Searching for the “natural” origins of the symmetrical scales: Traditional multipart Setu songs

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Background in acoustics and psychoacoustics. There are a considerable number of (ethno)musicological studies dealing with the acoustical measurement of musical scales. For this investigation, the studies on vertical (harmonic) sonorities seem to be the most relevant, especially those including microtonal measurements and their interpretations. On the one hand, there is a general attitude that natural harmonic consonances are preferable (as ideal) in a freely-retuned performance since beats are eliminated in this case. On the other hand, preferences for rough sonorities (even for maximum roughness) are observed in some traditional musics, particularly in vocal traditions (e.g., Brandl, 1989; Muszkalska, 2000, 2002; Ambrazevičius, 2008). The peculiar Setu one-three-semitone mode (see below) has not been analyzed acoustically and its possible biological (psychoacoustical) origins have not been discussed.

Background in ethnomusicology and music theory. The older multipart songs of the Setu (southeastern Estonia) are based on the unusual “one-three-semitone mode”, i.e., consisting of the intervals close to one and three semitones (succession 1-3-1-3-1; Pärtlas, 1997). Interestingly, this mode is similar to one of the “modes of limited transposition” (also known as “symmetrical modes”) used by Olivier Messiaen (1944). Messiaen’s modes are often considered to be artificially constructed, in contrast with “natural” diatonic, pentatonic, etc. scales (Kholopov, 1990a, 1990b), thus raising the question as to how such scales could emerge “naturally” in the ancient song tradition.

Aims. We aim to reveal the regularities in the sizes and usage of the harmonic intervals in the Setu songs with the one-three-semitone mode and their possible origins.

Main contribution. For the analysis, one typical Setu multipart song was chosen. Acoustical measurements of the pitches were carried out. The statistical generalization of the results led to the conclusion that the requirements for (“vertical”) sonorities prevail in the formation of the scale. Specifically, the scale framework comprises three bichords; their sizes decrease when going up roughly approximating different versions of major thirds. The influence of “natural” psychoacoustical roughness on the sizes of the thirds is discussed, suggesting that the origins of the symmetrical scales can possibly be linked to “natural” psychoacoustical phenomena.

Implications. The origins of the symmetrical scales can be linked to psychoacoustical phenomena. The present study provides a basis for further ethnomusicological discussion on the development of symmetrical scales in other multipart song traditions. A comprehensive account of the phenomena of symmetrical scales requires expertise in both the humanities (ethnomusicology, music theory, etc.) and the sciences (acoustics, statistics).

Keywords: traditional multipart singing, Setu, musical scales, symmetrical scales, roughness

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The Setu multipart song tradition

The basic facts about the Setu. The Setu (in local dialect – Seto) is a small ethnic group of Estonians living in the South-East of Estonia and within the adjoining border territories of Russia (Pskov region; Figure 1). The Setu tongue – a Võru-Setu dialect of Estonian – is now spoken by about 5000 people, and belongs to the Finnic subgroup of the Finno-Ugric languages. The traditional culture of the Setu differs notably from the culture of other Estonians. Unlike most other Estonians, who are Lutherans, the Setu people are Orthodox. With regard to music, the greatest peculiarity of the Setu culture is the ancient multipart singing style, which has been preserved in active use until today (Figure 2).

Figure 1. The map of Estonia; the ethnographic region of Setumaa.

The Setu multipart songs. Multipart singing is characteristic to almost all genres of Setu traditional songs (work, calendar, wedding, lyrical, lyroepic, game songs) except solo genres (funeral laments, herding songs, lullabies). The song performers are predominantly women.

The texture of Setu songs is comprised of two functionally different parts – the lower main part (torrō in folk terminology), which is sung heterophonically by a chorus, and the upper subsidiary part (killõ), which is sung by a solo voice. The torrō part repeats, usually with extensions and alternations, the leader’s melody. The killõ part moves along the two or three upper notes of the scale.

The one-three-semitone mode. In the Setu multipart songs one can find three types of scale structure: the one-three-semitone scale (for example, D-Eb-F♯-G-A♯-B), the anhemitonic-diatonic (E-G-A-B-C), and the pure diatonic (D-E-F♯-G-A-B-C) (Pärtlas, 2006). The last scale is characteristic of newer-style songs; the first two are presumably of very ancient origin because they are characteristic of the oldest song genres such as bride laments, work and ritual songs.

The one-three-semitone mode is the most peculiar feature of the Setu song tradition and it is very unusual even on a global scale. This mode consists of intervals close to one and three semitones and has a symmetrical structure, which can be expressed in semitones in the succession of the numbers 1-3-1-3-1 (this is the largest range of the scale; Figures 3 and 4). The intervallic structure of this mode was theoretically recognized only in the last decades of the 20th century (Sarv, 1980; Pärtlas, 1997) when the first multitrack recordings of the Setu songs were made. However, a certain
disbelief regarding the real existence of such a mode persists among (Estonian) ethnomusicologists even at the present time, so that acoustical investigations of the Setu multipart songs are very topical today, either to support, specify in more detail, or contest the results of empirical analysis.

Figure 3. The “ideal” scheme of the Setu one-three-semitone scale.

Figure 4. The Fishing song (Kalaranna laul) performed by Anne Vabarna and her choir in 1936. Here and hereinafter the pitches are transposed to the standard range so that the tonal centre is G4.

The problem of unstable intonation and transitional scales. The name of the one-three-semitone mode and the manner of its notation reflects only approximately the pitch structure of the Setu songs. Even on the basis of aural analyses one can say that the intervals between scale degrees are not exactly and always the minor and augmented seconds. Jaan Sarv has noticed that the upper “semitone” of the scale (A#-B in Figure 3) can be very narrow (Sarv, 1980, p. 113–114). Pärtlas supposed that in many cases two lower notes of the music transcriptions (D and Eb) essentially realize the same scale degree (Pärtlas, 2000), which means that the lower three-semitone interval of the scale (Eb-F#) is often larger than the augmented second and the vertical sonority Eb-G is larger than the major third (see the down arrows before Eb notes in Figure 4).

It is also frequently noted that the Setu singers vary the pitch of scale notes to a considerable extent. In addition to this, the scales have often the transitional forms and, as the analyses of the multitrack recordings reveal, the different interpretations of the scale can coexist within one song performance, especially when older and younger women sing together (Pärtlas, 1997). On the basis of aural analysis it seems that younger singers cannot anymore keep the one-three-semitone tuning and think diatonically. As one could expect, the most pure forms of the one-three-semitone mode occur more often in the older recordings of the Setu songs.

It is also interesting that the plentiful (micro-)alterations in the Setu songs have a very systematic character and are practically always connected with the one-three-semitone mode and its “traces”. Such an example is provided in Figure 5 where E and A in the predominantly diatonic scale D-E-F#-G-A-B-C are unstable and can be sometimes considered as Eb and A#. This creates an impression of the one-three-semitone mode
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(fragments D-Eb-F#-G in the lead singer’s section and F#-G-A#-B in the chorus section).

Figure 5. The work song “Rain and the Orphan”, performed by the choir Helmine from Mikitamäe village in 1998.

“Artificial” and “natural” in the symmetrical modes

“Symmetrical modes” in professional and traditional music. One of the reasons why the one-three-semitone mode seems so unusual in the context of traditional music is its symmetrical structure, which is kept strictly throughout the six-note scale. (Actually it is the maximal range for such a scale, because the continuation of this sequence would give the same notes in the next octave.) Although some examples of the usage of symmetrical scales (especially fragments of the whole tone and octatonic scale) are known in traditional music, in music theory such modes are associated mostly with the compositional techniques of the 20th century, which are often based on mathematical calculations and the deliberate invention of new expressive means (Baur, 1999; Cohn, 1991; etc.). Therefore the symmetrical modes are often considered to be artificially constructed, in contrast with “natural” diatonic, pentatonic, etc. scales (Kholopov, 1990a, 1990b).

The Setu one-three-semitone mode is similar to one of the “modes of limited transposition” (also known as “symmetrical modes”) by Olivier Messiaen (1944). To be precise, the one-three-semitone scale can be easily derived from the “third mode” based on augmented triads (Messiaen, 1944, p. 53–54; see Figure 6). Although the question about “artificial” and “natural” phenomena in music is very complicated and can hardly be answered in only one way, it would be interesting to discover how such an unusual scale could evolve in the ancient song tradition, where there was no place for calculations and intellectual exercises.

Figure 6. The derivation of the one-three-semitone mode from the “third mode” by Messiaen.
The terminological opposition of “artificial and natural modes”. This pair of terms is especially characteristic of Russian music theory. It is rooted partly in the outdated (and mistaken) opinion that symmetrical modes do not occur in folk music, a notion partly reinforced by the use of symmetrical scales in the 19th century by composers such as Glinka, Rimski-Korsakov, and Borodin to create supernatural or inhuman musical images. The theorist Yuzef Kon offers his own definition of the “artificial modes” proceeding from the position of the scale notes in the circle of fifths (Kon, 1972, p. 100). Yuri Kholopov (1990b) equates the concepts of artificial and symmetrical modes and, like Messiaen, explains their structure proceeding from the principle of symmetry (i.e., the periodic repetition of interval groups).

Coincidences or musical logic? Irrespective of some differences in definitions, in European art music, the symmetrical modes are based on the tempered chromatic system of 12 notes, and every similarity found in older traditional music, with its “untempered” and often unstable intonation, can only be mere coincidence. (One more coincidence that could be named in connection with the Setu one-three-semitone mode is the so-called “augmented scale” – the hexatonic scale (C-Eb-E-G-G#-B) known in jazz theory.) However, the analyses of such coincidences can reveal some general regularities which show that there is no insuperable barrier between Western and non-Western music and between “natural” and “invented” musical styles. Importantly, in the abovementioned musical styles using the one-three-semitone mode, the harmonic sonorities are based on the major thirds and augmented triads.

Some assumptions about the nature of the Setu “one-three-semitone mode”

The binary harmonic system and monointervallic principle. Harmonic thinking is characteristic of the Setu multipart song tradition. The harmonic system is based on the binary opposition of two harmonic complexes containing every second scale note. Under conditions of the one-three-semitone mode it results in monointervallic harmony, where all structural verticals (i.e., containing structural notes of a melody) and almost all real verticals are (approximately) four-semitone intervals (major thirds): G-B, F#-A#, Eb-G, and D-F# (see Figure 4 and 7). The monointervallic harmony determines the peculiar sound of the Setu songs and suggests the assumption that the one-three-semitone mode could result from a preference for the major third as a harmonic consonance.

This assumption is also supported by the fact that the four-semitone sonorities also enjoy special status in the songs based on the diatonic and anhemitonic-diatonic scales. The major thirds are often emphasized rhythmically; they are located at the important points of the tune form (such as beginnings and ends of phrases) and are also accented dynamically by the singers. The major thirds are especially noticeable at the moments of the entrance of the chorus (e.g., the sonority G-B in Figure 5). One more argument in favor of the harmonic origin of the one-three-semitone mode is because sometimes the structure of this scale gets its specific form only in the chorus part, while the lead singer uses the diatonic scale (see Figure 7). Nevertheless, the cause for the peculiar internal split of the major third (3+1 instead of, e.g., 2+2), i.e., for usage of a semitone, remains obscure.
Example and method

The song examined. As mentioned above, the Setu singers vary the pitch of scale notes extensively; furthermore the scales often have mixed or transitional forms (Pärlas, 1997). Thus the selection of material for analysis can influence the results to a considerable extent. For the present paper, which is pilot research applying the methods of acoustic analysis to the peculiar Setu modes, the possibly reliable (i.e., old and traditional) audio example was chosen. The sound recording under consideration (Figure 7) was the work-game song “The Grinding Stone” (Kääkivi). The performer was an outstanding Setu singer, Anne Vabarna (1877–1964), who was especially famous for her long epic songs. Anne Vabarna lived in Northern Setumaa, where the older song style and the one-three-semitone mode were better preserved. She used to sing with her family choir (3-5 singers), but in this case there are only two performers – Anne Vabarna as the lead singer, who sings the torrõ part in the chorus section, and her daughter Od′e, who sings the upper part killõ. The performance as a duet is not a very traditional situation, but it eliminates the problem of the wide unisons (wide due to intonation) in the torrõ part. This performance is from 1959 and it is one of the few recordings of Anne Vabarna recorded on tape (not on wax cylinders or shellac plates), and is, therefore, of sufficient technical quality for acoustic analysis.

Figure 7. Schematic transcription of the examined song. The pitches are transposed to the standard range so that the tonal centre is G4. Numbering of notes used in the succeeding analysis is supplemented.

Measurements. For the pitch measurements, Praat software was applied. The spectra of the vocal dyads were analyzed and the fundamental frequencies of both voices were calculated, mostly from the measurements of the upper (clearly standing out) harmonics. For monophonic – solo and unison (quasi-unison) – parts, direct pitch measurements from pitch tracks were also applied. The first five melostrophes of the song were examined. The performance features quite significant intratonal pitch changes. For instance, in the prolonged dyads even some break-up into short notes is perceived (as in Figure 8). Average pitch centroids were measured in this case. Some dyads actually start from a single pitch and then digress to target pitches (Figure 9). Here only the target pitches (as “true” ones) were considered.
Results

Scale considerations

Intertonal pitch change. The results of pitch measurements are exemplified by pitch tracks for the second melostrophe (Figure 10; here and hereafter only the segment of multipart performance is presented). It is obvious that the succeeding occurrences of certain scale degrees differ significantly in pitch. Moreover, some degrees (most notably, the highest two – approximately D# and E or A# and B in the transposed transcription) are hardly separable: their zones of intonation overlap (compare, for
instance, the sequences 9-10-11 and 14-15-16 (upper voice) in the graph and transcription).

Figure 10. Pitch tracks (bold lines) and scale degree tracks (white-gray borderlines; according to the aural transcription); 2nd strophe. Only multipart segment is shown.

Figure 11. Averaged pitch tracks (bold lines); only multipart segment is shown. The pitches are transposed so that the averaged tonal centre is zero. The horizontal dashes mark maximum deviations. Long dyads are highlighted (vertical ovals). Thin lines correspond to the transcription (Figure 7).

To get insight into the generalized form of the scale, averaged pitch tracks based on the measurements of the five melostrophes were designed (Figure 11). It was held that
each succeeding melostrophe features a certain increment or decrement in intonation (microtransposition; see Ambrazevičius, 2005-2006 for details of the procedure).

Similarly, as within the second melostrophe, discrepancies between the actual performance (possibly arising from the performers’ unique perception of the scale) and the aural generalization (transcription) can be observed.

**Scale structure.** The findings show that, from the point of view of scale, the performance comprises two conjunct bichords (transcribed as Eb-G and G-B) realized most distinctly by the (short) vocal dyads with intervals of thirds in between, plus additional anchor bichord realized predominantly by the prolonged dyads (transcribed as F#-A#). Rhythmically, the two upper bichords (G-B and F#-A#) are realized most distinctly by periodically distributed short-long duplexes (dyads 1-2, 6-7, 11-12, and 16-17). The case 6-7 is peculiar. The dyads 6 and 7 are presented by the same F# and A# in the transcription. The results of measurements, however, show actually the same (downward) type of conjunction movement as in the rest of the three cases. A slight fall in pitch in the case 6-7, can probably be explained by the differences in the melodic contexts: dyad 6 is preceded by an upward leap, in contrast with the other cases. Thus the dyads 1-2, 6-7, 11-12, and 16-17 manifest the same movements in the scale, and the slight actual differences in the movements result from the nature of the performance and can be detached from the scale design.

Partly because of the phenomena just discussed, the relation of the anchor bichord to the two-bichord-structure is quite peculiar: while in some cases the prolonged dyads are clearly perceived as moving downwards from the preceding short dyads, in other cases (mostly for the upper voice), this motion is not particularly noticeable. (Seemingly, the faint movement of the killõ is specific to this song and not necessarily a general feature of Setu songs.) All the occurrences fall into the same category as there is a quite homogeneous zone of intermediate cases between the extremes. The resulting scale intervals (averages, in ascending order of pitch) are: 357, 84, 312, and 42 cents (Figure 12). Once again, the highest interval actually covers a wide range, roughly from minor second to prime. These findings lead to the conclusion that the scale in the transcription (Figure 7) should be somewhat reconsidered, as well as the general findings on Setu scales and their changeability.
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Figure 12. Bichord structure of the scale, see text for details.

This also raises questions about the limits of the concept of the musical scale: the “solid frame” of the scale most clearly rests on the bichord-system discussed, yet it is somewhat loosened in performance. Moreover, the remaining sonorities (quasi-unisons and the solo introductions) “dissipate” the central solid structure and can be considered as the interplay between the scale structure and partly biologically or physiologically based performance rules. And as a result, already at this stage of the investigation, we can deduce an interaction between, on the one hand, nature in terms of the performance and, on the other, nurture in terms of the scale structure.

Aspect of psychoacoustical roughness

Stability of dyads. Importantly, in the performance analyzed vertical (harmonic) intervals are more stable than horizontal (melodic) ones. This holds especially for the intervals realized by the prolonged dyads: compare the standard deviation of 23.5 cents for the prolonged dyads with 32.6 cents for the horizontal intervals (averages). This means that the structure of the scale rests, first of all, on vertical thinking. Therefore it would be interesting to try to reveal the origins of the sizes of the vertical intervals. Here we do not pretend to clarify all the aspects responsible for the issue, but only to propose a couple of possible explanations.

Roughness as determinative of size of harmonic interval. When searching for possible explanations, first of all, we encounter roughness as a psychoacoustical phenomenon, thus as a “natural” or, more specifically, biological (i.e., universal, not cultural) phenomenon resulting from the peripheral auditory system – the resolution of the basilar membrane of the inner ear. It is generally agreed that minimum roughness is preferred in many cases resulting in vertical sonorities that employ simple frequency ratios. Actually the well-known essentials of early history of European theoretical musical scales exemplify this statement. Although a cultures specific soundscape results in modifications (e.g., Voss, 1986), strong preferences for
sensory consonances are still observed. For instance, it is argued that “good harmonic intonation is achieved by reducing the beating between partials, a particularly important feature in barbershop singing (Hagerman & Sundberg, 1980). This intonation corresponds roughly to a just tuning relative to the current chord” (Friberg, Bresin, & Sundberg, 2006).

However, the opposite tendencies are observed in different traditional musics. For example, the study of Brandl (1989) shows preferences for rough sonorities in vocal Schwebungsdiaaphonie of the Balkans and elsewhere. Ambrazevičius (2008, etc.) found the dyad-intervals in Sutartinės (a Lithuanian type of Schwebungsdiaaphonie) were slightly less than 12ET-whole tone. Collation of the results with the findings relating to psychoacoustical roughness (e.g., Kameoka & Kuriyagawa, 1969) led to the conclusion that the musical phenomenon (musical scale) is determined by a “natural” (universal) psychoacoustical domain. Muszkalaska measured “out-of-tune” thirds and other intervals in Portuguese multipart singing (2000, 2002). Thus it would be interesting to examine the Setu example from the viewpoint of roughness.

**Procedure of roughness evaluation.** For an analysis of roughness we applied the mathematical procedure proposed by Vassilakis (Vassilakis & Kendall, 2010; and earlier), based on earlier findings (Plomp & Levelt, 1965; Kameoka & Kuriyagawa, 1969; Sethares, 1998). Say, the lower pitch of dyad is G#3 minus 40 cents (which corresponds to the averaged lowest pitch of the dyads in the performance analyzed, Eb in the transcription) whereas the higher one is increased gradually by 10 cents. The harmonics of the two sounds are then calculated and the total roughness resulting from the interaction of all the harmonic pairs is evaluated. Harmonics up to 2 kHz are considered, since higher harmonics decrease rapidly in intensity, roughly from that frequency (as seen in the spectra of the performance) or, at least, they are significantly weaker, on average. Probably, this results from the predominant concentration of F2s lower than roughly 2 kHz (vowel i characteristic of high F2s does not appear frequently in the performance and it is somewhat “covered”). For the sake of simplicity, the amplitudes of the harmonics were assumed to be equal since (1) according to Vassilakis, the influence of amplitude is small, and (2) maximum roughness is sought (which corresponds to the equal amplitudes in the harmonic pair). The same procedure was repeated with pitch B3 plus 50 cents (roughly the averaged lower pitch of the two upper dyads – pooled F# and G in the transcription).

**Model of Vassilakis.** According to Vassilakis (Vassilakis & Kendall, 2010, p. 75270O-3), roughness \( R \) of a pair of sinusoidal tones (frequencies \( f_1, f_2 \), and amplitudes \( A_1, A_2 \)):

\[
R = X^{0.1} \times 0.5(Y^{3.11}) \times Z
\]

where

\[
X = A_1A_2;
\]

\[
Y = 2\min(A_1A_2)/(A_1+A_2);
\]

\[
Z = \exp(-3.5s) - \exp(-5.75s);
\]

\[
s = 0.24|f_2-f_1|(0.0207\min(f_1,f_2)+18.96).
\]
Here, some modifications of the original expressions by Vassilakis were applied, but without changing the final result. Since the amplitudes of the harmonics are assumed to be equal, only the function $Z$ is used for the evaluation of roughness in the present study.

**Results of roughness evaluations.** In the neighborhood of the major third, roughness for the upper dyads has one minimum whereas there are two minima for the lower dyads (Figure 13. These minima correspond to 5:4 (natural major third) and 9:7 ("large" major third) ratios. The 9:7 minimum for the lower dyad is even lower than the 5:4 minimum. Possibly this could explain the tendency to use the “large” major third in the lower dyads (measured 442 cents, on average) and the tendency to use the natural major third in the upper dyads (measured 389 cents, on average). Of course, actual values often deviate noticeably from these averages.

![Figure 13. Roughness of dyads, in arbitrary units, see text for details.](image)

Vassilakis’s model helps to make some numerical evaluations, but actually we could have come to our general conclusions on the possible origins of the pitch intervals examined without applying this model as well: the idea is that the 9:7 third becomes relatively (psychoacoustically) consonant in the case of certain combination of the fundamental frequencies (of the two voices constituting the dyad) and the most pronounced spectral range of the voices examined. In our case, the 9:7-dip in roughness curve appears for the dyads of (~)200 Hz and 200*9/7 Hz (the harmonics coincide at 1800 Hz), however, this dip does not appear for the dyads of (~)250 Hz and 250*9/7 Hz (the harmonics coincide at 2250 Hz; but we make a cutoff of the spectra at 2000 Hz). Of course, our simplification of the model (equal amplitudes of the harmonics, cutoff at 2000 Hz...) is crude, but we think that, at least, it illustrates the difference between the perceived consonance/dissonance for the two cases examined (lower and upper dyads).
Discussion

The findings suggest that the Setu singers try (probably unconsciously) to avoid rough sonorities; sizes of the harmonic intervals thus appear to be governed by a psychoacoustical phenomenon. The peculiarity is that the given combination of the fundamental frequencies and spectral qualities of the voices result in two versions of the preferred major thirds, the natural major third (5:4) and the “large” natural major third (9:7).

This result (evidence of natural consonances) is somewhat unexpected because just the opposite has been already mentioned with reference to Lithuanian polyphonic vocal Sutartinės, where the dyad intervals appear to be based on the principle of maximum roughness.

Intervals in the song examined decrease when going up (if one considers the bichords or, separately, seconds and thirds). This leads to the assumption that another phenomenon is possibly also at work: the so-called “proportional” scales (Alexeyev, 1976, p. 80–108) or “arithmetic” scales, i.e., scale structures based on frequency intervals instead of frequency ratios, as in the songs of Australian aborigines (Ellis, 1965, etc.). Australian aboriginal scales are also estimated to be an intermediate case between the “arithmetic” and “normal”, i.e., the pitch intervals decrease when going up, however, slower than in the case of a natural scale (the progression of harmonics); see, e.g., Brennan, 2010. It seems that the intermediate case can also be observed in the Setu scale.

Yet an important question remains unanswered. Why are contrasting intervals (in ratio of roughly three to one) used in the scale structure under discussion? We can only speculate that possibly the well-known preference for unequal scale intervals resulting in a referential framework is at work (Rosch, 1975; Krumhansl, 1990, p. 16–18; Balzano, 1982). Another cause might be similar to the performance rule of leading tone found in the Western musical tradition. Namely, the sense of tonal centre is strengthened when the neighboring (leading) tone is “attracted” by the tonic, i.e., the interval between them tends to constrict and become narrower than 12ET-semitone (Friberg, Bresin, & Sundberg, 2006, p. 151). Incidentally, a similar phenomenon was observed in Lithuanian traditional singing: the tone next to a tonal anchor “gravitated” to it in certain melodic contexts to make the anchor more salient (Ambrazevičius & Wiśniewska, 2008). Thus, possibly, a similar perceptual strategy could be applied in the Setu case as well, to highlight the anchor bichord.

To test these assumptions and to get a more comprehensive insight into the peculiarities of the Setu scales, the study should be extended to include more examples and other types of the Setu songs. For the meantime, in addition to the study presented in the paper, pilot analysis of another two song performances belonging to the group led by Anne Vabarna was executed: the fishing song Kalarannalaul (see Figure 4) and the funeral lament Sõbrakõnõ. Only intervals in the prolonged dyads were measured; nine melostrophes in Kalarannalaul and twelve melostrophes in Sõbrakõnõ. The results show essentially the same regularities found for Kūsikivi,
namely, 396 cents for F#-A# (Kalarannaul) and 455 cents for Eb-G (Sõbrakõnõ), on average.

The present study provides a basis for further ethnomusicological discussion on the development of symmetrical scales in other multipart song traditions (for example, the scales with the structures 2-2-2, 3-1-3, and 1-3-1 found in the southern regions of Russia). On the other hand, the phenomena discovered in these traditions could shed light onto the origins of the Setu scales, as well as onto more general facets of nature and nurture in the phylogenesis of musical scales.

References


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1 To be precise, here the function $12\log_{2}(f/440)$ is meant by pitch (in semitones from A4; $f$ stands for fundamental frequency). The substitution of the expression for the function with (“objective”) “pitch” is made for the sake of simplicity, i.e., applying the same flexibility in the usage of terms as it is done by the authors of Praat.

2 Not to be confused, the notion of bichord here is reserved to the two-sound constituents of the scale, and the “dyad” holds for the actual two-voiced chord at certain moment.

3 Incidentally, here one can refer to the Alexeyev’s “$\gamma$-intonation”, i.e., a more archaic type of a scale performance characteristic of loose “wandering tones” (Alexeyev, 1986, p. 80–99, etc.).

4 One should not be confused by the slight difference between this number and the one in Figure 12. It is because only dyads (in thirds) are considered here, and all pitches (including quasi-unisons) are considered in Figure 12.

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