OBJECTIVE ANALYSIS OF PERFORMANCE STYLE PARAMETERS
(ON THE MATERIAL OF CLASSICAL MUSIC OF THE EAST)

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Abstract: The paper deals with traditional musical performance of classical music of Transcaucasia and Central Asia. Some master performances of this branch have been compared, for example a phonogram of the famous Azerbaijani musician B. Mansurov who played one of the national classic music cycles on the string chordophone tar in 1960th, and of his pupil V. Rahimov (2012); recordings of famous Tadjik musician N. Aminov (1960th) and of M. Eshankulov (2013), now professor of Tadjik National Conservatory; they both played classic melodies on the string chordophone tanbour. The computer analysis shows a trend in pitch row structure and in the statistics of using of sound pitch stages, which showed up during the period 1960th–2012. It indicates changes in musical thinking of younger musicians who studied western music and played pianoforte in Conservatory. Precise computer analysis allowed to obtain objective parameters of this tradition trend.

Key words: Computer sound analysis, sound pitch row, classical music of the East, tar, tanbour, tradition, trend

1. Background

The description of performance of traditional music contains usually some colourful (but not exact) definitions which portray the style of per-formance, timbre palette, and also the specific of sound pitch row. It is common practice in musicological and ethnomusicological studies. However, researchers are looking for a way to get more accurate description of these phenomena. Contemporary computer methods allow to measure some characteristics of musical per-formance and to describe them objective and more precise [1, 2].

One of interesting directions of such investigations is the traditional classical music of Middle East, which uses a lot of tuning and interval systems. The performance tradition of classical Eastern music prescribes only the ‘mode’ of musical piece, i.e. every composition may be played in different versions and with the use of individual performer’s pitch row. On the other hand, the pitch row depends on the possibilities of musical instrument. Some of appropriate characteristics (base tuning of instruments) can be measured in laboratory. The performance practice, individual pitch row etc. can be estimated only by analysis of phonograms.

In our investigation, two types of instruments have been analyzed — tar and tanbour (tanbur). Both are the main instruments in traditional classical music of Middle East. On the basis of Azerbaijani tar and Central Asian tanbour, traditional Eastern music theory have been constructed. Both instruments are plector chordo-phones, they have: tar – 11 (including two pairs of melodic) strings, tanbour – 3 strings and a lot of fixed frets on the fingerboard. The first of them is well-known in music history from the beginning of Middle Ages; it have a 17-stage tuning with not even intervals between stages. The second one was firstly tuned to the ranks of the same 17-stage, but in the last century its tuning became near to 12-stage diatonic system. Therefore, a tanbour exemplars of elder musiciians can contain more frets.

For instance, the instrument used by M. Eshankulov in 2013 was before in possession of the famous Tajik musician Fazliddin Shahobov (1911–1974). But M. Eshankulov informed us, that he cut some of the frets because he doesn’t use them in his performance practice. This fact shows that it is important to obtain accurate sound pitch measurement results in order to fix possible changes in the pitch row of modern performance tradition and musical thinking, respectively.
In our investigation, following examples of musical performances have been analyzed. 1) A recording of famous Azerbaijani musician Bakhram Mansurov (1911–1985), who played in 1960th one of the national classic music cycles Mugham Shour on tar. 2) A recording of Mansurov’s former pupil, a famous contemporary musician Valekh Ragimov (2012). 3) Another musician of elder generation is the famous Tajik artist Neria Aminov (1916–1996) who played the classic piece Sarahbori Segoh. 4) A contemporary musician, professor of Tadjik National Conservatory M. Eshankulov, who played (2013) the classic melody Samoi-Dugoh.

Fig 1. shows the theoretical pitch row with 17 different intervals in comparison with some ‘practical’ pitch rows — for two instruments of B. Mansurov (B.M.1 and B.M.2) and one for V. Ragimov’s tar (V.R.). All these measurements were made in laboratory on ‘silent’ instruments. The really used pitch row with its deviations from base tuning, which use the musicians with the help of special performance techniques, can be measured only from a pho-nogram.

The measurements of ‘silent’ instruments allow to determine the basic theoretical system, which is a ‘guideline’ for musicians and crafts-men who manufacture musical instruments. This is important information for comparison of different versions of musical systems and of the performing style and its changes during time.

2. Method

The investigation is based on experimental analysis of sound pitch row measured with the help of computer program SPAX developed by A. Kharuto. Firstly, sound pitch values will be obtained for every time moment (with a time step of about 10 ms); these measured points build the melogram graph shown on Fig. 2. For sound pitch measurement, the cepstrum method will be used which provides accuracy of about 4-5 musical cents (1200 cents are equal to the interval of one octave, 100 cents is the interval between half tones in European musical system). The SPAX program does not follow different ‘voices’ separately, but it fixes the pitch of most powerful sound at every time moment. As result, the ‘summary’ sound pitch row can be es-timated, which includes pitches of different sounding strings.

In order to obtain the parameters of pitch row, statistical approach will be used. After building the melogram, the program calculates a hystogram of sound pitch time function. The width of hystogram ‘window’ is equal to 5 cents. The cumulative value in every ‘window’
characterize the summary ‘using time’ for the appropriate sound pitch. Fig 2. shows the sound pitch hystogram (at the right border) calculated for the whole phonogram length (B. Mansurov).

The maximal observed sounding time $T_{\text{max}}$ (global hystogram maximum) will be farther used as a scale for setting the threshold level $T_0$ (usually from 2% to 10% from $T_{\text{max}}$). The threshold level $T_0$ is the lower limit of sounding time for selecting pitch row stages. If this time is greater then $T_0$, the appropriate sound pitch will be included into the list of stages. The sound pitches, which sounded ‘too short’, will be not considered as pitch row stages. If the threshold is low, the sounding time for many pitch levels will overlap it and the program will fix many ‘false’ stages which appear because of accidental instability of sound pitch during performance. If the threshold is high, some of ‘true’ stages can be lost because of its ‘too short’ sounding time. In order to make more objective estimation of pitch row, the calculations will be repeated for some different levels of threshold.

In some cases the program will fix pairs of adjacent ‘stages’ with very small pitch difference $Q$, which are accidentally ‘variants’ of one ‘true’ stage. In order to eliminate such effects, a second variable parameter will be used — $Q_{\text{min}}$, the ‘minimal allowed’ distance between pitch row stages. If the distance between two stages is too small ($Q < Q_{\text{min}}$), the program will substitute this pair of ‘stages’ through one stage with a weighed mean value of sound pitch, and the number of stages will decrease. For different values of $Q_{\text{min}}$, the number of fixed stages $N$ will vary. Until $Q_{\text{min}}$ is lower as the real difference $Q$ between stages, $N$ will be constant. By rising of $Q_{\text{min}}$ it will overlap the real difference $Q$, and some of adjacent stages will be substituted as described above. As result, the number of stages $N$ will fall. The same effect will occur for $Q_{\text{min}} \approx 2Q$ and so on.

Fig. 3 shows the number of fixed stages as a function of $Q_{\text{min}}$ calculated for B. Mansurov’s phonogram. In this case, $N$ is constant ($N = 12$) for intervals $Q_{\text{min}}$ from 20 to 30 cents. This ‘area of stability’ for some values of $Q_{\text{min}}$ indicates the minimal interval between stages by B. Mansurov — about 20 cents. According to this estimation and setting $Q_{\text{min}} = 20$ cents, we get a list of stages and intervals between them for B. Mansurov’s performance, shown on Fig. 4.

Because of limited accuracy of sound pitch estimation, the intervals can be measured with possible errors of about 10 cents. Taking into account this value, one can see that many intervals on Fig. 4 are approximately equal to 25 cents (#5, #8), to cents (#3, #4), or to 175 cents (#7); other 6 intervals are ‘European-like’ — near to 100 cents (#2, #9) or 200 cents (#1, #6, #10, #11).

The measurement procedures described above have been fulfilled also for phonograms other musicians.

3. Results

As shown above, B. Mansurov used (in 1960th) a pitch row with 12 stages and 11 intervals between them, which are mostly equal or multiple of 25 cents. About a half of intervals are near to 100 or 200 cents — these are ‘European-like’ intervals.

For the recording of M. Eshankulov (2013), we get the value of system-forming step between stages near to 50 cents. His function is alike that on Fig. 3,
but the ‘stability area’ begins with confidence only from about 40..50 cents. This diagram is represented on Fig. 5. Setting to 40 cents, we get the interval sequence shown on Fig. 6.

One of famous pupils of B. Mansurov, V. Rahimov (born in 1950, Azerbaijan) delivered in 2012 a master-class in Moscow P.I. Thaikovsky Conservatory. Analysis of his performance gives a pitch row estimation shown on Fig. 7. The analysis of the performance of famous Tajik artist Neria Aminov (1916–1996) gives the pitch row presented on Fig. 8.

4. Discussion

The presence of ‘Euporean-like’ intervals (100 and 200 cents) in Eastern music performance can be considered as the influence of European 12-halfton music. Contrariwise, using of ‘micro’ intervals — 25 cents and its multiple, excluding 100 and 200 cents — belongs to the elements of older tradition. Comparison of percentage of ‘European-like’ and ‘micro-’ intervals, given in Table 1, shows that B. Mansurov used about 45% of ‘micro’ intervals in their pitch rows, and his pupil V. Rahimov — 30%; N. Aminov — 77% and M. Eshankulov — only 40%. The use of ‘European-like’ intervals occupies in B. Mansurov’s performance 45.5%, and in phonograms of V. Rahimov and M. Eshankulov — about 60..65%. N. Aminov used only about 23% of ‘European-like’ intervals.

5. Conclusions

The results of investigation showed some changes in the performing style of classical Eastern music during last 50 years. These changes in musical thinking can be explained through conservatory education of new
generation of musicians. This education includes study of western music and playing pianoforte. The influence of European music with its 12-halftone pitch row provokes increasing of using of 100- and 200-cent intervals and reducing of ‘micro’-intervals like 25-cent and its multiple (50-, 75-, 125-, 175-cent intervals). Similar results have been derived for two regional tradition of classic music – the Azerbaijani mugham and Tajik maqom.

The computer measurement of the pitch row used by musicians of different generations gives the possibility to observe and measure these differences and trends of performance style.

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