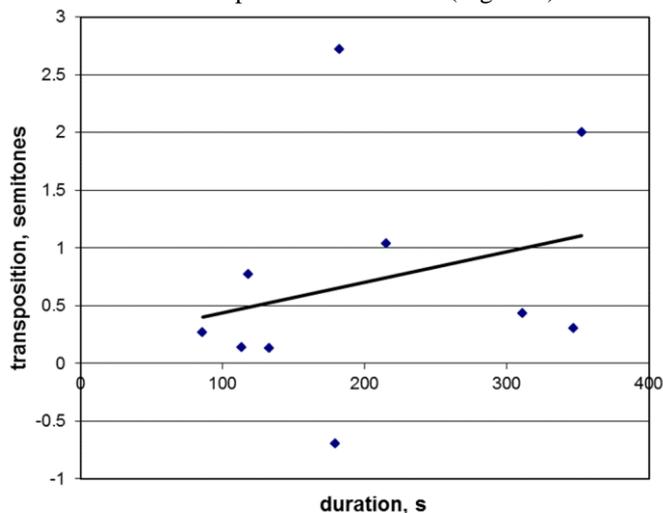


Figure 6. Dependence of transposition for tonic on the duration of song; sample of ten monophonic performances.

⁷ Translation of the first strophe: 'A green goldfinch grew in the yard, in the father's manor'.

⁸ Translation of the first strophe: 'Curly eglantine, don't stand at the road'.

Generally Figure 6 shows a rising tonality for the performances. The converse process – lowering towards the end of a song – is also observed for one case (this is the song *Bėkit, bareliai*). However, the tendency of rising transposition is obviously overwhelming, as well as the rough correlation of the rise to the duration of song. Actually the correlation is expected to be rough since perhaps the phenomenon is quite individual and also depends on certain melodic patterns, circumstances of performance, and so on.

B. Gradual Transposition: Evolution of Intervals

The evolution of intervals in monophonic performance is exemplified by song *Gali baralio mėlyni karveliai* (Figure 3). The sequence 3–2–1 (third–second–prime) represented by the syllables *ba-ra-lio* (the second measure in Figure 3) is chosen. The corresponding pitches in all melostrophes are measured (Figure 7).

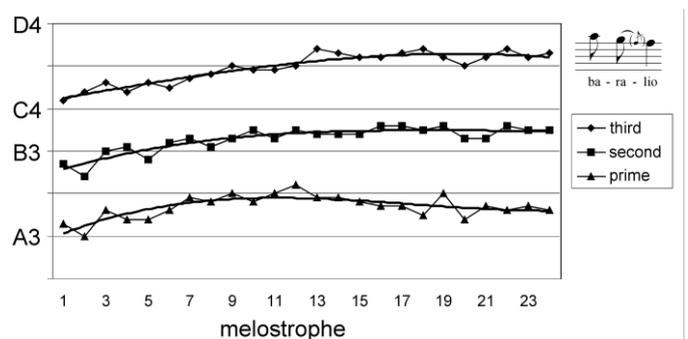


Figure 7. "Evolving" scale in *Gali baralio mėlyni karveliai*: pitches of sequence 3–2–1 in the different melostrophes.

It could be concluded that, up to around ninth melostrophe, the trichord is gradually rising, yet afterwards the tendency of rise is outweighed by the emerging tendency of widening of the trichord. The trichord sort of anchors in the second degree, while the third degree and especially the tonic recede progressively from the anchor. This change could be also interpreted somewhat differently: the gradual rise proceeds up to the end of song, yet slows down when the third degree approaches the upper limit of tessitura (or exits its most comfortable range). The second degree and tonic recede "pushing off" the restricted third degree.

In the end of song, the upper interval of second widens from 165 to 180 cents, on the average, while the lower second widens from 150 to 185 cents. Thus the interval of third (between the tonic and the third scale degree) widens from 315 to 365 cents. Hence the initial quasi-Phrygian tint of the trichord vanishes and transforms into a quasi-Ionian structure. Nevertheless, could the change be considered as a gradual transformation of one diatonic trichord into another? We propose that here one rather encounters the Alexeyev's "evolving" scale. It would be a mistake to treat an interval as changing from the minor third to the major third in the transcription, for instance, in terms of the original phonemic system, since, for the performer, it remains the same interval. In other words, the spreading intervals do not illustrate a *change* of the scale; they represent a *feature* of the scale.

As in the case of monophonic performances, the clear tendency of tonality rise can be stated. Somewhat surprisingly, here the tendency is even more prominent. In addition, the different extent of tonality rise for the two groups of singers should be noted.

B. Gradual Transposition: Evolution of Intervals

Closer inspection of the gradual transposition in *Auga kiemi dagilis* reveals that the evolution of scale degrees in the course of performance slightly differs. The tonic experiences the steepest rise while the higher degrees transpose progressively to a lesser extent (Figure 8). The lower fifth degree, again, rises slightly less than the tonic. These differences in the transposition appear especially apparent if observe the change of intervals in the vocal dyads (Figure 10). The width of the nominal major third 3-1 drops from a “very wide major third” (even closer to a fourth) to a “narrow major third” (narrower by some 20-30 cents compared to the 12TET-equivalent).

The same holds for the nominal pure fourth 5-2 which appears to be slightly stretched in the first melostrophe, but soon drops below the tempered equivalent and further narrows progressively to roughly midpoint between pure fourth and major third. Similarly, the nominal minor third 5-3 transforms from a “wide minor third” to something in between the minor third and major second. On the contrary, a slight stretch of the intervals containing the lower fifth degree (1-V and 2-V) is generally observed.

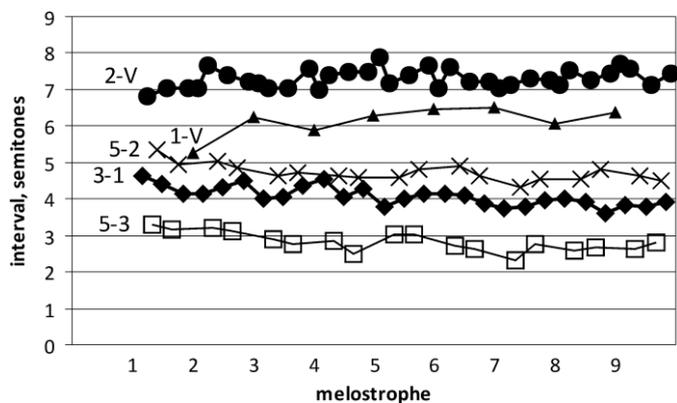


Figure 10. Evolution of dyadic intervals in *Auga kiemi dagilis*.

These transformations suggest the issues similar to those found for monophonic performance. Specifically, the harmonic intervals formed by the voices deviate significantly from their 12TET-equivalents. Moreover, the harmonic intervals undergo considerable gradual change from the beginning to the end of the song. The reasons of the discussed evolution seem to be analogous to those presumed for monophonic performance. The rise and widening might be attributed to warming-up, timbral brightening, and mastering of range, whereas the gradual shrinking manifests as the upper scale degrees reach gradually the upper part of a vocal range not comfortable for voice production.

Figures 11 and 12 pool results for Šeduva and Mištūnai samples. Quasistable segments of the occurrences of certain dyads were cut from the recordings of first melostrophes of all

ten songs. Then LTAS spectra for each set of the segments were composed and averaged pitches of the dyads were obtained. For example, the corresponding segments of the dyads 5-3 were left in the recording of the first melostrophe of *Arškētēli garbuonēli* (Figure 5): -tē- (first measure), -vėk (third measure), -lio (fourth measure), and -vėk (fifth measure). Then the averaged pitches of the third and fifth degrees were calculated from the LTAS. This technique of averaging weights automatically longer and more intense occurrences.

The same procedure was carried out with the last melostrophes. Then the pitches were normalized to the tonics of the analyzed melostrophes. Finally, deviations of the pitches of scale degrees from their counterparts in the twelve-tone equal temperament were calculated. The fourth scale degree is not shown for Šeduva sample (Figure 11) since it is faintly presented in the analyzed songs: at best, it appears in transitional notes only (as in *Auga kiemi dagilis*, Figure 4).⁹

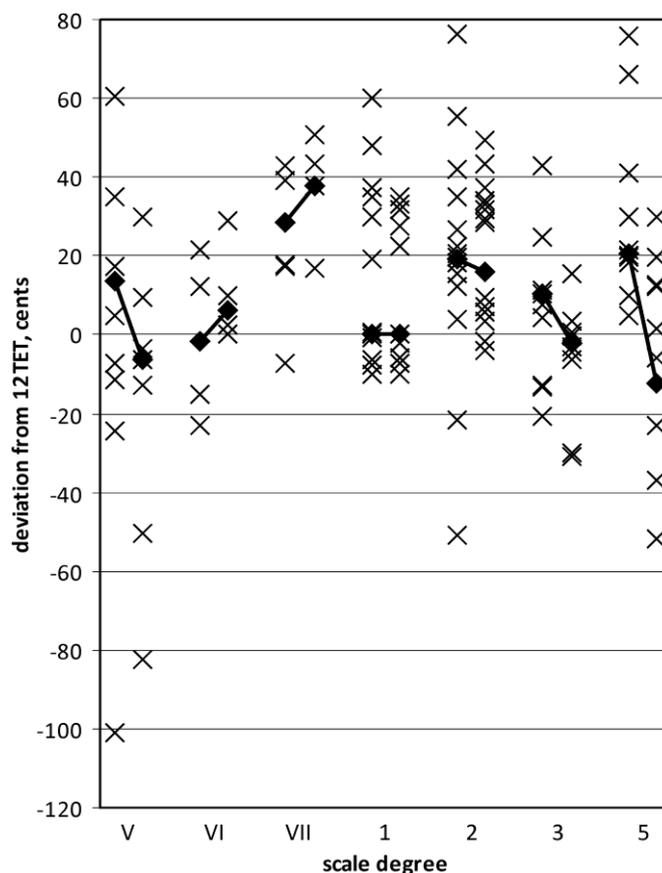


Figure 11. Pitch deviations of scale degrees from 12TET; Šeduva sample. Crosses: pitches of various dyads. Diamonds: medians of the pitches. Transposition is depicted: the values on the left stand

⁹ Statistical inference about the difference between two population means (i.e. the corresponding intonations in the first and the last melostrophes) gives fairly low one-tail p-values for the following scale degrees: V (.096), VI (.082), VII (.060), 3 (<.001), 5 (<.001) (Šeduva sample; Figure 11); 3 (.005), 5 (<.001), and 6 (.002) (Mištūnai sample, Figure 12). The few remaining scale degrees (2 in Šeduva sample, 2 and 4 in Mištūnai sample) show p-values larger than .1 which means that, for these degrees and based on the samples of limited size, the tendencies of the changes discussed are either not that strong or ambiguous.

for the beginnings of the songs whereas the values on the right show the endings.

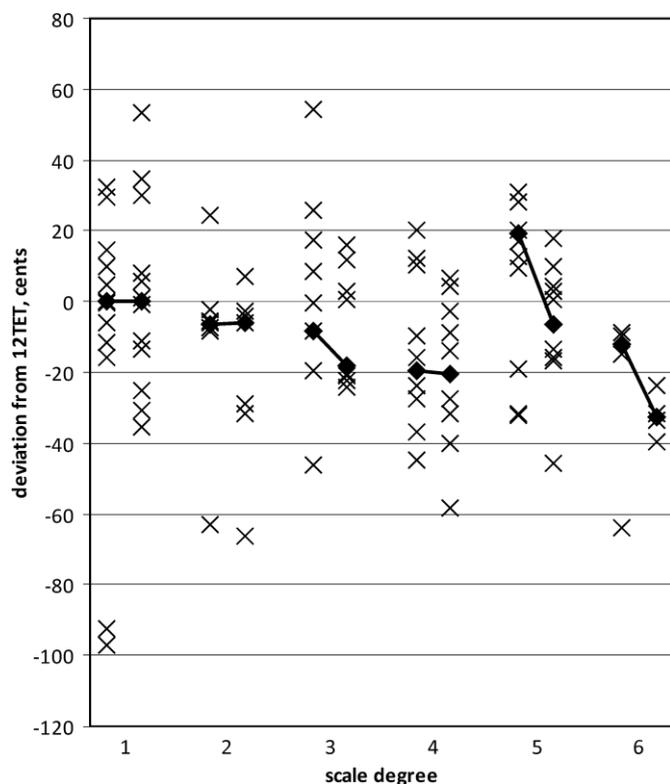


Figure 12. The same as in Figure 11; for Mištūnai sample.

Generally the results confirm the insights just derived for one single song *Auga kiemi dagilis*: the normalized pitches of scale degrees above tonic tend to drop in the course of performance (degrees 2, 3, and 5 in Figure 11, and degrees 2-6 in Figure 12) and those below tonic tend to rise (degrees VI and VII in Figure 11). This means narrowing of the intervals between the certain scale degrees and tonics, i.e. shrinking of the scales. The exception is made for the lower fifth scale degree (V in Figure 11). Probably this reflects the abovementioned tendency of “unfolding” characteristic, first of all, of the lowest tonal anchor.

Thus the tendencies of the temporal scale shrinking are essentially the same for both Šeduva and Mištūnai samples. However, the actual intervals differ quite significantly. Let's start from the fact that the tunes in both samples are based on the frame (or nucleus) of two main tonal anchors: tonic and fifth degree¹⁰. In both samples, the singers start from slightly stretched fifth (the fifth is some 20 cents sharper compared to its counterpart in 12TET), and this might be attributed to the common psychological preference for stretched intervals (e.g. Dowling and Harwood, 1986, p. 101-104). When approaching endings of the songs, the fifth degree becomes even flatter than the 12TET-fifth, but still similarly for both Šeduva and Mištūnai samples. However, the rest of scale degrees (i.e. not

belonging to the frame of two anchors) show relevant differences in pitch for the two samples. Briefly, the pitches tend to be sharper in the context of 12TET, for Šeduva sample, but flatter for Mištūnai sample (consider, for instance, the second and third scale degrees).

To generalize, the Šeduva singers apply a “bright” version of major-like scale whereas the “dark” version of major-like scale is characteristic of Mištūnai sample.

C. Role of musical context

Figure 8 shows that certain scale degrees are systematically intoned sharper or flatter in dependence of the dyads they belong to. For example, there is a slight tendency to intone the fifth degree sharper in the dyad 5-2 and flatter in the dyad 5-3. The deviations of intonations of tonic in the dyads 3-1 and 1-V are much larger; the same can be stated on the lower fifth degree (i.e. subfourth) in the dyads 2-V and 1-V. In some cases, these deviations even approach a semitone (!) Now I will not speculate about the reasons for every single scale degree, but most probably some generalizations of the phenomenon could be inferred. First, the vertical (harmonic) context could be at work: the tendencies to intone certain dyadic intervals wider or narrower could result in the corresponding tendencies of intonation of scale degrees.¹¹ Second, there could be also some impact of more extensive musical context including the horizontal component. Third, it is also possible that the vocal parts (or the singers corresponding to the vocal parts) have slightly different “versions” or even “models” of the scale to be applied. (The case of tonic in *Auga kiemi dagilis* is meant: the tonic is performed by the leading voice in the dyad 1-V and by the backing voice in the dyad 3-1.)¹²

V. DISCUSSION

The detailed analysis of twenty vocal performances representing Lithuanian traditional monophony and homophony reveals how complicated phenomena of musical scales are and how the actual performances differ from the simplified theoretical presuppositions. Just to remind, the common ethnomusicological attitude would tell that we deal with major or minor scales in classical meaning. The acoustical measurements provide data which let us try to reconstruct the original emic schemata and processes. First of all, this emic basis seems to be quite far from simplified theory because of significant deviations from 12TET leading to certain doubts concerning the minor- or major-like quality. Possibly, the scales could be considered in the wider and flexible context of major-minor continuum or something like this. This is not the end of story. One can expect that these microtonal deviations could be expressed in some unsophisticated way such as a static set of peculiar intervals between the scale degrees. Maybe this

¹⁰ Or, if based on more refined interpretation, the nether and upper tonics (Kharlap, 1972, p. 247).

¹¹ Actually this corresponds to the “harmonic intonation” rule in Friberg, Bresin, and Sundberg, 2006, p. 151, with a difference in target intervals which generally not necessarily have to be natural in our case.

¹² In more detail, the role of musical context is discussed in Ambrazevičius, 2014. The present paper is reworked and supplemented version of this earlier study.

might work for kind of very rough estimations, yet then the substantial properties of the scales would be overlooked and lost. These important properties include different levels of scalar dynamics: possible transposition (mostly rise) of the entire scale plus different rates of the transposition for different scale degrees, plus systematic effects of musical context on the intonation. These dynamic qualities of musical scale come from physiology and perception of singing. Interplay of these qualities result in peculiar outcomes such as evolving or shrinking scales in the course of performance of entire song.

To be analyzed, this interplay needs more sophisticated and multifaceted (or, generally, even multidimensional) techniques of measurements, evaluations, and visual presentations. A single static set of deviations in cents marked at the sequenced scale degrees is not enough.

To make things more complicated and more trivial at once, we should make clear that phenomenologically, for the performers, the musical scale of a single given song under discussion is probably unvaried from the beginning to the end of the song.¹³ By the way, contemporary listeners-ethnomusicologists usually also do not notice the slight tonality changes and changes of the intervals, unless asked to concentrate attention to the considered phenomena or unless they are possessors of absolute pitch. This is because the changes are slow and gradual. If compare the occurrences at distant moments of the performance, the changes become perceivable more easily. More importantly, the seeming stability of the scales supports the attitude that we deal not with changing scales (one scale transforming into other) but rather with a single scale embodying an intrinsic feature of change.

In the very end, it is worth repeated mentioning that the explored properties of the musical scales could possibly serve as idiosyncratic markers for different vocal idiolects and dialects, the markers which also manifest as bundles of colors for a contemporary listener-outsider.

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¹³ To be precise, performers of vocal tradition usually have no idea about the construct of musical scale. But let's imagine that they have learned somehow about the construct and we asked them to describe the certain cases of the scales in performances.