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Validity of acoustical pitch evaluations in traditional vocal performance

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Background in music perception

Significant work has been done in the evaluation of pitch jnds. It was found that pitch jnd is several cents (Hess, 1983; Zwicker & Fastl, 1999, p. 185; etc.). This mostly holds for the best listening conditions, and for the time and pitch ranges characterized by the sharpest perception. Thus, pitch jnd usually is considerably higher, exceeding 10, 20, or even more cents (Parncutt & Cohen, 1995, p. 863). It means that measurement precision of some 10 cents could be considered adequate for a study of pitch phenomena in traditional vocal solo performance characteristic of quite unstable fundamental frequency.

Brief changes of $\log f_0$ contribute to a certain fuzziness of a perceived pitch and make the evaluation of pitch problematic. It was demonstrated, for instance, in experiments of perception of short glides, vibrato, and other contours of $\log f_0$ (d'Alessandro & Castellengo, 1994; Rützel & Ross, 1985). Ambrazevičius proposed a simplified technique for perceptual pitch evaluation in vocal solo performance in these problematic cases (Ambrazevičius, 2005-2006, p. 67).

Background in ethnomusicology

Evaluations of pitch are very important in ethnomusicological research. First, there is abundant evidence of systematic differences between the traditional music scales and twelve-tone equal temperament (regarding Lithuanian cases, see Ambrazevičius 2005-2006 and other papers by the author). Relationships among intonation with sound durations and melodic context were traced (Ambrazevičius, 2008). Different types of folk intonation assigned to different stages of mode development were discussed (e.g., Alexeyev, 1986).

Thus, the techniques of the discussed evaluations should be developed and the sound material to be applied to get reliable results should be specified.

Aims

We aim to verify the presumption that sound duration (IOI) has influence on the precision of pitch evaluation in traditional vocal performance. If this is so, we need to specify the characteristic durations suitable for different tasks of evaluation.

Main contribution

One example of Lithuanian harvest song performed by prominent Lithuanian female folk singer Marė Navickienė has been chosen for the analysis. The recording of the song contained 14 melostrophes featuring complicated semi-free rhythm and abundant ornamentations. Software Praat was applied for the evaluation of IOIs and pitches employing the methods developed earlier (mentioned in the background section). The measurements were carried out by the three authors independently. One of the authors repeated her measurements after a pause of several days. Comparison of the results confirmed the presumptive tendency to evaluate individual long durations more similarly (by the three authors as well as by the author who repeated the experiment); both in IOIs and in pitches. Standard deviations of the pitch evaluations were less than 10 cents starting from app. 450 ms. This means that decisions on individual pitches can be considered valid only for such long sounds (if making no additional time consuming attempts and applying no additional intricate methods of evaluation). However, the decisions on the musical scales averaged across the entire performance can be considered valid when applying the data of significantly shorter sounds. The deviations of pitch (i.e., scale degree) evaluations were shown to be noticeably less than 10 cents (4 to 7 cents) even when all short ornamental sounds were included in the analysis.

Some further considerations (e.g., influence of melodic context on the validity of the decisions on musical scale, additional tips for the technique of measurements, etc.) will also be presented.

Implications

The results of the study could function as landmarks for acoustical measurement of recorded vocal performances, especially when there is a large amount of the material to be studied and when time is limited.

A comprehensive account of the phenomena of musical performance (its aspects of pitch and time) requires expertise in both the humanities (music analysis, ethnomusicology) and the sciences (music psychology, acoustics, statistics).

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Biography of Rytis Ambrazevičius

Rytis Ambrazevičius has a degree in physics from Vilnius University and he received his Ph.D. from the Lithuanian Academy of Music and Theatre. He is a Prof. at the Kaunas University of Technology and Assoc. Prof. at the Lithuanian Academy of Music and Theatre. His research interests include music and speech acoustics, ethnomusicology, and music cognition. He has authored or co-authored ca 50 papers and books, and ca 400 entries for the Lithuanian Encyclopedia of Music. Member of ESEM and ESCOM. He is also active as a folk and folkrock musician.

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Robertas Budrys has a degree in musicology from the Lithuanian Academy of Music and Theatre. His research interests include music cognition, especially tonal hierarchies and other features of musical scales that can be studied with the aid of psychological experiments and acoustical analysis.

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Irena Višnevska has a degree in musicology from the Lithuanian Academy of Music and Theatre; she is currently a doctoral student at Institute of Arts, Polish Academy of Sciences. Her research interests include ethnomusicology, especially traditional music of the Polish minority in Lithuania and the study of stylistic features of traditional singing through acoustical analysis. She is also active as a folk singer.