

# ANALYSIS OF THE PITCH COMPREHENSION OF SOME 20<sup>TH</sup> CENTURY TURKISH MUSIC MASTERS AND THE COMPARISON OF THE RESULTS WITH THE THEORETICAL VALUES OF TURKISH MUSIC

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## ABSTRACT

There has been an absence of a theory, which establishes the performance-theory unity, among Turkish music theories. The starting point of a study that aims to eliminate the disparities between the theory and performance should be a thorough analysis of performances.

This thorough analysis of performances enables the definition of a system that meshes the theory and the performance. In this work, we study *çeşni*, the tetrachords and the pentachords that are the basis of the Turkish music *maqams*. We analyze the frequencies of the audio recording samples of the performers to identify the usage of *çeşni*.

The recordings used are compiled from the recordings of the performers that are passed away and the masters who have quit their active musical practices. For each performer, we analyze how *çeşni* are performed and for each *çeşni* we provide the average values of all performers. For each performer, we calculate the average value of a *çeşni* using the values from all recordings that involve this *çeşni*. For each *çeşni*, we calculate the average value from all recordings by all performers that include the given *çeşni*. The frequency analyses are conducted automatically.

The results of this study are shown as histograms, in Holder<sup>1</sup> commas, and in cents. At the end, all results are compared with the theoretical values.

## 1. INTRODUCTION

Although there are some studies [1,2] on the *maqam* theory in Turkish Music, there is an absence of a system, which is approved by all music authorities and establishes the unity between the theory and the performance. Therefore, the debates on these topics and the research attempts for such a system have not been finalized. Within the frame of these attempts, the starting point should be the thorough analysis of performances to eliminate the disparities between the theory and the performance. Accurate evaluation of the results of this analysis leads to a theory that has roots from

<sup>1</sup> Holder Coma(Hc): The value calculated by the division of an octave to 53 pieces (1 Hc = 22,6415 cents).



**Figure 1:** Hicaz *çeşni*. The distances among the pitches of the *çeşni* are shown in Holder coma (S: 5 comas, A<sub>12</sub>: 12 comas, T: 9 comas).

the performance and enable us to describe a system that is coherent with the performance.

Tetrachords and pentachords, also called as “*çeşni*”s are the basis of *maqams* in Turkish Music. We can define *çeşni* as sound patterns in which the sounds between the start and end are arranged in a diatonic fashion according to an interval structure [3]. There are 15 *çeşni*s described in Arel Theory, which is used today [4, 5]. Figure 1 exemplifies Hicaz *çeşni* on Dugah (La) note and shows the distance between the pitches of the *çeşni*.

The main aim of this study is to identify how *çeşni*s are used during performance and what kind of changes pitches go through under different conditions. The results of this study can be used to solve existing problems in Turkish Music theory. Thus, we can propose solutions to the basic problems in a system, such as to how many pieces an octave is divided, or if there is a need for additional signs and symbols to represent change. We can describe *maqams* thoroughly and preserve the traditional music and convey it to the new generations easily as a result of presenting the performance with accurate signs and symbols.

As of our best knowledge, the most comprehensive work in measurement and analysis has been done under supervision of Barış Bozkurt [6]. In this project, novel techniques are proposed for automatic music transcription and *maqam* detection. In both our work and this project, frequency analysis is done using Makam Toolbox developed by Barış Bozkurt [7]. Makam Toolbox uses YIN to estimate the fundamental frequency [8]. In our work, we are working in a different set of recordings.

## 2. METHODOLOGY

In this paper, the frequency analysis of recordings from various performers is conducted and the results are presented in comparison to the theoretical values. The recordings used are compiled from the recordings of the performers that are passed away and the masters who have quit

their active musical practices. The used recordings are chosen from the commercial records and personal archives. In total, 416 recordings are analyzed. Table 1 presents the performers and the number of recordings analyzed from each performer.

	B.S Sezgin	İhsan Özgen	M.N. Selçuk	Necdet Yaşar	Niyazi Sayın	Cemil Bey
Buselik	6	13	18	4	2	1
Çargah	10	6	*	1	1	1
Ferahnak	1	*	1	*	*	1
Hicaz	37	16	17	4	1	2
Hüseyini	10	2	2	3	2	4
Hüzzam	32	*	6	6	1	1
Kürdi	1	4	*	4	1	1
Müstear	2	*	*	*	*	1
Nikriz	3	2	1	2	2	1
Nişabur	4	1	1	*	*	2
Pençgah	1	*	*	1	1	1
Rast	15	17	11	3	1	2
Saba	8	2	2	2	1	1
Segah	12	11	7	3	1	2
Uşşak	30	16	12	2	3	3
Total	172	90	78	35	17	24

**Table 1:** Number of *Çeşni* Per Performer

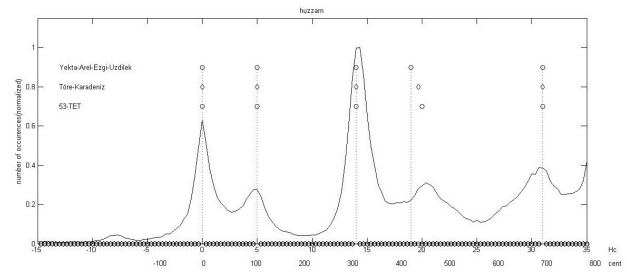
When choosing the recordings, we deliberately tried to find the recordings that belong to the *maqam*, which has the same name of the *çeşni*. Since the analysis is based on *çeşnis*, the analysis results are limited to the first five pitches to minimize the effects of the other features of the *maqam* to the results. For there are a limited number of recordings of the performers, we adopt two different methods for *maqams* for which there does not exist a recording:

1. Alternative *maqams* are used under the assumption that they produce similar results (Buselik-Nihavend, Çargah-Acemaşiran etc.).
2. *Çeşnis*, for which there does not exist a recording, are searched in other recordings of the same performer. Found *çeşni* samples are cut as musical sentences and then analyzed.

Since the recording of Bekir Sıtkı Sezgin and Munir Nurettin Selçuk are not solo, sections that do not include the performers are not included to the analysis. All results are shown as histograms, in Holder commas, and in cents.

Analysis is done for each performer and for each *çeşni*. The results are presented here are the results of the analysis for each *çeşni*. The results of the analysis is presented in comparison with the values from Arel-Ezgi-Uzdilek Theory (AEU), Töre-Karadeniz (TK) [9], and 53-TET [10] in histograms and tables (Section 3):

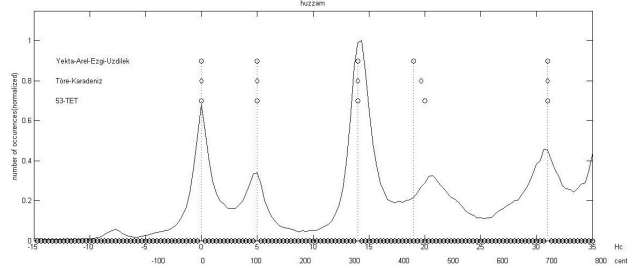
1. For each performer, the average values of each *çeşni* performed by this particular performer are calculated. (Figure 2, Table 2)
2. For each *çeşni*, the average values are calculated from the sum of all values of this particular *çeşni*, performed by all performers. The results are compared with the theoretical values and the values that differ are marked. (Figure 3, Table 3)



**Figure 2:** Pitch histogram of Hüzzam Çeşni performed by Bekir Sdk Sezgin.

	Holder coma				Cent			
<b>YAEU</b>	5	14	19	31	113.2	316.9	431.3	701.9
<b>TK</b>	5	14	19.5	31	113.2	316.9	441.5	701.9
<b>53-TET</b>	5	14	20	30	113.2	316.9	452.8	679.2
<b>Performance</b>	5	14	20.3	30.6	113.2	316.9	459.6	692.8

**Table 2:** Average Intervals in Hüzzam Çeşni Performed by Bekir Sıdkı Sezgin



**Figure 3:** Pitch histogram of Hüzzam Çeşni including all performers.

### 3. RESULTS

The performance values collected from all recordings and the theoretical values of the widely used Arel-Ezgi-Uzdilek Theory are compared in Table 4. When Table 4 is studied, substantial differences between the theoretical and performance values are found for Hüseyini, Hüzzam, Saba, and Uşşak *çeşnis*. The values that differ from each other are underlined.

The distance between the first and the second pitches of Hüseyini *çeşni*, Dügah and Segah, respectively, is measured as 6.3 comas as opposed to the theoretical value of 8 comas. The distances between the second and the third pitches, Segahandçargah, respectively, is measured as 6.4 comas as opposed to 5 comas. The distances between the third and the fourth pitches, çargah and Neva, respectively, is measured as 9.3 comas as opposed to 9 comas.

The distance between the third and the fourth pitches of Hüzzam *çeşni*, Neva and Hisar, respectively, is measured as 6.7 comas as opposed to the theoretical value of 5 comas. The distances between the fourth and the fifth pitches, Hisar and Eviç, respectively, is measured as 10.3 comas as opposed to 12 comas.

		Holder coma				Cent			
Performance	0 Hc Interval	5	14	19	31	113.2	316.9	431.3	701.9
		5	14	19.5	31	113.2	316.9	441.5	701.9
		5	14	20	30	113.2	316.9	452.8	679.2
Performance	0 Hc Interval	5	14	20.7	31	113.2	316.9	468.7	701.9
		5	9	6.7	10.3	113.2	203.7	151.7	233.2

**Table 3:** Average Intervals in Hüzam Çeşni Performed by All Performers

The distance between the first and the second pitches of Saba çeşni, Dügah and Segah, respectively, is measured as 7 comas as opposed to the theoretical value of 8 comas. The distances between the second and the third pitches, Segahandçargah, respectively, is measured as 5 comas as opposed to 5.7 comas. The distances between the third and the fourth pitches, çargah and Hicaz, respectively, is measured as 6.6 comas as opposed to 5 comas.

The distance between the first and the second pitches of Uşşak çeşni, Dügah and Segah, respectively, is measured as 6.7 comas as opposed to the theoretical value of 8 comas. The distances between the second and the third pitches, Segah and çargah, respectively is measured as 6.3 comas as opposed to 5 comas.

Çeşni		Intervals (in Holder comma)			
		01.Int.	02.Int.	03.Int.	04.Int.
Buselik	Theory	9.0	4.0	9.0	9.0
	Perf.	9.0	4.0	9.0	9.0
Cargah	Theory	9.0	9.0	4.0	9.0
	Perf.	9.0	9.0	4.0	9.0
Ferahnak	Theory	5.0	9.0	9.0	8.0
	Perf.	5.0	<b>9.3</b>	<b>8.4</b>	<b>8.3</b>
Hicaz	Theory	5.0	12.0	5.0	9.0
	Perf.	<b>4.7</b>	<b>12.6</b>	<b>4.7</b>	9.0
Hüseyni	Theory	8.0	5.0	9.0	9.0
	Perf.	<b>6.3</b>	<b>6.4</b>	<b>9.3</b>	9.0
Hüzam	Theory	5.0	9.0	<b>6.3</b>	<b>10.7</b>
	Perf.	5.0	9.0	<b>6.3</b>	<b>10.7</b>
Kürdi	Theory	4.0	9.0	9.0	9.0
	Perf.	4.0	9.0	9.0	<b>9.3</b>
Müstear	Theory	9.0	5.0	8.0	9.0
	Perf.	9.0	<b>4.7</b>	<b>9.3</b>	<b>7.7</b>
Nikriz	Theory	9.0	5.0	12.0	5.0
	Perf.	9.0	5.0	12.0	<b>4.7</b>
Nişabur	Theory	8.0	5.0	9.0	4.0
	Perf.	<b>8.3</b>	<b>4.7</b>	9.0	4.0
Pençgah	Theory	9.0	9.0	8.0	5.0
	Perf.	9.0	<b>8.7</b>	<b>8.3</b>	5.0
Rast	Theory	9.0	8.0	5.0	9.0
	Perf.	9.0	8.0	5.0	9.0
Saba	Theory	8.0	5.0	5.0	-
	Perf.	<b>7.0</b>	<b>6.0</b>	<b>6.7</b>	-
Segah	Theory	5.0	9.0	8.0	9.0
	Perf.	5.0	9.0	<b>8.3</b>	<b>8.0</b>
Uşşak	Theory	8.0	5.0	9.0	-
	Perf.	<b>7.0</b>	<b>6.0</b>	9.0	-

**Table 4:** Comparative Results.

#### 4. CONCLUSION

When the comparison with the AEU system results are concerned, we conclude that we need some intervals and pitches that are not present in AEU system. This need is obvious for Hüseyni, Hüzam, Saba, and Uşşak çeşni. For the 53-TET system, since these pitches are present, the difference between the theory and the performance is the least. Even we round up the values to the next integer, its inevitable that the AEU system lacks some of the pitches and intervals.

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