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A Study of the Reference Pitches in Ottoman - Turkish Music Through an Analysis of Historical Neys*

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Abstract

Ney master Niyazi Sayın defines music as "spiritual relationship" between two sounds, when it comes to collective performance, a reference sound is needed to ensure harmony between the instruments. The situation does not change in East or West; if a performance is to be performed with two instruments, it is essential that one fits the other. However, when the number of instruments increases, different organological structures are included in this situation. The need to unite on a common pitch / frequency has arisen due to reasons such as the fact that some instruments are fixedly tuned or tuning takes hours. In this study, it is aimed to reveal the performance ability that continues in the reference of the ney instrument in Ottoman – Turkish music by analyzing the neys belonging to the important neyzens (ney artists), with an introduction starting with how European music manages this process. All the data obtained here will provide a model for researchers studying theory or period music.

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Keywords: Hertz, Ney, Reference Pitch, Ottoman- Turkish Music, Frequency

Osmanlı-Türk Müziğinde Referans Perdelerin Tarihi Neylerin Analizi Yoluyla İncelenmesi

Özet

Neyzen Niyazi Sayın'ın "iki ses arasındaki mânevî münâsebet" olarak tanımladığı müzik kümesinde, toplu icra söz konusu olduğunda, enstrümanlar arasındaki ahengi sağlayabilmek için referans bir sese ihtiyaç duyulur. Doğuda ya da batıda durum değişmez; eğer iki enstrüman ile bir icra yapılacak ise birinin diğerine uyması elzemdir. Fakat enstrüman kümesi genişlediğinde artık farklı organolojik yapılar da bu zemine dahil olur ve bazı enstrümanların sabit akortlu olması ya da akord edilmesinin pratik olmaması gibi sebeplerle ortak bir ses / frekans üzerinde birleşilmesi ihtiyacı ortaya çıkar. Çalışma, Avrupa müziğinin bu süreci nasıl yönettiği üzerinden başlayan bir girişle, Osmanlı – Türk müziğinde ney enstrümanının referansında devam eden icra kabiliyetinin, tarih sahnesinde bilinen neyzenlere ait neylerin analiz edilmesiyle ortaya çıkarılmasını amaçlar. Burada elde edilecek tüm veriler ile, teori ya da dönem müziği çalışan araştırmacılara bir model sunulması hedeflenir.

Anahtar Kelimeler: Hertz, Ney, Referans Perdesi, Osmanlı – Türk Müziği, Frekans.

Introduction

Sounds produced by musical instruments have a certain frequency scale. The composition of the harmonic frequency of each note varies according to instrument and sound intensity in terms of numeric and relative strength. Reproducing a graph of the tonal spectrum of each instrument is possible through the mathematical analyses of its wavelengths and oscilloscope patterns (Çelebioğlu, 1986:259).

There are many sources in the Western world concerning the change in the reference note over the years. In this way, it is possible to hear, once again, the frequencies and timbres in which the music of various periods had been performed thanks to the information provided in these sources. For

instance, today there are Baroque orchestras tuned to the reference note of that period.

To summarise the change undergone by the reference pitch in the western world throughout history, we may mention that, during the Renaissance, it was used as 415 Hz. in Germany and as 466 Hz. in Venice, and between 415 Hz. and 380 Hz. during the Baroque era in France. The standard for tuning was declared in France as 435 Hz in 1859. The same standard was adopted in other countries too, but a truly international standard did not exist until the adoption of the pitch of 440 Hz. in 1939 (Cry, 1992:59).

With Ottoman - Turkish music, however, a source regarding reference pitch cannot be found in the literature. Therefore, the principal motivation of this article has been to create data relating to this aspect of Ottoman - Turkish music by analysing instruments of the period. It was thought that such a reference analysis relating to Ottoman - Turkish music could produce accurate results only if performed on an instrument such as the ney, which has fixed pitches, and which has preserved its structure and vocal range in time.

The ney is a wind instrument that has preserved its ancient structure through its history. It can preserve for many years the mathematical ratios it involves. Although factors such as the blowing angle, the position of the lips, the strength of blowing, and room temperature cause variations in an analysis of the ney, its length and pitch balance allow an overall tuning order. Therefore, this instrument may offer important information on the difference with the reference of 440 Hz.

The research and recordings performed by Prof. Dr. Ali Tan for his doctoral dissertation "Ney Açkısının Tarihi ve Teknik Gelişimi" [Technical and Historical Progress of Ney-making], written in 2011, formed the main source of this study. The doctoral dissertation in question focused on the transformation and development of the instruments by examining 62 historical neys made between 1718-1951 and kept at Topkapı Palace, the Galata Mevlevihane Museum, and the Konya Mevlana Museum. Also, recordings had been made of these neys, along with pitch analyses using the musical analysis software Makambox, but no assessment had been performed based on reference sounds in the study.

In this study, the recordings performed for the mentioned doctoral dissertation shall be analysed using the software Celemony Melodyne to identify the reference pitches. The fact that the analysed sounds had been produced by different neys required the transposition of the frequencies after the analyses. Therefore, the analysis involves an onerous process. It was aimed that this study shed some light on our history, and offer musicians, theoreticians, and musicologists a starting point for new studies on this subject. To continue with the present subject, it would be proper to explore how the changes in

reference pitch progressed through history particularly in Europe, starting from the Baroqe era.

Reference Pitch, Which Changed Constantly Throughout the History of European Music

As known, all orchestras must be tuned to the same reference pitch within themselves. Frequency denotes the number of vibrations or cycles per second. The unit used to describe frequency is Hertz. The pitch becomes higher or lower as the number of vibrations per second increases or decreases. Pitch is directly proportional with frequency. It rises and lowers along with the frequency (Önen, 2016:27).

Especially during the Baroque era, the understanding of tuning and the standard tuning pitch varied greatly from country to country. Indeed, even in the same city, different reference pitches were used for church music, opera, and other profane music (Cry, 1992:60). Therefore, members of orchestras tuned their instruments differently according to where they would be performing, which practice continued until the 20th century.

In Germany in the time of J. S. Bach, two separate tuning levels were being used. The first was the Chor-Ton, according to which the organ and the brass instruments were tuned a semitone higher (465 Hz.), and the other was the Cammer-Ton, where the woodwinds and strings were tuned a semitone lower (415 Hz.). The Cammer-Ton was tuned to a whole note lower, and sometimes a minor third lower compared to the Chor-Ton. Usually, vocal music was performed using the Chor-Ton, and instrumental music the Cammer-Ton (What is Baroque Music? 2018).

When concert halls started to become larger in the 19th century, orchestras began losing their audial brightness. Due to the lack of standardisation, orchestras opted to raise their reference pitches to eliminate this problem. This, in turn, caused other problems such as significant differences among regions, and technical difficulties imposed on vocal artists.

In 1859, by order of Napoléon III, studies were carried out to bring the standard for the orchestral pitch to 435 Hz. Subsequently, in 1919, with the Versailles Peace Treaty that ended the Great War, the use of 435 Hz. was adopted as the international standard. The 435 Hz. pitch identified by this treaty was adopted for a standard diapason at a temperature of 15°C. However, the limited sound of a diapason and the impossibility of using it to tune an entire orchestra opened the way for the practice by which a single instrument listened to the diapason and acted as reference for the others. The United Kingdom was not initially a party to the Versailles Peace Treaty, and struggled to discover a gap in this international law due to its discontent with the 435 Hz. standard. As a result, it proved that a standard oboe allowed a

tuning of 435 Hz. at 15 °C temperature, but one of 439 Hz. at 20 °C, as a result of which it refused to accept this international standard.*

In the early 20th century, in Germany, which boasted the most developed orchestras in the world, the standard frequencies were 428 Hz. for the Berlin Philharmonic Orchestra in 1920 and 435 Hz. in 1924, 444 Hz. for the Berlin Staatskapelle Choir in 1928, 445 Hz. for the Berlin Philharmonic Orchestra, again, in 1935, and 450 Hz. for the Städtisches Orchestra in 1943 (Haynes, 2002, retrieved from Erdal, Kindap Tepe, Çelik, Güçyetmez, Çiğdem, Topaktaş, 2021:14). The standard tuning frequency for all acoustic-electronic instruments under the equal temperament system was set to A = 440 Hz. at the 2nd International Conference on reference pitch that was held in London in 1939 (Michels, Vogel, 2015:). Today, tuning is performed to 440 – 442 Hz. with reference to the note A on the C4 octave of the piano.

Up to this point, the development in European music with respect to this matter was summarised to provide a better understanding of the same issue in Ottoman - Turkish music. The next section shall deal with the relationship between the East and the West in the context of tuning and transposition.

A Comparison Between Turkish Music and Western Music: Tuning and Transposition

According to the Arel – Ezgi – Uzdilek Turkish music system arranged by H. Sadettin Arel (1880-1955), Suphi Ezgi (1869-1962) and S. Murat Uzdilek (1891-1967), a whole note consists of 9 commas, and a semitone consists of 4 commas. Since our traditional instruments are capable of sounding these intermediate tones, Ottoman - Turkish music presents a rather different structure compared to the equal temperament system. In other words, due to the structure of the instruments of Ottoman - Turkish music, all maqams cannot be played employing the same technique and style after being transposed on every note, especially in the Istanbul kemençe, the oud, the tanbur, and the ney. Kanun artists, however, retune their instruments according to the maqam's scale tones when a maqam is to be performed with transposition. Due to this character, the kanun has a tuning system that is very similar to the harpsichord of the Baroque era (Yarkın, 2019:128).

In terms of technical structure, the oboe family is like the ney family on which our article focuses. Since the ney, like the oboe, is not part of the omnitonic woodwinds family, it contains members that have different pitches and sizes. When orchestras of the current structure first started to form in the late 17th century, they mostly included string instruments. While the

* *Llewelyn S., 1949:80-81, retrieved from Cavanagh, https://www.wam.hr/sadrzaj/us/Cavanagh_440Hz.pdf :2)*

strings constituted the basis of the orchestra, oboists were usually used to strengthen and support the sounds of the first and second violins. Following its ancestors, the oboe's structure was redesigned in the 17th century on its path to becoming the modern oboe in order to meet the requirements of the Baroque era. In the wake of this restructuring, composers started to realise that the bright and intense tone of the oboe could be put to better use, and began composing separate sections and even concertos for the instrument (Şensöz, 2008:66).

The most important factor that helped the oboe become the instrument that provides the orchestra with a tone for tuning was that it was considered a more reliable reference due to its fixed structure. This structure of the oboe proved even more important especially in the times when gut strings were used for string instruments. Although flutes, bassoons, French horns and clarinets joined the orchestras in time, the place occupied by the oboe did not change, and the instrument was recognised as the standard instrument for tuning. The piercing sound of the oboe, which could be easily distinguished from the rest of the orchestra, made it easier for all the other musicians to hear it (Tan Z., 2013:147). In the tradition, something similar occurred with respect to the ney family as well. That other instruments are made subject to the ney during performance in Mevlevi music is a known historical fact. It is also known from various recordings of the TRT radio that tuning was performed with reference to the ney (Erkahveci, Personal Interview, 20.04.2021). However, unlike the oboe, in the 20th century the ney was unable to preserve the central position it had previously enjoyed. It would be useful to provide, in the next section, general information on the historical neys analysed in the article.

The Historical Neys Analysed in the Study

The historical neys analysed in the study were made in the 18th and 19th centuries.

1) Ney kept in Topkapı Palace Museum under Inventory No. 2/3376

The mansur ney registered in the Topkapı Palace Treasury under inventory number 3376 is remarkable especially for its ornamentation. The phrase "Ya Hazreti Mevlânâ Kuddise Sirrûhûl Âlî" was inscribed in enamel and gilt on the parazvane of the ney, which is in good condition. Details of the ney can be seen in Images 1 and 2 and the pitch positions of the ney can be seen in Table 1.



Image 1. The Ney with Inventory No. 3376



Image 2. Details of Upper Parazvane of the Ney with Inventory No. 3376

Pitch Names	Measurement (cm)
Aşiran	39,3
Nevâ	48,5
Nim Hicaz	51,6
Çargâh	55
Segâh	61,4
Kürdî	64,7
Dügâh	67,9
Rast	79,6

Table 1. The Pitch Positions of the Ney with Inventory No. 3376

2) Ney kept in Topkapı Palace Museum under Inventory No. 886

The general structure of the bolahenk - süpürde mabeyni ney registered in the Topkapı Palace Harem under inventory number 886 can be seen in Image 3 and the pitch positions of the ney can be seen in Table 2.



Image 3. Ney kept in Topkapı Palace Museum with Inventory No. 886

Pitch Names	Measurement (cm)
Aşiran	28,2
Nevâ	34,7
Nim Hicaz	36,9
Çargâh	39
Segâh	43,3
Kürdî	45,5
Dügâh	48,1
Rast	56,4

Table 2. The Pitch Positions of the Ney with Inventory No. 886

3) Ney kept in Topkapı Palace under Inventory No. 913

The mansur ney registered in the Topkapı Palace Harem under inventory number 913 is the oldest ney found in Turkish museums. It is understood from the hegira date on the ney that it was made during the reign of Sultan Ahmed III. The general structure of the ney can be seen in Image 4 and the pitch positions of the ney can be seen in Table 3.



Image 4. Ney kept in Topkapı Palace with Inventory No. 913

Pitch Names	Measurement (cm)
Aşiran	39,8
Nevâ	47,7
Nim Hicaz	51,3
Çargâh	55,3
Segâh	61,5
Kürdî	65,5
Dügâh	68
Rast	79,6

Table 3. The Pitch Positions of the Ney with Inventory No. 913

4) Ney kept in the Mevlana Museum under Inventory No. 1166

The bolahenk - süpürde mabeyni ney kept in the Mevlana Museum under inventory number 1166 belonged to Neyzen Tevfik. It is a ney that is suitable for playing without requiring a başpare. The general structure of the ney can be seen in Image 5 and the pitch positions of the ney can be seen in Table 4.



Image 5. Ney kept in the Mevlana Museum with Inventory No. 1166

Pitch Names	Measurement (cm)
Aşiran	27
Nevâ	33,3
Nim Hicaz	35,3
Çargâh	37,5
Segâh	41,6
Kürdî	43,7
Dügâh	45,8
Rast	54,2

Table 4. The Pitch Positions of the Ney with Inventory No. 1166

5) Ney kept in the Mevlana Museum under Inventory No. 1174

The mansur ney registered in the Mevlana Museum under number 1174 belonged to Neyzen Aziz Dede. The general structure of this two-piece ney can be seen in Image 6 and the pitch positions of the ney can be seen in Table 5.



Image 6. Ney kept in the Mevlana Museum with Inventory No. 1174

Pitch Names	Measurement (cm)
Aşiran	40
Nevâ	48,8
Nim Hicaz	51,9
Çargâh	55,1
Segâh	61,4
Kürdî	64,6
Dügâh	67,7
Rast	79,07

Table 5. The Pitch Positions of the Ney with Inventory No. 1174

Methodology and Analysis Techniques

Setting out from the question of whether a modelling can be performed on the reference pitch in the historical neys, the study was carried out with an analysis of these historically important neys. The neys belonging to the prominent neyzens of their times and the historical neys believed to have been performed at the palace have been prioritised in the study.

The selected data were recorded for the doctoral dissertation "Ney Açkısının Tarihi ve Teknik Gelişimi" [Technical and Historical Progress of Ney-making] by Dr. Ali Tan in 2011, and were freshly analysed in accordance with the objectives of this study. These data, which had also been used in the doctoral dissertation in question, were carefully analysed using statistical methods for the first time for this study. Researchers may analyse the results by remodelling the neys based on the pitch measurements we present here. All data have been provided clearly to ensure the reproducibility of the study.

The recordings used in the study were made at room temperature at the Mevlana Museum and Topkapı Palace Museum. To ensure that head and lip positions had minimal impact on the measurements, the head, held at 90°, made a 30° angle with the ney, and vibrato was not employed.* While the results presented here depend on certain variables, a modelling offered by the data obtainable under the current conditions has nevertheless been presented to researchers (More definite results could be available if creating a computer simulator, or revealing the interior structure of the historical neys by obtaining cross sections from them, were possible. However, no such procedure on the historical neys is allowed, which renders the available data valuable). These measurements were recorded, analysed and interpreted in the above-mentioned manner.

Data**

The frequencies of the dügâh pitch obtained on 5 historical neys, put in chronological order from the 18th to the 20th centuries (the precise production dates of these neys are not available in the museum records) constitute an important set of data for identifying the ney's position with respect to the current reference pitch in terms of its performance in general. It is believed that offering the ney, the pitches of which are known to remain unchanged for centuries, as a model for this subject would provide researchers with a different perspective. The obtained recordings were analysed using Celemony Melodyne, which is a pitch analysis and correction software, and differences in pitch were measured in units of cent in the analyses.***

** Since vibrato, performed according to several techniques depending on the period, the orchestra, the instrument, and the composer, has no standard structure, the objective has been to increase the reliability of the analysis and ensure an accurate frequency.*

*** We wish to thank Dr. Ozan Sarıer for his stimulating inputs with respect to the analysis.*

**** Not being fixed measurements, ranges in units of Hz. differ between octaves; in other words, they*

The distance of the analysed tones to their closest notes in the equal temperament system in units of cent were identified with reference to A4= 440 Hz. in order to provide a comparable table in the next step. Accordingly, the frequencies in Table 6 were created (Conversion of Intervals : http://www.sengpielaudio.com/calculator-centsratio.htm)

Number	Note	Difference	Type of Ney	Period
913	A	A4+14 cent	Mansur	1718
1174	A	A4-36 cent	Mansur	1870
886	A	D4-23 cent	Mabeyn	Second half of the 19th Century
3376	A	A4-21 cent	Mansur	Early 20th Century
1166	A	D#4 +35 cent	Mabeyn	First half of the 20th Century

Table 6. Changing of the Frequency About a Cent Value

Examining the tuning of the oldest mansur ney in Turkish museums, which was made in 1718, it can be seen that the reference pitch was 14 cents higher compared to that of today. Moving forward in history, we come across a structure in which the reference pitch becomes lower, while it is seen that the reference pitch in the ney made in 1921 was higher compared to that of today.

The dügâh pitch (A), which was higher in the 18th century compared to the current 440 Hz. reference pitch, demonstrated a consistent lowering in the course of the following centuries. While the pitch of the ney that belonged to Aziz Dede (number 1174) was 36 cents lower, the Mansur ney of the early 20th century, number 3376, believed to have been performed at Topkapı Palace, presents a 21-cent lower dügâh. Therefore, it may be said in the light of the data at hand that general harmony demonstrated a tendency towards becoming higher when proceeding from the 19th century to the 20th.

Conclusion

In this study that set out from historical neys' ability to preserve their pitches for many years, the data and factual findings obtained as a result of the analyses of performances made using 5 historical neys belonging to neyzens known to have offered important performances between the 18th and 20th centuries have been presented in detail in Table 7 (Blood, 2018).

are calculated by being increased logarithmically. However, since the ranges in units of cent are fixed and do not differ according to octave, the ranges have been calculated in terms of cents.

Number	Note	Reference Pitch	Type of Ney	Period
913	A	443,57	Mansur	1718
1174	A	430,94	Mansur	1870
886	A	434,19	Mabeyn	Second half of the 19th Century
3376	A	434,69	Mansur	Early 20th Century
1166	A	448,98	Mabeyn	First half of the 20th Century

Table 7. The frequency distance of neys from A4 = 440 Hz.

It is seen that the dügâh pitch measured as 443,57 Hz. for the ney with the inventory number 913 is higher compared to the current reference pitch. The lower pitches of the neys with the inventory numbers 886 and 3376, on the other hand, are at frequencies closer to each other. It is seen that the pitch of the ney with the inventory number 1174 is lower compared to the current reference pitch. The ney with inventory number 1166, which belonged to Neyzen Tevfik, has a higher pitch compared to the current reference pitch as is the case with the ney with inventory number 913.

Studies on the reference pitch corresponding to 435 Hz., which were commenced by order of Napoléon III in 1859, were recognised across Europe in 1919. The analyses revealed that the frequencies of the pitches of ney 3376 (434,69) and ney 886 (434,19 Hz.) were close to the frequency of 435 Hz., that is, the reference pitch of European Music at that period. Because the reference pitch became higher in Europe in the 20th century, and in the light of the search for different approaches among countries,* the rise in the pitch of ney 1166, known to have been performed in the mid-20th century, to 448,98 Hz. suggests that this occurred simultaneously with the rise of pitch in Europe.

The study, rather than measuring pitches in history against each other, was interested in examining the general tendency, which resulted in the above table. Considering that these historical neys had been performed at their time within an orchestra, it may be suggested that the frequencies that were found were also those to which the other instruments had been tuned. Although reaching a definite conclusion is not possible on this matter, an effort has been made to present researchers a general model on the subject.

* *The Berlin Philharmonic Orchestra set its reference pitch at 445 Hz. in 1935, and the Städtisches Orchestra at 450 Hz. in 1943.*

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