79-TONE TUNING & THEORY FOR TURKISH MAQAM MUSIC
As A Solution To The Non-Conformance Between
Current Model And Practice

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Date of submission : 18 Aralık 2007
Date of defence examination : 10 Haziran 2008

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JUNE 2008
TÜRK MAKAM MÜZİĞİ İÇİN 79-SESLİ DÜZEN VE KURAM

Hazırladığı Model İle İcra Arasındaki Örtüşmeliği Yönelik
Bir Çözüm Denemesi

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Tezin Savunulduğu Tarih : 10 Haziran 2008

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HAZİRAN 2008
FOREWORD

Motivated by a personal resentment against the prevalence of insurmountable inconsistencies in the theory of Turkish Maqam Music that hinder this fair genre’s progress, while no less grieved by the widespread habit throughout the Arab World of dividing the octave into 24 equal parts, the author of this dissertation has undertaken the task of conceptualizing a novel 79-tone tuning, which not only bridges the chasm between written music and performance, but also prepares the way for prospective maqam polyphony.

Already implemented on a unique custom-built Turkish qanun with success, the author desires this tuning to be benefitted by nations sharing the maqam tradition; seeing as it is, by far, the only comprehensive and realistic model which accords with pitch measurements and accommodates at every step diverse melodic intervals peculiar to the genre.

I, the author, would like to thank the following persons for their valuable contributions to the maturation and completion of this study: Can Akköç, Kemal Karaosmanoğlu, Ömer Tulgan, and Uğur Kececioğlu of the “notayaz community”, for their encouragement, camaraderie, and guidance; George Secor and David Keenan, for the time they spared on issues of notation as regards the tuning endorsed in this dissertation; Paul Erlich, Gene Ward Smith, Joseph Monzo, Carl Lumma, Yahya Abdalaziz, Shaahin Mohajeri, Manuel Op de Coul, Margo Schuler, John Chalmers, and several other prestigious members of the “tuning list community” who have devoted much of their time to augmenting my understanding of microtonality; honourable members of the examining committee, Şehvar Beşiroğlu (supervisor), Erol Deran, Mutlu Torun, Nermin Kaygusuz, Nilgün Doğrusöz, Hasan Uçarsu, and Özkan Manav for their diligent scrutiny and appreciation of this work; and last, but not the least, Tolga Yarman, my esteemed father, for his endless patience and high academic wisdom, Işıl Yarman, my respected mother, for her spiritual support, and Sadullah Talat Büyükünal, my faithful companion, for his unequalled friendship in times of distress.

All things being temporary and evanescent, so is mortal contemplation categorically fallible. As such, may this earnest enterprise aid the efforts of those who can do better in the future.

Ozan Yarman

14 December 2007
TABLE OF CONTENTS

ABBREVIATIONS vi
LIST OF TABLES vii
LIST OF FIGURES ix
ÖZET xii
SUMMARY xiv
~Öz XVI
~Abstract XVII
~Author's Preamble to the Expanded Publication XIX
~Gene Ward Smith’s Invited Exposition XVIII

1. INTRODUCTION 1

2. CHAPTER: A SYNOPSIS OF CHRONICLES UNDERLYING THE CONTROVERSY BETWEEN THE THEORY AND PRACTICE OF TURKISH MAQAM MUSIC 7
   2.1. Prologue 7
   2.2. Music Reformation in Türkiye 8
   2.3. Rise of the ‘Yekta-Arel-Ezgi School’ 15
   2.4. Ethnocentric Revisionism as Source of Conflict 21

3. CHAPTER: ELECTROACOUSTICALLY CAPTURED “QUARTER-TONES” CONTRADICT THEORY IN EFFECT 25
   3.1. Prologue 25
   3.2. Empirical Measurement of Played Intervals 26
   3.3. Debunking the 24-tone Pythagorean Model 31

4. CHAPTER: COMPARATIVE ANALYSIS OF ALTERNATE HISTORICAL AND MODERN TUNINGS & NOTATIONS OF TRADITIONAL PERDES IN TURKISH MAQAM MUSIC 42
   4.1. Prologue 42
   4.2. Abjad Tone-System 45
   4.3. Late Ottoman Phonetic Notations 62
   4.4. Contemporary Rival Theories 73
   4.5. Equal 106-tone Grid: Not Up to the Mark 83
5. CHAPTER: A 79-TONE TUNING & THEORY SIMULATING JUST INTONATION, TRUE TO MAQAMAT, AND ENCOURAGING MICROTONAL POLYPHONY
   5.1. Prologue
   5.2. 79/80 Moment of Symmetry 2°159-tET
   5.3. 79-tone Maqam Theory: A Trial
   87
   93
   117

6. CHAPTER: CONCLUSION
   123

APPENDIX A : QUOTES FROM CHAPTER TWO
   129

APPENDIX B : COMPLETE SET OF INTERVALS WITHIN AN OCTAVE OF THE 24-TONE PYTHAGOREAN MODEL
   158

APPENDIX C : TRADITIONAL PERDES OF NEY
   176

REFERENCES
   187

BIBLIOGRAPHY
   206

GLOSSARY OF TERMS
   223

CURRICULUM VITAE
   226
   ~Updates to the CV
   227

~Epilogue by the Thesis Supervisor (Turkish/English)
   228

~Index
   234

~Three (Revised) Progress Reports (Turkish)
   286

~Unabridged Article produced from the Thesis (Turkish)
   396

~Doctoral Defense Presentation Slides (Turkish)
   412

~Supplementary of Maqam Scales
   428
## ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADO</td>
<td>Arithmetical divisions of the octave</td>
</tr>
<tr>
<td>AEU</td>
<td>Arel-Ezgi-Uzdilek System</td>
</tr>
<tr>
<td>ASCII</td>
<td>American Standard Code for Information Exchange</td>
</tr>
<tr>
<td>CPS</td>
<td>Cycles per second</td>
</tr>
<tr>
<td>EDO</td>
<td>Equal divisions of the octave</td>
</tr>
<tr>
<td>HZ</td>
<td>Hertz</td>
</tr>
<tr>
<td>JI</td>
<td>Just Intonation</td>
</tr>
<tr>
<td>MIDI</td>
<td>Musical Instrument Digital Interface</td>
</tr>
<tr>
<td>MM</td>
<td>Millimeter</td>
</tr>
<tr>
<td>MOS</td>
<td>Moment of Symmetry</td>
</tr>
<tr>
<td>TET</td>
<td>(n)-tone equal temperament</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 3.1: Pitch Data from Niyazi Saym’s Uşşak Ney Taksim ......................... 27
Table 3.2: Pivotal Intervals in Niyazi Saym’s Uşşak Ney Taksim ................... 29
Table 3.3: Signell-Akkoç-Karaosmanoğlu Analysis of Necdet Yaşar’s Special Tanbur Intervals .......................................................... 30
Table 3.4: Arel-Ezgi-Uzdilek System .......................................................... 31
Table 3.5: Generation of AEU by a Chain of Pure Fifths ............................ 34
Table 3.6: Generation of Yekta-24 by a Chain of Pure Fifths ...................... 35
Table 3.7: Comparison of AEU & Yekta-24 .............................................. 37
Table 3.8: Approximation of AEU & Yekta-24 by 53-tET .......................... 38
Table 3.9: Exposition of the 9-comma Division of the Fa-Sol Whole Tone in AEU & Yekta-24 .......................................................... 39
Table 4.1: Chain of Fifths Making Urmavi’s 17-tone Scale ......................... 46
Table 4.2: Complete Abjad Notation of Perdes ........................................ 47
Table 4.3: Comparison of AEU with the Abjad System .............................. 49
Table 4.4: Speculation on Nasr Dede’s Consonant Ney Intervals ............... 55
Table 4.5: Catalogue of Nasr Dede’s Dyadic Consonances ......................... 56
Table 4.6: Complete List of Dyads in the Abjad System ........................... 56
Table 4.7: Kantemir & Osman Dede Phonetic Notations of Perdes ............. 63
Table 4.8: Mixture of Kantemir & Osman Dede Perdes ............................. 65
Table 4.9: Recapitulation of 22 Kantemir & Osman Dede Perdes in 50-EDO .......................... 67
Table 4.10: Hamparsum & Harutin Phonetic Notations of Perdes .......... 70
Table 4.11: Mushaqah’s Quasi-Equal 24-tone System .............................. 73
Table 4.12: Amin Ad-Dik’s 24-tone Egyptian Tuning ................................. 75
Table 4.13: Details of Oransay-29 ............................................................ 78
Table 4.14: Entire Range of Perdes in Töre-Karadeniz .............................. 81
Table 4.15: Comparison of Turkish Tunings in 106-EDO ......................... 84
Table 5.1: 79/80 MOS 159-tET ................................................................. 95
Table 5.2: Complete Range of Detailed Traditional Perdes in 79/80 MOS 159-tET ................................................................. 98
Table 5.3: 1006-ADO approximation of 79/80 MOS 159-tET .................... 99
Table 5.4: Simple Frequencies Approximation to 79/80 MOS 159-tET ... 103
Table 5.5: Comparing Several Versions of 79/80 MOS 159-tET .............. 105
Table 5.6: Temperings in Cents of Pure 5ths, Pure Major 3rds, and Pure Minor 3rds in the 12-tone Closed Cycle Mode of 79 MOS 159-tET ........................................................................ 116
Table B.1: Complete List of Dyads in the 24-tone Pythagorean System . 175
Table C.1: Harmonics of the Ney expressed as Perdes of Nasr Dede ..... 179
Table C.2: Relative Positions of Ney Fingerholes .......................... 180
Table C.3: Measurements of Three Common Sizes of Ney according to
Turkish Neymaker Yilmaz Kale ........................................ 181
Table C.4: Rauf Yekta’s Perde Frequencies on Seven Common Ney Types
.................................................................................................. 182
Table C.5: Süleyman Erguner’s Nine Common Types of Ney with Perdes
yielding Concert Pitch ........................................................ 182
Table C.6: Complete Ney Ahenks and their Measurements by Turkish
Neymaker Gökhan Özkök .................................................. 183
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Histogram of Niyazi Saym’s Uşşak Ney Taksim</td>
<td>27</td>
</tr>
<tr>
<td>3.2</td>
<td>Interval Measurements by “AralkÖlcer”</td>
<td>28</td>
</tr>
<tr>
<td>3.3</td>
<td>Comparison of Pivotal Intervals from Niyazi Saym’s Uşşak Ney Taksim with the Arel-Ezgi-Uzdilek Model</td>
<td>29</td>
</tr>
<tr>
<td>3.4</td>
<td>Notation of the AEU System</td>
<td>33</td>
</tr>
<tr>
<td>3.5</td>
<td>Notation of Yekta-24</td>
<td>36</td>
</tr>
<tr>
<td>3.6</td>
<td>AEU Division of the Whole Tone into 9 equal commas</td>
<td>39</td>
</tr>
<tr>
<td>3.7</td>
<td>Correct Sequence of Notes in a Chain of Pure Fifths</td>
<td>40</td>
</tr>
<tr>
<td>4.1</td>
<td>Safiuddin Urmavi’s 17-tone Pythagorean System</td>
<td>46</td>
</tr>
<tr>
<td>4.2</td>
<td>Abjad Notation of the Principal Mode in Ascending Order of Maqam Rast with Schismatic Simplifications</td>
<td>50</td>
</tr>
<tr>
<td>4.3</td>
<td>Staff Notation of Nasr Dede’s Octave Consonances</td>
<td>58</td>
</tr>
<tr>
<td>4.4</td>
<td>Staff Notation of Nasr Dede’s Consonances of the Fifth, Fourth, Twelfth, and Eleventh</td>
<td>59</td>
</tr>
<tr>
<td>4.5</td>
<td>Staff Notation of Nasr Dede’s Consonances of the Major Third, Minor Third, and Middle Second</td>
<td>60</td>
</tr>
<tr>
<td>4.6</td>
<td>Staff Notation of Nasr Dede’s Consonances of Whole and Half Tones</td>
<td>61</td>
</tr>
<tr>
<td>4.7</td>
<td>SCALA© Tone-Circle of &quot;Quarter-tones&quot; betwixt A Blend of Kantemir &amp; Osman Dede Perdes Mapped to Degrees of 50-EDO</td>
<td>68</td>
</tr>
<tr>
<td>4.8</td>
<td>Kantemir’s Tanbur from Kitâb ‘Ilmi’l-Müsiķî ‘alâ vechîl- ‘Hürûfî, p.131</td>
<td>69</td>
</tr>
<tr>
<td>4.9</td>
<td>Final Review on Staff of Ottoman Phonetic Notations &amp; Abjad</td>
<td>71</td>
</tr>
<tr>
<td>4.10</td>
<td>Modern Arabic Staff Notation of Perdes</td>
<td>74</td>
</tr>
<tr>
<td>4.11</td>
<td>Oransay’s 29-tone System for Turkish Maqam Music</td>
<td>77</td>
</tr>
<tr>
<td>4.12</td>
<td>SCALA© Tone-Circle Showing 10 Instances of 2/3 Tones &amp; 7 Instances of 4/5 Tones in Oransay-29</td>
<td>79</td>
</tr>
<tr>
<td>4.13</td>
<td>Staff Notation of Töre-Karadeniz</td>
<td>80</td>
</tr>
<tr>
<td>4.14</td>
<td>SCALA© Tone-Circle Showing 10 Instances of 2/3 Tones, 31 Instances of 3/4 Tones, and 20 Instances of 4/5 Tones in Töre-Karadeniz</td>
<td>82</td>
</tr>
<tr>
<td>5.1</td>
<td>Picture of the 79-tone Turkish qanun by Gülec &amp; Sons</td>
<td>87</td>
</tr>
<tr>
<td>5.2</td>
<td>A Close-up of mandals on the 79-tone qanun</td>
<td>88</td>
</tr>
<tr>
<td>5.3</td>
<td>Picture of Fine-Tuners on the 79-tone qanun</td>
<td>89</td>
</tr>
<tr>
<td>5.4</td>
<td>Sagittal Notation® of the Whole Tone Sector of 79/80 MOS 159-tET</td>
<td>107</td>
</tr>
<tr>
<td>5.5</td>
<td>Tone-Circle of 2/3 Tones in 79 MOS 159-tET</td>
<td>109</td>
</tr>
<tr>
<td>5.6</td>
<td>Tone-Circle of 2/3 Tones in 80 MOS 159-tET</td>
<td>110</td>
</tr>
</tbody>
</table>
Figure 5.7: Tone-Circle of 3/4 Tones in 79 MOS 159-tET ...................... 111
Figure 5.8: Tone Circle of Minor 3rds Showing Neutral Seconds in 80 MOS 159-tET ………………………………………… 112
Figure 5.9: Tone-Circle of 4/5 Tones in 79 MOS 159-tET ...................... 113
Figure 5.10: Tone-Circle of 4/5 Tones in 80 MOS 159-tET ...................... 114
Figure 5.11: Twelve-tone Circle out of 79 MOS 159-tET ...................... 116
Figure 5.12: *Maqam Rast* Notated in 79 MOS 159-tET ...................... 118
Figure 5.13: Some Main *Maqams* of Moderate Complexity Notated in 80 MOS 159-tET ………………………………………… 119
Figure 5.14: Some Composite *Maqams* Notated in 80 MOS 159-tET ………………………………………… 121
Figure B.1: Tone-Circle Showing 12 Pythagorean Commas in *AEU/Yekta-24* ………………………………………… 158
Figure B.2: Tone-Circle Showing 7 Pythagorean Double Diminished Thirds in *AEU/Yekta-24* ………………………………………… 159
Figure B.3: Tone-Circle Showing 19 Pythagorean Minor Semitones in *AEU/Yekta-24* ………………………………………… 160
Figure B.4: Tone-Circle Showing 17 Apotomes in *AEU/Yekta-24* ………………………………………… 161
Figure B.5: Tone-Circle Showing 5 Two Third Tones in *AEU/Yekta-24* ………………………………………… 161
Figure B.6: Tone-Circle Showing 2 Three Fourth Tones in *AEU/Yekta-24* ………………………………………… 162
Figure B.7: Tone-Circle Showing 14 Pythagorean Diminished Thirds in *AEU/Yekta-24* ………………………………………… 163
Figure B.8: Tone-Circle Showing 22 Major Whole Tones in *AEU/Yekta-24* ………………………………………… 164
Figure B.9: Tone-Circle Showing 10 Pythagorean Double Augmented Primes in *AEU/Yekta-24* ………………………………………… 165
Figure B.10: Tone-Circle Showing 9 Pythagorean Double Diminished Fourths in *AEU/Yekta-24* ………………………………………… 165
Figure B.11: Tone-Circle Showing 21 Pythagorean Minor Thirds in *AEU/Yekta-24* ………………………………………… 166
Figure B.12: Tone-Circle Showing 21 Pythagorean Augmented Seconds in *AEU/Yekta-24* ………………………………………… 167
Figure B.13: Tone-Circle Showing 3 Comma-augmented Sesqui-tones in *AEU/Yekta-24* ………………………………………… 167
Figure B.14: Tone-Circle Showing 4 Middle Thirds in *AEU/Yekta-24* ………………………………………… 168
Figure B.15: Tone-Circle Showing 16 Pythagorean Diminished Fourths in *AEU/Yekta-24* ………………………………………… 169
Figure B.16: Tone-Circle Showing 20 Pythagorean Major Thirds in *AEU/Yekta-24* ………………………………………… 169
Figure B.17: Tone-Circle Showing 8 Pythagorean Double Augmented Seconds in *AEU/Yekta-24* ………………………………………… 170
Figure B.18: Tone-Circle Showing 11 Pythagorean Double Diminished Fifths in *AEU/Yekta-24* ………………………………………… 171
Figure B.19: Tone-Circle Showing 23 Perfect Fourths in *AEU/Yekta-24* ………………………………………… 171
Figure B.20: Tone-Circle Showing 13 Pythagorean Augmented Thirds in *AEU/Yekta-24* ………………………………………… 172
Figure B.21: Tone-Circle Showing a Semi-Diminished Fifth in *AEU/Yekta-24* ………………………………………… 173
Figure B.22: Tone-Circle Showing a Pythagorean Double Diminished Sixth in AEU/Yekta-24 ................................................................. 173

Figure B.23: Tone-Circle Showing a Pythagorean Diminished Fifth in AEU/Yekta-24 ........................................................................ 174

Figure C.1: Ney Perdes According to Nasır Dede ............................................. 177

Figure C.2: Fingering Chart for Ney Perdes with Key-Transposing Staff Notation................................................................................. 178

Figure C.3: Key-Transposing Staff Notation of Nasır Dede’s Natural Perdes Conforming to Concert Pitch in Süpürde Ahenk .......... 184

Figure C.4: Key-Transposing Staff Notation of the Principal Rast Mode in Ascending Order in Reference to the Concert Pitch .......... 184

Figure C.5: Scoring of the Principal Rast Mode in Ascending Order for Key-Transposing vs Standard Diapason Instruments ............... 185

Figure C.6: In Unison Scoring of the Principal Rast Mode in Ascending Order at Concert Pitch for all Ney Ahenks................................. 186
TÜRK MAKAM MÜZİĞİ İÇİN 79-SEKLİ DÜZEN VE KURAM
Hazırdaki Model İle İcra Arasındaki Örtüşmezliğe Yönelik
Bir Çözüm Denemesi

ÖZET


Yazar ayrıca, Ebced, Kantemir, Osman Dede, Harutin, Hamparsum, Arap Dünyası’nda tanımlı 24-perdeli diziler, Oransay’ın 29 sesli düzeni ve Karadeniz’in 106-ton eşit taksimat içinde çıkardığı 41-perdeli sistem gibi tarihsel ve çağdaş alternatiflerin – her ne kadar, bunların çoğu 106-ton eşit taksimat izgarasına oturuyor ise de – icrada gözlemlenilen birçok mikrotonu
tatminkar düzeyde yansıtamadığını bulgulamaktadır. Bu çalışmada, söz konusu seçeneklerin ayrıntılı bir değerlendirilmesi sunulmuştur.

Kanun yapıcılardan, kanunlara, çalgıların icra esnasında tellerin uzunluğunu değiştirilmekte kullandığı ve “mandal” olarak adlandırılan küçük metal parçaların, dışarıdan getirilen standart elektronik akort ayardlarının sıkıla referans alınmasında kaynaklanmış olarak, 72-ton eşit taksimat göre çalışan, yaygın olan “oktava 53 Holder komması” metodolojisinin kaft üstüne kaldığını delil sayabilir ve en azından, Türk Makam Müziği icracılarının daha yüksek bir çözünürlük arayışı işaret ediyor olarak gözetilebilir.

53-ton eşit taksimat kanunlara uygulanmadığı ve oktava 72 eşit parça ayrılmış, Batı Müziği’ne özgü “oktava 12 eşit yarım adım” metodolojisinin alt taraflarında kaldıguna delil sayabilir ve en azından, Türk Makam Müziği geleneği ile daha uyumlu bir düzen tasarlanmasi gerekli görülmektedir.


Makam kuramına yönelik yukarıda adı geçen diğer yaklaşımları kayıtlıdır, 79-sesli düzen, karmaşık 13 asal-küsimli dizilerin notalamasına, ötelenmesine ve armonize edilmesine son derecede elverişlidir.
SUMMARY

The long-standing conflict between the “Arel-Ezgi-Uzdilek” System and Turkish Maqam Music practice has been established through computer analyses of audio recordings by master musicians such as Neyzen Niyazi Sayın and Tanburi Necdet Yaşar. Results incontrovertibly manifest the deliberate employment of multifarious middle second intervals peculiar to the genre, yet evaded by the current model. These middle seconds are roughly expressible as 2/3, 3/4, and 4/5 tones, and often referred to by the protagonists of the Music Reformation in Türkiye during the early 20th century as “quarter-tones”.

While the frequency ratios of the Pythagorean theory in effect are naturally limited by prime 3, the middle seconds observed in performance and dubbed “mücennel bölgesi” (the mujannab zone) by Yağmur Tura require the employment of superparticular simple-integer ratios whose numerators or denominators are mathematically constrained by as high a prime as 13. Here, prime-limit denotes the mathematical constraint by the highest prime in the factorization of both the numerator and denominator of a given frequency ratio for any set of intervals in a Just Intonation system.

It is maintained that non-conformance arose because the 24-tone Pythagorean theory in effect was specifically engendered by what may properly be named the ‘Yekta-Arel-Ezgi School’ to ward off these “quarter-tones” which allegedly affiliated the Maqam Music heritage to Byzantine & Arabs. It may be said that the ‘Yekta-Arel-Ezgi School’ condoned alienating theory to practice in an effort to save the genre from the disfavour of the new regime.

The author debunks the current model for falling short of accommodating played intervals, and shows that, the 24 tone Pythagorean tuning used in notation and music education embodies only five 2/3 tones and two 3/4 tones between uncommon, hence unrecognized tone pairs – that is to say, at untraversed and inconvenient locations – rendering it a model far from representing actual practice.

The author predicates, furthermore, that historical and contemporary alternatives such as the 17-tone Abjad Scale, late-Ottoman Phonetic Notations like Kantemir, Osman Dede, Harutin and Hamparsum, Arabic 24-tone Scales, Oransay’s 29-tone Tuning, and Karadeniz’s 41-tone subset out of 106 equal divisions of the octave – although most of them settle into a global 106-tone equal temperament grid – cannot favourably reflect the
plethora of microtones observed in performance either. Detailed analysis for each of these options is presented herein.

The fact that metallic levers on qanuns called “mandals” – which are manipulated by the executant on the fly to alter the lengths of the courses – are affixed by qanun-makers on these instruments in such a way as to yield 72 equal divisions of the octave due to the common usage of standard electronic tuners imported from overseas, is proof that the widespread “53 equal commas to the octave” methodology is most likely confined to paper, and that, a higher resolution is demanded by performers of Turkish Maqam Music.

Since 53-tone equal temperament does not appear to be applied to qanuns, and dividing the octave into 72 parts is none other than the sixfold elaboration of “twelve equal steps per octave” methodology of Western Music, it henceforth becomes a necessity to devise a tuning which is more compatible with Turkish Maqam Music tradition.

On these grounds, a novel 79-tone tuning has been developed and implemented on a unique custom-made qanun by the author. This one-of-a-kind Turkish qanun was manufactured by Ejder Güleç in 2005, a renown instrument maker in Izmir, and acclaimed by music circles at various occasions. The 79-tone tuning, which has been derived from a subset of 159 equal divisions of the octave, is minutely explained in this work and defended as a solution to overcome persisting issues regarding the accurate representation and consistent understanding of maqamat.

A complementary Sagittal Notation® has been adapted to the 79-tone tuning and explained in this dissertation. With the employment of only three microtonal accidentals in addition to ordinary sharps and flats, it becomes possible to express subtle nuances of pitch in Maqam Music. Also, Sagittal Notation® may serve as a gateway to future maqam polyphony.

As a preliminary approach to 79-tone maqam theory, some main and composite maqams have been notated to demonstrate the capabilities of the 79-tone tuning. Categorizing and redefining maqams as main and composite, as opposed to their division into simple and composite/transposed in “Arel-Ezgi-Uzdilek” theory, is an innovation by the author in this thesis. Problematic maqams such as Hüzzam and Saba are consistently notated with the pitches of the 79-tone tuning.

Compared to other approaches to maqam theory, the 79-tone tuning appears to be most suitable for the notation, transposition, and harmonization of complex 13-limit scales.
Üniversitesi : İstanbul Teknik Üniversitesi
Enstitüsü : Sosyal Bilimler
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Programı : Müzikoloji ve Müzik Teorisi
Tez Danışmanı : Prof. Şehvar Beşiroğlu, Prof. Erol Deran
Tez Türü ve Tarihi : Doktora – Haziran 2008

ÖZ

TÜRK MAKAM MÜZİĞİ İÇİN 79-SESLİ DÜZEN VE KURAM
Hazırdaki Model İle İcra Arasındaki Ortüşmezliğe
Yönelik Bir Çözüm Denemesi

Ozan YARMAN


Anahtar Kelimeler: Türk Makam Müziği, mikroton, 79-sesli düzenn, makam
ABSTRACT

79-TONE TUNING & THEORY FOR TURKISH MAQAM MUSIC
As A Solution To The Non-Conformance Between
Current Model And Practice

Ozan YARMAN

The long-standing conflict between the Arel-Ezgi-Uzdilek System and Turkish Maqam Music practice had been established through computer analyses of audio recordings. Results incontrovertibly manifest the conscious employment of multifarious “middle second” intervals peculiar to the genre, yet, evaded by the current model. It is maintained, that non-conformance arose because the 24-tone Pythagorean theory in effect was specifically engendered to ward off “quarter-tones” which allegedly affiliated the Maqam Music heritage to Byzantines & Arabs. The author debunks the current model for falling short of accommodating played intervals, and predicates furthermore, that historical and contemporary alternatives cannot favourably reflect the plethora of microtones observed in performance, either. On such grounds, a novel 79-tone tuning has been developed and implemented on a unique custom-made qanun by the author. This tuning is defended as a solution to overcome persisting issues regarding the accurate representation and consistent understanding of maqamat.

Keywords: Turkish Maqam Music, microtone, 79-tone tuning, maqam
AUTHOR’S PREAMBLE TO THE
EXPANDED PUBLICATION

In the Name of Allah; The Bounteous-Nourisher, The Ever-Merciful.

All Praise is due to the Sovereign Lord of Worlds, Exalted in Power, Wise. Through boundless Grace hath He, in this author’s belief, endowed mankind with discerning intelligence and the capacity to act on an uncoerced will; so that our beholden selves mayst be held accountable, and glean true knowledge, however limited, of the multitudinous facets of this transcendent yet mechanistically unveiling Nature – in order that we may receive, voluntarily and in reverent humility, the Divinely Ordained Teachings of Peace to earn bliss eternal.

As revealed in the Noble Qur’an (30:22):

وَمِن آيَاتِهِ خَلْقُ السَّماوَاتِ وَالأَرْضِ وَاختِلافُ الْأَلسَّنَاتِ وَأَلوَانِكُمْ أَنَّهُمْ فِي ذَلِكَ لَآيَاتٌ لِّلْعَالمِينَ

“And among His signs is the creation of the Celestial Vaults and the Earth, and the diversity of your languages (spoken or written, as well as musical) and colours (of complexion, of art, and of sound). Verily, in this are signs for those of knowledge.”
In my becoming a sociopolitically pluralist Mu’tazilite Muslim bolstered with Kantian transcendentalist ideals – who had hitherto received much of his essential views and formal music education in accordance with imperiously blinkered local indoctrinations or while staying as an estranged student in European cities – I was gradually motivated (as had been expressed earlier in the FOREWORD) by a personal resentment against firstly the domestic haut monde elitist viewpoint that unquestioningly venerates and tries to imitate Western molds of art-making as aesthetically superior or exemplary to indigenous lore, and later, the prevalence of insurmountable dogmatic inconsistencies and theoretical shortcomings in the representation of the diametrically opposed genuine classical/folk practice known as Turkish Maqam Music.

This had begun to culminate at a time when – especially during my Master’s Degree studies – I was growing increasingly aware of, and in the meanwhile getting unpleasantly confronted by, the deep-seated bicentennial cultural/ideological dichotomy referred to as the “Alla Turca – Alla Franca strife” (though not so much mentioned in name nowadays) that persists between irreconcilably polarized erudite factions of my homeland today.

Seeing as this dichotomy, – in stark contradistinction to the illuminating all-inclusive maxim of the above-given Qur’anic verse that promotes multicultural fellowship between diverse human groups – is hindering the natural progress and artistic evolution of a fair (yet very much underappreciated) authentic microtonal genre belonging to our World Heritage, I have undertaken (as mentioned previously and as shall be explained thoroughly) the task of conceptualizing a novel 79-tone tuning extracted basically out of 159 equal divisions of the octave; which not only promises to bridge the chasm between written music and performance for the Middle East at large (e.g., if consistently applied to respective native music education curriculums), but also prepares the way for prospective maqam/dastgah polyphony (i.e., in fully preserving the historic traits of classically/traditionally understood perde or flexible pitch intonations under the expanded framework of the “more academical and methodical” common-practice music theory and terminology principles of Europe).

Recently deceased luthier Ejder Güleç (1934-2014) had successfully implemented this comprehensive tuning on a custom-built Turkish qanun based on my mathematical design and specifications by October 2005; subsequent to which, “double-sharp mandals” (i.e., the metallic levers under the courses) were added and marked with distinct colour by May 2006 upon the recommendation of my thesis supervisor Şehvar Beşiroğlu and compeers, so as to accommodate all needed enharmonical respellings and related
pragmatic transpositions for the complete and satisfactory representation of \textit{maqamat} at every degree of the proposed 79-tone tuning.

Following these developments, my 79-tone \textit{qanun} received acclaim in many circles (like \textit{International Qanun Symposium and Festival I & II} held in 2012 and 2015 respectively) and by many proponents of the instrument; such as the late \textit{Halil Karaduman} (1959-2012) – to whom I owe much debt and gratitude for his public endorsement of my work up until the very week of his untimely passing, the reputed practitioner and “my substitute doctoral co-supervisor” maestro \textit{Erol Deran} for his unwavering espousal and open-mindedness, and even the eccentric and possibly the best-qualified theoretician rival to this author, the now deceased \textit{Julien “Jalaladdin” Weiss} (1953-2015).

Other venerable mentions ought to include such prominent names as \textit{Ruhi Ayangil}, who – despite his unexpected and much deceiving withdrawal from this thesis’ examining committee (and against all our subsequent efforts to win him back) based on calculatingly unreasonable and disruptive last-minute demands leading to an unfortunate academic squabble even though we were in such good terms for many years – had demonstrated his mastery on the 79-tone \textit{qanun} several times in the past and initially used to vocalize his appreciation of the results; and also my cherished elder \textit{Nevzat Sümür}, with whom we first met at the IV. (and again later) installment(s) of “\textit{Kanun Çevresi}” (Qanun Circle) Colloquia spearheaded by Ayangil – whereupon maestro Sümür wholeheartedly supported me and my work ever since; as well as \textit{Tahir Aydoğdu}, son of esteemed father and senior \textit{qanun} artist \textit{Gülsin Aydoğdu}, who had been indispensable in organizing the aforementioned Qanun Symposia and was very kind in having personally invited me to both events; besides \textit{Güldeniz Ekmen} (with whom we met at said Symposia), for her always congenial and favourable stance every time she studiously inspected and played on my 79-tone \textit{qanun}.

Regardless of the aforementioned acclaim and acknowledgements, and notwithstanding the quick silencing of any would-be opposition from adverse performers or luthiers in the light of brief live demonstrations that would let people see the merit of my work for themselves, the 79-tone \textit{qanun} never quite gained the recognition that I believe it deserves – partly on account of the general inaccessibility (especially for “\textit{troublemakers like myself}”) to sacrosanct havens and zealously guarded trade secrets of instrument-builders in Türkiye, as well as the intransigence or lassitude by practitioners to update their mental template of the moving parts of their \textit{qanuns}; and possibly more so owing to my having refrained thus far from establishing a compendium of all \textit{maqam} scales and their \textit{seyirs} (melodic progressions) with relevant score examples based on the 79-tone scheme.
(that I excuse myself from given the difficulty of notational typesetting and sounding of microtonal accidentals at all levels of transposition – for which, thankfully [though still remaining somewhat cumbersome], Mus2© software by DataSoft™ came to the rescue in 2010; but even more so given my ongoing reluctance to “dictate theory” to musicians who already had enough of obliviously complacent and conflicted theorists telling them how they should play and teach their art).

Nevertheless, next-generation qanun executants such as Esra Berkman, Ayşegül Kostak Toksoy, Halil Altınköprü (nephew to the deceased Karaduman), Mehmet Çeliksu, Pınar Somakçı, Volkan Gidiş, etc… (alongside several foreign musician acquaintances) have, on many occasions, expressed their appreciation of, and/or willingness to participate in, the intonational accomplishments of the 79-tone tuning for the wholesome expression of maqamat/dastgaha – particularly in the face of prevalent non-systematized habits that remain in open conflict with the demonstrably incomplete or outright flawed theoretical models in force called Arel-Ezgi-Uzdilek and Arabic-Persian quarter-tonal systems.

Time will reveal if the author of this thesis will be able to exercise the determination to effectuate changes that will persuade at least some professionals to adopt (even so much as an “experimental undertaking”) the proposed 79-tone tuning as worthy of consideration.

It should be mentioned in passing that, the author had later on devised at least two other significant theoretical alternatives for Maqam Music experts and dilettanti who might find the 79-tone scheme too complicated or transposition-wise superfluous under various circumstances – or yet, simply impossible to wholly implement on a musical instrument other than the qanun or the like due to technical limitations. These alternative “fallback” tuning solutions – dubbed Yarman-24/31(a, b, c, d) and Yarman-36(a, b, c) respectively (where the letters indicate subtle variants) – have been published on the author’s website (www.ozanyarman.com), as well as in book and article format in the provided links therein.

The 24c variant has already been applied to the neck of the author’s bowed tanbur, and also to TouchKeys© created by Andrew McPherson, and finally on a specially re-fretted guitar of Tolgahan Çoğulu via our mutual collaboration based on my meticulous calculations and instructions. Skillfully prepared videos exemplifying all of these can be found on YouTube™ through the author’s channel.
Without delving into excessive detail, it should suffice for me to say that I advance these alternative theoretical solutions with as equal a force as I had initially endorsed (and still endorse) the 79-tone tuning in this dissertation. Admittedly, this has caused some confusion and maybe even distrust. I proffer them altogether without any ultimate preference since many years and without concretely specifying maqam scales or their seyirs, simply because, Maqam music circles do not know exactly what they really want and can’t even seem to agree on the basics. Some performers desire comprehensive detail without understanding the technical, mathematical, and notational consequences; others are apprehensive of voluminous grids and will generally be content to settle (at least on paper) on irregular subsets of either the Holderian comma system or multiples of 12-equal; and even others tend to insist on the greatest simplicity at the expense of critical pitch detail (to say nothing of their inadvertent sanctioning of modulation/transposition deficiencies). There is also the reality of the wider geography of the Middle East, where differing tastes across borders will most understandably and naturally warp the accustomed intonations and inflexions of maqamat/dastgaha.

That being the case, my aforementioned alternative theoretical solutions shall very likely be quite inapplicable the more one distances oneself from the vicinity of Asia Minor & Thrace. Otherwise, I defend that the 79-tone tuning presented in this dissertation should cause no serious problems in accommodating all regional flavours and savours throughout the entire Middle East – and possibly beyond as well.

It would be prudent to mention as a side note here that, Aaron Andrew Hunt – who kindly invited me to publish this updated doctoral work by Zwillinge Verlag – developed an application by the name of ScalaVista® under the H-Pi Instruments™ banner with permission from our mutual colleague Manuel op de Coul (programmer of SCALA®); wherein thousands of “SCALA database” scales, including my Yarman-24 and Yarman-36 tunings, as well as the 79-tone system explained in this thesis, are made available for auditory and intervallic examination.

Similarly, starting from more than a decade earlier, my senior colleague M. Uğur Keçecioğlu brilliantly designed a nifty software called VIRTUAL QANUN free of charge and available for download from the www.notist.org website; which – through years of e-mail exchange and highly technical interactions on the phone during mostly late-hours with this author – now canonically contains the 79-tone tuning based on real sample sounds recorded from the actual 79-tone qanun.
In addition, one might find it interesting to check the author’s website for a “79-tone recipe” page and incidental Microsoft EXCEL™ document detailing mathematical calculations, as well as some Mus2© template files demonstrating the Sagittal® and (my later invention) MANDALATURA® notations, for the 79-tone tuning.

This expanded publication (with corrections to minor typographic errors previously found in the original text) comprises, subsequent to the author’s updated CV, an Epilogue by my Thesis Supervisor, after which I placed an exhaustive Index, followed by “3 Progress Reports” in Turkish (slightly revised herein) that had been delivered to and accepted by the Examining Committee, as well as the unabridged article in Turkish produced from the thesis that was originally published in itüdergisi/b, together with my Doctoral Defense Presentation in Turkish, and finally, a Supplementary of select maqam scales and their transpositions on staff in the 79-tone tuning – besides the exposition of the entire temperament itself – using both Sagittal® and MANDALATURA® accidentals.

Note that, the extra items indicated above and their associated page numbers have been appended to the Table of Contents, and corrections were made to the References on account of obsolete internet links – among which, my re-uploaded 2015 redaction of the web-cited paper titled “Ulusal Müzik Sorunsalızm” (Our National Music Quandary) is worth mentioning; wheras, later publications (such as Cris Forster’s complete release of “Musical Mathematics” [180, 213] in 2010 by Chronicle Books, and Gönül Paçacı’s finished transliteration of Rauf Yekta’s “Turkish Music Theory” tractate in successive issues of the fanzine Mûskîşinas [324]) were not incorporated.

This thesis, by all acounts for the first time, makes the following unique assertions:

1. That the electroacoustically substantiated intonational discrepancies between the theoretical representation of Turkish Maqam Music in effect called the Arel-Ezgi-Uzdilek System and actual instrumental/vocal practice appears to stem from a deliberate ethnocentric tailoring of the historical perdes of maqamat; which was apparently aimed to placate Kemalist political agendas during the 1920s and 1930s on the creation of a national music ridded of Byzantine/Arabic “quarter-tones” – and thus, of all the musical heritage this entailed – but based instead on twelve-tone harmonizations of folk ayres akin to what 19th Century European nationalist composers had done.
2. That this work possibly features the first, as well as the best, scholarly English translations of historical anecdotes and quotes in chronological order from some of the relevant literature and leading personas in Turkish appertaining to the Music Reformation years and the ensuing “Alla Turca – Alla Franca strife” in Türkiye.

3. That the official theory of Turkish Maqam Music is hampered – as shown through an extensive analysis – by the absence of crucial middle/neutral seconds in highly required dyadic locations; signifying that the 24-tone Pythagorean tuning is indeed fundamentally incompatible with practice as had long been suspected.

4. That historical Abjad and Ottoman Phonetic Notations on Maqam music (despite looking “very stylish” in print) are anatomically neither very much consistent, nor sufficient, to express the myriad middle/neutral second interval flavours measured in the recordings of master performers. At least, they certainly are not anymore suited to represent the Maqam music of the modern era; where ever more demanding modulations/transpositions have come into vogue in increasing emulation of Western tonality and key changes – to say nothing of escalated complexity in rhythmic embellishments.

5. That 20th Century alternatives to the 24-tone Pythagorean tuning in effect are also lacking in the same respects. None of them fulfill expectations in terms of mathematical consistency and completeness, let alone intonational subtlety as captured in audio recordings; and all of them are further undermined by dysfunctionality in the usage of their associated accidentals. This last statement seems to be the only area where Arabic or Persian quarter-tonal notation excels at.

6. That Abdulbaki Nasır Dede’s modified Abjad was converted to a novel staff notation accompanied by a complementary solmization (which is, in essence, an offshoot of the “Ra-Dü-Se” system by M. Kemal Karaosmanoğlu) in order to transcribe all perde pair consonances. Additionally, an entire section (APPENDIX C) was devoted to the ney, including an exquisite fingering chart of ney perdes as derived from Nasır Dede’s treatise, aside from a panoply of related detail.
7. That in order to accommodate all of the necessary pitch nuances for \textit{maqamat} at every principal and \textit{mabeyn} (intermedial) \textit{Ney Ahenk} (key transposing of sounded notes) – over and above satisfying the theoretical stipulations expounded on page 4 (\textit{where historicity is treated to a methodical re-synthesis with modernity}) – no less a scheme than the 79/80-tone subset out of 159 equal divisions of the octave is posited to suffice.

Since \textit{qanun} has always been an indispensable (and to me, as a pianist, “fascinating”) lead instrument for performance traditions and ensembles of \textit{Maqam} Music throughout the centuries, and seeing as the ingenious implementation – towards the end of the 19\textsuperscript{th} Century – of the “\textit{mandal} system” made it possible to precisely and swiftly adjust effective string lengths for each course of its diatonically tuned ambitus (insofar as transforming the \textit{qanun} to the level of a virtuosic device), I deemed it an excellent choice to install and demonstrate the merits of my proposed 79-tone tuning.

All the more so in the light of the fact that, several Balkan nations, Turks, Arabs, Kurds, Turkmens, Azeris, Persians, and Armenians perform on \textit{qanuns} featuring different and, on the whole, discontinuous \textit{mandal} arrays – where desultory temperings or insets employed in both instrument construction and informal music theory hardly yield the desired pitches without fail, because the intervals required of \textit{maqamat} are diverse and mathematically challenging to systematize even at common transpositions – which moreover can result in blurred unisons and nauseous intonations when the \textit{qanun} is combined in concert with unfretted instruments like the \textit{ney}, \textit{ud}, and \textit{kemençe}.

Incidentally, it was noted that the experimental and heuristic undertaking in the course of this dissertation pushed the “\textit{mandal system}” to its limits; where increments of the 79-tone tuning more or less mark the upper threshold of the pitch detail that can be consistently and practicably applied to the \textit{qanun} from the lowest strings all the way up to an appreciable treble range (from A\textsubscript{2} to E\textsubscript{5}).

In any event, this undertaking proved to be quite necessary; for neither the established theoretical models prevailing over classical/traditional music education curricula, nor their computationally appraised alternatives were found satisfactory in explaining the “ulterior pitch palette” of the ubiquitous \textit{Maqam} music genre.
It has furthermore been understood that, the absence of an “all-encompassing tone-system” has lead to the cultural divide that I define as the Alla Turca – Alla Franca Dichotomy. Dissent between traditionalism (the stronghold of those who adhere to the monodic practice and who refuse to acknowledge polyphony & orchestration to be great and inspiring technical advancements in music) and modernism (the stronghold of those who adhere to the Westernization of music, and yet forego the importance of the utilization of characteristic native microtones, scales, and rhythms) is so severe even today, that national music education in Türkiye remains sundered in half as a result. This happens to constitute the core of the degeneration in art that encumbers Turkish music-making.

The author now hopes that his approach can remedy deep-seated cultural schisms and help enhance the expressivity of local tradition. By the same token, he desires this painstaking work to be recognized for the benefit of Maqam Music at large; seeing as the proposed tuning solution is, by far, the only comprehensive and notationally consistent theoretical candidate which promises to incorporate at every step diverse, and every so often fluid, melodic intervals peculiar to the genre – while at the same time, remaining fully compatible with Western Music also.

This dissertation was purposefully written in English, instead of Turkish, to avoid needless semantical/terminological discussions, and to publicize the findings hereunder to a wider international audience.

Allah alone is Inerrant and Flawless, while all mortal contemplation is categorically fallible. May my oversights, if any, be forgiven, and may this earnest enterprise aid the efforts of those who can do better than I.

And Allah knows best!..

Dr. Ozan Yarman
July 2016
GENE WARD SMITH’S
INVITED EXPOSITION

(Author’s Note: Gene Ward Smith is a master tuning & temperament mathematician who has been active in the “Alternate Tunings Mailing List” under Yahoo Groups™ since the past two decades. He was instrumental – as an outspoken music theorist and xenharmonic composer – in coining several neoteric terms and procedures that define rigid properties of tone-systems, and was the first to identify my 79-tone tuning as a “Moment of Symmetry” subset of 159 equal divisions of the octave, i.e. 79 MOS 159-tET, as well as indicate the existence of its twin 80 MOS 159-tET.)

The 159 equal division of the octave means the division of 2/1 into 159 equal steps of 1200/159 = 7.547 cents each. One of the things such a division can do is allow for the accurate approximation of rational intervals. From the size of these steps, any interval – rational or not – can be approximated to within 3.774 cents. However, often we might wish to do so *consistently*; so that, for instance, the approximation for 3/2 is the sum of the approximations for 6/5 and 5/4, and so forth. This can be accomplished by choosing a number of steps for each prime number, or each prime number up to some limiting number $p$, and make the rest follow from that.

The set of positive rational numbers which can be factored into primes up to $p$ is called the $p$ prime-limit. By choosing the number of steps for each prime up to $p$, we can express everything in the $p$ prime-limit. In our case, we can choose $159 \ast \log_2(q)$, rounded off to the nearest integer, for each prime number $q \leq 17$. We can present this in vectorized form as $<159 \ 252 \ 369 \ 446 \ 550 \ 588 \ 650|$. This is called a “val”; this particular val, obtained by rounding off, is the 17-limit patent val.
Using this val allows us to find, for example, how many steps to use to represent $7/5$. $7$ takes $446$ steps, and $5$, $369$ steps; and so, $7/5$ takes $446-369 = 77$ steps. In musical practice, we are mostly concerned with approximating rational intervals such as $7/5$, e.g., of a simple type – that is to say, with numerators and denominators not too large. We can quantify “of a simple type” in various ways; but for many purposes, it’s preferable not to count factors of two, so that intervals separated by an octave are viewed as equally simple. One way to measure the complexity of an interval $2^n \cdot N/D$, where $N/D$ is a reduced fraction of odd integers, is via “Kees height”, which gives it a complexity equal to the larger of $N$ and $D$. The set of intervals with Kees height less than or equal to some odd number $q$ is called the $q$ odd limit tonality diamond. Hence, for example, $10/9$ has a Kees height of $9$, and so is in the $9$-limit diamond but not in the $5$-limit diamond, despite being a $5$ prime limit interval.

An equal division is said to be $q$ odd limit consistent if, for every two intervals $a$ and $b$ in the $q$ limit tonality diamond, the sum of the number of steps assigned to ‘a’ by the $p$-limit patent val and the number of steps assigned to ‘b’ by the $p$-limit patent val is equal to the number of steps assigned to $a \cdot b$. Here $p$ is the least prime limit containing $q$. In the case of $159$, it is $17$ odd limit consistent – and thus, $q$ odd limit consistent for any odd $q$ less than $17$; but it is not $19$ odd limit consistent. A division is said to be $q$ odd limit distinctly consistent if it is consistent and if no two intervals in the $q$ limit diamond are assigned to the same number of steps; whereby $159$ is not only consistent, but it is distinctly consistent.

The $17$ limit tonality diamond defines a scale of $65$ notes to the octave – a massive universe of tones which the $159$ division approximates to within $3.5$ cents – with both $17/14$ and $17/13$ being sharp by a bit less than $3.5$ cents. The $15$ odd limit and below is even better approximated – to within $2.8$ cents. The $159$ division in fact has a lower maximum error on the $17$ limit diamond than any smaller division; and likewise, also a maximum error on the $15$ limit diamond better than any smaller division.

However, there is more to equal divisions than how well they approximate intervals. Also of interest is the question of the structural features induced by the approximations – i.e., the kinds of “puns” inherent in them. These “puns” exist whenever intervals are tempered out, making for commas of the division – meaning, they are mapped to zero steps. In many ways, these commas characterize the equal divisions.

The $5$-limit commas for the best mapping of $159$ are precisely the same as those for $53$ equal, leading to the same puns – most notably the schismatic relationship characterized by the vanishing of $32805/32768$, the
kleismic relationship tempering out the kleisma 15625/15552, and the semicomma relationship from 1600000/1594323. Any two of these define 53 equal, but not 159; where we sometimes say 159 is “contorted” in the 5-limit, consisting of three copies of 53 equal a third of an octave apart.

In the 7-limit, more commas appear; most notably 1029/1024. Now, when we put that together with 32805/32768 and 15625/15552, we do get 159 in the 7-limit with no contortion. In the 11-limit, we have 1029/1024 = 385/384 * 441/440; and these two commas, together with our 5-limit schisma-kleisma pair, define 159 in the 11-limit. In the 13-limit we have a number of interesting commas, any of which can be added to the mix to define 13-limit 159 equal temperament: 325/325, 364/363, 625/624, 676/675, 1001/1000; and less likely looking options, including even 123201/123200. In the 17-limit, there is a flood of more commas, including 273/272, 375/374, 595/594, 715/714, 833/832, 936/935, 1089/1088, and so forth. All of these imply intervallic and harmonic relationships which would take a book to expound.

The musical scale proposed in this book by Dr. Ozan Yarman is not 159 equal, but a 79 note scale within 159 equal. This scale can be characterized in various ways. For one, it is the maximally even 79 note scale within 159 equal; meaning, it is the closest 159 equal can get to 79 equal. One mode of it, which we will take as standard, has an nth note at floor(159/79 * n); where the floor function floor(x) is the largest integer less than or equal to x. This consists of steps of size 2, except for the last step, which is of size 3. The scale consists of notes which are the even integers 0 2 4 6 8 ... up to 156, followed by a step size of 3 to 159; whereupon the pattern repeats.

One consequence of being a maximally even scale is that it is also a MOS scale, also called a “distributionally even” scale. Such a scale has exactly two specific intervals in each interval class – excepting the class of the unison plus multiples of an octave; i.e., the octave class. Here the mth interval class are the intervals within the scale produced by taking m steps of the scale. The specific intervals in the class are defined by the number of steps of 159 equal they constitute. If the specific interval is n steps, then the interval class is the m = floor(n/2) class. If n is even, then m = n/2; and there are 79-m of these specific intervals in the class. If n is odd, then m = (n-1)/2; and there are m intervals in the class. So, for example, for the approximation of 3/2, the mapping tells us this is 93 steps of 159 equal; so that n = 93. Then, m = floor(93/2) = 46; so that 3/2 belongs to the interval class of 46. Since 93 is odd, there are 46 approximate 3/2 intervals in this class, and the other intervals in the class are slightly flatter, consisting of 92 steps of 159.
In terms of cents, the 3/2 is closely approximated by \((93/159) \times 1200.0 = 701.887\) cents; with the other interval in the class one step less, at 694.340 cents, so that \(m\) appears 79-46 = 33 times. A scale with either the nearly just 701.887 cent fifth or the flat 694.34 cent fifth will mutate between the one and the other as a scale is transposed to various positions within the Yarman MOS.

For example, a scale of twelve notes derived from a cycle of fifths in the 46 interval class will come in twelve forms – each of which occurs six or seven times as the scale is transposed. Such a scale can contain four flat fifths, seven near-just fifths, and a 709.434 cent fifth. Or, it can contain five flat fifths, six near-just fifths, and a 716.981 cent fifth. Other interval classes, such as the one for major thirds, show a similar pattern.

Gene Ward Smith
September 2016
Dissertation
1. INTRODUCTION

Turkish Maqam Music is a unique Near Eastern genre founded upon the crowning achievements in art and culture of Islamic Civilization, which are shared by Turks, Arabs, Persians, and Indians alike.

Believed to have originated in Transoxania around 3rd century anno Hegirae, this refined tradition was handed down to posterity via a multiethnic community of distinguished theorists and executants particular to the vast geography conquered by Turko-Muslim dynasties of the past millennium; e.g. Seljuks, Mamluks, Ottomans and Timurids [1-4], and hence, implies the elegant style forged from edvar/maqams/terkibs i [5-6] and ika'/usûls ii [7], comprising such vocal forms as gazel, ilâhi, n’at, mevlid [8,9], and instrumental forms as semâî, peşrev, beste and kâr [10,11].

At present, Maqam Music in Türkiye is performed by ensembles featuring ud, tanbur (plectrum strings), qanun, santur (zithers), kemençe, rebab, violin (bowed strings), ney, clarinet (woodwinds), qudüm, bendir, daire, def, and darbuka (percussion) [12-14], and grouped under such categories as “Classical Turkish Music” iii [15] and “Turkish Art Music” iv [16].

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i Roughly, “modes characterized by microtones”. (See, accompanying endnotes.)

ii “Metrical or rhythmic patterns”. (See, accompanying endnote.)

iii Also referred to as “Ottoman Music” or “Ottoman Court Music” and often associated with obsolete institutions like Saray (palace), Enderun (palace academy), Mehterhane (house of the ‘Imperial Janissary Music Ensemble’), Tekkes/Dergâhs (sufi convents), so forth… (See, accompanying endnote.)

iv A ‘lay’ version of the aforesaid, largely based on şarkı̇s and similar easy-listening forms from the past hundred years, including celebrated compositions of the 19th century C.E., the rapturous lyrics of which can still be comprehended and savoured by quotidian audiences. (See, accompanying endnote.)
While the provenance and legitimacy of a Turkish Music based on *maqamat* have been the subject of intense debate for most of the 20th century C.E. [17-23], the genre, nonetheless, is firmly grounded today in Türkiye as an urbane flavour in its own right [24-30].

*Per contra*, the theory in effect on Turkish *Maqam* Music is still hotly disputed. The 24-tone Pythagorean model, christened *Arel-Ezgi-Uzdilek*, has long been suspected to clash with practice [31]; yet, only recently did reliable computer analyses show beyond reasonable doubt that there indeed exists an unremediable discrepancy between that which is professed and that which is executed by musicians [32].

Existence of 32 or more frets per octave on the necks of Turkish *tanburs*, and the affixture on *qanuns* of *mandals*¹ at “equal semitones” (due to the *qanun*-makers’ usage of conventional tuners imported from overseas) followed by the apportionment of the remaining length to the nut into 6, or even 7 equally spaced *mandals* (for the lower courses in particular – to the detriment of octave equivalences) which yields 72 or 84 equal divisions of the octave [33], are further evidence that theory dictates one thing, while practice, wholly another.

The tuning mesh resulting from the fusion of instruments based on incompatible pitch configurations – to say nothing of eclectic quotidian arrangements accomodating guitars and fortepianos – have caused naught but a blurring of intonation and loss of timbre clarity in ensembles of Turkish *Maqam* Music. Meanwhile, arbitrariness exacerbated by the merger of spontaneous triadic harmonies with melody-oriented native settings uncompliant to the international diapason promotes stagnation and hampers endeavours toward serious microtonal polyphony.

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¹ Metallic levers arrayed across the diagonal side of the *qanun* that serve to alter vibrating lengths of the courses on the fly by an amount foreordained at the time of their installation.
This study aims to contribute to the solution of said theoretical and performance issues in *Maqam* Music by propounding a novel 79-tone model both compensating measured Just Intonation intervals (*videlicet*, simple-integer frequency ratios) and suitable for microtonal polyphony via seamless modulation and/or transposition of *maqamat* at every step.

It would be helpful at this point to elaborate the aims of this dissertation.

The main purpose of this work is to pinpoint the relative positions and inflection ranges of problematic *perdes* (tones) in conformance with electroacoustic pitch measurements, and seek out a tuning more compatible with the ubiquitous practice of Turkish *Maqam* Music, since the 24-tone Pythagorean theory in effect is proven herein to fall short of accommodating characteristic middle seconds observed in recordings of master performers.

While alternatives to the widespread *Arel-Ezgi-Uzdilek* System have been proposed in the past, it will be shown in this thesis that practically none of them can be considered a remedy to the prevailing issues abound between theory and practice.

Still, 53 and 72 equal divisions of the octave are two models that require further attention. “53 Holderian commas per octave” methodology is famous in Türkiye as a template comprising the 24-tone Pythagorean tuning by which *perde* inflections are explained today. On the other hand, 72-tone equal temperament instead is applied to *qanuns* as described above. These temperaments embody almost all the intervals that are required of *maqamat*, and would surely alleviate the conflict between written music and actual performance should they be utilized as a whole.

However, 72-tone equal temperament is none other than the sixfold enrichment of “twelve equal steps per octave” methodology of Western Music, and 53-tone equal temperament appears to be a model restricted to calculations on paper. At any rate, it becomes obvious that a high resolution is demanded by performers of Turkish *Maqam* Music.
Therefore, a new tuning that faithfully represents the *maqam* tradition should be devised, and it ought to be nothing less than a 79-tone subset out of 159 equal divisions of the octave. The task in question constitutes the primary goal in this thesis.

Itself a voluminous “xenharmonic well-temperament” satisfactorily approximating a cornucopia of pitch ratios, the 79-tone subset out of 159 equal divisions of the octave has the following advantages:

A- Properly representing on staff the traditional *perdes* of *Maqam* Music at any key.

B- Consistently mapping *maqam* scales, among other things, at every degree.

C- Facilitating the understanding, notation, and execution of heretofore equivocal *perdes*.

D- Allowing the extraction of a cyclic 12-tone subset suitable for chromaticism.

It is physically demonstrated on a Turkish *qanun* designed and manufactured for the present purpose that this 79-tone “xenharmonic well-temperament” conforms admirably with *Maqam* Music practice, and fulfills expectations tremendously regarding the correct and accurate representation of myriad middle seconds peculiar to the genre.

A subsequent purpose of this work is to consistently notate the new 79-tone tuning so as to resolve transposition and polyphony issues in *Maqam* Music. Thus, a complementary Sagittal Notation® has been adapted to the 79-tone tuning and explained in this dissertation. With the employment of only three microtonal accidentals in addition to ordinary sharps and flats, it becomes possible to express subtle nuances of pitch peculiar to the genre. Sagittal Notation® may serve as a gateway to future maqam polyphony, and also the integration of Turkish musicianship with international microtonal music circles.
A further goal resulting from the present approach is the foundation of a 79-tone *maqam* theory based on uniquely categorized choice *maqams* by which the capabilities of the new tuning are demonstrated.

Based on the foregoing discussion, one may henceforth enumerate the methodologies employed throughout in this work.

The author had felt much personal discomfort when he first crosschecked what he had thus far been hearing in Turkish *Maqam* Music with the 24-tone Pythagorean tuning on his computer. Some *maqams* could not be properly expressed with this tuning. Later on, he observed with relief that his discomfort was also felt by others, and that, the theory in effect had grave shortcomings. Not much later, he found out that empirical measurements clearly and quantitatively justified said discomfort.

That was not all; the author’s experience with the tuning of his first *qanun* proved to be equally disappointing. Search in different directions to overcome non-conformance issues in Turkish *Maqam* Music ensued, which particularly lead the author, by exhaustive trial and error, to the discovery of the 79-tone tuning. This trial and error method consisted of partitioning the octave into a minimal number of correctly placed pitches optimized for transposition and polyphony, so that, the outcome encompassed all of the known *maqams* at every step.

The author then proceeded to prove the adequacy of his model by working with a *qanun*-maker on an instrument specifically designed to accommodate the 79-tone tuning. The author had no misgivings when he experimented on his new 79-tone *qanun*. No further reiteration and convergence was needed.

The author nevertheless comparatively checked historical and contemporary alternatives to the theory in effect in order to find possible candidates conforming to pitch measurements. The results, on the whole, turned out to be negative.

Lastly, the author enquired the source of the conflict between theory and practice.
Stated methodologies finally lead to the following structure in this dissertation:

In the following second chapter, it is argued that the reason for the conflict between the 24-tone Pythagorean theory and practice, is seemingly due to the deliberate twisting and misrepresentation of executed intervals of Turkish *Maqam* Music through a feigned refutation of “quarter-tones” which symbolized a spurned trait of Byzantinism/Arabism in the eyes of the modernist elite.

In the third chapter, the critical role of “quarter-tones” in Turkish *Maqam* Music is brought to the reader’s attention through computer analyses of audio recordings of Turkish masters of the genre, and how current theory eschews them is thoroughly examined.

In the fourth chapter, historical and contemporary alternatives to the theory in effect are comparatively analysed in order to demonstrate the insufficiency of even these in meeting the indispensable middle second intervals identified in the previous chapter, although most of them settle neatly into a rather elaborate, if not altogether impracticable, 106 equal divisions to the octave.

The fifth chapter features the generation of a 79-tone tuning extracted practically out of 159 equal divisions of the octave and applied to a customized Turkish *qanun*, that not only closely simulates a plethora of JI intervals and boasts the capacity to favourably express subtle pitch nuances characteristic of *maqamat* at every degree, but also encourages future endeavours in *maqam* polyphony. A Sagittal® microtonal notation is employed to express the 79-tone tuning. Also included here is a draft for a 79-tone *maqam* theory based on choice *maqams* that demonstrates the capabilities of the new tuning.

Chapter six sums up the conclusions reached in this dissertation. The 79-tone tuning is shown to be a most appropriate theoretical and practical device for Turkish *Maqam* Music compared to the current model and its alternatives.
2. CHAPTER: A SYNOPSIS OF CHRONICLES UNDERLYING THE CONTROVERSY BETWEEN THE THEORY AND PRACTICE OF TURKISH MAQAM MUSIC

2.1. Prologue

The core argument of this chapter is based on the author’s assertion that the 24-tone Pythagorean model – which has been elevated to the status of ‘the official theory of Turkish Music’ under the name of Arel-Ezgi-Uzdilek – had, in fact, been devised to acquit the maqam tradition of charges of Byzantinism/Arabism, and propitiate it through the abnegation of “quarter-tones” at the expense of falsifying and distorting practice. In elaborating on this point, a historical recount with apposite quotes and anecdotes from the protagonists shall be given on the following issues:

A- Music Reformation in Türkiye during the final century of the Ottoman Empire and the first decade of the Republic in line with the bicentennial trend of westernization.

B- Restrictions imposed by the new regime against the education and publicity of Turkish Maqam Music in preparation for the “modernization” of Anatolian folk ayres vis-à-vis twelve-tone instruments & forms of Europe.

C- ‘Yekta-Arel-Ezgi’ School’s struggle to counter the Reformation; conception of a music theory ridded of “quarter-tones”; institutionalization, starting from 1976, of ‘Turkish Music Conservatories’, and adoption of the 24-tone Pythagorean model as the undisputed tuning of Turkish Music.
2.2. Music Reformation in Türkiye

By early 19th century, the decline of the Ottoman Empire in the face of advancing European powers sparked a startled reaction among the Turkish literati that amounted to a haughty inquisitiveness for, and consequently, an obsequious awe of Western Civilization which triggered an impetuous surge of liberalist reforms and snobbish imitation of European manners and fashion [34].

Culminating with the 1826 coup [35] which replaced the obsolescent Mehter i [36,37] with an imported brass band christened Mûsikâ-i Hümâyûn ii [38,39], the frenzy of westernization was quick to manifest itself in music as the precarious duality of Fasl-i Atik vs Fasl-i Cedid iii [40-42], which brusquely induced the polarization of Turkish musicianship into two antagonistic camps that persist to this day: Alla Turca iv vs Alla Franca v [43-46].

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i Mehter ("majestic", "most sublime" in Persian), is the name given to the military music ensemble of the Janissary corps. Historically, it was one of the distinguishing regal symbols and a prerequisite for the legitimacy of the Turkish Sultanate. When the Janissaries were overthrown in 1826, so too was Mehterhane ('House of Mehter') shut down. The ensemble was reinstated – while lacking its former glory – in 1911, only to be discarded once more after the foundation of the Republic of Türkiye. It had been reestablished in 1952 though, and fulfills scenic functions since. (See, accompanying endnotes.)

ii 'Royal Military Band', founded in place of Mehter by decree of Sultan Mahmud II for his new army Asâkir-i Mansûre-i Muhammediyye ('Victorious Soldiery of Prophet Muhammed'). Notable among the first commanders of this ensemble are its originator Guiseppe Donizetti Pasha (between 1828-1856) and Callisto Guatelli Pasha (between 1856-1858 and 1868-1899), both of whom were composers of imperial marches for the Sultans. The official entrance into Türkiye of staff notation and 12-tone music education begins with Mûsikâ-i Hümâyûn. (See, accompanying endnotes.)

iii i.e., ‘Old Concert’ vs ‘New Concert’, where traditional music instruments of the court, barring discontinued ones, were used as before in the former, and Western instruments also in the latter. It is not surprising that only those works closest to being performed in major and minor tonalities of Western common-practice music were chosen for Fasl-i Cedid. (See, accompanying endnotes.)

iv i.e., “In the manner of the Muslim Turk”, from a Euro-Christian perspective, initially signifying Mehter music of roughly the past half millennium. Synonymous with Maqam Music in Türkiye since the onset of the Fasl-i Cedid era. The term has been used derogately by reformist Turks to label the tradition. (See, accompanying endnotes.)
The ramifications of this trend were not inconsequential. In an effort to reconcile the aforesaid dichotomy, Haşim Bey 1 [47], under a publication bearing his name dated 1864, analyzed close to eighty maqams, added to the customary definition for each a phrase that solecistically equated them to the major and minor keys of Western common-practice music, and promised to make available scores of semâîs, pêşrevs, and şârks in the future pertaining to the maqams he gave the descriptions for [48-51].

Although, Haşim Bey could not fulfill the promise in his lifetime [51], Notac (Notator) Emin Efendi ii [52] and others after him did; wherefore maqam tones, called perdes, were translated to pitches on the staff, albeit not those of twelve tone equal temperament as was the case with the common usage of European notation by Alla Franca factions, and choice works published on staves soon began to be circulated all around the empire [53-57].

Multi-cultural collaboration prevailed for the time being, until tensions escalated following the Anatolian revolution which transformed the last vestiges of the country into a nation state upon having gained independence in the aftermath of the defeat and subjugation of the Ottoman Empire at the end of World War I [58].

When modernization of Türkiye had been set in motion, an ‘outmoded culture’ appertaining to an ‘antiquated order that nearly brought about total ruin’ was no longer to be sanctioned by the new regime.

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1 *i.e.*, “In the manner of the Frankish giaour”, from a Turco-Muslim perspective, denoting tonal music forms imported from the West since the reign of Sultan Mahmud II. The term has been since employed by the Turkish orthodoxy with disdain and xenophobia, to denounce, in particular, native proponents of westernization of aberrance and ‘betrayal of one’s own kith and kin’. (See, *ibid.*)

ii Müezzinbaşı Hacı Haşim Bey (1815-1868); composer and music theorist; he was one of the last graduates from the Enderun palace academy. (See, accompanying endnote.)

ii Notacı Hacı Emin Efendi (1845-1907); entered Mûsîkâ-i Hûmâyûn after primary school; composer and score publisher after 1875. (See, accompanying endnote.)
Accused of being “Byzantine”\(^1\), and even “Arabic”\(^2\) [59,60], Maqam Music was stigmatized [61] and swiftly uprooted from Dar‘ül-Elhan\(^3\) [62,63] in 1926\(^4\) [64,65].

As an anticipated backlash to this coercion, Alla Turca – Alla Franca strife unfurled instantly [65,66].

A concert attended by Turkish National Leader and President, Gazi\(^5\) Mustafa Kemal, was staged in the Istanbul Sarayburnu Park\(^6\) [67] Casino on 9 August 1928\(^7\), featuring the Arabic diva Munirah al-Mahdiyyah from Egypt, the Eyüp (Maqam) Music Society, and a Jazz Band [68], where he seized the opportunity at the end of the performance to disparage the “somnifacient & base” in favour of the “lively & gay”; stating that the unleashed Turkish spirit, while apathetic for centuries to ‘dull and dismal Eastern singing’, became immediately festive upon hearing the ‘jive of the modern world’ [69, pp. 24-7]:

\(^1\) i.e., “non-Muslim”, or rather, “non-Turkish”, hence, ‘perfidious’ in this context. (See, accompanying endnotes.)

\(^2\) i.e., “reactionary” in this context, with an emphasis on the presumed ‘indolence’ of the Arab race, insinuating the so-called ‘soporiferousness’ of the genre. (See, ibid.)

\(^3\) Dar‘ül-Elhan (‘House of Melodies); established on January 1st, 1917 as the continuation of Dar‘ül-Bedai (‘House of Innovations’, founded 1914), functioning by 1926 as Istanbul Music School, and by 1944, as Istanbul Municipality Conservatory, integrated into Istanbul University in 1986, becoming Istanbul University State Conservatory. (See, accompanying endnotes.)

\(^4\) A ‘Fine Arts Council’ summoned by the Ministry of National Education reached the decision, on December 9th, 1926, to abolish Maqam Music education from the school, leaving behind a small committee charged with the investigation, notation, and categorization of classical and folk répertoire. Notwithstanding, dissident music societies persevered in seclusion during the ensuing hiatus, and continued passing on the tradition to new generations by way of meşk – i.e., vocal and instrumental training depending entirely on oral instruction. (See, accompanying endnotes.)

\(^5\) Ghazi; a veteran Muslim warrior; title given to the Turkish military elite.

\(^6\) Curiously, this was the location where the first life-size statue of Mustafa Kemal was erected on October 3rd, 1926. (See, accompanying endnote.)

\(^7\) It is worth mentioning that the latinization of the Turkish alphabet commenced under Mustafa Kemal’s leadership on the same spot just the previous day. (See, ibid. pp. 73-4.) Arguably, the concert might have been premeditated to justify the ban.
Despite escalating public disgruntlement, not to mention an apparent lack of support from the bourgeoisie, the ruling elite encouraged fully the inception of a national music built upon the amalgamation of contemporaneous norms imported from overseas with ‘indigenous folk melodies’ \(^1\) [70-73] reduced to twelve tones [74], as stressed in the Turkism ideology of Ziyâ Gôkalp, which sanctimoniously declared that Turks must acquire their authentic (\(i.e.,\) unadulterated) culture from the (rural) inhabitants of (Turkicized) Anatolia and their new civilization from the (Industrialized) West [59, pp. 130-1]:

As baffling as it may seem, Gôkalp’s baseless and erroneous views [75] disseminated unhindered among the Republican cadre. As a result, foreign music standards were wholly procured by early 1930s [76].

This fact is also affirmed by Mustafa Kemal in an interview with Emil Ludwig, a German-Jewish reporter for Vössiche Zeitung [69, pp. 32-3]:

And so, in the course of the radical metamorphosis from declining imperial power to westernizing nation state, not only were native music schools and ensembles modelled after their European counterparts [77], but also, young composers were sent abroad to acquire the technical knowledge and skills in harmony, counterpoint, and orchestration desired by the ruling elite [78].

\(^1\) The prevalent opinion among the orthodoxy is that, Folk music (or rather, the manifold of Folk genres) in Türkiye is nothing other than a rustic variety of Turkish *Maqam* Music, since they share similar melodic intervals and motifs. (See, accompanying endnotes.)
One such composer, *Adnan Saygun* ¹ [79,80], draws a rather fanciful parallel between discarding unuttered Arabic letters from the Turkish alphabet and tempering ² traditional *perdes* to twelve (equal) tones that he claims to have acquired from Anatolia [78, p. 23]:

[See, APPENDIX A: Quote A.4]

Another composer, *Cemal Reşit Rey*, declaims likewise in favour of the Music Reformation [81, pp. 46-7]:

[See, APPENDIX A: Quote A.5]

*Saygun*'s and *Rey*'s hubristic pattern of thought finds its roots in the ‘Opening Speech of the Fourth Convening of the Grand National Assembly’ delivered by President *Mustafa Kemal*, where he addressed his audience with the following words [65, p. 48]:

[See, APPENDIX A: Quote A.6]

It comes as little surprise that right after this exhortation, a directive was dispatched by the Ministry of Internal Affairs for the prohibition of *Alla Turca* music broadcasts for a period of two years ³ [82,83], allowing only music composed and performed by musicians educated according to Western techniques [84].

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¹ One of the “Turkish Five” (taking after the “Russian Five”), who were pre-eminent first-generation nationalist Turkish composers; namely, *Cemal Reşit Rey* (1904-1985), *Ahmet Adnan Saygun* (1907-1991), *Ulvi Cemal Erkin* (1906-1972), *Necil Kâzım Akses* (1908-1999) and *Hasan Ferit Alnar* (1906-1978). (See, accompanying endnotes.)

² *i.e.*, ‘averaging (the pitches) via vanishing commatic intervals.’

³ Effective between November 2nd, 1934 – September 6th, 1936, on the pretense that *Alla Turca* music encouraged the consumption of alcoholic beverages. (See, accompanying endnotes.)
This manoeuvre provided ample opportunity for the formation, in Ankara, of a state conservatory \(^1\) [85,86] geared entirely toward the native emulation of the European opera [87,88].

By the same token, a tergiversating traditionalist, the ‘Istanbul Music Union’ director \(^{ii}\) \(\text{Mildan Niyazi Ayomak}\) [89,90], blatantly supported the prohibition of *Alla Turca* in an article entitled “*To Arms, Our Ideal is Being Realized*” with these presumptuous words [87, p. 24]:

[See, APPENDIX A: Quote A.7]

Ayomak’s overconfidence proved to be a blunder. What may come as a surprise, is that, \(\text{Mustafa Kemal Atatürk}\) himself was a patron of traditionalist musicians more than acculturated ones [91,92], and hence, a dilettante of the very music he laboured so zealously to disallow. This is discernable in passages narrated by a young devotee oft-present in his retinue, the reputed folk artist, Sadi Yaver Ataman [93, pp. 20-1]:

[See, APPENDIX A: Quote A.8]

It becomes apparent that Atatürk considered appreciating this ‘wailing music’ a vice at the time, and hence, endeavoured with hardened resolve to deny his nation what he himself could not renounce in his right mind [94]. Though, he too made a considerable effort to abstain, it was to no avail [93, pp. 18-22]:

\[^{i}\] Ankara State Conservatory was institutionalized in 1936, and legalized in 1940. Its precursor was the *Musiki Muallim Mektebi* (‘School of Music Teachers’) founded in Ankara in 1924 as the continuation of *Mûsikâ-i Hümâyûn* that was established by decree of Sultan Mahmud II in place of the disbanded Mehter following the 1826 coup against the Janissaries. (See, accompanying endnotes.)

\[^{ii}\] \(\text{Mildan Niyazi Ayomak}\) (1883-1947); violinist and composer. Ayomak happens to be one of the eccentric figures in the *Alla Turca – Alla Franca* strife, and among the first advocates, in Türkiye, of the ‘9 commas per whole tone; 53 equidistant tones per octave’ methodology in order to explain the subtle pitch nuances of *maqamat*. (See, accompanying endnote.)
Alas, Atatürk’s confessed admiration of the genre and frustration at making himself understood toward the end did not deter in the least those faithful to his legacy to cease their relentless persecution of the venerable Maqam Music heritage.

For instance, Ankara State Conservatory’s response – given upon the consultation by the Ministry of National Education – to the resolution, dated 1951, of the board of instructors of Istanbul Municipality Conservatory specializing in both Alla Turca and Alla Franca music, requesting the annulment, on its 25th anniversary, of the decision proscribing the education of Turkish Maqam Music instruments, was severe indeed [95, pp. 106-7]:

This awkward situation lasted until the opening, under more propitious political circumstances, of a ‘Turkish Music State Conservatory’ \textsuperscript{1} [96] in Istanbul another twenty five years later [97] despite the fact that a dissident theory class on Turkish Maqam Music had already been started in Istanbul Municipality Conservatory by 1943 [98] thanks to the dedicated efforts and tutorage of its newly appointed director at that time, \textit{Hüseyin Sadettin Arel} \textsuperscript{ii} [99-101].

\textsuperscript{1} Founded under the Ministry of National Education on March 3rd, 1976. Functioning under the Ministry of Culture by August 17th, 1978, incorporated as a high education institute into Istanbul Technical University on June 20th, 1982, becoming Istanbul Technical University State Conservatory. It is the leading institution in the country on the education of Turkish Maqam Music (See, accompanying endnote.)

\textsuperscript{ii} \textit{Hüseyin Sadettin Arel} (1880-1955); lawyer, writer, composer, music theorist, and musicologist. Son of a senior Ottoman official, he was a prolific and innovative Turkish intellectual. He is regarded by his disciples as the ‘founding father’ of the theory in effect on Turkish Maqam Music. (See, accompanying endnotes.)
In the meantime, Music Reformation years witnessed the “new art for the new society”\(^1\) flop, and the masses regress to familiar ayres from Arabic broadcasts and films rather than be subjected to the censored programmes of Turkish radios which were abjectly disfavoured among the populace\(^{106,107}\); a phenomenon that accounts for the megalopolitan emergence – owing to the unorganized industrialization, rampant emigration, and squalid urbanization of Türkiye during 1960s and 70s – of the highly controversial pop genre known as *Arabesque*\(^{108}\).

Presumably, under such impending danger of ‘Arabization’ would the heterodox model promoted by Sadettin Arel, Suphi Ezgi\(^{109,110}\) and Salih Murat Uzdilek\(^{111,112}\) make its way into segregate conservatories as the ‘genuine theory of Turkish Music’.

### 2.3. Rise of the ‘Yekta-Arel-Ezgi School’

*Rauf Yekta*\(^iv\)\(^{113}\), author of the 24-tone Pythagorean tuning and theory that was to inspire *Ezgi* and *Arel*\(^{114}\), was, by all indications, a staunch defender of the subtle nuances of pitch in Turkish *Maqam* Music against the ‘corrupting influence of 12-tone equal temperament’ infiltrating Türkiye since the reign of Sultan Mahmud II.

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\(^1\) A slogan coined by Atatürk in 1934 during one of his Çankaya dinner receptions featuring Saygın’s improvisational piano recital, signifying the zeal wherewith Turkish ears should be cleansed of the Arabic-Persic lexicon and turned to pentatonic folk themes rendered in twelve equal tones. (See, accompanying endnotes.)

\(^{iv}\) *Suphi Zühdü Ezgi* (1869-1962); army doctor, violinist, tanburist, composer, and music theorist. He was instrumental in systematizing the *Arel-Ezgi-Uzdilek* theory in his colossal treatise: *Theoretical and Practical Turkish Music*. (See, accompanying endnotes.)

\(^{iv}\) *Salih Murad Uzdilek* (1891-1967); naval man, electrical engineer, mathematician, and physicist. Together with *Arel* and *Ezgi*, he helped revamp *Rauf Yekta*’s 24-tone tuning by undertaking the pitch calculations. (See, accompanying endnotes.)

\(^{iv}\) *Mehmet Rauf Yekta* (1871-1935); bureaucrat, tanburist, neyzenbaşı, composer, music theorist, and premier Turkish musicologist. He began to conceive, by assistance from the famous Ottoman-Turkish mathematician *Salih Zeki Bey*, the original 24-tone system (*ca.1910*) on Turkish *Maqam* Music that the *Arel-Ezgi-Uzdilek* theory was modelled after. (See, accompanying endnote.)

At first, he considered it prudent to try to reason with the official ideology and convince the Republican intelligentsia that the genre was the sophisticated complement of folk music and just as national [115].

Being as political as possible, he confronted Gökalp’s “fallacious views” on national music policy in a series of journal articles dated 1925, and accused uninformed “occidentalist salon fops” of badly influencing Gökalp on this matter [116, pp. 64-8]:

[See, APPENDIX A: Quote A.11]

Unfortunately, Yekta’s tactic backfired. A year later, Maqam Music education was completely abolished from his school while he was away on an expedition as part of a musicological mission to collect and record folk ayres from Anatolia [117]; wherewith he exclaimed [94, p. 18]:

[See, APPENDIX A: Quote A.12]

To which a quick and poignant response [94, pp. 20-1] was delivered by Osman Zeki Üngör in defense of the prevailing Music Reformation [118,119]:

[See, APPENDIX A: Quote A.13]

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1 Osman Zeki Üngör (1880-1958); violinist and concertmeister of Mûsîkî-i Hümâyûn, conductor, with the rank of major, of the (same) ‘Palace Orchestra’ during the reign of Sultan Abdulhamid II, and of the ‘Presidency Symphony Orchestra’ after the declaration of the Republic of Türkiye. He was the founder and director of Mûsiki Muallîm Mektebi (‘School of Music Teachers’), and composer of the second official and current Turkish “Independence March” since 1930. (See, accompanying endnotes.)
Nonplussed and unable to effect change, Yekta could do little better than accept the position assigned to him at Dar’ül-Elhan’s “Asar’ül-Eslaf Tasnif Heyeti / Türk Musikisi Tasnif ve Tespit Heyeti” following his dismissal – contrary to his expectations to be appointed director – from his ‘emendated’ school, a position that he would keep for nine more years until his death.

In the meantime, he did not remain in abeyance while Turkish Maqam Music plummeted into an abyss of scurrilous derision. Unswayed, Yekta kept instructing friends and pupils on his theory (among whom were Ezgi and Ataman previously mentioned) and pioneered in the founding of ‘Turkish Music Federation’ for the purpose of organizing amateur ensembles, as well as encouraging record shops to resist – although, proving to be in vain – against the state-sponsored onset, in hopes that the realpolitik would let Alla Turca and Alla Franca coexist side by side. He also attended the ‘Cairo Music Congress’ in 1932 to persuade Arabs to opt for his views; although, much to his chagrin, they did not.

After the cancellation, in 1934, of Alla Turca on air to pave the way for a national opera, it became incontestable that Maqam Music was unconforming to the subversive agendas of the young Republic, leaving a weary, despondent, and sullen Yekta to resign a year later his worldly struggles on 9 January 1935.

---

1 ‘Committee for the Classification and Evaluation of Works of the Predecessors in Turkish Music’. Headed by Rauf Yekta, this committee, however exiguous, housed important figures such as Hâfiz Ahmet Irsoy, İsmâil Hakkı Bey, Ali Rıfat Çağatay (upon Hakkı Bey’s death in 1927), and later, Suphi Ezgi (by 1932, upon Arel’s recommendation in response to Muhittin Üstündağ’s complaint on the committee’s inefficiency), and was instrumental in rescuing from oblivion innumerable classical compositions of Turkish Maqam Music during the Music Reformation years. (See, accompanying endnote.)

2 It is understood that, Yekta gained the rudiments on maqam theory – which would later lead to his systematization of the 24-tone tuning – from the Sheiks of Bahariye, Galata and Yenikapı Mevlevihanes: Hüseyin Fahrettin Dede Efendi, Ataullah Dede Efendi, and Celâlettin Dede Efendi respectively, who, we are told, were themselves excelling musicians of Turkish Maqam Music. (See, accompanying endnote.)
When nationwide fiascos resulting from the slipshod staging of the first array of epic operas [128,129] by the “Turkish Five” \(^{i}\) [130-133] necessitated the invitation of experienced foreigners such as Paul Hindemith, Ernst Praetorius, Max Reinhardt, and Carl Ebert at the behest of the Republican intelligentsia to enhance music schools and theatres in the country to the level of their avant-garde siblings in Germany and Austria [134-136], Yekta’s chief successors, Ezgi and Arel, laboured extensively during this opportune interim to salvage the battered maqam tradition, and, with the assistance of Uzdilek, reformulated (to refrain from saying ‘plagiarized’) Yekta’s tuning – by shifting pitches a tone higher \(^{ii}\) and choosing a new set of symbols for accidented notes – to arrive at the ‘national theory of Turkish Music’ in use today known as the Arel-Ezgi-Uzdilek (AEU) System [137-139].

Arel’s nomination as director to Istanbul Conservatory (Dar’ül-Elhan) for a five-year term with special privileges in 1943 marked the turn of the tide in favour of Turkish Maqam Music [140-142].

As much a patriotic adherent of the genre as a lover of Western polyphony [143-145], Arel’s first act as fresh executive and catalyst was to immediately commence lessons on the blooming AEU theory and authorize the permanent accommodation of a body of traditionalist musicians whose duty was to perform hundreds of classical works now being converted from Yekta’s scoring to – as well as new ones being churned out daily in conformity with – the AEU template [146,147].

---

\(^{i}\) Save, Cemal Reşit Rey’s revues and operettas, commissioned by Governor Muhittin Üstündağ in 1932 to entertain the beau monde of Istanbul, which became as much an issue of morality for the ‘Music Commission’ assembled in Ankara on November 26th, 1934, as the restrictive measures pronounced against Alla Turca record sales following the expulsion of the genre from Turkish radios. (See, accompanying endnotes.)

\(^{ii}\) That is to say: ‘moving – in reference to the prime – the pitch ratios of the original tuning up by a major tone (along with their perde/note epithets) and reducing the overflowing pitches into the range of an octave.’
Although, he could not succeed in rescinding the official ban on the education of Maqam Music instruments, Arel nevertheless managed to apply his personal connections to link the administration of his school to the city’s mayoralty as a safeguard for his operations [62].

At the same time, he endorsed – apparently more in order to appease, and even, oblige music reformists than to satisfy his private passion for Western polyphony – the foundation of ‘Turkish Philharmonic Association’ and ‘Istanbul Metropolitan Orchestra’ [148,149].

Notwithstanding objections to the theory by conservative factions and purists, Arel-Ezgi-Uzdilek triumvirate secured a rigid foothold in the renovated Municipality Conservatory, and proceeded to spread their teachings within the academia [150,151].

Through their combined efforts, the AEU System gathered a strong following and overshadowed even rival models proposed by Ekrem Karadeniz [152,153] and Gültekin Oransay [154-156].

At the end of his term as director of Istanbul Municipality Conservatory (that reverted anon to its phlegmatic stance toward the heritage), Arel founded the ‘Advanced Turkish Music State Conservatory Association’ which became the precursor to the first ‘Turkish Music State Conservatory’ launched by his disciples in 1976 [157,158].

When Arel died in 1955, he left behind a remarkable legacy, a repository of innovations, and a mission which came to fruition two decades later.

---

1 Mehmet Ekrem Karadeniz (1904-1981); qanunist and music theorist. He wrote his notorious treatise based on a 41-tone tuning by influence of his peer Abdulkadir Töre (d. 1946) whom he met in 1930. Hence, the tuning and theory is known as the “Töre-Karadeniz System”. Owing to the author’s impeding blindness, the work could only be completed in 1965. (See, accompanying endnotes.)

ii Gültekin Oransay (1930-1989); historian, philologist, music theorist and musicologist. Whilst studying his doctorate on musicology in the Faculty of Philosophy in Munich University, he proposed a little known 29-tone tuning on Turkish Maqam Music in an article dated 1959 and published in the tenth issue of the German musicology journal “Die Musikforschung”. (See, accompanying endnotes.)
On 3 March 1976 – that fateful year designating the *quinquagesimal* anniversary of the ban – an *Alla Turca* conservatory, a forerunner to ‘Turkish Music Conservatories’ to come, incorporating departments that also embraced folk music and dance, was granted leave under the auspices of the Turkish government for the first time since 1926 [96].

It was not long before this conjuncture led to the establishment of similar conservatories across the country which were eager to reclaim the forsaken heritage in retaliation against *Alla Franca* conservatories and their unquestioning veneration of twelve-tone music from overseas for the past half century.

The forthwith acceptance by these renegade schools of *AEU* as core curriculum rent asunder and continues to eviscerate any semblance of unity in national music education in Türkiye i [159].

An interview between Süleyman Cevad and Rauf Yekta in 1922 sheds further light on this dichotomy in Turkish Music [147, pp. 180-7]:

[See, APPENDIX A: Quote A.14]

Yekta’s postulates were carried one step further *post eius mortem* in the indomitable rhetoric of Sadettin Arel [17, pp. 1-2 ... 9-11]:

[See, APPENDIX A: Quote A.15]

In like manner, Suphi Ezgi, in the mundane absence of his peer, demurely states [160, pp. 185-7]:

[See, APPENDIX A: Quote A.16]

---

1 In the wake of the 1980 military coup, all conservatories in the country were, without exception, joined with state universities, effectively making the cultural dichotomy official. (See, accompanying endnotes.)
It follows that the rise and unprecedented triumph of what may be termed the ‘Yekta-Arel-Ezgi School’ is founded upon three counterarguments, opposed to the precepts, in the field of music, of the official Turkism ideology:

1. That, *Maqam* Music practiced in Türkiye is a national entity conceived by scholars and practitioners of pure Turkic lineage since about a thousand years ago, and therefore, embraces the indigenous pastoral styles of Anatolia (whose harmonization through twelve equal tones was promoted by the regime);

2. That, the genre does not sport cumulative “quarter-tones” \(^i\) [161,162] which would implicate it as being the offshoot of Byzantine Music; but instead, is based on “melodic intervals” distinguished by commatic differences misconstrued in the eyes of Westerners (and Westernists) as the division of the whole tone into four equal parts;

3. That, these subtle nuances of pitch not only are indispensable features of *maqamat*, but also are essential regarding native endeavours, if any, in harmony and polyphony.

### 2.4. Ethnocentric Revisionism as Source of Conflict

In brief, a chronological survey of the causes behind the cultural fracture in Turkish Music will reveal the following facts:

A- Intensification of chauvanistic sentiments throughout Balkan and Arab provinces during the final century of the Ottoman Empire instigated a ‘solidarist Turkish identity’ to surface athwart Thrace and Asia Minor [163].

---

\(^i\) As may be observed in the ‘enharmonic tetrachordal genera’ of the Ancient world. (See, accompanying endnotes.)
B- Concurrent recognition among Jacobin Turks of the ascendancy of Western Civilization \([164]\) likewise inflamed a ‘cultural inferiority complex’ that conduced an inexorable obsession with occidentalist mimicry, particularly in regards to music-making, which persists to this day.

C- Together, these phenomena fuelled the ethnocentrist idiosyncracy that drove Yekta, Arel, and Ezgi to attribute a millennium of progress in music under Islam and Ottoman rule to the ‘Turkishness’ alone of its arch-theorists and practitioners.

D- In spite of this vaunting revisionism, the official ideology condemned “Oriental music” as “Byzantine” and “Arabic”, hence, “diseased” due to the presumed existence of “quarter-tones” \(^1\) \([165-167]\) that supposedly impeded the development of harmony.

E- As an outcome of Gökalp’s spurious conjectures, the new regime initiated, between 1926-1936, the methodical substitution of Alla Turca music by the mimesis of Western common-practice forms tinged with newfangled notions of pentatonism thought to be reminiscent of the nomadic origins of pre-Islamic Turks.

F- In rebuttal, Yekta promoted the idea that there were no “quarter-tones” in authentic Turkish Music, and that the maqam tradition was inseperable from and just as national as Anatolian folk ayres being harvested for harmonization by the regime.

---

\(^1\) As if to drive the point home, Arabic Maqam Music adopted, despite Yekta’s protests, the Lebanese polemicist Mikha’il Mushaqah’s \((1800-1889)\) quasi-equal 24-tone tuning after the ‘Cairo Music Congress’ of 1932. (See, accompanying endnotes.)
G- Having failed – malgré his acknowledgement of the benefits of merging European techniques with tradition – to swerve the impervious Republican intelligentsia, Yekta departed this life with the one consolation of having bequeathed his teachings to his acolytes Arel and Ezgi, who, upon the participation of Uzdilek, took advantage of the remission in Music Reformation due to Atatürk’s death to launch a fresh campaign in defense of the heritage.

H- A combination of momentous occurrences toward the end of World War II ¹ [168] provided the awaited opening for the inauguration of the refurbished 24-tone (AEU) theory that began to flourish under Arel’s directorship of Istanbul Municipality Conservatory between 1943-1948.

I- In as much as sociopolitical turmoils throughout the course of unhealthy urbanization under extensive migrations from Northern and Eastern Anatolia amplified the popularity of Arabesque among ‘slum-dwellers and the impoverished’, apprehension of cultural degeneracy spread in tandem, and along came government support in 1976, for the institutionalization of the first and leading ‘Turkish Music State Conservatory’ erected upon the AEU template.

J- Proliferation, thanks to this outlet, of similar schools opposed to twelve-tone music education proffered by Alla Franca conservatories under the pretext of modernity, affirmed and continues to guarantee the predominance of AEU as the ‘national theory of Turkish Music’.

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¹ Namely, a change in Türkiye’s “Fabian” policies, her last-minute fealty to The Allies and entry into the UN, materialization of the Stalinist threat, McCarthyism, multipartyism, and “democratization” of the Republic which hurled the country to right-wing – left-wing struggles. (See, accompanying endnote.)
The abrupt transfiguration of the *maqam* tradition from an heterogeneous Near Eastern art, associated mainly with the *Saray* and circumjacent *Sufi* convents, to a national icon owes to the safeguarding reflex poised against the pertinacious rejection, by the official Turkism ideology, of all the vanity and pomp that once was Ottoman.

The severely harsh and oppressive conditions between 1926-36, during which time Turkish *Maqam* Music had to persevere, provides an initial clue as to how the theory in effect could have been ‘tailored’.

*Yekta, Arel,* and *Ezgi* appear to be excessively concerned with the removal of all textual references to the infamous Byzantine “quarter-tones” in Turkish Music, which could incriminate the genre as extraneous, and legitimize bureaucratic imputation in the new political order – so much so that they seem to have condoned alienating theory to practice in an effort to save the genre from desuetude.

‘*Yekta-Arel-Ezgi* School’s overall strategy becomes very much transparent at this juncture: To rescue the venerable tradition from the asperity of the westernizing regime, and redeem it as an inextricable component of the maiden nationalization project.

The end result of the trade-off was as much a denaturalization of *maqamat* [169,170] as was the uncouth ‘quarter-tonal framework’ adopted by Arabs and wrongfully associated with Byzantine by Gökalp [171].

Ironically, the Arabic quarter settled on the same number of tones as the ‘*Yekta-Arel-Ezgi* School’, albeit ‘equal-tempered’; which could not in the least have facilitated the mission of Turkish theorists in the fatherland.

Twisting theory to conform to the borderlines of the regime seems to have been a price dearly, if not grudgingly, paid, and a compromise that barely sufficed in reaching its goal.
3. CHAPTER: ELECTROACOUSTICALLY CAPTURED “QUARTER-TONES” CONTRADICT THEORY IN EFFECT

3.1. Prologue

Inconsistencies between theory in effect and practice in Turkish Maqam Music have been irrefutably shown through groundbreaking research carried out by mathematicians Can Akkoç [172] and Mustafa Kemal Karaosmanoğlu [173, 174].

This research confirmed suspicions that the ‘melodic intervals’ most characteristic of the genre are expressible by such epimoric ratios i as 12:11 ii, 13:12 iii, and 14:13 iv – which appear in the earliest Islamic sources on Maqam Music theory under the denomination “mujannab-i sebbabe” (anterior finger position on the ud) [177-180].

These intervals are undoubtedly the “quarter-tones” branded by Gökalp and the new political order of Türkiye that the 24-tone Pythagorean theory is in pains to obfuscate.

Seeing as the 24-tone Pythagorean theory was spawned to ingratiate the Republican regime, and since it is observed to conflict with performance due most likely to that very reason, the validity of the current model is now in question.

---

i  i.e., superparticular numbers expressed as (n+1)/ n. (See, accompanying endnote.)

ii  Interval between the 11th and 12th harmonics; “Unidecimal neutral second”, 150.637 ¢. (See, ibid.)

iii  Interval between the 12th and 13th harmonics, “Tridecimal 2/3 tone”, 138.573 ¢. (See, ibid.)

iv  Interval between the 13th and 14th harmonics; “2/3 tone”, 128.298 ¢. (See, ibid.)
This chapter highlights the intrepid practice of 2/3 and 3/4 tones in the recordings of masters of Turkish Maqam Music, and demonstrates the inadequacy of the 24-tone Pythagorean model in compensating all executed intervals.

Ultimately, *ad hoc* computer analyses bear out that florid microtonal shades peculiar to the genre are wholly encompassed by neither the ideologically motivated 24-tone Pythagorean model, which is scrutinized further down, nor vestigial contenders offered as alternative, as shall be affirmed in the next chapter.

3.2. Empirical Measurement of Played Intervals

Recent studies pioneered by mathematicians Akkoç and Karaosmanoğlu have verified that traditional *perde* are strikingly elusive “pitch-clusters” at odds with the theory in effect; and that, the problematic relative frequency range is the “quarter-tonal” region historically referred to as “*mujannab-i sebbabe*”.

While it is beyond the scope of this thesis to document extensive proof that the pitch continuum popularly dubbed the “*mujannab zone*” \(^1\) [181-184] is what apparently renders Maqam Music its unique texture, the latterly illustration of the current model as a 24-tone subset of 53 equal divisions of the octave [185-188], efforts to cover up vagrant pitches via glissandi & portamenti [189], and the illicit, yet occasional allowance to overstep by commas the boundaries of this cast depending on the *maqam* [190,191], are indications enough that several seemingly anchored *perde* are in fact quite flexible [192,193], and that Turkish music theory can no longer shelve to account for clustering microtonal savours [194-196] supersaturated with harmonically complex intervals of varying hues.

\(^1\) A term coined by Yalçın Tura and given as a continuum of intervals comprising 14:13, 13:12, and 12:11, all of which he associates with “*eclysis*” and “*spondiasme*” that are attributed to Aristides Quintilianus. (See, accompanying endnotes.)
The histogram presented in Figure 3.1 displaying the periodicity (y-axis) of each sound frequency (x-axis) demonstrates such “pitch-clusters” detected in an Üşşak taksim (instrumental improvisation in the given maqam) by a venerable Turkish Neyzen – Niyazi Sayın [32]:

![Figure 3.1: Histogram of Niyazi Sayın's Üşşak Ney Taksim](image)

Immediately conspicuous in this figure is the revelation of stalactical formations whose peaks and means are projected in Table 3.1:

<table>
<thead>
<tr>
<th>Perde</th>
<th>Peak Value</th>
<th>Average of ± 35.3 cents-wide Band</th>
</tr>
</thead>
<tbody>
<tr>
<td>Düğah</td>
<td>452.11 cps</td>
<td>452.626 cps</td>
</tr>
<tr>
<td>Segâh</td>
<td>483.72 cps</td>
<td>486.085 cps</td>
</tr>
<tr>
<td>Çargâh</td>
<td>526.89 cps</td>
<td>526.154 cps</td>
</tr>
<tr>
<td>Nevâ</td>
<td>599.32 cps</td>
<td>600.173 cps</td>
</tr>
</tbody>
</table>

Table 3.1: Pitch Data from Niyazi Sayın's Üşşak Ney Taksim

---

[1] Graphical output produced by “İcraAnalizi©”, courtesy of M. Kemal Karaosmanoğlu; a computer wave-file pitch analysis tool programmed by Karaosmanoğlu. The x-axis shows the frequency and y-axis the total time-length in centiseconds of pitches occurring throughout the audio recording of the performance.
The average of the boundaries whose widths equal one degree of 17-tone equal temperament i are then wielded to arrive at proximate ratios via the utility shown in Figure 3.2:

![Figure 3.2: Interval Measurements by “Aralık Ölçer”](image)

A criterion chosen by Karaosmanoğlu & Akkoç to facilitate the exhumation from within performance of 17 historical perdes of Maqam Music – to be detailed in the next chapter.

Graphical display of “Aralık Ölçer”, courtesy of M. Kemal Karaosmanoğlu; a musical interval database, calculation, and conversion utility programmed by Karaosmanoğlu. The first column shows prime factors from the numerators of the second column, and the fourth column shows prime factors from the denominators of the third column. Primes are constrained by the numerical entry far down left, which effectively defines the n-limit of the output. The fifth column displays errors in cents of possible ratios of relatively increasing complexity in each corresponding row compared to the value entered, in unit cents or as a relative frequency number, into the tabs with the calculator icons. Adorning the right and left therewith are results in other intervallic units. Underneath these are provided the nearest and second nearest intervals from the database. The topmost horizontal bar with the incremental slide indicates the location of the input on an open vibrating string of a length that may be specified in any geometric unit in the box to the far right. Another important function of the program is its integration with “İçraAnalizi”.

---

1. A criterion chosen by Karaosmanoğlu & Akkoç to facilitate the exhumation from within performance of 17 historical perdes of Maqam Music – to be detailed in the next chapter.

2. Graphical display of “Aralık Ölçer”, courtesy of M. Kemal Karaosmanoğlu; a musical interval database, calculation, and conversion utility programmed by Karaosmanoğlu. The first column shows prime factors from the numerators of the second column, and the fourth column shows prime factors from the denominators of the third column. Primes are constrained by the numerical entry far down left, which effectively defines the n-limit of the output. The fifth column displays errors in cents of possible ratios of relatively increasing complexity in each corresponding row compared to the value entered, in unit cents or as a relative frequency number, into the tabs with the calculator icons. Adorning the right and left therewith are results in other intervallic units. Underneath these are provided the nearest and second nearest intervals from the database. The topmost horizontal bar with the incremental slide indicates the location of the input on an open vibrating string of a length that may be specified in any geometric unit in the box to the far right. Another important function of the program is its integration with “İçraAnalizi”.
With the aid of this versatile utility, the following Just intervals in Table 3.2 are found to occur the most in the solo *ney* performance of Niyazi Sayın:

**Table 3.2: Pivotal Intervals in Niyazi Sayın’s Uşşak Ney Taksim**

<table>
<thead>
<tr>
<th>Frequency (Hertz)</th>
<th>Interval with neighbouring perde</th>
<th>Near Ratio &amp; Cent Value</th>
<th>Error (¢)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dügâh 452.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segâh 486.09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Çargâh 526.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nevâ 600.17</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Crucial here is the affirmation that none of these intervals are properly represented in the current model, as may be seen in Figure 3.3 below:

**Figure 3.3: Comparison of Pivotal Intervals from Niyazi Sayın’s Uşşak Ney Taksim with the Arel-Ezgi-Uzdilek Model**

1 i.e., degrees of 53-tone equal divisions of the octave, hence “Holderian commas”. (See, ibid.)
The proof that this is not an isolated case is supplied by Karl Signell in his evaluation of unconventional *Maqam* Music *perdes* as executed by Necdet Yaşar – an honoured Turkish tanbur virtuoso [198]; wherewith, data unconforming to theory in effect and grouped under “diminished small whole tone” are expressed in familiar fractions by Akkoç & Karaosmanoğlu as shown in Table 3.3 [32]:

Table 3.3: Signell-Akkoç-Karaosmanoğlu Analysis of Necdet Yaşar’s Special Tanbur Intervals

<table>
<thead>
<tr>
<th>Perde-1</th>
<th>Perde-2</th>
<th>Measured Interval</th>
<th>Ratio</th>
<th>Cents</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>hüseynî aşîrân</td>
<td>nîm-tvâk</td>
<td>148 ¢</td>
<td>12:11</td>
<td>150.64</td>
<td>-2.64</td>
</tr>
<tr>
<td>düğâh</td>
<td>uşşak</td>
<td>145 ¢</td>
<td>12:11</td>
<td>150.64</td>
<td>-5.64</td>
</tr>
<tr>
<td>çargâh</td>
<td>sabâ</td>
<td>143 ¢</td>
<td>13:12</td>
<td>138.57</td>
<td>4.43</td>
</tr>
<tr>
<td>nevâ</td>
<td>hîzzam</td>
<td>143 ¢</td>
<td>“ “</td>
<td>“ “</td>
<td>“ “</td>
</tr>
<tr>
<td>hüseynî</td>
<td>nîm-evîç</td>
<td>133 ¢</td>
<td>14:13</td>
<td>128.30</td>
<td>4.70</td>
</tr>
<tr>
<td>gerdaniye</td>
<td>dikçe şehnâz</td>
<td>133 ¢</td>
<td>“ “</td>
<td>“ “</td>
<td>“ “</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td><strong>141 ¢</strong></td>
<td><strong>13:12</strong></td>
<td>138.57</td>
<td>2.43</td>
</tr>
</tbody>
</table>

In addition to the simple-integer ratios specified in the table, it is also likely that Yaşar may have intended to sound 27:25 i, 88:81 ii, 162:149 iii, and 49:45 iv [176, 199-200] along the mujannab continuum.

Whatsoever the minute subtleties of this middle second range might be, it has been sufficiently corroborated at this stage that there indeed exists an apodictic discrepancy between theory and its application by professional executants of Turkish *Maqam* Music.

The results entail a thorough criticism of the 24-tone Pythagorean model to be undertaken in the next section.

---

i Interval of “Great-limma”, 133.237 ¢. (See, accompanying endnote.)

ii Interval of “2nd unidecimal neutral second”, 143.498 ¢. (See, concomitant endnotes.)

iii Interval of “Persian neutral second”, 144.818 ¢. (See, concomitant endnotes.)

iv Interval of “Bohlen-Pierce minor semitone”, 147.428 ¢. (See, concomitant endnotes.)
3.3. Debunking the 24-tone Pythagorean Model

The Arel-Ezgi-Uzdilek (AEU) System, with which traditional perdes of Turkish Maqam Music are explained today, is enclosed in Table 3.4 [201,202]:

Table 3.4: Arel-Ezgi-Uzdilek System

<table>
<thead>
<tr>
<th>Pitch</th>
<th>Frequency Ratios</th>
<th>Cents</th>
<th>Classic Interval Names</th>
<th>I. Octave Perdes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>1/1</td>
<td>0.000</td>
<td>(tone of origin – perfect prime)</td>
<td>KABA ÇÂRGÂH</td>
</tr>
<tr>
<td>1:</td>
<td>256/243</td>
<td>90.225</td>
<td>limma, Pythagorean minor 2nd</td>
<td>Kaba Nîm Hicâz</td>
</tr>
<tr>
<td>2:</td>
<td>2187/2048</td>
<td>113.685</td>
<td>apotome</td>
<td>Kaba Hicâz</td>
</tr>
<tr>
<td>3:</td>
<td>65536/59049</td>
<td>180.450</td>
<td>Pythagorean diminished 3rd</td>
<td>Kaba Dik Hicâz</td>
</tr>
<tr>
<td>4:</td>
<td>9/8</td>
<td>203.910</td>
<td>major whole tone</td>
<td>YEGÂH</td>
</tr>
<tr>
<td>5:</td>
<td>32/27</td>
<td>294.135</td>
<td>Pythagorean minor 3rd</td>
<td>Kaba Nîm Hisâr</td>
</tr>
<tr>
<td>6:</td>
<td>19683/16384</td>
<td>317.595</td>
<td>Pythagorean augmented 2nd</td>
<td>Kaba Hisâr</td>
</tr>
<tr>
<td>7:</td>
<td>8192/6561</td>
<td>384.360</td>
<td>Pythagorean diminished 4th</td>
<td>Kaba Dik Hisâr</td>
</tr>
<tr>
<td>8:</td>
<td>81/64</td>
<td>407.820</td>
<td>Pythagorean major 3rd</td>
<td>HÜSEYNİ AŞİRÂN</td>
</tr>
<tr>
<td>9:</td>
<td>4/3</td>
<td>498.045</td>
<td>perfect 4th</td>
<td>ACEM AŞİRÂN</td>
</tr>
<tr>
<td>10:</td>
<td>177147/131072</td>
<td>521.505</td>
<td>Pythagorean augmented 3rd</td>
<td>Dik Acem Aşîrân</td>
</tr>
<tr>
<td>11:</td>
<td>1024/729</td>
<td>588.270</td>
<td>Pythagorean diminished 5th</td>
<td>Irak</td>
</tr>
<tr>
<td>12:</td>
<td>729/512</td>
<td>611.730</td>
<td>Pythagorean tritone</td>
<td>Geveşt</td>
</tr>
<tr>
<td>13:</td>
<td>262144/177147</td>
<td>678.495</td>
<td>Pythagorean diminished 6th</td>
<td>Dik Geveşt</td>
</tr>
<tr>
<td>14:</td>
<td>3/2</td>
<td>701.955</td>
<td>perfect 5th</td>
<td>RÂST</td>
</tr>
<tr>
<td>15:</td>
<td>128/81</td>
<td>792.180</td>
<td>Pythagorean minor 6th</td>
<td>Nim Zirgûle</td>
</tr>
<tr>
<td>16:</td>
<td>6561/4096</td>
<td>815.640</td>
<td>Pythagorean augmented 5th</td>
<td>Zirgûle</td>
</tr>
<tr>
<td>17:</td>
<td>32768/19683</td>
<td>882.405</td>
<td>Pythagorean diminished 7th</td>
<td>Dik Zirgûle</td>
</tr>
<tr>
<td>18:</td>
<td>27/16</td>
<td>905.865</td>
<td>Pythagorean major 6th</td>
<td>DÜGÂH</td>
</tr>
<tr>
<td>19:</td>
<td>16/9</td>
<td>996.090</td>
<td>Pythagorean minor 7th</td>
<td>Kürdî</td>
</tr>
<tr>
<td>20:</td>
<td>59049/32768</td>
<td>1019.550</td>
<td>Pythagorean augmented 6th</td>
<td>Dik Kürdî</td>
</tr>
<tr>
<td>21:</td>
<td>4096/2187</td>
<td>1086.315</td>
<td>Pythagorean diminished 8th</td>
<td>Segâh</td>
</tr>
<tr>
<td>22:</td>
<td>243/128</td>
<td>1109.775</td>
<td>Pythagorean major 7th</td>
<td>BÜSELİK</td>
</tr>
<tr>
<td>23:</td>
<td>1048576/531441</td>
<td>1176.540</td>
<td>Pythagorean diminished 9th</td>
<td>Dik Bûselik</td>
</tr>
<tr>
<td>24:</td>
<td>2/1</td>
<td>1200.000</td>
<td>octave</td>
<td>ÇÂRGÂH</td>
</tr>
<tr>
<td>Pitch</td>
<td>Frequency Ratios</td>
<td>Cents</td>
<td>Classic Interval Names</td>
<td>II. Octave Perdes</td>
</tr>
<tr>
<td>-------</td>
<td>------------------</td>
<td>-------</td>
<td>------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>24:</td>
<td>2/1</td>
<td>1200.000</td>
<td>octave</td>
<td>ÇÂRGÂH</td>
</tr>
<tr>
<td>25:</td>
<td>512/243</td>
<td>1290.225</td>
<td>Pythagorean minor 9th</td>
<td>Nîm Hicâz</td>
</tr>
<tr>
<td>26:</td>
<td>2187/1024</td>
<td>1313.685</td>
<td>apotome + octave</td>
<td>Hicâz</td>
</tr>
<tr>
<td>27:</td>
<td>131072/59049</td>
<td>1380.450</td>
<td>Pythagorean diminished 10th</td>
<td>Dîk Hicâz</td>
</tr>
<tr>
<td>28:</td>
<td>9/4</td>
<td>1403.910</td>
<td>major ninth</td>
<td>NEVÅ¹</td>
</tr>
<tr>
<td>29:</td>
<td>64/27</td>
<td>1494.135</td>
<td>Pythagorean minor 10th</td>
<td>Nîm Hisâr</td>
</tr>
<tr>
<td>30:</td>
<td>19683/8192</td>
<td>1517.595</td>
<td>Pythagorean augmented 9th</td>
<td>Hisâr</td>
</tr>
<tr>
<td>31:</td>
<td>16384/6561</td>
<td>1584.360</td>
<td>Pythagorean diminished 11th</td>
<td>Dîk Hisâr</td>
</tr>
<tr>
<td>32:</td>
<td>81/32</td>
<td>1607.820</td>
<td>Pythagorean major 10th</td>
<td>HÜSEYNİ</td>
</tr>
<tr>
<td>33:</td>
<td>8/3</td>
<td>1698.045</td>
<td>perfect 11th</td>
<td>ACEM</td>
</tr>
<tr>
<td>34:</td>
<td>177147/65536</td>
<td>1721.505</td>
<td>Pythagorean augmented 10th</td>
<td>Dîk Acem</td>
</tr>
<tr>
<td>35:</td>
<td>2048/729</td>
<td>1788.270</td>
<td>Pythagorean diminished 12th</td>
<td>Evîç</td>
</tr>
<tr>
<td>36:</td>
<td>729/256</td>
<td>1811.730</td>
<td>Pythagorean tritone + octave</td>
<td>Mâhûr</td>
</tr>
<tr>
<td>37:</td>
<td>524288/177147</td>
<td>1878.495</td>
<td>Pythagorean diminished 13th</td>
<td>Dîk Mâhûr</td>
</tr>
<tr>
<td>38:</td>
<td>3/1</td>
<td>1901.955</td>
<td>perfect 12th</td>
<td>GERDÂNİYE</td>
</tr>
<tr>
<td>40:</td>
<td>6561/2048</td>
<td>2015.640</td>
<td>Pythagorean augmented 12th</td>
<td>Şehnâz</td>
</tr>
<tr>
<td>41:</td>
<td>65536/19683</td>
<td>2082.405</td>
<td>Pythagorean diminished 14th</td>
<td>Dîk Şehnâz</td>
</tr>
<tr>
<td>42:</td>
<td>27/8</td>
<td>2105.865</td>
<td>Pythagorean major 13th</td>
<td>MUHÂYYER</td>
</tr>
<tr>
<td>43:</td>
<td>32/9</td>
<td>2196.090</td>
<td>Pythagorean minor 14th</td>
<td>Sünbüle</td>
</tr>
<tr>
<td>44:</td>
<td>59049/16384</td>
<td>2219.550</td>
<td>Pythagorean augmented 13th</td>
<td>Dîk Sünbüle</td>
</tr>
<tr>
<td>45:</td>
<td>8192/2187</td>
<td>2286.315</td>
<td>Pythagorean diminished 15th</td>
<td>Tîz Segâh</td>
</tr>
<tr>
<td>46:</td>
<td>243/64</td>
<td>2309.775</td>
<td>Pythagorean major 14th</td>
<td>TİZ BÜSELİK</td>
</tr>
<tr>
<td>47:</td>
<td>2097152/531441</td>
<td>2376.540</td>
<td>Pythagorean diminished 16th</td>
<td>Tîz Dîk Bûselik</td>
</tr>
<tr>
<td>48:</td>
<td>4/1</td>
<td>2400.000</td>
<td>two octaves</td>
<td>TİZ ÇÂRGÂH²</td>
</tr>
</tbody>
</table>

The habitual notation for this tuning is provided in Figure 3.4:

¹ Taken as 440 cps, although notated as D.

² Further extending until 6/1 from “Tîz Nîm Hicâz” to “TİZ GERDÂNİYE” according to Ezgi.
<table>
<thead>
<tr>
<th>II. Octave</th>
<th>I. Octave</th>
<th>Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>24. ÇÂRGÂH</td>
<td>0. KABA ÇÂRGÂH</td>
<td>(with previous)</td>
</tr>
<tr>
<td>27. Dik Hicâz</td>
<td>3. Kaba Dik Hicâz</td>
<td>66.765 e</td>
</tr>
<tr>
<td>28. NEVÂ</td>
<td>4. YEGÂH</td>
<td>23.460 e</td>
</tr>
<tr>
<td>32. HÜSEYNÎ</td>
<td>8. HÜSEYNÎ AŞİRÂN</td>
<td>23.460 e</td>
</tr>
<tr>
<td>33. ACEM</td>
<td>9. ACEM AŞİRÂN</td>
<td>90.225 e</td>
</tr>
<tr>
<td>34. Dik Acem</td>
<td>10. Dik Acem Aşîrân</td>
<td>23.460 e</td>
</tr>
<tr>
<td>35. Eviç</td>
<td>11. Irak</td>
<td>66.765 e</td>
</tr>
<tr>
<td>38. GERDANÎYE</td>
<td>14. RÂST</td>
<td>23.460 e</td>
</tr>
<tr>
<td>40. Şehnâz</td>
<td>16. Zirgûle</td>
<td>23.460 e</td>
</tr>
<tr>
<td>41. Dik Şehnâz</td>
<td>17. Dik Zirgûle</td>
<td>66.765 e</td>
</tr>
<tr>
<td>42. MUHAYYER</td>
<td>18. DÜGÂH</td>
<td>23.460 e</td>
</tr>
<tr>
<td>43. Sünbüle</td>
<td>19. Kûrdî</td>
<td>90.225 e</td>
</tr>
<tr>
<td>44. Dik Sünbüle</td>
<td>20. Dik Kûrdî</td>
<td>23.460 e</td>
</tr>
<tr>
<td>45. Tîz Segâh</td>
<td>21. Segâh</td>
<td>66.765 e</td>
</tr>
<tr>
<td>46. TÎZ BÜSELİK</td>
<td>22. BÜSELİK</td>
<td>23.460 e</td>
</tr>
<tr>
<td>47. Tîz Dik Bûselik</td>
<td>23. Dik Bûselik</td>
<td>66.765 e</td>
</tr>
<tr>
<td>48. TÎZ ÇÂRGÂH</td>
<td>24. ÇÂRGÂH</td>
<td>23.460 e</td>
</tr>
</tbody>
</table>
Pitches of AEU are assembled within the octave via the juxtaposition to the assumed tone of origin (kaba çargah) of 11 pure fifths upward, and 12 downward, as outlined in Table 3.5:

<table>
<thead>
<tr>
<th>Fifths</th>
<th>Frequency Ratios</th>
<th>Octave Normalization</th>
<th>Classic Interval Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>3(^{11}) : 2(^{11})</td>
<td>177147/2048</td>
<td>10. 177147/131072</td>
<td>Pythagorean augmented third</td>
</tr>
<tr>
<td>3(^{10}) : 2(^{10})</td>
<td>59049/1024</td>
<td>20. 59049/32768</td>
<td>Pythagorean augmented sixth</td>
</tr>
<tr>
<td>3(^{9}) : 2(^{9})</td>
<td>19683/512</td>
<td>6. 19683/16384</td>
<td>Pythagorean augmented second</td>
</tr>
<tr>
<td>3(^{8}) : 2(^{8})</td>
<td>6561/256</td>
<td>16. 6561/4096</td>
<td>Pythagorean augmented fifth</td>
</tr>
<tr>
<td>3(^{7}) : 2(^{7})</td>
<td>2187/128</td>
<td>2. 2187/2048</td>
<td>apotome</td>
</tr>
<tr>
<td>3(^{6}) : 2(^{6})</td>
<td>729/64</td>
<td>12. 729/512</td>
<td>Pythagorean tritone</td>
</tr>
<tr>
<td>3(^{5}) : 2(^{5})</td>
<td>243/32</td>
<td>22. 243/128</td>
<td>Pythagorean major seventh</td>
</tr>
<tr>
<td>3(^{4}) : 2(^{4})</td>
<td>81/16</td>
<td>8. 81/64</td>
<td>Pythagorean major third</td>
</tr>
<tr>
<td>3(^{3}) : 2(^{3})</td>
<td>27/8</td>
<td>18. 27/16</td>
<td>Pythagorean major sixth</td>
</tr>
<tr>
<td>3(^{2}) : 2(^{2})</td>
<td>9/4</td>
<td>4. 9/8</td>
<td>major whole tone</td>
</tr>
<tr>
<td>3 : 2</td>
<td>3/2</td>
<td>14. 3/2</td>
<td>perfect fifth</td>
</tr>
<tr>
<td>0</td>
<td>1/1</td>
<td>0. 1/1</td>
<td>(tone of origin – perfect prime)</td>
</tr>
<tr>
<td>2 : 3</td>
<td>2/3</td>
<td>9. 4/3</td>
<td>perfect fourth</td>
</tr>
<tr>
<td>2(^{2}) : 3(^{2})</td>
<td>4/9</td>
<td>19. 16/9</td>
<td>Pythagorean minor seventh</td>
</tr>
<tr>
<td>2(^{3}) : 3(^{3})</td>
<td>8/27</td>
<td>5. 32/27</td>
<td>Pythagorean minor third</td>
</tr>
<tr>
<td>2(^{4}) : 3(^{4})</td>
<td>16/81</td>
<td>15. 128/81</td>
<td>Pythagorean minor sixth</td>
</tr>
<tr>
<td>2(^{5}) : 3(^{5})</td>
<td>32/243</td>
<td>1. 256/243</td>
<td>limma, Pythagorean minor second</td>
</tr>
<tr>
<td>2(^{6}) : 3(^{6})</td>
<td>64/729</td>
<td>11. 1024/729</td>
<td>Pythagorean diminished fifth</td>
</tr>
<tr>
<td>2(^{7}) : 3(^{7})</td>
<td>128/2187</td>
<td>21. 4096/2187</td>
<td>Pythagorean diminished octave</td>
</tr>
<tr>
<td>2(^{8}) : 3(^{8})</td>
<td>256/6561</td>
<td>7. 8192/6561</td>
<td>Pythagorean diminished fourth</td>
</tr>
<tr>
<td>2(^{9}) : 3(^{9})</td>
<td>512/19683</td>
<td>17. 32768/19683</td>
<td>Pythagorean diminished seventh</td>
</tr>
<tr>
<td>2(^{10}) : 3(^{10})</td>
<td>1024/59049</td>
<td>3. 65536/59049</td>
<td>Pythagorean diminished third</td>
</tr>
<tr>
<td>2(^{11}) : 3(^{11})</td>
<td>2048/177147</td>
<td>13. 262144/177147</td>
<td>Pythagorean diminished sixth</td>
</tr>
<tr>
<td>2(^{12}) : 3(^{12})</td>
<td>4096/531441</td>
<td>23. 1048576/531441</td>
<td>Pythagorean diminished ninth</td>
</tr>
</tbody>
</table>

Little is it perceived that AEU is actually a modification of Yekta’s 24-tone Pythagorean tuning beginning on yegah (D) instead of the dronish and cumbersome to produce kaba çargah (C) [203]; in which case, the above-mentioned frequency ratios (hence, perdes) are shifted down by a major whole tone and normalized (viz., reduced & sorted) within an octave; or in other words, regenerated via the chain of 14 pure fifths down and 9 up from the new tone of origin (yegah), as shown in Table 3.6 on the next page:
Table 3.6: Generation of Yekta-24 by a Chain of Pure Fifths

<table>
<thead>
<tr>
<th>Fifths</th>
<th>Frequency Ratios</th>
<th>Octave Normalization</th>
<th>Classic Interval Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3^9 : 2^9$</td>
<td>19683/512</td>
<td>6.</td>
<td>19683/16384 Pythagorean augmented second</td>
</tr>
<tr>
<td>$3^8 : 2^8$</td>
<td>6561/256</td>
<td>16.</td>
<td>6561/4096 Pythagorean augmented fifth</td>
</tr>
<tr>
<td>$3^7 : 2^7$</td>
<td>2187/128</td>
<td>2.</td>
<td>2187/2048 apotome</td>
</tr>
<tr>
<td>$3^6 : 2^6$</td>
<td>729/64</td>
<td>12.</td>
<td>729/512 Pythagorean tritone</td>
</tr>
<tr>
<td>$3^5 : 2^5$</td>
<td>19683/16384</td>
<td>22.</td>
<td>2187/2048 Pythagorean major seventh</td>
</tr>
<tr>
<td>$3^4 : 2^4$</td>
<td>6561/4096</td>
<td>8.</td>
<td>19683/16384 Pythagorean major seventh</td>
</tr>
<tr>
<td>$3^3 : 2^3$</td>
<td>2187/128</td>
<td>14.</td>
<td>2187/128 Pythagorean major sixth</td>
</tr>
<tr>
<td>$3^2 : 2^2$</td>
<td>729/64</td>
<td>1.</td>
<td>729/512 Pythagorean major sixth</td>
</tr>
<tr>
<td>$3 : 2$</td>
<td>3/2</td>
<td>17.</td>
<td>3/2 perfect fifth</td>
</tr>
<tr>
<td>0</td>
<td>1/1</td>
<td>0.</td>
<td>1/1 (tone of origin – perfect prime)</td>
</tr>
<tr>
<td>2 : 3</td>
<td>2/3</td>
<td>10.</td>
<td>2/3 perfect fourth</td>
</tr>
<tr>
<td>$2^2 : 3^2$</td>
<td>4/9</td>
<td>20.</td>
<td>4/9 Pythagorean minor seventh</td>
</tr>
<tr>
<td>$2^3 : 3^3$</td>
<td>16/81</td>
<td>5.</td>
<td>16/81 Pythagorean minor seventh</td>
</tr>
<tr>
<td>$2^4 : 3^4$</td>
<td>32/243</td>
<td>15.</td>
<td>32/243 Pythagorean minor sixth</td>
</tr>
<tr>
<td>$2^5 : 3^5$</td>
<td>64/729</td>
<td>1.</td>
<td>64/729 Pythagorean diminished fifth</td>
</tr>
<tr>
<td>$2^6 : 3^6$</td>
<td>128/2187</td>
<td>11.</td>
<td>128/2187 Pythagorean diminished fifth</td>
</tr>
<tr>
<td>$2^7 : 3^7$</td>
<td>256/6561</td>
<td>7.</td>
<td>256/6561 Pythagorean diminished octave</td>
</tr>
<tr>
<td>$2^8 : 3^8$</td>
<td>512/19683</td>
<td>17.</td>
<td>512/19683 Pythagorean diminished seventh</td>
</tr>
<tr>
<td>$2^9 : 3^9$</td>
<td>1024/59049</td>
<td>3.</td>
<td>1024/59049 Pythagorean diminished third</td>
</tr>
<tr>
<td>$2^{10} : 3^{10}$</td>
<td>2048/177147</td>
<td>13.</td>
<td>2048/177147 Pythagorean diminished sixth</td>
</tr>
<tr>
<td>$2^{11} : 3^{11}$</td>
<td>4096/531441</td>
<td>23.</td>
<td>4096/531441 Pythagorean diminished ninth</td>
</tr>
<tr>
<td>$2^{12} : 3^{12}$</td>
<td>8192/1594323</td>
<td>9.</td>
<td>8192/1594323 Pythagorean double dim. fifth</td>
</tr>
<tr>
<td>$2^{13} : 3^{13}$</td>
<td>16384/4782969</td>
<td>19.</td>
<td>16384/4782969 Pythagorean double dim. octave</td>
</tr>
</tbody>
</table>

Yekta’s staff notation for this 24-tone tuning – where he treats F-sharp on the 7th degree (arak) as F-natural, and thus, turning Fb-C into a perfect fifth at the expense and forfeiture of international legibility – is delineated in Figure 3.5.

Also, a comparison of AEU with Yekta-24 may be seen further below in Table 3.7.

Because of the excellent proximity of either model to the related tones of 53-equal divisions of the octave, the “9 commas per whole tone; 53 commas per octave” methodology is unanimously accepted in Turkish Maqam Music parlance and education.
### II. Octave

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>24.</td>
<td>NEVA</td>
</tr>
<tr>
<td>25.</td>
<td>Nim Hisar</td>
</tr>
<tr>
<td>26.</td>
<td>Hisar</td>
</tr>
<tr>
<td>27.</td>
<td>Dik Hisar</td>
</tr>
<tr>
<td>28.</td>
<td>HÜSEYNİ</td>
</tr>
<tr>
<td>29.</td>
<td>Acem</td>
</tr>
<tr>
<td>30.</td>
<td>Dik Acem</td>
</tr>
<tr>
<td>31.</td>
<td>EVİÇ</td>
</tr>
<tr>
<td>32.</td>
<td>Mahur</td>
</tr>
<tr>
<td>33.</td>
<td>Dik Mahur</td>
</tr>
<tr>
<td>34.</td>
<td>GERDANİYE</td>
</tr>
<tr>
<td>35.</td>
<td>Nim Şehnaz</td>
</tr>
<tr>
<td>36.</td>
<td>Şehnaz</td>
</tr>
<tr>
<td>37.</td>
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</tr>
<tr>
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<td>MUHAYYER</td>
</tr>
<tr>
<td>39.</td>
<td>Sünbüle</td>
</tr>
<tr>
<td>40.</td>
<td>Dik Sünbüle</td>
</tr>
<tr>
<td>41.</td>
<td>TİZ SEGÂH</td>
</tr>
<tr>
<td>42.</td>
<td>Tiz Puselik</td>
</tr>
<tr>
<td>43.</td>
<td>Dik Tiz Puselik</td>
</tr>
<tr>
<td>44.</td>
<td>TİZ ÇARGÂH</td>
</tr>
<tr>
<td>45.</td>
<td>Nim Tiz Hicaz</td>
</tr>
<tr>
<td>46.</td>
<td>Tiz Hicaz</td>
</tr>
<tr>
<td>47.</td>
<td>Dik Tiz Hicaz</td>
</tr>
<tr>
<td>48.</td>
<td>TİZ NEVA</td>
</tr>
</tbody>
</table>

### I. Octave

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
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<tr>
<td>2.</td>
<td>Pest Hisar</td>
</tr>
<tr>
<td>3.</td>
<td>Dik Pest Hisar</td>
</tr>
<tr>
<td>4.</td>
<td>HÜSEYNİAŞİRAN</td>
</tr>
<tr>
<td>5.</td>
<td>Acemaşiran</td>
</tr>
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<td>Dik Acemaşiran</td>
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<td>7.</td>
<td>ARAK</td>
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<td>Gevest</td>
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</tr>
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<td>Dik Zengûle</td>
</tr>
<tr>
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<td>DÜGÂH</td>
</tr>
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<td>15.</td>
<td>Kûrdî</td>
</tr>
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<td>16.</td>
<td>Dik Kûrdî</td>
</tr>
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<td>17.</td>
<td>SEGÂH</td>
</tr>
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<td>Dik Puselik</td>
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<td>ÇARGÂH</td>
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<td>21.</td>
<td>Nim Hicaz</td>
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<tr>
<td>22.</td>
<td>Hicaz</td>
</tr>
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<td>23.</td>
<td>Dik Hicaz</td>
</tr>
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<td>24.</td>
<td>NEVA</td>
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</table>

<table>
<thead>
<tr>
<th>Intervals</th>
<th>(with previous)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>90.225 €</td>
</tr>
<tr>
<td></td>
<td>23.460 €</td>
</tr>
<tr>
<td>38.</td>
<td>66.765 €</td>
</tr>
<tr>
<td></td>
<td>90.225 €</td>
</tr>
<tr>
<td>46.</td>
<td>23.460 €</td>
</tr>
<tr>
<td></td>
<td>66.765 €</td>
</tr>
<tr>
<td>35.</td>
<td>23.460 €</td>
</tr>
<tr>
<td></td>
<td>90.225 €</td>
</tr>
<tr>
<td>36.</td>
<td>66.765 €</td>
</tr>
<tr>
<td></td>
<td>23.460 €</td>
</tr>
<tr>
<td>27.</td>
<td>23.460 €</td>
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<td></td>
<td>66.765 €</td>
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<td>28.</td>
<td>23.460 €</td>
</tr>
<tr>
<td></td>
<td>66.765 €</td>
</tr>
<tr>
<td>26.</td>
<td>23.460 €</td>
</tr>
<tr>
<td></td>
<td>66.765 €</td>
</tr>
<tr>
<td>25.</td>
<td>23.460 €</td>
</tr>
<tr>
<td></td>
<td>66.765 €</td>
</tr>
<tr>
<td>24.</td>
<td>23.460 €</td>
</tr>
</tbody>
</table>

*Figure 3.5: Notation of Yekta-24*
Table 3.7: Comparison of AEU & Yekta-24

<table>
<thead>
<tr>
<th>AEU Ratios</th>
<th>Cents</th>
<th>Perdes</th>
<th>Yekta-24 Ratios</th>
<th>Cents</th>
<th>Perdes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0: 1/1</td>
<td>0.000</td>
<td>KABA ÇÂRGÂH</td>
<td>0: 1/1</td>
<td>0.000</td>
<td>YEGÂH</td>
</tr>
<tr>
<td>1: 256/243</td>
<td>90.225</td>
<td>Kaba Nim Hicaz</td>
<td>1: 256/243</td>
<td>90.225</td>
<td>Nim Pest Hisar</td>
</tr>
<tr>
<td>2: 2187/2048</td>
<td>113.685</td>
<td>Kaba Hicaz</td>
<td>2: 2187/2048</td>
<td>113.685</td>
<td>Pest Hisar</td>
</tr>
<tr>
<td>3: 65536/59049</td>
<td>180.450</td>
<td>Kaba Dik Hicaz</td>
<td>3: 65536/59049</td>
<td>180.450</td>
<td>Dik Pest Hisar</td>
</tr>
<tr>
<td>4: 9/8</td>
<td>203.910</td>
<td>YEGÂH</td>
<td>4: 9/8</td>
<td>203.910</td>
<td>HÜSEYNİ AŞİRAN</td>
</tr>
<tr>
<td>5: 32/27</td>
<td>294.135</td>
<td>Kaba Nim Hisar</td>
<td>5: 32/27</td>
<td>294.135</td>
<td>Acemaışırhan</td>
</tr>
<tr>
<td>6: 19683/16384</td>
<td>317.595</td>
<td>Kaba Hisar</td>
<td>6: 19683/16384</td>
<td>317.595</td>
<td>ARAK</td>
</tr>
<tr>
<td>7: 8192/6561</td>
<td>384.360</td>
<td>Kaba Dik Hisar</td>
<td>7: 8192/6561</td>
<td>384.360</td>
<td>Geveşt</td>
</tr>
<tr>
<td>8: 81/64</td>
<td>407.820</td>
<td>HÜSEYNİ AŞİRAN</td>
<td>8: 81/64</td>
<td>407.820</td>
<td>Dik Geveşt</td>
</tr>
<tr>
<td>9: 4/3</td>
<td>498.045</td>
<td>ACEM AŞİRAN</td>
<td>9: 4/3</td>
<td>498.045</td>
<td>RÂST</td>
</tr>
<tr>
<td>10: 177147/131072</td>
<td>521.505</td>
<td>Dik Acem Aşırân</td>
<td>10: 177147/131072</td>
<td>521.505</td>
<td>Dik Acemâşiran</td>
</tr>
<tr>
<td>11: 1024/729</td>
<td>588.270</td>
<td>Irak</td>
<td>11: 1024/729</td>
<td>588.270</td>
<td>Nim Zengûle</td>
</tr>
<tr>
<td>12: 729/512</td>
<td>611.730</td>
<td>Zengûle</td>
<td>12: 729/512</td>
<td>611.730</td>
<td>Zengûle</td>
</tr>
<tr>
<td>13: 262144/177147</td>
<td>678.495</td>
<td>Dik Zengûle</td>
<td>13: 262144/177147</td>
<td>678.495</td>
<td>Dik Zengûle</td>
</tr>
<tr>
<td>14: 3/2</td>
<td>701.955</td>
<td>RÂST</td>
<td>14: 3/2</td>
<td>701.955</td>
<td>DÜGÂH</td>
</tr>
<tr>
<td>15: 128/81</td>
<td>792.180</td>
<td>Nim Zirgûle</td>
<td>15: 128/81</td>
<td>792.180</td>
<td>Kûrdî</td>
</tr>
<tr>
<td>16: 6561/4096</td>
<td>815.640</td>
<td>Kûrdî</td>
<td>16: 6561/4096</td>
<td>815.640</td>
<td>Dik Kûrdî</td>
</tr>
<tr>
<td>17: 32768/19683</td>
<td>882.405</td>
<td>Segâh</td>
<td>17: 32768/19683</td>
<td>882.405</td>
<td>SEGÂH</td>
</tr>
<tr>
<td>18: 27/16</td>
<td>905.865</td>
<td>DÜGÂH</td>
<td>18: 27/16</td>
<td>905.865</td>
<td>Puselik</td>
</tr>
<tr>
<td>19: 16/9</td>
<td>996.090</td>
<td>Kûrdî</td>
<td>19: 16/9</td>
<td>996.090</td>
<td>ÇÂRGÂH</td>
</tr>
<tr>
<td>20: 59049/32768</td>
<td>1019.550</td>
<td>Dik Kûrdî</td>
<td>20: 59049/32768</td>
<td>1019.550</td>
<td>Nim Hicaz</td>
</tr>
<tr>
<td>21: 4096/2187</td>
<td>1086.315</td>
<td>Segâh</td>
<td>21: 4096/2187</td>
<td>1086.315</td>
<td>Hicaz</td>
</tr>
<tr>
<td>22: 243/128</td>
<td>1109.775</td>
<td>BÜSELÎK</td>
<td>22: 243/128</td>
<td>1109.775</td>
<td>Dik Hicaz</td>
</tr>
<tr>
<td>23: 1048576/531441</td>
<td>1176.540</td>
<td>Dik Bûselik</td>
<td>23: 1048576/531441</td>
<td>1176.540</td>
<td>ÇÂRGÂH</td>
</tr>
<tr>
<td>24: 2/1</td>
<td>1200.000</td>
<td>ÇÂRGÂH</td>
<td>24: 2/1</td>
<td>1200.000</td>
<td>ÇÂRGÂH</td>
</tr>
</tbody>
</table>

How well 53-tone equal temperament embodies both AEU and Yekta-24 to the point of doing away with either may be seen in Table 3.8:
### Table 3.8: Approximation of AEU & Yekta-24 by 53-tET

<table>
<thead>
<tr>
<th>AEU Ratios</th>
<th>Cents</th>
<th>Yekta-24 Ratios</th>
<th>Cents</th>
<th>53-tET Aprx.</th>
<th>Diff.</th>
</tr>
</thead>
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<td>0: 1/1</td>
<td>0.000</td>
<td>0: 1/1</td>
<td>0.000</td>
<td>0: 0.000</td>
<td>0</td>
</tr>
<tr>
<td>1: 256/243</td>
<td>90.225</td>
<td>1: 256/243</td>
<td>90.225</td>
<td>4: 90.566</td>
<td>0.341</td>
</tr>
<tr>
<td>2: 2187/2048</td>
<td>113.685</td>
<td>2: 2187/2048</td>
<td>113.685</td>
<td>5: 113.208</td>
<td>-0.4775</td>
</tr>
<tr>
<td>3: 65536/59049</td>
<td>180.450</td>
<td>3: 65536/59049</td>
<td>180.450</td>
<td>8: 181.132</td>
<td>0.6821</td>
</tr>
<tr>
<td>4: 9/8</td>
<td>203.910</td>
<td>4: 9/8</td>
<td>203.910</td>
<td>9: 203.774</td>
<td>-0.1364</td>
</tr>
<tr>
<td>6: 19683/16384</td>
<td>317.595</td>
<td>6: 19683/16384</td>
<td>317.595</td>
<td>14: 316.981</td>
<td>-0.6139</td>
</tr>
<tr>
<td>7: 8192/6561</td>
<td>384.360</td>
<td>7: 8192/6561</td>
<td>384.360</td>
<td>17: 384.906</td>
<td>0.5457</td>
</tr>
<tr>
<td>8: 81/64</td>
<td>407.820</td>
<td>8: 81/64</td>
<td>407.820</td>
<td>18: 407.547</td>
<td>-0.2728</td>
</tr>
<tr>
<td>10: 177147/131072</td>
<td>521.505</td>
<td>10: 4/3</td>
<td>498.045</td>
<td>22: 498.113</td>
<td>0.0682</td>
</tr>
<tr>
<td>11: 1024/729</td>
<td>588.270</td>
<td>11: 1024/729</td>
<td>588.270</td>
<td>23: 520.755</td>
<td>-0.7503</td>
</tr>
<tr>
<td>12: 729/512</td>
<td>611.730</td>
<td>12: 729/512</td>
<td>611.730</td>
<td>26: 611.321</td>
<td>0.4093</td>
</tr>
<tr>
<td>13: 262144/177147</td>
<td>678.495</td>
<td>13: 262144/177147</td>
<td>678.495</td>
<td>27: 679.245</td>
<td>-0.4093</td>
</tr>
<tr>
<td>14: 3/2</td>
<td>701.955</td>
<td>14: 3/2</td>
<td>701.955</td>
<td>30: 701.887</td>
<td>-0.0682</td>
</tr>
<tr>
<td>15: 128/81</td>
<td>792.180</td>
<td>15: 128/81</td>
<td>792.180</td>
<td>31: 792.453</td>
<td>0.2728</td>
</tr>
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<td>16: 6561/4096</td>
<td>815.640</td>
<td>35: 815.094</td>
<td>-0.5457</td>
</tr>
<tr>
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<td>882.405</td>
<td>17: 32768/19683</td>
<td>882.405</td>
<td>39: 883.019</td>
<td>0.6139</td>
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<tr>
<td>18: 27/16</td>
<td>905.865</td>
<td>18: 27/16</td>
<td>905.865</td>
<td>40: 905.660</td>
<td>-0.2046</td>
</tr>
<tr>
<td>19: 16/9</td>
<td>996.090</td>
<td>19: 8388608/4782969</td>
<td>972.630</td>
<td>43: 973.585</td>
<td>0.9549</td>
</tr>
<tr>
<td>20: 59049/32768</td>
<td>1019.550</td>
<td>20: 16/9</td>
<td>996.090</td>
<td>44: 996.226</td>
<td>0.1364</td>
</tr>
<tr>
<td>21: 4096/2187</td>
<td>1086.315</td>
<td>21: 4096/2187</td>
<td>1086.315</td>
<td>45: 1018.868</td>
<td>-0.6821</td>
</tr>
<tr>
<td>22: 243/128</td>
<td>1109.775</td>
<td>22: 243/128</td>
<td>1109.775</td>
<td>48: 1086.792</td>
<td>0.4775</td>
</tr>
<tr>
<td>23: 1048576/531441</td>
<td>1176.540</td>
<td>23: 1048576/531441</td>
<td>1176.540</td>
<td>49: 1109.434</td>
<td>-0.341</td>
</tr>
<tr>
<td>24: 2/1</td>
<td>1200.000</td>
<td>24: 2/1</td>
<td>1200.000</td>
<td>52: 1177.358</td>
<td>0.8185</td>
</tr>
</tbody>
</table>

Average absolute difference: 0.4486 cents  
Highest absolute difference: 0.9549 cents

Additionally, a stereotypical schema pertaining to the AEU division of the whole tone into 9 equal commas is reproduced in Figure 3.6 [202]:
The frequency ratios of and intervals between these accidentals – including their counterparts in Yekta-24 and equivalents in 53 equal divisions of the octave – are projected onto Table 3.9:

Table 3.9: Exposition of the 9-comma Division of the Fa-Sol Whole Tone in AEU & Yekta-24

<table>
<thead>
<tr>
<th>AEU Ratios</th>
<th>Notation</th>
<th>Yekta-24 Ratios</th>
<th>Notation</th>
<th>Intervals</th>
<th>53-tET, Cents</th>
</tr>
</thead>
<tbody>
<tr>
<td>0: 4/3</td>
<td>F G♭</td>
<td>32/27</td>
<td>F</td>
<td>(with previous)</td>
<td>(22.31.)</td>
</tr>
<tr>
<td>1: 177147/131072</td>
<td>F♯ G♭</td>
<td>19683/16384</td>
<td>F♯ G♭</td>
<td>531441:524288</td>
<td>22.642 ¢</td>
</tr>
<tr>
<td>2:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4: 1024/729</td>
<td>F♯ G♭</td>
<td>8192/6561</td>
<td>F♯ G♭</td>
<td>134217728:129140163</td>
<td>67.925 ¢</td>
</tr>
<tr>
<td>5: 729/512</td>
<td>F♯ G♭</td>
<td>81/64</td>
<td>F♯ G♭</td>
<td>531441:524288</td>
<td>22.642 ¢</td>
</tr>
<tr>
<td>6:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8: 262144/177147</td>
<td>F♯ G♭</td>
<td>2097152/1594323</td>
<td>F♯ G♭</td>
<td>134217728:129140163</td>
<td>67.925 ¢</td>
</tr>
<tr>
<td>9: 3/2</td>
<td>F♯ G</td>
<td>4/3</td>
<td>G</td>
<td>531441:524288</td>
<td>22.642 ¢</td>
</tr>
</tbody>
</table>

1 Depiction borrowed from p. 46 of the reference to this figure. The correct range, however, should have been Fa-Sol. Each comma is Holderian, i.e., ~22.642 cents wide, hence, one step of 53 equal divisions of the octave – which is a decent approximation with less than a cent error to the Pythagorean comma (difference of a stack of 12 pure fifths from 7 octaves) expressed as $3^{12}: 2^{19} = 531441:524288$ and equalling 23.46 cents.
On close scrutiny, the gross asymmetry in the deployment of AEU accidentals catches the eye, and F# (4 commas sharp) not being the same distance from F as Gb (5 commas flat) is from G, to say nothing of Fx and Gbb not being double at all, leaves something to be desired. Surely, Yekta’s symbols are less disproportionate in comparison, particularly if the Fa-Sol region is notated properly as shown above.

Even so, Yekta-24 is handicapped due to diatonic naturals not being the product of an uninterrupted cycle of fifths; a feature AEU flaunts despite its lack of credentials for a Pythagorean C-major scale running from kaba çargah to çargah as the basis of Turkish Music theory [204,205].

Yekta-24 is further dysfunctional, in that, order of sharps and flats in the chain is not faithful to Western idiom. AEU is likewise encumbered in the sharps sector. The correct notation for the sequence of fifths should have been the one in Figure 3.7:

\[
\begin{align*}
Gbb & \quad Dbb & \quad Abb & \quad Ebb & \quad Bb & \quad Fb & \quad Cb & \quad Gb & \quad Db & \quad Ab & \quad Eb & \quad Bb & \quad F \\
3/2 & \quad 9/4 & \quad 27/8 & \quad 81/16 & \quad 243/32 & \quad 729/64 & \quad 2187/128 & \quad 6561/256 & \quad 19683/128 & \quad 59049/1024 & \quad 177147/2048 & \quad 4096/531441 & \quad 2048/177147 & \quad 1024/19683 & \quad 512/6561 & \quad 256/128 & \quad 64/64 & \quad 32/243 & \quad 16/81 & \quad 8/27 & \quad 4/9 & \quad 2/3 & \quad F & \quad C & \quad G & \quad D & \quad A & \quad E & \quad B & \quad F# & \quad C# & \quad G# & \quad D# & \quad A#
\end{align*}
\]

Figure 3.7: Correct Sequence of Notes in a Chain of Pure Fifths

\(^1\) Since, in the series C-G-D-A-E-B-F#, the interval between E-B (262144:177147) is a wolf fifth of 678.5 cents, and B-F# is found at the other end of the chain 8-9 fifths below C.
Plain to say, without a correctly ordered generator sequence by which one can cycle through 53 equal divisions of the octave, neither Yekta-24, nor AEU bodes well when modulating between, let alone transposing, the large body of maqam scales ¹.

Adding to this the discovery that some perdes of the 24-tone Pythagorean model (kaba dik hicaz, dik acem aşıran, dik gevest, and dik buselik to be exact) are outright useless for the repertory [206], one is left pondering if simply dividing the octave into 17 equal parts as Tura suggested [207], or exactly double that amount, might not have been a more pertinent, albeit adventitious theoretical solution for having at least the merit of nestling 17 traditional perdes at every key.

When all is said and done, the heart of the matter lies in whether or not the 24-tone Pythagorean model accords with measured intervals of Turkish Maqam Music practice.

APPENDIX B comprises the complete set of intervals occurring within an octave between any two perdes of the 24-tone Pythagorean System.

This comprehensive pandect circums titiates that the only “quarter-tones” worth mentioning in AEU/Yekta-24 are the five 2/3 tones (1162261467:1073741824 or 137.145 cents) concealed between dik buselik-hicaz, kaba dik hicaz-kaba hisar, kaba dik hisar-dik acem aşıran, dik gevest-zirgule, dik zirgule-dik kürdi, and two 3/4 tones (156.99 cents) hidden amongst dik kürdi-dik buselik, and dik acem aşıran-dik gevest – none of which are feasible, let alone, significative in a performance – proving once and for all that the 24-tone Pythagorean model fundamentally fails to reflect Turkish Maqam Music practice in regards to those maqams where middle second intervals are indispensable.

¹ It is no wonder that rescoring a piece by a change of key is yet a skill to be mastered by executants of Turkish Maqam Music, and that, altering the diapason without any regard for non key-transposing instruments in the middle of a concert is the only sure way of shifting scales intact.
4. CHAPTER: COMPARATIVE ANALYSIS OF ALTERNATE HISTORICAL AND MODERN TUNINGS & NOTATIONS OF TRADITIONAL PERDES IN TURKISH MAQAM MUSIC

4.1. Prologue

The purpose of this chapter is to investigate possible alternatives to the 24-tone Pythagorean model, and to see which, if any, best encapsulates the “quarter-tone” region observed in recordings and referred to as the “mujannab zone”.

Since there are numerous sources on the subject, one must be selective as well as concise. For this reason, a laconic excursus in well-known tunings and notations of Maqam Music in history must be undertaken.

The reader was informed in the preceding chapter that the ‘Yekta-Arel-Ezgi School’ explains perdes in terms of 3-limit ratios generated by a ‘chain of pure fifths’, which is a tuning procedure generally associated with the ancient Greek geometer and philosopher Pythagoras of Samos (ca.580-500 B.C.E.) [208,209].

This 24-tone Pythagorean tuning is actually, in all but name, an extension of the hemiolic ud notation in Abjad [210,211] effected by the first Mu‘tazili Muslim philosopher and scientist, Abu Yusuf Yaqub ibn Ishaq Al-Kindi (ca.800-873 C.E.) [212,213], and incarnated in 17-tone form circa 1235 by the late Abbasid music theorist, the legendary Safiuddin Abdulmu‘min Urmavi (1216-1294) [214,215].

---

1 Arabic “ABCD”. Initially a guide to learn the Arabic alphabet and pronounciation by rote, Abjad or Jummel became in time a method for calculating numbers and dates via Arabic letters. In notating music, letters are made to correspond to degrees of a scale. (See, accompanying endnotes.)
Other tractates written in between whiles on the genre, were, to all appearances, importation of Hellenic lore on music theory to the lingua franca that was Arabic at the time [216-218].

Among the leading scholars inspired by Al-Kindi and influenced by early sources from Antiquity dealing with miscellaneous diatonic, chromatic and enharmonic divisions of the tetrachord were the Muslim philosophers Abu Nasr Muhammed Al-Farabi (ca.850-970) and Abu Ali al-Husayn ibn Abdullah ibn Sina (ca.980-1037) [207,216,218,219-221].

Somehow, after Urmavi a pre-Socratic reversion occured, and – in the words [222, pp. 370-1] of Harry Partch ¹ [223,224]:

« …Arabic theory ii fell into a groove of Pythagoreanism from which it has seemingly never extricated itself.» (Wisconsin, April 1947.)

Since Urmavi never confined himself to the 3-limit [225], Partch’s statement sounds as though it was meant as a homage to another legendary figure in Islamic music theory, Abdulkadir Meragi (ca.1360-1435) – musician to the Herat iii court of the Turco-Mongol ruler Timur the Lame [226] – who revived Urmavi’s 17-tone scale in his various tractates [227,228].

Urmavi’s System again appears in the treatise of Nureddin Abdurrahman Cami (1414-1492) [229,230]; an indication that the “quarter-tones” of old – even if performed – were no longer deemed imperative to betoken by the middle of the 15th century.

---

¹ Harry Partch (1901-1974); American maverick, microtonal theorist, instrument builder, and composer, and an advocate of 11-limit Just Intonation. He is famous for his 43-tone scale dubbed, not surprisingly, “Genesis”, with which he had written most of his music. (See, accompanying endnotes.)

ii That is to say, music theory at large amidst the Islamic Civilization, penned in the Arabic language, and common to many nations.

iii Largest city of west Afghanistan, bordering Iran and Turkmenistan. Historically, it was a major centre for trade, arts, and sciences.
Arithmetical calculation of pitches lapsed right after about this date, and did not resurface again for a *quadricentennial* epoch – though rife with *ilm-i edvar* (treatises on modes) [231-238] – deserving to be titled ‘The Dark Ages of *Maqam* theory’.

Still, it would be unfair to overlook the contributions of such prestigious individuals as Dimitrie Kantemir i [239-241], Nayi Osman Dede ii [242], Abdulbaki Nasır Dede iii [243,244], Tanburi Küçük Harutin iv [245,246], and Hamparsum Limonciyan v [247] – all of whom are remembered for developing distinctive pitch notations during the late Ottoman Era.

The awakening in tangible musical mathematics recommenced with Mikha’il Mushaqah of Lebanon [248], and reached an apex with modern Turkish theorists Rauf Yekta [249], Sadettin Arel [250], and Sufi Ezgi [109,138], followed by Ekrem Karadeniz [152,153], and Gültekin Oransay [154].

A *tabula rasa* review of prominent historical and contemporary tunings & notations in Turkish *Maqam* Music for comparative analysis will yield the following list:

---

1 *Dimitrie Kantemir* (1673-1723); Ottoman-Moldavian voivode and pantologist. He detailed his notation in the Turkish language in *Kitabu 'ilm'i-Musiki 'ala vech'i-Hurufat*. (See, accompanying endnotes.)

2 *Kutb-i Nayi Osman Dede* (ca.1645-1729); Sheik of the Galata Mevlevihane. He detailed his notation in the Turkish language in *Risale-i Edvar*. (See, accompanying endnote.)

3 *Abdulbaki Nasır Dede* (1765-1821); Sheik of the Yenikapı Mevlevihane. He detailed his notation in the Turkish language in *Tahririyye* and *Maqam* Music *perdes* in *Tedkik u Tahkik*. (See, accompanying endnotes.)

4 *Tanburi Küçük Harutin* (d. ca.1750); Ottoman-Armenian musician and theorist. He detailed his notation in the Turkish language in *Mûsikî Edvârî*. (See, accompanying endnote.)

5 *Hamparsum Limonciyan* (1768-1839); Choir conductor & hymnist to the Gregorian Armenian Church of Istanbul. He is the author of the famous notation system on Turkish *Maqam* Music bearing his name which became quite popular among musicians during the 19th Century. (See, accompanying endnote.)
A- *Urmavi*’s 17-tone Pythagorean tuning and *Abjad* notation;
B- *Perdes* according to *Nasir Dede* in extended and modified *Abjad* notation;
C- *Perdes* in Arabic phonetics by *Kantemir* & *Osman Dede*;
D- *Perdes* in Armenian phonetics by *Harutin* & *Hamparsum*;
E- *Mushaqah*’s pseudo-equal 24-tone tuning and modern Arabic staff notation of *perdes*;
F- *Yekta*’s 24-tone Pythagorean tuning and modern Turkish staff notation of *perdes*;
G- *Karadeniz*’s 41-tone tuning and staff notation of *perdes*;
H- *Oransay*’s 29-tone tuning and staff notation.

This chapter is devoted to the investigation of three categories:

1. The *Abjad* Tone-System of *Urmavi* and *Nasir Dede*;
2. Late Ottoman Phonetic Notations by *Kantemir*, *Osman Dede*,
   *Harutin*, and *Hamparsum*;
3. Rival theories of *Mushaqah*, *Karadeniz*, and *Oransay*.

Although, Phonetic Notations in Arabic and Armenian contain only elusive clues as to the implied tuning, their mention will shed light on the flexible utilization of traditional *perdes*.

On the whole, this conspectus shall demonstrate that *Abjad* and modern tunings fit snugly into 106 equal divisions of the octave, and that, even this is not an appropriate basis to explain *Maqam* Music *perdes*.

### 4.2. Abjad Tone-System

The 17-tone Pythagorean scale, with which the traditional *perdes* of *Maqam* Music came to be associated, has been expounded three quarters of a millennium ago by *Urmavi* as drawn in Figure 4.1 [215,251]:

---

1. *Abjad* Tone-System of *Urmavi* and *Nasir Dede*;
2. Late Ottoman Phonetic Notations by *Kantemir*, *Osman Dede*,
   *Harutin*, and *Hamparsum*;
3. Rival theories of *Mushaqah*, *Karadeniz*, and *Oransay*.

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---
Figure 4.1: Safiuddin Urmavi’s 17-tone Pythagorean System

This scale was constructed via a concatenation of 4 pure fifths up and 12 fifths down from an assumed tone of origin, as shown in Table 4.1:

<table>
<thead>
<tr>
<th>Fifths</th>
<th>Frequency Ratios</th>
<th>Octave Normalization</th>
<th>Classic Interval Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3^4 : 2^4$</td>
<td>81/16</td>
<td></td>
<td>7. 81/64</td>
</tr>
<tr>
<td>$3^3 : 2^3$</td>
<td>27/8</td>
<td></td>
<td>14. 27/16</td>
</tr>
<tr>
<td>$3^3 : 2^2$</td>
<td>9/4</td>
<td></td>
<td>4. 9/8</td>
</tr>
<tr>
<td>$3^2 : 2^2$</td>
<td>3/2</td>
<td></td>
<td>11. 3/2</td>
</tr>
<tr>
<td>2 : 3</td>
<td>1/1</td>
<td></td>
<td>1. 1/1</td>
</tr>
<tr>
<td>$2^2 : 3^2$</td>
<td>4/9</td>
<td></td>
<td>8. 4/3</td>
</tr>
<tr>
<td>$2^3 : 3^3$</td>
<td>8/27</td>
<td></td>
<td>15. 16/9</td>
</tr>
<tr>
<td>$2^4 : 3^4$</td>
<td>16/81</td>
<td></td>
<td>5. 32/27</td>
</tr>
<tr>
<td>$2^5 : 3^4$</td>
<td>32/243</td>
<td></td>
<td>12. 128/81</td>
</tr>
<tr>
<td>$2^6 : 3^5$</td>
<td>64/729</td>
<td></td>
<td>2. 256/243</td>
</tr>
<tr>
<td>$2^7 : 3^5$</td>
<td>128/2187</td>
<td></td>
<td>9. 1024/729</td>
</tr>
<tr>
<td>$2^8 : 3^6$</td>
<td>256/6561</td>
<td></td>
<td>16. 4096/2187</td>
</tr>
<tr>
<td>$2^9 : 3^6$</td>
<td>512/19683</td>
<td></td>
<td>6. 8192/6561</td>
</tr>
<tr>
<td>$2^{10} : 3^{10}$</td>
<td>1024/59049</td>
<td></td>
<td>13. 32768/19683</td>
</tr>
<tr>
<td>$2^{11} : 3^{11}$</td>
<td>2048/177147</td>
<td></td>
<td>3. 65536/59049</td>
</tr>
<tr>
<td>$2^{12} : 3^{12}$</td>
<td>4096/531441</td>
<td></td>
<td>10. 262144/177147</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>17. 1048576/531441</td>
</tr>
</tbody>
</table>
The *Abjad* numeric system repeating the pattern ابجد هوژ حططي originally spanned two octaves. *Nastr Dede* extended the gamut by a whole tone and labelled the tones [252] as shown in Table 4.2:

Table 4.2: Complete *Abjad* Notation of *Perdes* ¹

<table>
<thead>
<tr>
<th>Abjad</th>
<th>Urmavi Ratios</th>
<th>Cents</th>
<th>Intervals</th>
<th>Degrees</th>
<th>Nasr Dede Perdes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1/1</td>
<td>0.000</td>
<td></td>
<td>′</td>
<td>Yegah</td>
</tr>
<tr>
<td>B</td>
<td>256/243</td>
<td>90.225</td>
<td>90.225 ′</td>
<td>2</td>
<td>Pes Beyati</td>
</tr>
<tr>
<td>Ce</td>
<td>65536/59049</td>
<td>180.450</td>
<td>90.225 ′</td>
<td>3</td>
<td>Pes Hisar</td>
</tr>
<tr>
<td>D</td>
<td>9/8</td>
<td>203.910</td>
<td>23.460 ′</td>
<td>4</td>
<td>Aşiran</td>
</tr>
<tr>
<td>hc</td>
<td>32/27</td>
<td>294.135</td>
<td>90.225 ′</td>
<td>5</td>
<td>Acem Aşiran</td>
</tr>
<tr>
<td>Ve</td>
<td>8192/6561</td>
<td>384.360</td>
<td>90.225 ′</td>
<td>6</td>
<td>Arak</td>
</tr>
<tr>
<td>Z</td>
<td>81/64</td>
<td>407.820</td>
<td>23.460 ′</td>
<td>7</td>
<td>Gevašt</td>
</tr>
<tr>
<td>Hu</td>
<td>4/3</td>
<td>498.045</td>
<td>90.225 ′</td>
<td>8</td>
<td>Rast</td>
</tr>
<tr>
<td>T</td>
<td>1024/729</td>
<td>588.270</td>
<td>90.223 ′</td>
<td>9</td>
<td>Şuri</td>
</tr>
<tr>
<td>Y</td>
<td>262144/177147</td>
<td>678.495</td>
<td>90.225 ′</td>
<td>10</td>
<td>Zirgule</td>
</tr>
<tr>
<td>YA</td>
<td>3/2</td>
<td>701.955</td>
<td>23.460 ′</td>
<td>11</td>
<td>Düğah</td>
</tr>
<tr>
<td>YeB</td>
<td>128/81</td>
<td>792.180</td>
<td>90.225 ′</td>
<td>12</td>
<td>Kûrdî/Nihavend</td>
</tr>
<tr>
<td>YeC</td>
<td>32768/19683</td>
<td>882.405</td>
<td>90.225 ′</td>
<td>13</td>
<td>Segah</td>
</tr>
<tr>
<td>YeD</td>
<td>27/16</td>
<td>905.865</td>
<td>23.460 ′</td>
<td>14</td>
<td>Buselik</td>
</tr>
<tr>
<td>Yeh</td>
<td>16/9</td>
<td>996.090</td>
<td>90.225 ′</td>
<td>15</td>
<td>Çargah</td>
</tr>
<tr>
<td>YeV</td>
<td>4096/2187</td>
<td>1086.315</td>
<td>90.225 ′</td>
<td>16</td>
<td>Saba</td>
</tr>
<tr>
<td>YeZ</td>
<td>1048576/531441</td>
<td>1176.540</td>
<td>90.225 ′</td>
<td>17</td>
<td>Hicaz/Uzzal</td>
</tr>
<tr>
<td>YaH</td>
<td>2/1</td>
<td>1200.000</td>
<td>23.460 ′</td>
<td>18</td>
<td>Neva</td>
</tr>
</tbody>
</table>

¹ *Perdes* expressed in bold are diatonic naturals.
Table 4.2: Complete Abjad Notation of Perdes  –Continued

<table>
<thead>
<tr>
<th>Abjad</th>
<th>Urmavi Ratios</th>
<th>Cents</th>
<th>Intervals</th>
<th>Degrees</th>
<th>Nasr Dede Perdes</th>
</tr>
</thead>
<tbody>
<tr>
<td>YaH</td>
<td>2/1</td>
<td>1200.000</td>
<td>23.460 ć</td>
<td>٨</td>
<td>Neva (ع)</td>
</tr>
<tr>
<td>YaT</td>
<td>512/243</td>
<td>1290.225</td>
<td>90.225 ć</td>
<td>٩</td>
<td>Beyati</td>
</tr>
<tr>
<td>ke</td>
<td>131072/59049</td>
<td>1380.450</td>
<td>90.225 ć</td>
<td>١٠</td>
<td>Hisar</td>
</tr>
<tr>
<td>kÅ</td>
<td>9/4</td>
<td>1403.910</td>
<td>23.460 ć</td>
<td>٢١</td>
<td>Hüseyni</td>
</tr>
<tr>
<td>keB</td>
<td>64/27</td>
<td>1494.135</td>
<td>90.225 ć</td>
<td>٢٢</td>
<td>Acem</td>
</tr>
<tr>
<td>keC</td>
<td>16384/6561</td>
<td>1584.360</td>
<td>90.225 ć</td>
<td>٢٣</td>
<td>Eve</td>
</tr>
<tr>
<td>keD</td>
<td>81/32</td>
<td>1607.820</td>
<td>23.460 ć</td>
<td>٢٤</td>
<td>Mahur</td>
</tr>
<tr>
<td>keh</td>
<td>8/3</td>
<td>1698.045</td>
<td>90.225 ć</td>
<td>٢٥</td>
<td>Gerdaniye</td>
</tr>
<tr>
<td>keV</td>
<td>2048/729</td>
<td>1788.270</td>
<td>90.225 ć</td>
<td>٢٦</td>
<td>Şehnaz</td>
</tr>
<tr>
<td>keZ</td>
<td>524288/177147</td>
<td>1878.495</td>
<td>90.225 ć</td>
<td>٢٧</td>
<td>i</td>
</tr>
<tr>
<td>kaH</td>
<td>3/1</td>
<td>1901.955</td>
<td>23.460 ć</td>
<td>٢٨</td>
<td>Muhayyer (کر)</td>
</tr>
<tr>
<td>keT</td>
<td>256/81</td>
<td>1992.180</td>
<td>90.225 ć</td>
<td>٢٩</td>
<td>Sünbule (کر)</td>
</tr>
<tr>
<td>L</td>
<td>65536/19683</td>
<td>2082.405</td>
<td>90.225 ć</td>
<td>٣٠</td>
<td>Tiz Segah (کط)</td>
</tr>
<tr>
<td>LÅ</td>
<td>27/8</td>
<td>2105.865</td>
<td>23.460 ć</td>
<td>٣١</td>
<td>Tiz Buseik (ل)</td>
</tr>
<tr>
<td>LeB</td>
<td>32/9</td>
<td>2196.090</td>
<td>90.225 ć</td>
<td>٣٢</td>
<td>Tiz Çargah (لا)</td>
</tr>
<tr>
<td>LeC</td>
<td>8192/2187</td>
<td>2286.315</td>
<td>90.225 ć</td>
<td>٣٣</td>
<td>Tiz Saba (ليب)</td>
</tr>
<tr>
<td>LeD</td>
<td>2097152/531441</td>
<td>2376.540</td>
<td>90.225 ć</td>
<td>٣٤</td>
<td>Tiz Hicaz (لجه)</td>
</tr>
<tr>
<td>Leh</td>
<td>4/1</td>
<td>2400.000</td>
<td>23.460 ć</td>
<td>٣٥</td>
<td>Tiz Neva (لده)</td>
</tr>
<tr>
<td>LeV</td>
<td>1024/243</td>
<td>2490.225</td>
<td>90.225 ć</td>
<td>٣٦</td>
<td>Tiz Beyati (لله)</td>
</tr>
<tr>
<td>LeZ</td>
<td>262144/59049</td>
<td>2580.450</td>
<td>90.225 ć</td>
<td>٣٧</td>
<td>Tiz Hisar (لوز)</td>
</tr>
</tbody>
</table>

1 The octave complement of zirgule does not exist in Nasr Dede and is therefore skipped.
A comparison is made between *Arel-Ezgi-Uzdilek* (AEU) and *Abjad* scale in Table 4.3:

<table>
<thead>
<tr>
<th>AEU Ratios</th>
<th>Cents</th>
<th>Perdes</th>
<th>Abjad Ratios</th>
<th>Cents</th>
<th>Perdes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0: 1/1</td>
<td>0.000</td>
<td>KABA ÇÂRGÂH</td>
<td>0: 1/1</td>
<td>0.000</td>
<td>YEGÂH</td>
</tr>
<tr>
<td>1: 256/243</td>
<td>90.225</td>
<td>Kaba Nim Hicáz</td>
<td>1: 256/243</td>
<td>90.225</td>
<td>Pes Beyati</td>
</tr>
<tr>
<td>2: 2187/2048</td>
<td>113.685</td>
<td><em>Kaba Hicáz</em></td>
<td>2: 65536/59049</td>
<td>180.450</td>
<td>Pes Hisar</td>
</tr>
<tr>
<td>3: 65536/59049</td>
<td>180.450</td>
<td><em>Kaba Dik Hicáz</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4: 9/8</td>
<td>203.910</td>
<td>YEGÂH</td>
<td>4: 32/27</td>
<td>294.135</td>
<td>Acem Aşiran</td>
</tr>
<tr>
<td>5: 19683/16384</td>
<td>317.595</td>
<td>Kaba Nim Hisâr</td>
<td>5: 8192/6561</td>
<td>384.360</td>
<td>ARAK</td>
</tr>
<tr>
<td>6: 8192/6561</td>
<td>384.360</td>
<td>Kaba Hisâr</td>
<td>6: 81/64</td>
<td>407.820</td>
<td>Gevaşt</td>
</tr>
<tr>
<td>7: 81/64</td>
<td>407.820</td>
<td>HÜSEYNİ AŞİRÂN</td>
<td>7: 262144/177147</td>
<td>678.495</td>
<td>Dik Gevešt</td>
</tr>
<tr>
<td>8: 4/3</td>
<td>498.045</td>
<td>ACEM AŞİRÂN</td>
<td>8: 1024/729</td>
<td>588.270</td>
<td>Şuri</td>
</tr>
<tr>
<td>9: 177147/131072</td>
<td>521.505</td>
<td>Dik Acem Aşırân</td>
<td>9: 32768/19683</td>
<td>882.405</td>
<td>Zengûle</td>
</tr>
<tr>
<td>10: 1024/729</td>
<td>588.270</td>
<td>Irak</td>
<td>10: 262144/177147</td>
<td>678.495</td>
<td></td>
</tr>
<tr>
<td>11: 729/512</td>
<td>611.730</td>
<td>Gevešt</td>
<td>11: 32768/19683</td>
<td>882.405</td>
<td></td>
</tr>
<tr>
<td>12: 262144/177147</td>
<td>678.495</td>
<td>Dik Gevešt</td>
<td>12: 1048576/531441</td>
<td>1176.540</td>
<td></td>
</tr>
<tr>
<td>13: 27/16</td>
<td>905.865</td>
<td>DÜGÂH</td>
<td>13: 27/16</td>
<td>905.865</td>
<td>Bûselik</td>
</tr>
<tr>
<td>14: 16/9</td>
<td>996.090</td>
<td>Kürdî</td>
<td>14: 16/9</td>
<td>996.090</td>
<td>ÇÂRGÂH</td>
</tr>
<tr>
<td>15: 59049/32768</td>
<td>1019.550</td>
<td>Dik Kürdî</td>
<td>15: 4096/2187</td>
<td>1086.315</td>
<td>Sâbâ</td>
</tr>
<tr>
<td>16: 4096/2187</td>
<td>1086.315</td>
<td>Segâh</td>
<td>16: 1048576/531441</td>
<td>1176.540</td>
<td>Hicaz</td>
</tr>
<tr>
<td>17: 243/128</td>
<td>1109.775</td>
<td>BÜSELİK</td>
<td>17: 2/1</td>
<td>1200.000</td>
<td>NEVA</td>
</tr>
</tbody>
</table>

*Omitting in Table 3.8 degrees 5, 14, 23, 27, 36, 45, 49 of 53-tET yields (Continued in next column…)*

Average absolute difference: 0.3531 cents

Highest absolute difference: 0.8185 cents
In Nasr Dede, “Pes” (bass) signifies pitches an octave low, and “tiz” (treble) signifies pitches an octave high. However, the octave complement of zirgule does not exist.

Nasr Dede employs the letter ‘ayn for degrees 18 and 28 instead of Urmavi’s Y. The diatonic natural major scale, for instance, of the most basic Maqam Rast [253,254] is notated in Nasr Dede’s Abjad as shown in Figure 4.2:

\[
\frac{16}{15} \times \frac{10}{9} \times \frac{9}{8}
\]

\[\text{II. Tetrachord}\]

\[
\frac{16}{15} \times \frac{10}{9} \times \frac{9}{8}
\]

\[\text{I. Tetrachord}\]

\[
\begin{array}{cccccccc}
Gerdaniye & Evc & Hüseyni & Neva & Çargah & Segah & Düğah & Rast \\
\end{array}
\]

\[(^* \text{Disjunct tone})\]

\[
\begin{array}{c}
\text{Figure 4.2: Abjad Notation of the Principal Mode in Ascending Order of Maqam Rast with Schismatic Simplifications}^a \quad [255]
\end{array}
\]

1 Nasr Dede uses the letter “؟” instead of the digraph “؟ة” for perde neva.

2 The interval of a schisma (32805:32768) – attained by subtracting 5 octaves from a stack of 8 pure fifths plus 1 pure major third – equals the difference between a Pythagorean diminished fourth (8192:6561) and a pure major third (5:4), has a size of ~1.954 cents, and is, to all intents and purposes, the disparity between a pure and an equal tempered fifth. (See, accompanying endnote.) The simplification is done by adding a schisma to the Pythagorean ratios of the 3rd (segah) and 7th (evc) degrees of the Rast scale.
Although, Nasir Dede too notated Maqam Music perdes in Abjad, the sheik did not specify any ratios. Instead, he derived them from the nay in the following fashion [256, pp. 153-6; 257, pp. 6-8]:

« … The fingerholes of the nay that enlivens the soul are seven fingerholes from its opening to the blown end [mouthpiece]. By order, the first is known as Düğâh, second is Kürdî, third is Segâh, fourth is Çârgâh, fifth is Sâbâ, sixth is Nevâ, seventh [in the back] is ‘Aşrân.

Now that these are learnt;

■ Yegâh, the perde of; does not possess a perde [i.e., fingerhole] of its own on the nay. Due to being the low [viz., first undertone] of perde Nevâ, it is again ascribed perde [viz., the fingerhole of] Nevâ at the 1st register whence reaching from high to low – which is called “dem” [pedal tone] – of the breath of the blower.

■ Pes Beyâti; this does not possess a perde [i.e., fingerhole] of its own either, and is [produced, just like yegâh, as a pedal tone] from the said perde [viz., the fingerhole of Nevâ] by tilting [the nay] toward the side that the blower tilts the head.

☞ Pes Hisâr; [is blown] from the opening of the seventh ‘Aşrân fingerhole [by an inclination of the nay] more than customary.

☞ ‘Aşrân; [is blown from the ‘Aşrân fingerhole] as customary.

☞ ‘Acem ‘Aşrân; [is blown from the ‘Aşrân fingerhole] by a little declination toward the side of obliquity.

☞ ‘Arak; is blown [from the ‘Aşrân fingerhole] with a declination as much as pes beyâti.

1 Underlined perdes denote diatonic naturals; “■” signifies pedal tones, “☞” the fingerhole of ‘Aşrân, “●” that all fingerholes are to be shut, “►” normal blowing, “►►” 1st level of overblowing, “►►►” 2nd level of overblowing, “►►►►” 4th level of overblowing.
• Gevâş; [is produced by blowing] from the closed fingerhole of Dügâh [viz., with all fingerholes closed] as much straight as [was the case with] pes hisâr.

• Râst; [is produced by blowing] as customary [with all fingerholes closed].

• Şûri; is [achieved] by blowing [rast askance] like 'arâk.

• Zîrgûle; is [achieved] by opening the said fingerhole of Dügâh by half.

• Dügâh; is [sounded] as customary by opening [the fingerhole of Dügâh].

• Kürdî; is [the perde of] the fingerhole by its name [which is Kürdî].

• Segâh; Likewise [blown from its own fingerhole that is Segâh].

• Bâselik; [is sounded by blowing the ney] with half-opening the fourth Çârgâh fingerhole.

• Çârgâh; is [sounded] by blowing as customary [after fully opening the fingerhole of Çârgâh].

• Sâbâ; [is blown from the Sâbâ fingerhole] when ascending from perde rast to nevâ.

• Hicâz; is [blown] from the fifth fingerhole of Sâbâ when descending from perde nevâ to rast.

• Nevâ; is produced from the fingerhole of Nevâ.

• Beyâtî; Ditto, but blown askance like pes beyâtî.

• Hisâr; [is produced by blowing] with the 2nd register of breath from the fingerhole of the previously mentioned Dügâh in the manner of zîrgûle [viz., by half-opening].
Hüseynî: is [produced] by [similarly over] blowing from its [i.e., the Düğâh fingerhole’s] opening.

‘Acem: [is overblown] from the fingerhole of Kûrdî.

Evê: is [overblown] from the fingerhole of Segâh.

Mâhur: like bûselik [it is overblown with the fourth fingerhole of Çârgâh half-open].

Gerðâniye: [is overblown] from the opening of the fourth Çârgâh [fingerhole].

Şehnâz: is [overblown] from the fifth Sâbâ fingerhole.

Muhayyer: [is overblown] with the 3rd register of breath from the previously mentioned [fingerhole of] Düğâh.

Sünbûle: is [overblown similarly] from the Kûrdî fingerhole.

Tîz Segâh; Tîz Bûselik; Tîz Çârgâh; Tîz Sâbâ; Tîz Hicâz; Tîz Nevâ; Tîz Beyâtî; are [overblown] at this register from the outlets of their lower counterparts.

Tîz Hisâr; Tîz Hüseynî; are [overblown] at the 4th register of breath again from the outlets of hisâr and hüseynî.

And some of the perdes that transcend perde beyâtî are even produced from outlets other than those assigned [above]. Nevertheless, they [viz., alternate fingerings] have been waived due to our not having a need for mentioning them.

And even though there are perdes beyond these, they are [mostly] disused. And just as is the case with sînekeman [viola d’amore], some lowest of the low perdes are for ornamentation, and need for them is miniscule.
But, if these are desired to be performed on the soul-soothing nay, they [too] – just like \textit{yeg\dn{\text{"ah}}} and \textit{nev\dn{\text{"a}}} are considered one as has been stated above – are [similarly] \textit{perdes} [viz., pedal tones] below \textit{nev\dn{\text{"a}}} \textsuperscript{1} [252].

And \textit{perde} inception in between them are forbidden, and learning it useless and against the rule – unless it be for [attaining] the interval of an \textit{irh\dn{\text{"a}}} [i.e., diesis] \textsuperscript{ii} [31].

Moreover, it is obvious beyond doubt that the [presence of the] \textit{perde} tied by the name of \textit{ni\dn{\text{"a}}b\dn{\text{"u}}r} on the \textit{tanbur} [just] below \textit{perde b\dn{\text{"u}}selik} is genuinely absurd; for, seeing as the intermedial of \textit{b\dn{\text{"u}}selik} and \textit{seg\dn{\text{"a}}h} – like the intermedials, in sequence, of \textit{perdes} [viz., dyads] from \textit{yeg\dn{\text{"a}}h} to \textit{t\dn{\text{"i}}z h\dn{\text{"u}}seyn\dn{\text{"i}}} – is [only] a short distance, the [aural] difference between one side and the other will be very much indistinct when so much as a single [new] \textit{perde} is ordained [after them] \textsuperscript{iii} [258].

Even with its counterparts, the ratios of full consonance are somewhat impossible to realize. The arguments concerning the laws [for this] are explained in music theory [books] at length.

After this, [remember that] each \textit{perde} from \textit{nev\dn{\text{"a}}} to \textit{t\dn{\text{"i}}z hic\dn{\text{"a}}z} are the [octave] equivalents of \textit{yeg\dn{\text{"a}}h} to \textit{hic\dn{\text{"a}}z}, and are at the second level [of pitch] from \textit{t\dn{\text{"i}}z nev\dn{\text{"a}}} till \textit{t\dn{\text{"i}}z h\dn{\text{"u}}seyn\dn{\text{"i}}}; so much so that they [readily] substitute each other in the construction of melody. . . . » (Istanbul, 1795.)

APPENDIX C contains relevant information on the \textit{perdes} of \textit{ney} based on these explanations, including details of fingering, harmonics, instrument-making, reed sizes, and an attempt at instrumental standardization in reference to the concert pitch via transpositions of the principal mode of the most basic \textit{Maqam Rast}.

\textsuperscript{1} The sheik notates these ornamental pedal tones with the same \textit{Abjad} symbols he used for \textit{seg\dn{\text{"a}}h} to \textit{hic\dn{\text{"a}}z} (their octave equivalents), save his addition to the top right of each character of a superscript notch: \textasciitilde. (See, accompanying endnote.)

\textsuperscript{ii} By \textit{irh\dn{\text{"a}}}, the sheik surely insinuates “quarter-tone alterations”. (See, accompanying endnote.)

\textsuperscript{iii} It is odd that Nasir Dede objects to the insertion of \textit{ni\dn{\text{"a}}b\dn{\text{"u}}r} after \textit{b\dn{\text{"u}}selik} while contradicting himself further down the text by nonchalantly dodging \textit{nihavend} just above \textit{k\dn{\text{"u}}rd\dn{\text{"i}}}, and \textit{uzzal} amidst \textit{hic\dn{\text{"a}}z} and \textit{saba}. (See, accompanying endnote.)
Nasir Dede also provides a list of consonances in his treatise, stating that “each perde is fully harmonious seriatim with its eighteenth, eleventh, eighth, twenty eighth, twenty fifth, fourth, third, second, fifth, and sixth” [259]; leading to the speculations glossed in Table 4.4 below:

**Table 4.4: Speculation on Nasir Dede’s Consonant Ney Intervals**

<table>
<thead>
<tr>
<th>Steps</th>
<th>Classic Interval Names</th>
<th>Ratios</th>
<th>Cents</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(Fundamental Tone)</td>
<td>1:1</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>Octave</td>
<td>2:1</td>
<td>1200.000</td>
</tr>
<tr>
<td>10</td>
<td>Fifth</td>
<td>3:2</td>
<td>701.955</td>
</tr>
<tr>
<td>7</td>
<td>Fourth</td>
<td>4:3</td>
<td>498.045</td>
</tr>
<tr>
<td>27</td>
<td>Twelfth</td>
<td>3:1</td>
<td>1901.955</td>
</tr>
<tr>
<td>24</td>
<td>Eleventh</td>
<td>8:3</td>
<td>1698.045</td>
</tr>
<tr>
<td>3</td>
<td>Major Second (Tanini)</td>
<td>8:7 to 9:8</td>
<td>231.174 to 203.910</td>
</tr>
<tr>
<td>2</td>
<td>Middle Second (Mujannab)</td>
<td>10:9 to 16:15</td>
<td>182.403 to 111.731</td>
</tr>
<tr>
<td>1</td>
<td>Minor Second (Bakiye)</td>
<td>256:243 to 25:24</td>
<td>90.225 to 70.672</td>
</tr>
<tr>
<td>4</td>
<td>Minor Third</td>
<td>6:5 to 7:6</td>
<td>315.641 to 266.871</td>
</tr>
<tr>
<td>5</td>
<td>Major to Middle Third</td>
<td>81:64 to 27:22</td>
<td>407.82 to 354.547</td>
</tr>
</tbody>
</table>

This tabulation gives one the impression that some perdes deviate from Urmavi’s original tuning so far as to suggest a transition to 17-equal divisions of the octave [260]. Though, in reality, the execution of the traditional perde system may involve more complicated scordatura procedures [261]. Not only is it plausible that “intonation shift” [262] plays a vital role in their reinterpretation, but more importantly, the traditional framework could be a disguise for a very much intricate and dynamic, albeit cryptic tuning scheme.

Another thing of concern is that, Nasir Dede places the major and minor thirds at the end of the list of consonances, and does not mention their octave inversions, which brings to mind the prospect of melodic, rather than harmonic, “accordance” [263].

In any event, consonances, from broad to narrow, amid any two perdes of Nasir Dede are catalogued in Table 4.5:
Table 4.5: Catalogue of *Nasir Dedê’s* Dyadic Consonances

<table>
<thead>
<tr>
<th>Perdes of the first octave</th>
<th>(28.) Octave+ Fifth</th>
<th>(25.) Octave+ Fourth</th>
<th>(18.) Octave</th>
<th>(11.) Fifth</th>
<th>(8.) Fourth</th>
<th>(6.) Major Third</th>
<th>(5.) Minor Third</th>
<th>(4.) Major Second</th>
<th>(3.) Middle Second</th>
<th>(2.) Minor Second</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. AŞİRAN</td>
<td>Tiz</td>
<td>Muhay.</td>
<td>Hüseynî</td>
<td>Buselik</td>
<td>Dügah</td>
<td>Şurî/ Zırğule</td>
<td>Rast</td>
<td>Gevaşt</td>
<td>Arak</td>
<td>Acem Aşiran</td>
</tr>
<tr>
<td>5. Acem Aşiran</td>
<td>Tiz</td>
<td>Çargah</td>
<td>Sünbüle</td>
<td>Acem</td>
<td>Çargah</td>
<td>Kürdi</td>
<td>Dügah</td>
<td>Şuri</td>
<td>Rast</td>
<td>Gevaşt</td>
</tr>
<tr>
<td>6. ARAK</td>
<td>Hicaz</td>
<td>Tiz</td>
<td>Segah</td>
<td>Evc</td>
<td>Hicaz</td>
<td>Kürdi</td>
<td>Zırğule</td>
<td>Şuri</td>
<td>Rast</td>
<td>Gevaşt</td>
</tr>
<tr>
<td>7. Gevaşt</td>
<td>Tiz Saba</td>
<td>Tiz</td>
<td>Buselik</td>
<td>Mahur</td>
<td>Saba</td>
<td>Buselik</td>
<td>Kürdi</td>
<td>Dügah</td>
<td>Zırğule</td>
<td>Şuri</td>
</tr>
<tr>
<td>8. RAST</td>
<td>Tiz</td>
<td>Neva</td>
<td>Gerdan.</td>
<td>Neva</td>
<td>Çargah</td>
<td>Segah</td>
<td>Kürdi</td>
<td>Dügah</td>
<td>Zırğule</td>
<td>Şuri</td>
</tr>
<tr>
<td>9. Şuri</td>
<td>Tiz</td>
<td>Beyati</td>
<td>Şehnaz</td>
<td>Beyati</td>
<td>Hicaz</td>
<td>Çargah</td>
<td>Segah</td>
<td>Kürdi</td>
<td>Dügah</td>
<td>Zırğule</td>
</tr>
<tr>
<td>10. Zırğule</td>
<td>Tiz</td>
<td>Hisar</td>
<td>Tiz Hicaz</td>
<td>Şehnaz</td>
<td>Hisar</td>
<td>Hicaz/ Saba</td>
<td>Çargah</td>
<td>Buselik</td>
<td>Segah</td>
<td>Kürdi</td>
</tr>
<tr>
<td>11. DÜGAH</td>
<td>Tiz</td>
<td>Hüseynî</td>
<td>Tiz Neva</td>
<td>Muhay.</td>
<td>Hüseynî</td>
<td>Neva</td>
<td>Hicaz/ Saba</td>
<td>Çargah</td>
<td>Buselik</td>
<td>Segah</td>
</tr>
<tr>
<td>12. Kürdi (Nihav.)</td>
<td>Tiz</td>
<td>Beyati</td>
<td>Sünbüle</td>
<td>Acem</td>
<td>Beyati</td>
<td>Neva</td>
<td>Hicaz</td>
<td>Çargah</td>
<td>Buselik</td>
<td>Segah</td>
</tr>
<tr>
<td>13. SEGAH</td>
<td>Tiz</td>
<td>Hisar</td>
<td>Tiz Segah</td>
<td>Evc</td>
<td>Hisar</td>
<td>Beyati</td>
<td>Saba</td>
<td>Hicaz</td>
<td>Çargah</td>
<td>Buselik</td>
</tr>
<tr>
<td>15. ÇARGAH</td>
<td>Tiz</td>
<td>Çargah</td>
<td>Gerdan.</td>
<td>Acem</td>
<td>Hüsey.</td>
<td>Beyati</td>
<td>Neva</td>
<td>Saba</td>
<td>Hicaz</td>
<td>Çargah</td>
</tr>
<tr>
<td>16. Hicaz ii</td>
<td>Tiz</td>
<td>Şehnaz</td>
<td>Evc</td>
<td>Acem</td>
<td>Hisar</td>
<td>Beyati</td>
<td>Neva</td>
<td>Saba</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Saba (Uzzal)</td>
<td>Tiz</td>
<td>Saba</td>
<td>Şehnaz</td>
<td>Mahur</td>
<td>Acem</td>
<td>Hüsey.</td>
<td>Hisar</td>
<td>Beyati</td>
<td>Neva</td>
<td></td>
</tr>
</tbody>
</table>

1 Sometimes, this interval should be the 7th.

2 The reason for the precedence of hicaz over saba is due to its being a lower pitch in alignment with *Nasir Dedê’s* derivation of these perdes from the ney despite the order by which they are customarily listed in his treatise. Note that uzzal is equivalent to or lower than saba.
### Table 4.5: Catalogue of Nasır Dede’s Dyadic Consonances—Continued

<table>
<thead>
<tr>
<th>Perdes of the second octave</th>
<th>(18.) Octave</th>
<th>(11.) Fifth</th>
<th>(8.) Fourth</th>
<th>(6.) (^1) Major Third</th>
<th>(5.) Minor Third</th>
<th>(4.) Major Second</th>
<th>(3.) Middle Second</th>
<th>(2.) Minor Second</th>
</tr>
</thead>
<tbody>
<tr>
<td>23. EVC</td>
<td>Tiz Hicaz</td>
<td>Tiz Segah</td>
<td>Sünb. Şehnaz Gerd.</td>
<td>Mahur</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. GERDANIYE</td>
<td>Tiz Neva</td>
<td>Tiz Çargah</td>
<td>Tiz Segah</td>
<td>Sünb. Muhay. Şehnaz Şehnaz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29. Sünbüle</td>
<td>Tiz Beyati</td>
<td>Tiz Neva</td>
<td>Tiz Hicaz</td>
<td>Tiz Saba</td>
<td>Tiz Çargah</td>
<td>Tiz Buselik</td>
<td>Tiz Segah</td>
<td></td>
</tr>
<tr>
<td>30. TIZ SEGAH</td>
<td>Tiz Hisar</td>
<td>Tiz Saba</td>
<td>Tiz Hicaz</td>
<td>Tiz Çargah</td>
<td>Tiz Buselik</td>
<td>Tiz Segah</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32. TIZ ÇARGAH</td>
<td>Tiz Hüsey</td>
<td>Tiz Neva</td>
<td>Tiz Beyati</td>
<td>Tiz Saba</td>
<td>Tiz Hicaz</td>
<td>Tiz Çargah</td>
<td>Tiz Buselik</td>
<td></td>
</tr>
<tr>
<td>33. Tiz Hicaz</td>
<td>Tiz Hisar</td>
<td>Tiz Saba</td>
<td>Tiz Hüsey.</td>
<td>Tiz Beyati</td>
<td>Tiz Neva</td>
<td>Tiz Saba</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34. Tiz Saba</td>
<td>Tiz Hüsey.</td>
<td>Tiz Hisar</td>
<td>Tiz Beyati</td>
<td>Tiz Neva</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Sometimes, this interval ought to be the 7th.
Arranged on the stave in Figure 4.3 with a highly flexible notation pertaining to the *ney* fingering chart of APPENDIX C and extemporary *perde* syllables are the octave consonances of *Nasir Dede*:

![Stave Notation of Nasir Dede's Octave Consonances](image)

Solf: Sol La Si Ut Re Mi Fa Sol La
Degree: -4. -3. -2. 1. 2. 3. 4. 5. 6.
Octave: 5. 6. 7. 8. 9. 10. 11. 12. 13.

Figure 4.3: Staff Notation of Nasir Dede’s Octave Consonances ¹

In like manner, *Nasir Dede*’s consonances of the fifth, fourth, twelfth and eleventh are transcribed in Figure 4.4:

¹ Notation is key-transposing. Whole notes are diatonic naturals, black notes are *perdes* in between. Flattened tones are lower in pitch than their sharpened pairs. Diamond-shaped notes signify *perdes* produced by half-opening the next *ney* fingerhole (zirgule, buselik, hisar, mahur, *tiz* buselik, *tiz* hisar) and their octave equivalents (pes hisar, gevašt, şehnaz). Enharmonic tones in brackets are produced from the same fingerhole (Aşiran fingerhole: acem aşiran); (Kürdi fingerhole: kürdi/mihavend – acem – sünbüle); (Saba fingerhole: saba/hicaz/uzzal – şehnaz – *tiz* saba/hicaz/uzzal). Accidentals in parantheses are reminders of the direction of flexibility for related tones. Solf and degrees are diatonical. Legend for *perde* syllables is as follows:

<table>
<thead>
<tr>
<th>Perdes of 1st Fifth</th>
<th>Perdes of 2nd Fifth</th>
<th>Perdes of 3rd Fifth</th>
<th>Perdes of 4th Fifth</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEGAH 1. YA</td>
<td>DÜGAH 11. DÜ</td>
<td>HÜSEYNI 21. HÜ</td>
<td>T. Buselik 29. Tu</td>
</tr>
<tr>
<td>Aşem Aş. 5. Cin</td>
<td>ŞARGAH 15. ÇA</td>
<td>GERDAN. 25. DA</td>
<td>T. NEVA 34. ZA</td>
</tr>
<tr>
<td>RAST 8. RA</td>
<td>NEVA 18. NA</td>
<td>MUHAY. 27. MU</td>
<td>T. HÜSEY. 37. ZÜ</td>
</tr>
<tr>
<td>Zirgule 10. Le</td>
<td>Hisar 20. Hi</td>
<td>T. SEGAH 29. TE</td>
<td></td>
</tr>
</tbody>
</table>
Figure 4.4: Staff Notation of Nasır Dede’s Consonances of the Fifth, Fourth, Twelfth, and Eleventh

Furthermore, Nasır Dede’s consonances of the major third, minor third, and the middle second are exposed in Figure 4.5:
Figure 4.5: Staff Notation of Nasir Dedê’s Consonances of the Major Third, Minor Third, and Middle Second
And finally, Nasir Dede’s consonances of the whole and half tones can be observed in Figure 4.6:

8:7 to 9:8

25:24 to 256:243

Figure 4.6: Staff Notation of Nasir Dede’s Consonances of Whole and Half Tones
Except the fairly unorthodox perde gestalt of Nasir Dede – which may very well suggest a volatile range for the mujannab zone – the early Abjad System is completely bereft of any “quarter-tones”, as manifested in Table 4.6:

<table>
<thead>
<tr>
<th>Interval Class</th>
<th># of occurrence</th>
<th>Dyads up to Period</th>
<th>Cents</th>
<th>Mirrored</th>
<th>Cents</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>1 time</td>
<td>(1/1)</td>
<td>0.000</td>
<td>2/1</td>
<td>1200.000</td>
</tr>
<tr>
<td>1:</td>
<td>5 times</td>
<td>531441/524288</td>
<td>23.460</td>
<td>1048576/531441</td>
<td>1176.540</td>
</tr>
<tr>
<td>1:</td>
<td>12 times</td>
<td>256/243</td>
<td>90.225</td>
<td>243/128</td>
<td>1109.775</td>
</tr>
<tr>
<td>2:</td>
<td>10 times</td>
<td>2187/2048</td>
<td>113.685</td>
<td>4096/2187</td>
<td>1086.315</td>
</tr>
<tr>
<td>2:</td>
<td>7 times</td>
<td>65536/59049</td>
<td>180.450</td>
<td>59049/32768</td>
<td>1019.550</td>
</tr>
<tr>
<td>3:</td>
<td>15 times</td>
<td>9/8</td>
<td>203.910</td>
<td>16/9</td>
<td>996.090</td>
</tr>
<tr>
<td>4:</td>
<td>3 times</td>
<td>4782969/4194304</td>
<td>227.370</td>
<td>8388608/4782969</td>
<td>972.630</td>
</tr>
<tr>
<td>3:</td>
<td>2 times</td>
<td>16777216/14348907</td>
<td>270.675</td>
<td>14348907/8388608</td>
<td>929.325</td>
</tr>
<tr>
<td>4:</td>
<td>14 times</td>
<td>32/27</td>
<td>294.135</td>
<td>27/16</td>
<td>905.865</td>
</tr>
<tr>
<td>5:</td>
<td>8 times</td>
<td>19683/16384</td>
<td>317.595</td>
<td>32768/19683</td>
<td>882.405</td>
</tr>
<tr>
<td>5:</td>
<td>9 times</td>
<td>8192/6561</td>
<td>384.360</td>
<td>6561/4096</td>
<td>815.640</td>
</tr>
<tr>
<td>6:</td>
<td>13 times</td>
<td>81/64</td>
<td>407.820</td>
<td>128/81</td>
<td>792.180</td>
</tr>
<tr>
<td>7:</td>
<td>1 time</td>
<td>43046721/33554432</td>
<td>431.280</td>
<td>67108864/43046721</td>
<td>768.720</td>
</tr>
<tr>
<td>6:</td>
<td>4 times</td>
<td>2097152/1594323</td>
<td>474.585</td>
<td>1594323/1048576</td>
<td>725.415</td>
</tr>
<tr>
<td>7:</td>
<td>16 times</td>
<td>4/3</td>
<td>498.045</td>
<td>3/2</td>
<td>701.955</td>
</tr>
<tr>
<td>8:</td>
<td>6 times</td>
<td>177147/131072</td>
<td>521.505</td>
<td>262144/177147</td>
<td>678.495</td>
</tr>
<tr>
<td>8:</td>
<td>11 times</td>
<td>1024/729</td>
<td>588.270</td>
<td>729/512</td>
<td>611.730</td>
</tr>
</tbody>
</table>

4.3. Late Ottoman Phonetic Notations

Phonetic Notations encountered during 18th-19th centuries in the Ottoman realm are the Arabic ones known as Kantemir & Osman Dede and Armenian ones named Harutin & Hamparsum. They will be explained in this section.

\[\text{Inverted by the interval of repetition, which is the octave.}\]
Table 4.7 contains an overview of Arabic Phonetics of tanbur perdes by Kantemir and ney perdes by Osman Dede [264-266]:

**Table 4.7: Kantemir & Osman Dede Phonetic Notations of Perdes**

<table>
<thead>
<tr>
<th>Low Octave Perdes</th>
<th>Kantemir’s Hints</th>
<th>Kantemir</th>
<th>Osman Dede</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Nerm Çargâh]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yegâh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Aşiran</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acem ‘Aşiran</td>
<td>Tetimme-i perde ve agaze-i Irak (leading tone below Irak)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irak</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rehavi / Geveş</td>
<td>na-ism / Rehavi-i Cedid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rast</td>
<td>Sâba perdesinin şeddi (fourth below Sâba)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zengule / Zirgule</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dûgâh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nihavend iii / Kürdi</td>
<td>Tetimme-i agaze-i Maqam-i Segâh – Maye (leading tone to Segah)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segâh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buselik</td>
<td>Rehavi-i ‘Atik / Nişâbür</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Çargâh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sâba / Hicaz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uzzal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neva</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{i}\) Perdes seperated by slashes are Osman Dede’s denominations. Bold terms indicate diatonic naturals yclept “tam”. Nerm çargâh is a drone mentioned by Kantemir alone.

\(^{ii}\) Delitescent nim perdes, which are: “tetimme-i perde ve agaze-i Irak” (adjunct/leading tone of the cadence of Irak) a semitone below, and “na-ism” (nameless) above irak; rehavi-i cedid (new rehavi) a semitone below, and “saba perdesinin şeddi” (transposition of perde saba) above rast; “tetimme-i agaze-i Maqam-i Segah” (leading tone of Maqam Segah’s cadence) also known as maye a semitone below, and rehavi-i ‘atik (old rehavi) above segah; and nişâbûr in place of buselik when descending over uzzal.

\(^{iii}\) Kantemir defines nihavend as a perde distinguished by its extreme proximity to dügah in Maqam Kürdî – aptly named kürdi by Merâğı and Osman Dede, but possibly even lower in pitch than specified – which accords with Nâsir Dede’s tendency to differentiate the two.
Table 4.7: Kantemir & Osman Dede Phonetic Notations of Perdes - Continued

<table>
<thead>
<tr>
<th>High Octave Perdes</th>
<th>Kantemir’s Hints</th>
<th>Kantemir</th>
<th>Osman Dede</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neva</td>
<td>نا</td>
<td>نا</td>
<td>نا</td>
</tr>
<tr>
<td>Bayati / Şuri</td>
<td>ضا</td>
<td>ضا</td>
<td>ضا</td>
</tr>
<tr>
<td>Hisar</td>
<td>حضر</td>
<td>حضر</td>
<td>حضر</td>
</tr>
<tr>
<td>Hüseyni</td>
<td>حضر</td>
<td>حضر</td>
<td>حضر</td>
</tr>
<tr>
<td>Acem</td>
<td><strong>Evc</strong></td>
<td>ع</td>
<td>ع</td>
</tr>
<tr>
<td></td>
<td>Tetimme-i agaze-i Maqam-i Evc</td>
<td>ع</td>
<td>ع</td>
</tr>
<tr>
<td>Mahur</td>
<td>ما</td>
<td>ما</td>
<td>ما</td>
</tr>
<tr>
<td>Gerdaniye</td>
<td>كرك</td>
<td>كرك</td>
<td>كرك</td>
</tr>
<tr>
<td>Şehnaz</td>
<td>شه</td>
<td>شه</td>
<td>شه</td>
</tr>
<tr>
<td>Muhayyer</td>
<td>مرح[267]</td>
<td>مرح</td>
<td>مرح</td>
</tr>
<tr>
<td>Sünbüle</td>
<td>لج</td>
<td>لج</td>
<td>لج</td>
</tr>
<tr>
<td>Tız Segah</td>
<td>سج</td>
<td>سج</td>
<td>سج</td>
</tr>
<tr>
<td>Tız Buselik</td>
<td>بسل</td>
<td>بسل</td>
<td>بسل</td>
</tr>
<tr>
<td>Tız Çargah</td>
<td>ئج</td>
<td>ئج</td>
<td>ئج</td>
</tr>
<tr>
<td>Tız Sâba / Tız Hicaz</td>
<td>حصر</td>
<td>حصر</td>
<td>حصر</td>
</tr>
<tr>
<td>Tız Uzzal</td>
<td>له</td>
<td>له</td>
<td>له</td>
</tr>
<tr>
<td>Tız Neva</td>
<td>نی</td>
<td>نی</td>
<td>نی</td>
</tr>
<tr>
<td>Tız Bayati / Tız Şuri</td>
<td>۷</td>
<td>۷</td>
<td>۷</td>
</tr>
<tr>
<td>(Tız Hisar) iv [268]</td>
<td>حضر</td>
<td>حضر</td>
<td>حضر</td>
</tr>
<tr>
<td>Tız Hüseyni</td>
<td>حبح</td>
<td>حبح</td>
<td>حبح</td>
</tr>
</tbody>
</table>

1 Perdes seperated by slashes are Osman Dede’s denominations. Bold terms indicate diatonic naturals yclept “tam”. Pitches above tız neva belong to the III. Octave.

2 Delitescent nim perdes, to wit: “tetimme-i perde ve agaze-i Maqam-i Evc” (leading tone of the cadence of Maqam of Evc) a semitone below, and “na-ism” (nameless) above Evc.

3 As reported by Yekta in La Histoire de la Musique. (See, accompanying endnote)

4 This perde is omitted in Kantemir and Osman Dede and its notation is invented. However, the latter mentions it and a two octave equivalent (nerm hisar) in an extant treatise where he seems to prefer Kantemir’s choice of names. (See, accompanying endnote).
While 17 traditional *perdes* from *rast* to *gerdaniye* – with the inclusion of *kürdi*¹ as distinct from *nihavend* – may be counted in the tables above, more interesting is the presence of 22 *perdes* lurking between *añiran* and *hüseyni*, as shown in Table 4.8:

<table>
<thead>
<tr>
<th>#</th>
<th>Lower Octave Perdes</th>
<th>#</th>
<th>Higher Octave Perdes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>[Nerm Çargâh]</td>
<td>26</td>
<td>Hüseyni</td>
</tr>
<tr>
<td>2</td>
<td>Yegâh</td>
<td>27</td>
<td>Têtimme-i Evc</td>
</tr>
<tr>
<td>3</td>
<td>‘Aşîran</td>
<td>28</td>
<td>Acem</td>
</tr>
<tr>
<td>4</td>
<td>Têtimme-i Irak</td>
<td>29</td>
<td>Evc</td>
</tr>
<tr>
<td>5</td>
<td>Acem ‘Aşîran</td>
<td>30</td>
<td>Mahûr</td>
</tr>
<tr>
<td>6</td>
<td>Irak</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Rehavi(-i Cedid) / Gevest</td>
<td>31</td>
<td>Gerdaniye</td>
</tr>
<tr>
<td>8</td>
<td>Na-ism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Rast</td>
<td>32</td>
<td>Şehnaz</td>
</tr>
<tr>
<td>10</td>
<td>Şedd-i Saba ² [269] (Şuri)</td>
<td>33</td>
<td>Muhayyer</td>
</tr>
<tr>
<td>11</td>
<td>Zengule / Zirgule</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Dûgâh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Têtimme-i Segâh (Maye) / Kürdi</td>
<td>34</td>
<td>Sûnbûle</td>
</tr>
<tr>
<td>14</td>
<td>Nihavend</td>
<td>35</td>
<td>Tiz Segâh</td>
</tr>
<tr>
<td>15</td>
<td>Segâh</td>
<td>36</td>
<td>Tiz Buselik</td>
</tr>
<tr>
<td>16</td>
<td>Buselik</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Nişabûr</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Rehavi-i ‘Atik</td>
<td>38</td>
<td>Tiz Sâba / Tiz Hicaz</td>
</tr>
<tr>
<td>19</td>
<td>Çargâh</td>
<td>39</td>
<td>Tiz Uzzal</td>
</tr>
<tr>
<td>20</td>
<td>Sâba / Hicaz</td>
<td>40</td>
<td>Tiz Neva</td>
</tr>
<tr>
<td>21</td>
<td>Uzzal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Neva</td>
<td>41</td>
<td>Tiz Bayati / Tiz Şuri</td>
</tr>
<tr>
<td>23</td>
<td>Bayati / Şuri</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Hisar</td>
<td>42</td>
<td>(Tiz Hisar)</td>
</tr>
<tr>
<td>25</td>
<td>Hüseyni</td>
<td>43</td>
<td>Tiz Hüseyni</td>
</tr>
</tbody>
</table>

¹ Which is none other than “*têtimme-i agaze-i Maqam-i Segah*”, or maye of Kantemir.

² This *perde* must be Nasr Dede’s şuri, which is also a technique of blowing the *ney* tilted. As such, Osman Dede acquires the same via overblowing. (See, accompanying endnote)
Two superlative causes for the irregularity of this scale are conceivable: First, no lower octave complement for bayati/şuri or hisar exists – since Kantemir deems them injudicious for melody-making; second, some of the higher octave perdes are missing – due probably to a lesser usage, lack of fretting space on the tanbur, and loss of auditory distinction when playing higher frequencies.

Osman Dede’s perdes slightly differ from those of Nasır Dede as follows: Pest beyati and pest hisar are not present, şuri is displaced by a pure fifth upwards and occupies the position of bayati, hicaz substitutes saba, uzzal appears instead of hicaz, higher octave equivalents for these are treated similarly, and there is no tiz hisar.

Likewise, in Kantemir, pest beyati and pest hisar are skipped, geves is replaced by rehavi, zirgule with zengule, kürdi by nihiavend, and hicaz/tiz hicaz with uzzal/tiz uzzal. Moreover, tiz hisar is omitted.

Other than these, contemporary Arabic Phonetic Notations are identical with Nasır Dede’s perde gestalt; thus, the same staff notation of the preceding section applies to them also.

However, if one were to enquire into Kantemir’s 8 arcane nim perdes (i.e., semitones), 50 equal divisions of the octave could be inferred. Accordingly, a recapitulation of the densest region resulting from the mixture of both Arabic Phonetic Notations mapped to this “cyclic meantone temperament” is produced in Table 4.9.

Locations of thirteen 144 cent (\{12:11=150.637 \(\varepsilon\}\) - 6.637 \(\varepsilon\}) and fifteen 168 cent (\{11:10=165.004 \(\varepsilon\}\) + 2.996 \(\varepsilon\)) middle seconds adorning the aforesaid compass are shown in Figure 4.7.

Of note in this figure, are the two 3/4 tones between rast-trak, segah-cargah, and three 4/5 tones between asiran-trak, dügah-segah, and segah-nişabur.
Table 4.9: Recapitulation of 22 Kantemir & Osman Dede Perdes in 50-EDO

<table>
<thead>
<tr>
<th>Degree</th>
<th>Cents</th>
<th>Tam (Natural) perdes</th>
<th>Nim (Half) perdes</th>
<th>Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>0.000</td>
<td>0. ‘Aşiran</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1:</td>
<td>24.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td>48.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3:</td>
<td>72.000</td>
<td>1. Tetimme-i Irak</td>
<td>72-120 ¢ down</td>
<td></td>
</tr>
<tr>
<td>4:</td>
<td>96.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5:</td>
<td>120.000</td>
<td>2. Acem ‘Aşiran</td>
<td>120 ¢ up ‘Aşiran</td>
<td></td>
</tr>
<tr>
<td>6:</td>
<td>144.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7:</td>
<td>168.000</td>
<td>3. Irak</td>
<td>192 ¢ from ‘Aşiran</td>
<td></td>
</tr>
<tr>
<td>8:</td>
<td>192.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9:</td>
<td>216.000</td>
<td>4. Rehavi(-i Cedid) / Geveş</td>
<td>72-96 ¢ down Rast</td>
<td></td>
</tr>
<tr>
<td>10:</td>
<td>240.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:</td>
<td>264.000</td>
<td>5. Na-ism</td>
<td>72-96 ¢ up Irak</td>
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<tr>
<td>12:</td>
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<td>13:</td>
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<td>120 ¢ from Irak</td>
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<tr>
<td>14:</td>
<td>336.000</td>
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<td>15:</td>
<td>360.000</td>
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<td>16:</td>
<td>384.000</td>
<td>7. Şedd-i Saba</td>
<td>72-96 ¢ up Rast</td>
<td></td>
</tr>
<tr>
<td>17:</td>
<td>408.000</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>18:</td>
<td>432.000</td>
<td>8. Zengule / Zirgule</td>
<td>72 ¢ down Düğâh</td>
<td></td>
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<tr>
<td>19:</td>
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<td>21:</td>
<td>504.000</td>
<td>9. Düğâh</td>
<td>192 ¢ from Rast</td>
<td></td>
</tr>
<tr>
<td>22:</td>
<td>528.000</td>
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<td></td>
<td></td>
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<tr>
<td>23:</td>
<td>552.000</td>
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<td></td>
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<tr>
<td>24:</td>
<td>576.000</td>
<td>10. Tetimme-i Segâh (Maye) / Kürdî</td>
<td>72-120 ¢ down Segâh</td>
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<tr>
<td>25:</td>
<td>600.000</td>
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<td>26:</td>
<td>624.000</td>
<td>11. Nihavend</td>
<td>120 ¢ up Düğâh</td>
<td></td>
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<tr>
<td>27:</td>
<td>648.000</td>
<td></td>
<td></td>
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<td>28:</td>
<td>672.000</td>
<td>12. Segâh</td>
<td>192 ¢ from Rast</td>
<td></td>
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<tr>
<td>29:</td>
<td>696.000</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>30:</td>
<td>720.000</td>
<td>13. Buselek</td>
<td>96 ¢ down Çargâh</td>
<td></td>
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<tr>
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<td>744.000</td>
<td>14. Nişabûr</td>
<td>72 ¢ down Çargâh</td>
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<td>15. Rehavi-i ’Atik</td>
<td>72-96 ¢ up Segâh</td>
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<td>34:</td>
<td>816.000</td>
<td>16. Çargâh</td>
<td>120 ¢ from Segâh</td>
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<td>35:</td>
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<td></td>
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<td>36:</td>
<td>864.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37:</td>
<td>888.000</td>
<td>17. Sâba / Hicaz</td>
<td>72-96 ¢ up Çargâh</td>
<td></td>
</tr>
<tr>
<td>38:</td>
<td>912.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39:</td>
<td>936.000</td>
<td>18. Uzzal</td>
<td>72 ¢ down Neva</td>
<td></td>
</tr>
<tr>
<td>40:</td>
<td>960.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41:</td>
<td>984.000</td>
<td></td>
<td></td>
<td></td>
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<td>42:</td>
<td>1008.000</td>
<td>19. Neva</td>
<td>192 ¢ from Çargâh</td>
<td></td>
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<tr>
<td>43:</td>
<td>1032.000</td>
<td></td>
<td></td>
<td></td>
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<td>44:</td>
<td>1056.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45:</td>
<td>1080.000</td>
<td>20. Bayati / Şuri</td>
<td>72-96 ¢ up Neva</td>
<td></td>
</tr>
<tr>
<td>46:</td>
<td>1104.000</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>47:</td>
<td>1128.000</td>
<td>21. Hisar</td>
<td>72 ¢ down Hüseynî</td>
<td></td>
</tr>
<tr>
<td>48:</td>
<td>1152.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>49:</td>
<td>1176.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50:</td>
<td>1200.000</td>
<td>22. Hüseynî</td>
<td>192 ¢ from Neva</td>
<td></td>
</tr>
</tbody>
</table>
A tanbur drawing by Kantemir given in Figure 4.8 adumbrates – as if whispering the notion of “pitch-clusters” from three centuries ago – the direction of sinuosity for nim perdes\(^{ii}\) [270]. Here, left-hand-side nim perdes may denote a general tendency to raise, right-hand-side nim perdes may denote a general tendency to lower the pitch; possibly by a supple backward or forward – or even sideways – motion of the fingertip on the frets.

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\(^{i}\) See footnote to the first page of APPENDIX B.

\(^{ii}\) Original document scanned from the source provided in accompanying endnote. Lines and perde names have been added.
Figure 4.8: Kantemir’s Tanbur from Kitābū ‘Ilmi’l-Muşīkī ‘alā vechi’l-Ḥurūfāt, p.131
As for how traditional perdes appear in Armenian Phonetic Notations known as Harutin & Hamparsum, let the reader refer to Table 4.10 [271-274].

Table 4.10: Hamparsum & Harutin Phonetic Notations of Perdes

<table>
<thead>
<tr>
<th>Letters</th>
<th>I. Octave Perdes</th>
<th>Letters</th>
<th>II. Octave</th>
<th>Letters</th>
<th>III. Octave</th>
</tr>
</thead>
<tbody>
<tr>
<td>ւ</td>
<td>Koba Çargâh</td>
<td>ջ</td>
<td>Çargâh</td>
<td>թ</td>
<td>Tiz Çargâh</td>
</tr>
<tr>
<td>չ</td>
<td>Pes Hicaz</td>
<td>ջ</td>
<td>Hicaz / Sâba</td>
<td>թ</td>
<td>Tiz Hicaz / Sâba</td>
</tr>
<tr>
<td>ե</td>
<td>Yegâh</td>
<td>ե</td>
<td>Neva</td>
<td>թ</td>
<td>Tiz Neva</td>
</tr>
<tr>
<td>կ</td>
<td>Pes Hisar / Շորիզեն</td>
<td>կ</td>
<td>Hisar / Beyati</td>
<td>թ</td>
<td>Tiz Hisar</td>
</tr>
<tr>
<td>ձ</td>
<td>(Hüseyni) Aşiran</td>
<td>ձ</td>
<td>Hüseyni</td>
<td>թ</td>
<td>Tiz Hüseyni</td>
</tr>
<tr>
<td>ն</td>
<td>Acem Aşiran</td>
<td>ն</td>
<td>Acem</td>
<td>թ</td>
<td>Tiz Acem</td>
</tr>
<tr>
<td>ա</td>
<td>Arak</td>
<td>է</td>
<td>Eve</td>
<td>թ</td>
<td>Tiz Eve</td>
</tr>
<tr>
<td>ղ</td>
<td>Geveşt</td>
<td>փ</td>
<td>Mahur</td>
<td>թ</td>
<td>Tiz Mahur</td>
</tr>
<tr>
<td>օ</td>
<td>Rast</td>
<td>ը</td>
<td>Gerdaniye</td>
<td>թ</td>
<td>Tiz Gerdaniye</td>
</tr>
<tr>
<td>Զ</td>
<td>Zirgâle</td>
<td>Շ</td>
<td>Şehnaz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>թ</td>
<td>Dûgâh</td>
<td>Ս</td>
<td>Muhayer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ե</td>
<td>Kûrdî / Nihavend</td>
<td>Ս</td>
<td>Sülbule</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ե</td>
<td>Segâh</td>
<td>թ</td>
<td>Tiz Segâh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>բ</td>
<td>Bûselik</td>
<td>թ</td>
<td>Tiz Bûselik</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A twelve-tone plan is all but traceable in both, if not for the presence of Pythagorean-like gevešt/ (tiz) buselik/ (tiz) mahur: Nonetheless, it is suspect whether this 14-tone mould foments dodecaphony at all. Rather, the inclusion of Pythagorean-like perdes as distinct from the more flexible arak/(tiz) segah/(tiz) evc imply propriety and transpositional consistency without destroying wholly the subtle nuances requisite of maqamat.

\[1\] Denominations seperated by slashes and extended in paranthesis are Harutin's. Shaded cells indicate tam (natural) perdes.
A final review of Phonetic Notations & Abjad is shown in Figure 4.9 below:

Figure 4.9: Final Review on Staff of Ottoman Phonetic Notations & Abjad
In this figure, de facto frequency ratios for whole natural notes known as tam perdes are more or less fixed, where only arak/(tiz) segah/(tiz) evc show great variance of pitch as much as a quarter-tone down.

Semitones known as nim perdes, on the other hand, are literally quite loose. Flats often approach the notes preceding them, while sharps as well as gevest/ (tiz) buselik/ (tiz) mahur incline toward their upper neighbours.

Still, accidentals can be made to enharmonically coincide at midpoints amid the whole notes.

Unruly perdes acknowledged by Kantemir and shunned by Nasir Dede are disregarded.

No clear-cut tunings for Phonetic Notations are inferrable, aside from, perhaps, a rugged 50 equal divisions of the octave. Even Nasir Dede’s Abjad does not appear to abide with Urmawi’s 17-tone Pythagorean tuning given the way consonances are defined.

As a side note, Hamparsum, in the author’s opinion, is the best Phonetic Notation for Turkish Maqam Music due to its elegance, integrity, emancipation from a standard diapason, and supersedure of the burden of key changes (all of which are concinnuous with the monodic tradition) – if not for its considerable lack of particulars. This view is supported by its immense popularity among musicians during 19th and early 20th centuries as a means of recording and deciphering works.

Nevertheless, be it Hamparsum, Harutin, Kantemir, Osman Dede, or Nasir Dede, late Ottoman Phonetic/Abjad Notations are vague systems, valid only as teaching tools in the hands of instructors, or for jotting down compositions, and have little mathematical value besides.

Thus, it is safe to state that they – and any particular tuning(s) they might once have involved – are likely outdated.
4.4. Contemporary Rival Theories

By middle 1800s, Mushaqah had revived mathematization of musical intervals in the Near East, inspiring not only Yekta to promote his 24-tone Pythagorean model early in the 20th century, but also numerous others in the Arab World to come up with myriad schemes to determine the locations of traditional *perdes* [275].

*Mushaqah*’s System is disclosed in Table 4.11 [276], and modern Arabic staff-notation derived from it, in Figure 4.10 [277]:

<table>
<thead>
<tr>
<th>#</th>
<th>Perdes of I. Octave</th>
<th>Frequency Ratios</th>
<th>Cents</th>
<th>Consecutive Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>YAK-GĀH (Sol)</td>
<td>3456 / 3456</td>
<td>0.000</td>
<td>(with previous)</td>
</tr>
<tr>
<td>1:</td>
<td>Qarār Nīm Ḥiṣār</td>
<td>3456 / 3361</td>
<td>48.255</td>
<td>48.255 ¢</td>
</tr>
<tr>
<td>2:</td>
<td>Qarār Ḥiṣār</td>
<td>3456 / 3268</td>
<td>96.834</td>
<td>48.579 ¢</td>
</tr>
<tr>
<td>3:</td>
<td>Qarār Tik Ḥiṣār</td>
<td>3456 / 3177</td>
<td>145.726</td>
<td>48.892 ¢</td>
</tr>
<tr>
<td>4:</td>
<td>‘UŠAYRĀN (La)</td>
<td>3456 / 3088</td>
<td>194.917</td>
<td>49.191 ¢</td>
</tr>
<tr>
<td>5:</td>
<td>Nīm ‘Ajam-‘Ušayrān</td>
<td>3456 / 3001</td>
<td>244.392</td>
<td>49.475 ¢</td>
</tr>
<tr>
<td>6:</td>
<td>‘Ajam-‘Ušayrān</td>
<td>3456 / 2916</td>
<td>294.135</td>
<td>49.743 ¢</td>
</tr>
<tr>
<td>7:</td>
<td>‘IRĀQ (Si ṭ)</td>
<td>3456 / 2833</td>
<td>344.127</td>
<td>49.992 ¢</td>
</tr>
<tr>
<td>8:</td>
<td>Gavašt</td>
<td>3456 / 2752</td>
<td>394.347</td>
<td>50.220 ¢</td>
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<tr>
<td>9:</td>
<td>Tik Gavašt</td>
<td>3456 / 2673</td>
<td>444.772</td>
<td>50.425 ¢</td>
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<tr>
<td>10:</td>
<td>RĀST (Do)</td>
<td>3456 / 2596</td>
<td>495.375</td>
<td>50.603 ¢</td>
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<tr>
<td>11:</td>
<td>Nīm Zīrgūlah</td>
<td>3456 / 2521</td>
<td>546.129</td>
<td>50.754 ¢</td>
</tr>
<tr>
<td>12:</td>
<td>Zīrgūlah</td>
<td>3456 / 2448</td>
<td>597.000</td>
<td>50.871 ¢</td>
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<tr>
<td>13:</td>
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<td>647.954</td>
<td>50.954 ¢</td>
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<tr>
<td>14:</td>
<td>DŪ-GĀH (Re)</td>
<td>3456 / 2308</td>
<td>698.952</td>
<td>50.998 ¢</td>
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<tr>
<td>15:</td>
<td>Nīm Kurdī</td>
<td>3456 / 2241</td>
<td>749.953</td>
<td>51.001 ¢</td>
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<td>3456 / 2176</td>
<td>800.910</td>
<td>50.957 ¢</td>
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<td>17:</td>
<td>SAH-GĀH (Mi ṭ)</td>
<td>3456 / 2113</td>
<td>851.773</td>
<td>50.863 ¢</td>
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<td>18:</td>
<td>Büsalīk</td>
<td>3456 / 2052</td>
<td>902.487</td>
<td>50.714 ¢</td>
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<td>19:</td>
<td>Tik Büsalīk</td>
<td>3456 / 1993</td>
<td>952.994</td>
<td>50.507 ¢</td>
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<td>TŠAHĀR-GĀH (Fa)</td>
<td>3456 / 1936</td>
<td>1003.229</td>
<td>50.235 ¢</td>
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<td>Nīm Hijāz</td>
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<td>1053.124</td>
<td>49.895 ¢</td>
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<td>3456 / 1828</td>
<td>1102.605</td>
<td>49.481 ¢</td>
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<td>48.986 ¢</td>
</tr>
<tr>
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<td>NAWĀ (Sol)</td>
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<td>1200.000</td>
<td>48.409 ¢</td>
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<td>I. Octave</td>
<td>Intervals</td>
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<td>-----------</td>
<td>-----------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. NAWĀ</td>
<td>0. YAKĀH</td>
<td>(with previous)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. Nīm Ḥiṣār</td>
<td>1. Qarār Nīm Ḥiṣār</td>
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<td></td>
</tr>
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<td>26. Ḥiṣār</td>
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</tr>
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<td>4. ‘USHAYRĀN</td>
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<td>7. ‘IRĀQ</td>
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<td></td>
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<td>8. Gawasht</td>
<td>50.220 (\text{¢} )</td>
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<td>9. Tik Gawasht</td>
<td>50.425 (\text{¢} )</td>
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<tr>
<td>34. KURDĀN</td>
<td>10. RĀST</td>
<td>50.603 (\text{¢} )</td>
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<td>13. Tik Zīrgūlah</td>
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<td>14. DŪKĀH</td>
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<td>16. Kurdī</td>
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<td></td>
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<td>41. BUZURK</td>
<td>17. SĪKĀH</td>
<td>50.863 (\text{¢} )</td>
<td></td>
<td></td>
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<tr>
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<td>18. Būsalik</td>
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<td>19. Tik Būsalik</td>
<td>50.507 (\text{¢} )</td>
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<td>44. MĀḤŪRĀN</td>
<td>20. JAHĀRKĀH</td>
<td>50.235 (\text{¢} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45. Jawāb ‘Arbā’</td>
<td>21. Nīm Ḥijāz (‘Arbā’)</td>
<td>49.895 (\text{¢} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46. Jawāb Ḥijāz</td>
<td>22. Ḥijāz</td>
<td>49.481 (\text{¢} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47. Jawāb Tik Ḥijāz</td>
<td>23. Tik Ḥijāz</td>
<td>48.986 (\text{¢} )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48. RAMAL TŪṬĪ</td>
<td>24. NAWĀ</td>
<td>48.409 (\text{¢} )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 4.10: Modern Arabic Staff Notation of Perdes
Contrary to the Arab infatuation with the “quarter-tone”, exponents insist that dividing the octave into 24 equal parts is detrimental to the vocal and instrumental tradition of Arabic Maqam Music [277]. Admittedly, this state of affairs is well portrayed in the Egyptian tuning of Amin Ad-Dik [278] seen in Table 4.12 below:

**Table 4.12: Amin Ad-Dik’s 24-tone Egyptian Tuning**

<table>
<thead>
<tr>
<th>#</th>
<th>Perdes of I. Octave</th>
<th>Frequency Ratios</th>
<th>Cents</th>
<th>Consecutive Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>YAK-GĀH (Sol)</td>
<td>1/1</td>
<td>0.000</td>
<td>(with previous)</td>
</tr>
<tr>
<td>1</td>
<td>Nim Qarār Ḥiṣār</td>
<td>1053/1024</td>
<td>48.348</td>
<td>48.348 ˚</td>
</tr>
<tr>
<td>2</td>
<td>Qarār Ḥiṣār</td>
<td>256/243</td>
<td>90.225</td>
<td>41.877 ˚</td>
</tr>
<tr>
<td>3</td>
<td>Tik Qarār Ḥiṣār</td>
<td>12/11</td>
<td>150.637</td>
<td>60.412 ˚</td>
</tr>
<tr>
<td>4</td>
<td>‘UŚAYRĀN (La)</td>
<td>9/8</td>
<td>203.910</td>
<td>53.237 ˚</td>
</tr>
<tr>
<td>5</td>
<td>Nim ‘Ajam-‘Ušayrān</td>
<td>147/128</td>
<td>239.607</td>
<td>35.697 ˚</td>
</tr>
<tr>
<td>6</td>
<td>‘Ajam-‘Ušayrān</td>
<td>32/27</td>
<td>294.135</td>
<td>54.528 ˚</td>
</tr>
<tr>
<td>7</td>
<td>‘IRĀQ (Si ū)</td>
<td>27/22</td>
<td>354.547</td>
<td>60.412 ˚</td>
</tr>
<tr>
<td>8</td>
<td>Gavašt</td>
<td>5/4</td>
<td>386.314</td>
<td>31.767 ˚</td>
</tr>
<tr>
<td>9</td>
<td>Tik Gavašt</td>
<td>9/7</td>
<td>435.084</td>
<td>48.770 ˚</td>
</tr>
<tr>
<td>10</td>
<td>RĀST (Do)</td>
<td>4/3</td>
<td>498.045</td>
<td>62.961 ˚</td>
</tr>
<tr>
<td>11</td>
<td>Nim Zīrgūlah</td>
<td>48/35</td>
<td>546.815</td>
<td>48.770 ˚</td>
</tr>
<tr>
<td>12</td>
<td>Zīrgūlah</td>
<td>1024/729</td>
<td>588.270</td>
<td>41.455 ˚</td>
</tr>
<tr>
<td>13</td>
<td>Tik Zīrgūlah</td>
<td>81/56</td>
<td>638.994</td>
<td>50.724 ˚</td>
</tr>
<tr>
<td>14</td>
<td>DŪ-GĀH (Re)</td>
<td>3/2</td>
<td>701.955</td>
<td>62.961 ˚</td>
</tr>
<tr>
<td>15</td>
<td>Nim Kurdī</td>
<td>49/32</td>
<td>737.652</td>
<td>35.697 ˚</td>
</tr>
<tr>
<td>16</td>
<td>Kurdī</td>
<td>128/81</td>
<td>792.180</td>
<td>54.528 ˚</td>
</tr>
<tr>
<td>17</td>
<td>SAH-GĀH (Mī ū)</td>
<td>18/11</td>
<td>852.592</td>
<td>60.412 ˚</td>
</tr>
<tr>
<td>18</td>
<td>Būsalīk</td>
<td>27/16</td>
<td>905.865</td>
<td>53.237 ˚</td>
</tr>
<tr>
<td>19</td>
<td>Tik Būsalīk</td>
<td>26/15</td>
<td>952.259</td>
<td>46.394 ˚</td>
</tr>
<tr>
<td>20</td>
<td>TŠAHĀR-GĀH (Fa)</td>
<td>9/5</td>
<td>1017.596</td>
<td>65.337 ˚</td>
</tr>
<tr>
<td>21</td>
<td>Nim Hijāz</td>
<td>11/6</td>
<td>1049.363</td>
<td>31.767 ˚</td>
</tr>
<tr>
<td>22</td>
<td>Hijāz</td>
<td>15/8</td>
<td>1088.269</td>
<td>38.906 ˚</td>
</tr>
<tr>
<td>23</td>
<td>Tik Hijāz</td>
<td>35/18</td>
<td>1151.230</td>
<td>62.961 ˚</td>
</tr>
<tr>
<td>24</td>
<td>NAWĀ (Sol)</td>
<td>2/1</td>
<td>1200.000</td>
<td>48.770 ˚</td>
</tr>
</tbody>
</table>

No matter what critics say, highest absolute difference between dividing the octave into 24 equal parts and Mushaqah’s quasi-equal 24-tone tuning is a negligible 5.873 cents, with an average absolute difference of 3.1602 cents.
Remarkably though, splitting each of the 53 Holderian commas into halves approximates Mushaqah’s System with even less error: In 106-tone equal temperament, highest absolute difference is 5.0528 cents, with an average absolute of 2.7642 cents; however, cycling through 12-tones is no longer viable due to the consignment to a 691 cent wolf fifth.

The Egyptian tuning of Ad-Dik is likewise approximated with a maximum error of 5.0318 cents in 106 equal divisions of the octave, where the average absolute difference is only 1.8676 cents.

Seen in this respect, systematization of *perdes* in the Arab World as much parallels Turkish taste as it involves quirks. The same is probably also true for the Classical Music of Iran [279].

While naming conventions are mostly shared by the Middle Eastern trichotomy, tuning trends apparently are not. The question whether Arabs and Persians also suffer from serious conflicts between notation and practice, and whether quarrels abound concerning which model should qualify above others, remains to be answered.

Unfortunately, 24-tone equal temperament does grave injustice to the majority of Maqam Music *perdes* to the extent of rendering almost half of them inoperable [277].

It should be noted, however, that Mushaqah’s 24-tone quasi-equal tuning has, in the very least, the merit of embodying one type of “quarter-tone” observed in Turkish practice at every step, 12:11 (151 cents), which is at worst 5.3941 cents off. This error is reduced to a cent at every key if the octave is divided into 24 equal parts.

In Türkiye, rivalry against the ‘Yekta-Arel-Ezgi School’ materialized in the form of a little-known 29-tone tuning by Oransay and a 41-tone tuning by Töre-Karadeniz.

*Oransay’s* system is outlined in Figure 4.11 and Table 4.13:
Figure 4.11: Oransay’s 29-tone System for Turkish Maqam Music

Parts extracted from “Das Tonsystem Der Türkei-Türkischen Kunstmusik”. Asterisk on the 24th tone denotes insertion to preserve symmetry. (See, accompanying endnote.)
Here, highest absolute difference between Oransay’s values and the author’s 5-limit JI ratios is 0.582 cents, with an average absolute difference of only 0.2972 cents.

As for middle seconds, there are 10 instances of 2/3 tones (133 cents) and 7 instances of 4/5 tones (161 and 163 cents), but no 3/4 tones in this tuning as drawn in Figure 4.12:

<table>
<thead>
<tr>
<th>#</th>
<th>Oransay Cents</th>
<th>Implied JI Ratios</th>
<th>Cents</th>
<th>Difference</th>
<th>Consecutive Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>0 (D)</td>
<td>1/1</td>
<td>0.000</td>
<td>0.000 ¢ (with previous)</td>
<td></td>
</tr>
<tr>
<td>1:</td>
<td>22</td>
<td>81/80</td>
<td>21.506</td>
<td>0.494 ¢</td>
<td>21.506 ¢</td>
</tr>
<tr>
<td>2:</td>
<td>90</td>
<td>256/243</td>
<td>90.225</td>
<td>-0.225 ¢</td>
<td>68.719 ¢</td>
</tr>
<tr>
<td>3:</td>
<td>112</td>
<td>16/15</td>
<td>111.731</td>
<td>0.269 ¢</td>
<td>21.506 ¢</td>
</tr>
<tr>
<td>4:</td>
<td>182</td>
<td>10/9</td>
<td>182.404</td>
<td>-0.404 ¢</td>
<td>70.673 ¢</td>
</tr>
<tr>
<td>5:</td>
<td>204 (E)</td>
<td>9/8</td>
<td>203.910</td>
<td>0.090 ¢</td>
<td>21.506 ¢</td>
</tr>
<tr>
<td>6:</td>
<td>274</td>
<td>75/64</td>
<td>274.582</td>
<td>-0.582 ¢</td>
<td>70.672 ¢</td>
</tr>
<tr>
<td>7:</td>
<td>294 (F)</td>
<td>32/27</td>
<td>294.135</td>
<td>-0.135 ¢</td>
<td>19.553 ¢</td>
</tr>
<tr>
<td>8:</td>
<td>316</td>
<td>6/5</td>
<td>315.641</td>
<td>0.359 ¢</td>
<td>21.506 ¢</td>
</tr>
<tr>
<td>9:</td>
<td>386</td>
<td>5/4</td>
<td>386.314</td>
<td>-0.314 ¢</td>
<td>70.673 ¢</td>
</tr>
<tr>
<td>10:</td>
<td>408</td>
<td>81/64</td>
<td>407.820</td>
<td>0.180 ¢</td>
<td>21.506 ¢</td>
</tr>
<tr>
<td>11:</td>
<td>476</td>
<td>320/243</td>
<td>476.539</td>
<td>-0.539 ¢</td>
<td>68.719 ¢</td>
</tr>
<tr>
<td>12:</td>
<td>498 (G)</td>
<td>4/3</td>
<td>498.045</td>
<td>-0.045 ¢</td>
<td>21.506 ¢</td>
</tr>
<tr>
<td>13:</td>
<td>520</td>
<td>27/20</td>
<td>519.551</td>
<td>0.449 ¢</td>
<td>21.506 ¢</td>
</tr>
<tr>
<td>14:</td>
<td>590</td>
<td>45/32</td>
<td>590.224</td>
<td>-0.224 ¢</td>
<td>70.673 ¢</td>
</tr>
<tr>
<td>15:</td>
<td>610</td>
<td>64/45</td>
<td>609.776</td>
<td>0.224 ¢</td>
<td>19.552 ¢</td>
</tr>
<tr>
<td>16:</td>
<td>680</td>
<td>40/27</td>
<td>680.449</td>
<td>-0.449 ¢</td>
<td>70.673 ¢</td>
</tr>
<tr>
<td>17:</td>
<td>702 (A)</td>
<td>3/2</td>
<td>701.955</td>
<td>0.045 ¢</td>
<td>21.506 �¢</td>
</tr>
<tr>
<td>18:</td>
<td>724</td>
<td>243/160</td>
<td>723.461</td>
<td>0.539 ¢</td>
<td>21.506 ¢</td>
</tr>
<tr>
<td>19:</td>
<td>792</td>
<td>128/81</td>
<td>792.180</td>
<td>-0.180 ¢</td>
<td>68.719 ¢</td>
</tr>
<tr>
<td>20:</td>
<td>814</td>
<td>8/5</td>
<td>813.686</td>
<td>0.314 ¢</td>
<td>21.506 ¢</td>
</tr>
<tr>
<td>21:</td>
<td>884</td>
<td>5/3</td>
<td>884.359</td>
<td>-0.359 ¢</td>
<td>70.673 ¢</td>
</tr>
<tr>
<td>22:</td>
<td>906 (B)</td>
<td>27/16</td>
<td>905.865</td>
<td>0.135 ¢</td>
<td>21.506 ¢</td>
</tr>
<tr>
<td>23:</td>
<td>926*</td>
<td>128/75</td>
<td>925.418</td>
<td>0.582 ¢</td>
<td>19.553 ¢</td>
</tr>
<tr>
<td>24:</td>
<td>996 (C)</td>
<td>16/9</td>
<td>996.090</td>
<td>-0.090 ¢</td>
<td>70.672 ¢</td>
</tr>
<tr>
<td>25:</td>
<td>1018</td>
<td>9/5</td>
<td>1017.596</td>
<td>0.404 ¢</td>
<td>21.506 ¢</td>
</tr>
<tr>
<td>26:</td>
<td>1088</td>
<td>15/8</td>
<td>1088.269</td>
<td>-0.269 ¢</td>
<td>70.673 ¢</td>
</tr>
<tr>
<td>27:</td>
<td>1110</td>
<td>243/128</td>
<td>1109.775</td>
<td>0.225 ¢</td>
<td>21.506 ¢</td>
</tr>
<tr>
<td>28:</td>
<td>1178</td>
<td>160/81</td>
<td>1178.494</td>
<td>-0.494 ¢</td>
<td>68.719 ¢</td>
</tr>
<tr>
<td>29:</td>
<td>1200 (D)</td>
<td>2/1</td>
<td>1200.000</td>
<td>0.000 ¢</td>
<td>21.506 ¢</td>
</tr>
</tbody>
</table>
It is possible to approximate *Oransay-29* by 53 equal divisions of the octave with greatest absolute error of 2.8843 and an average absolute error of 0.9899 cents. In so doing, the tuning may be considered a quasi-cyclic 5-limit extension of the 24-tone Pythagorean model [280]. However, employment of sharps and flats are no less problematic due to the asymmetry in their respective sizes. Adding to this the fact that *Oransay-29* does not include *perde* denominations and has never gained a following in Türkiye, it may be summarily dismissed without further ado.

At last, the *Töre-Karadeniz* 41-tone tuning out of 106 equal divisions of the octave is given in Figure 4.13 and Table 4.14 [281]:

---

*Figure 4.12: SCALA© Tone-Circle Showing 10 Instances of 2/3 Tones & 7 Instances of 4/5 Tones in *Oransay-29*
II. ½ Octave

21. Hicaz
22. Dikçe Hicaz
23. Sabâ
24. NEVÂ
25. Gülzar
26. Dikçe Gülzar
27. Nim Hisar
28. Hisar
29. Dikçe Hisar
30. Hisârek
31. HÜSEYNİ
32. Dilâviz
33. Dikçe Dilâviz
34. ACEM
35. Nevruz
36. Dikçe Nevruz
37. Eviç
38. Mâhur
39. Dikçe Mâhur
40. Dik Mâhur
41. GIRDÂNİYE

I. ½ Octave

0. RAST
1. Nigâr
2. Dikçe Nigâr
3. Nim Zengûle
4. Zengûle
5. Dikçe Zengûle
6. Dik Zengûle
7. DÜGÂH
8. Dilârâ
9. Dikçe Dilârâ
10. Nim Kûrdî
11. Kûrdî
12. Uşşak
13. SEGÂH
14. Bûselik
15. Dikçe Bûselik
16. Dik Bûselik
17. ÇÂRGÂH
18. Niyaz
19. Dikçe Niyaz
20. Nim Hicaz

Commas
(with previous)

1.5
2.5  3
3.5  4
5  5.5
6.5  7
7.5  8
9
10.5
11.5  12
12.5  13
14  14.5
15.5  16
16.5  17
18  18.5
19.5  20
20.5  21
22
23.5
24.5  25
25.5  26

Figure 4.13: Staff Notation of Töre-Karadeniz
### Table 4.14: Entire Range of Perdes in Töre-Karadeniz

<table>
<thead>
<tr>
<th>Relative Frequency</th>
<th>Row # &amp; 106-EDO Cents</th>
<th>I. Octave Perdes</th>
<th>II. Octave Perdes</th>
<th>III. Octave Perdes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>1: 0.000</td>
<td>Pest Rast</td>
<td>Rast</td>
<td>Gerdâniye</td>
</tr>
<tr>
<td>1.02</td>
<td>13: 33.962</td>
<td>Pest Dikçe Nigâr</td>
<td>Nigâr</td>
<td>Tiz Nigâr</td>
</tr>
<tr>
<td>1.04</td>
<td>25: 67.925</td>
<td>Pest Dikçe Nigâr</td>
<td>Dikçe Nigâr</td>
<td>Tiz Dikçe Nigâr</td>
</tr>
<tr>
<td>1.053</td>
<td>37: 90.566</td>
<td>Pest Nim Zengûle</td>
<td>Nim Zengûle</td>
<td>Nim Şehnaz</td>
</tr>
<tr>
<td>1.074</td>
<td>8: 124.528</td>
<td>Pest Zengûle</td>
<td>Zengûle</td>
<td>Şehnaz</td>
</tr>
<tr>
<td>1.096</td>
<td>20: 158.491</td>
<td>Pest Dikçe Zengûle</td>
<td>Dikçe Zengûle</td>
<td>Dikçe Şehnaz</td>
</tr>
<tr>
<td>1.110</td>
<td>32: 181.132</td>
<td>Pest Dik Zengûle</td>
<td>Dik Zengûle</td>
<td>Dik Şehnaz</td>
</tr>
<tr>
<td>1.125</td>
<td>3: 203.774</td>
<td>Pest Dêgah</td>
<td>Dêgah</td>
<td>Muhayyer</td>
</tr>
<tr>
<td>1.147</td>
<td>15: 237.736</td>
<td>Pest Dîlârâ</td>
<td>Dîlârâ</td>
<td>Tiz Dîlârâ</td>
</tr>
<tr>
<td>1.170</td>
<td>27: 271.698</td>
<td>Pest Dikçe Dîlârâ</td>
<td>Dikçe Dîlârâ</td>
<td>Tiz Dikçe Dîlârâ</td>
</tr>
<tr>
<td>1.185</td>
<td>39: 294.340</td>
<td>Pest Nim Kûrdî</td>
<td>Nim Kûrdî</td>
<td>Nim Sûnbûle</td>
</tr>
<tr>
<td>1.209</td>
<td>10: 328.302</td>
<td>Pest Kûrdî</td>
<td>Kûrdî</td>
<td>Sûnbûle</td>
</tr>
<tr>
<td>1.234</td>
<td>22: 362.264</td>
<td>Pest Üşşak</td>
<td>Üşşak</td>
<td>Tiz Üşşak</td>
</tr>
<tr>
<td>1.250</td>
<td>34: 384.906</td>
<td>Pest Segâh</td>
<td>Segâh</td>
<td>Tiz Segâh</td>
</tr>
<tr>
<td>1.274</td>
<td>5: 418.868</td>
<td>Pest Bûselik</td>
<td>Bûselik</td>
<td>Tiz Bûselik</td>
</tr>
<tr>
<td>1.299</td>
<td>17: 452.830</td>
<td>Pest Dikçe Bûselik</td>
<td>Dikçe Bûselik</td>
<td>Tiz Dikçe Bûselik</td>
</tr>
<tr>
<td>1.316</td>
<td>29: 475.472</td>
<td>Pest Dik Bûselik</td>
<td>Dik Bûselik</td>
<td>Tiz Dik Bûselik</td>
</tr>
<tr>
<td>1.333</td>
<td>41: 498.113</td>
<td>Pest Çârgâh</td>
<td>Çârgâh</td>
<td>Tiz Çârgâh</td>
</tr>
<tr>
<td>1.360</td>
<td>12: 532.075</td>
<td>Pest Niyaz</td>
<td>Niyaz</td>
<td>Tiz Niyaz</td>
</tr>
<tr>
<td>1.388</td>
<td>24: 566.038</td>
<td>Pest Dikçe Niyaz</td>
<td>Dikçe Niyaz</td>
<td>Tiz Dikçe Niyaz</td>
</tr>
<tr>
<td>1.406</td>
<td>36: 588.679</td>
<td>Pest Nim Hicaz</td>
<td>Nim Hicaz</td>
<td>Tiz Nim Hicaz</td>
</tr>
<tr>
<td>1.434</td>
<td>7: 622.642</td>
<td>Pest Hicaz</td>
<td>Hicaz</td>
<td>Tiz Hicaz</td>
</tr>
<tr>
<td>1.463</td>
<td>19: 656.604</td>
<td>Pest Dikçe Hicaz</td>
<td>Dikçe Hicaz</td>
<td>Tiz Dikçe Hicaz</td>
</tr>
<tr>
<td>1.481</td>
<td>31: 679.245</td>
<td>Pest Sabâ</td>
<td>Sabâ</td>
<td>Tiz Sabâ</td>
</tr>
<tr>
<td>1.500</td>
<td>2: 701.887</td>
<td>Yegâh</td>
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In this table, highest absolute error between relative frequencies of Töre-Karadeniz and corresponding 106 equal divisions of the octave degrees are 2.112 cents, with an average absolute difference of 0.565 cents.
But that is only due to number truncation. The 41-tone scale perfectly fits the mode $3\ 3\ 2\ 3\ 3\ 2\ 2\ 3\ 3\ 2\ 3\ 3\ 2\ 2\ 3\ 3\ 2\ 3\ 3\ 2\ 2\ 3\ 3\ 2\ 3\ 3\ 2\ 2\ 3\ 3\ 2\ 2\ 3\ 3\ 2\ 3\ 3\ 2\ 2\ 3\ 3\ 2\ 3\ 3\ 2\ 2\ 3\ 3\ 2$ of 106-tone equal temperament, yielding degrees 0, 3, 6, 8, 11, 14, 16, 18, 21, 24, 26, 29, 32, 34, 37, 40, 42, 44, 47, 50, 52, 55, 58, 60, 62, 65, 68, 70, 73, 76, 78, 80, 83, 86, 88, 91, 94, 96, 99, 102, 104, 106.

The merit of the tuning lies in its embodiment of 61 middle seconds, as seen in Figure 4.14:

Figure 4.14: SCALA© Tone-Circle Showing 10 Instances of $2/3$ Tones, 31 Instances of $3/4$ Tones, and 20 Instances of $4/5$ Tones in Töre-Karadeniz
In the abovegiven figure, ten instances of 135.849 cent 2/3 tones, twenty-four instances of 147.17 cent 3/4 tones, seven instances of 158.491 cent 3/4 tones, and twenty instances of 169.811 cent 4/5 tones are displayed, nominating Töre-Karadeniz as the most comprehensive system for Turkish Maqam Music thus far encountered.

Nevertheless, here too are the regular sharps (+4 commas) and flats (-5 commas) not of equal size, flats for nim kürdi (-4 commas instead of -5) and kürdi (-2.5 commas instead of -3.5) are out of proportion, and the scale is too irregular for consistent transpositions.

Adding to these the facts that values of fourteen perdes (nigar, dikçe nigar, dilara, dikçe dilara, dikçe buselik, dik buselik, dikçe hicaz, saba, gülzar, dikçe gülzar, dilaviz, dikçe dilaviz, dikçe mahur and dik mahur to be exact) do not accord with the measured frets of tanburs in TRT Ankara State Radio, and six of the frets are unaccounted for [282], Töre-Karadeniz comes riddled with defects, does not excel over 41 equal divisions of the octave (which is a substitute of 53-tone equal temperament), and is incapable of substituting the 24-tone Pythagorean model.

Seeing as this 41-tone tuning was not received with much enthusiasm in Turkish Maqam Music circles owing to said issues, it too may be dismissed without further reservation.

4.5. Equal 106-tone Grid: Not Up to the Mark

This prolix discursion has demonstrated that all of the investigated Turkish tunings, the 17-tone Abjad scale, Yekta-24 & AEU, Oransay-29, and Töre-Karadeniz, are embraced admirably by an equal 106-tone octave grid – basically an elaborated, if not unwieldy, form of the already acknowledged “53 commas per octave methodology”. A general comparison of 106 equal divisions of the octave and discussed Turkish Maqam Music tunings is produced in Table 4.15:

---

1 “Türkiye Radio Television” Institution.
<table>
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<tr>
<th>106-EDO Degree &amp; Cents</th>
<th>17-tone Abjad</th>
<th>Yekta-24 &amp; AEU</th>
<th>Oransay-29</th>
<th>Töre-Karadeniz</th>
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<tr>
<td>-15: 169.811</td>
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### Table 4.15: Comparison of Turkish Tunings in 106-EDO – Continued

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<th>Yekta-24 &amp; AEU</th>
<th>Oransay-29</th>
<th>Töre-Karadeniz</th>
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<tr>
<td>82: 928.302</td>
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<td>Çârgâh (C)</td>
<td>C</td>
<td>Çârgâh (C)</td>
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<td>*</td>
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<td>106: 1200.000</td>
<td>Neva</td>
<td>Nevâ (D)</td>
<td>D</td>
<td>Nevâ (D)</td>
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</table>

In spite of its embodiment of no less than five kinds of middle seconds, 106 equal divisions of the octave is not a resolution that may be put to use on an acoustic instrument as a whole, nor any subset, except 53 Holderian commas, chosen from it shows any promise of applicability to maqamat.

Aggravatingly, even 53-tone equal temperament may be said to fail due, among other things, to its ‘crudeness’ in approximating practiced middle seconds and confinement to paper alone. Besides, a higher resolution is demanded by Turkish exponents of qanun.

Hence, designing a new and practicable tuning for Maqam Music becomes a must.
5. CHAPTER: A 79-TONE TUNING & THEORY SIMULATING JUST INTONATION, TRUE TO MAQAMAT, AND ENCOURAGING MICROTONAL POLYPHONY

5.1. Prologue

Presented herein is a novel 79-tone tuning out of practically 159 equal divisions of the octave – including a rudimentary just intonation *maqam* theory built on it – developed and applied to a custom-built Turkish *qanun* by the author, which parallels previously discussed pitch measurement data, and houses traditional *perde* in detail, endowing the proposed model with the capacity to not only accurately express *maqamat* at every degree, but also to expedite future endeavours in microtonal polyphony.

Manufactured by the famous Izmirite *qanun*-makers *Ejder Güleç & Sons™*, and having a regular diatonic compass from A2 to E6, a picture of the said instrument is given in Figure 5.1:

![Picture of the 79-tone Turkish qanun manufactured by Güleç & Sons™](image)
Instructions for implementing the 79-tone tuning were delivered by the author to Güleç, who laboriously affixed arrays of *mandals* – i.e., metallic levers – underneath each course at locations designated by cent offsets input to a *Korg™* type electronic tuner. A section of *mandals* on the 79-tone *qanun* is shown in Figure 5.2:

![Figure 5.2: A Close-up of mandals on the 79-tone qanun](image)

Royal fuchsia colouring of central *mandals* is an innovation by the author to demarcate positions for natural diatonic tones. Last four *mandals* per course in tarnished gold denote double-sharps.

Another unique feature of the 79-tone *qanun* is the addition, upon *Üğur Keçecioğlu*’s astute suggestion, of *Wittner™* model 901 fine-tuners on strings beyond the bridge and prior to the fastening ends, as seen in Figure 5.3:
Thanks to these improvements and the new 79-tone tuning, precise pitch adjustments, accurate and full-scale transpositions, as well as a more pleasing intonation became a reality for this fine instrument.

Renaissance Music expert Margo Schulter, in a personal correspondence with the author dated March 2007, makes sympathetic observations germane to the topic at hand:

« ...In as much as ‘Yekta-Arel-Ezgi School’ may be said to have maximized political objectives – to distinguish Turkish music theory from either 12-tone-equal Western norms or 24-tone-equal Arabic notions while permitting a bit of artistic “crawl space” (not the most spacious or illuminating shelter, as one might guess) for maqamat to find refuge in – the focus on the comma appears to have abetted the development of a more sophisticated model of intonation with the potential to unite Arabic/Turkish/Kurdish/Persian maqam and/or dastgah traditions, and quite possibly, the Hindustani (Islamic Mughal) rag tradition as well.»
As a matter of fact, some Turkish musicologists had adopted long ago the concept of “kommalı sesler” – fine intonational inflections or adjustments involving increments of two or three commas – in the study of folk music, to record pastoral melodies the way they are sung, rather than how they should be sung.

Such adjustments, of course, are often synonymous with the inflections marked by the Arab half-flat and half-sharp, or the Persian “koron” and “sori”, producing middle or neutral flavors of intervals such as seconds, thirds, sixths, and sevenths – the very intervals that the Kemalist ideology rejects as "Byzantine-Arabic" exercises in "quarter-tones."

Certain Syrian musicians too have embraced the Turkish comma system as a means to make more refined indications of how a maqam should be ideally tuned than is possible with a 24-note model (equal or unequal).

But why should some Arab musicians prefer this comma approach with its 1/9-tones – 53 to an octave – rather than simpler schemes such as the "24 quarter-tone" system taught in many conservatories in the Arab World?

In considering this question, we might helpfully note that it is unnecessary to invoke ninth-tones, or indeed, "quarter-tones" in order to describe the basic types of seconds, thirds, etc… mostly used by maqamat or dastgaha: minor, middle or neutral, and major.

In fact, it is quite possible to catalogue these three general kinds of intervals using steps no smaller than a semitone. In a 17-EDO (equal divisions of the octave) model, each whole tone is divided into three small semitones or "thirdtones", with two making a middle or neutral second, three a whole tone, and 17 an octave.

This 17-EDO semitone or thirdtone at 70.59 cents is almost identical in size to the “eksik bakiye” or "diminished limma" of AEU measured at 66.76 cents (a usual limma at 256:243 of 90.22 cents less one Pythagorean comma).

The conceptualization of 17 historical perdes or tones per octave in Turkish and related maqam and/or dastgah traditions reflects this situation – but with the actual steps in practice being unequal, and often subtly varying as a performance unfolds.
Hence, 17 historical perdes provide a rough yet useful map for the aforementioned types of fundamental intervals used in a maqam, with each step placed according to a given performance tradition and the taste of the musician.

In the 24-EDO system prevalent among the Arabic academia, a semitone consists of two quarter-tone steps at an even 50 cents each, a middle second of three, and a whole tone of four. Among traditional performers, as with Egyptian practitioners studied by Scott Marcus, these steps are understood to be unequal, and varying in their ideal placement from maqam to maqam.

As long as any one of these equal divisions is understood to be only an elementary classification scheme, with singers and players free to follow the flexible intonation style of a given performance tradition, then no harm is done. Nevertheless, one could still wish for a more sophisticated system for measuring, comparing, and faithfully notating different intonational styles, or tuning a fixed-pitched instrument such as the qanun to best match the requirements of maqamat.

Ironically, much dissatisfaction has surfaced among noted Arab musicians and scholars due to the cliché-ridden tendency to set fixed-pitched instruments such as the traditional qanun or modern keyboards to 24-EDO. For instance, Ali Jihad Racy laments in a recent book that the routine of setting the qanun at equally spaced quarter-tones is disrupting the art of playing in tune and interferes with the mood and expressiveness demanded of maqamat.

Indeed, taken as a literal guide to tuning rather than a blunt classification scheme, 17-EDO has only one size of middle second, at about 141 cents, and in 24-EDO, likewise, there is just one size, at an even 150 cents.

The comma system with its 53 steps per octave, by contrast, can distinguish notionally between two middle seconds: a smaller of six commas or about 137 cents, and a larger at seven commas or about 157 cents.

From this pragmatical Turkish/Arabic viewpoint, the comma system allows one to not only specify that a given interval is a middle or neutral second, but also to have some idea of where it lands on the pitch continuum.
Many styles of Maqam/Dastgah Music may use unequal middle seconds with sizes not too dissimilar to these, so that the comma system may reflect practice rather more closely than 17-EDO or 24-EDO. To borrow some Greek terminology familiar from music as well as other departments of philosophy and science, a 17-EDO or 24-EDO model can be helpful in identifying the “genus” or general type of an interval, but a more accurate and refined model, such as that of 53 commas, can better describe the “species” of an interval.

Although, it is understandable that even 53-EDO might not always be the most satisfactory resolution to reflect intonation and practice.

As explained in your thesis, a yet more refined development of the comma model is now possible: the division of each of the 53 commas into three steps, so that there are 159 to an octave, from which a subset of 79 or 80 nearly equal steps can be selected for use on an instrument such as a qanun or a keyboard as well as faithfully rendering maqamat.

In short, as you said, the Turkish 24-tone Pythagorean System, complaisant to Kemalist doctrines in sidestepping "Arabic-Byzantine quarter-tones", seems to have inadvertently provided a more accurate tool – namely, the comma – for calibrating these same intervals. The 79-note system described here carries this process of fine calibration one step further, while embracing both the commonalities and diversities of many local and regional manifestations, including those found in Turkey, Iran, Caucasus, Syria, Egypt, so forth... therefore, effectively reconciling theory with the elegant and ubiquitous practice of maqam and/or dastgah traditions.» (March 18th, 2007)

Given the fact that qanun-makers in Türkiye nowadays affix mandals at “equal semitones” due to their increasing preference of imported Western tuners originally meant for 12 equal divisions of the octave, and proceed to casually divide the remaining length to the nut into 6 or 7 equal parts (for the lower courses, at the expense of octave equivalences) arriving at 72 or 84 equal divisions of the octave (a “derailleur” or “bike-chain” – hence a multiple – of the twelve equal tone cycle), it is no wonder such instruments wreak havoc with a performance tradition orally founded on the “comma system”.

Since 53-tone equal temperament does not appear to be applied to qanuns, and dividing the octave into 72 parts is none other than the sixfold enhancement of “twelve equal steps per octave” methodology of Western Music, it henceforth becomes a necessity to devise a tuning which is more compatible with the maqam tradition.

It is hoped that Schulter’s sentiments regarding the author’s contribution to maqam theory will be shared by many others once the pragmatically and edifying worth of the 79-tone tuning is appreciated.

5.2. 79/80 Moment of Symmetry 2°159-tET

The novel 79-tone qanun tuning which constitutes the backbone of this dissertation has been identified in a personal communication by American mathematician Gene Ward Smith as “79 & 80 MOS 2°159-tET” – in other words, virtually a 79 or 80 member subset of 159-tone equal temperament, where all, but one, of the steps correspond to 2 degrees of it. The subsets are called “Moment of Symmetry” – a term coined by Ervin Wilson in 1975 [283,284] – because of the coherent pattern arising from the employment of only one generator and two basic step sizes.

The procedure used to derive 79 MOS 159-tET is as follows:

1. Equally partition the pure fourth into 33,

\[
\{(\log_{10} (4:3) \times 1200 / (\log_{10} 2)) / 33
= 498.045 / 33
= 15.0923 \text{ cents}\}
\]

2. Multiply the resultant comma 78 times,

\[
\{15.0923 \times 1 = 15.0923 \text{ cents}
15.0923 \times 2 = 30.1845 \text{ cents}
15.0923 \times 3 = 45.2768 \text{ cents}
\text{etc…}
15.0923 \times 78 = 1177.1973 \text{ cents}\}
\]
3. Introduce an octave; a Holderian comma appears at the top,

\{1200.0000 - 1177.1973 = 22.8027 \text{ cents}\}

4. Move the Holderian comma between the 45th-46th steps, and a pure fifth is attained,

\{(15.0923 \times 45) + 22.8027 \\
= 679.1523 + 22.8027 \\
= 701.955 \text{ cents} \\
= [\log_{10} (3:2) \times 1200 / (\log_{10} 2)]\}

5. The rest of the pitches above this fifth are likewise raised by 2/3 Holderian commas,

\{701.955 + (15.0923 \times 1) = 717.0473 \text{ cents} \\
701.955 + (15.0923 \times 2) = 732.1395 \text{ cents} \\
701.955 + (15.0923 \times 3) = 747.2318 \text{ cents} \\
\text{etc...} \\
701.955 + (15.0923 \times 33) = 1200.0000 \text{ cents}\}.

For 80 MOS 159-tET, simply add one extra fifth at \[498.045 / 33\] x 46 
= 694.2445 \text{ cents}, which is notated the same as pure.

79 MOS 159-tET follows the pattern or mode 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2. In 80 MOS 159-tET, the 3 step gap at the centre is replaced by 2+1 steps, yielding a meantone fifth beneath pure that is ascribed the same note.

The logic behind keeping both and alternating between these subsets from time to time is going to become lucid when transposing categories of dyads such as seconds, thirds, sevenths, etc... Hereon, the tuning will be referred to as 79/80 MOS 159-tET.

79/80 MOS 159-tET is divulged in Table 5.1:
Table 5.1: 79/80 MOS 159-tET

<table>
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<th>Degree</th>
<th>Cents</th>
<th>159-tET</th>
<th>Difference</th>
<th>Approximated JI Ratios</th>
<th>Perdes</th>
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<td>0:</td>
<td>0.000</td>
<td>0</td>
<td>0.0000 č</td>
<td>1/1</td>
<td>Rast</td>
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<td>0.0021 č</td>
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<td>Şuri</td>
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<td>(Nim Nihavend)</td>
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<td>Kürdi</td>
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<td>0.0785 č</td>
<td>25/18,32/23,39/28</td>
<td>Nerm Hicaz</td>
</tr>
<tr>
<td>39:</td>
<td>588.599</td>
<td>78</td>
<td>0.0806 č</td>
<td>7/5,1024/729,45/32</td>
<td>Hicaz</td>
</tr>
<tr>
<td>40:</td>
<td>603.691</td>
<td>80</td>
<td>0.0827 č</td>
<td>24/17,17/12</td>
<td>Uzzal</td>
</tr>
<tr>
<td>41:</td>
<td>618.783</td>
<td>82</td>
<td>0.0847 č</td>
<td>10/7</td>
<td>Saba</td>
</tr>
<tr>
<td>42:</td>
<td>633.875</td>
<td>84</td>
<td>0.0868 č</td>
<td>23/16,36/25,49/34</td>
<td></td>
</tr>
<tr>
<td>43:</td>
<td>648.968</td>
<td>86</td>
<td>0.0889 č</td>
<td>16/11,8192/5625,35/24</td>
<td></td>
</tr>
<tr>
<td>44:</td>
<td>664.060</td>
<td>88</td>
<td>0.0909 č</td>
<td>22/15,69/47,72/49</td>
<td></td>
</tr>
<tr>
<td>45:</td>
<td>679.152</td>
<td>90</td>
<td>0.0930 č</td>
<td>37/25,40/27</td>
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Table 5.1: 79/80 MOS 159-tET – Continued

<table>
<thead>
<tr>
<th>Degree</th>
<th>Cents</th>
<th>159-tET</th>
<th>Difference</th>
<th>Approximated JI Ratios</th>
<th>Perdes</th>
</tr>
</thead>
<tbody>
<tr>
<td>46:</td>
<td>694.245</td>
<td>92</td>
<td>0.0951 e</td>
<td>3/2</td>
<td>Neva</td>
</tr>
<tr>
<td>47:</td>
<td>701.955</td>
<td>93</td>
<td>-0.0682 e</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48:</td>
<td>717.047</td>
<td>95</td>
<td>-0.0661 e</td>
<td>53/35,50/33,1024/675</td>
<td>Dik Neva</td>
</tr>
<tr>
<td>49:</td>
<td>732.140</td>
<td>97</td>
<td>-0.0641 e</td>
<td>32/21,29/19,75/49</td>
<td>(Sarp Neva)</td>
</tr>
<tr>
<td>50:</td>
<td>747.232</td>
<td>99</td>
<td>-0.0620 e</td>
<td>192/125,20/13,54/35</td>
<td>(Neva+irha)</td>
</tr>
<tr>
<td>51:</td>
<td>762.324</td>
<td>101</td>
<td>-0.0599 e</td>
<td>45/29,59/38,14/9</td>
<td>(Nerm Bayati)</td>
</tr>
<tr>
<td>52:</td>
<td>777.416</td>
<td>103</td>
<td>-0.0579 e</td>
<td>25/16,47/30,11/7</td>
<td>Bayati</td>
</tr>
<tr>
<td>53:</td>
<td>792.509</td>
<td>105</td>
<td>-0.0558 e</td>
<td>30/19,128/81,19/12</td>
<td>Nim Hisar</td>
</tr>
<tr>
<td>54:</td>
<td>807.601</td>
<td>107</td>
<td>-0.0537 e</td>
<td>43/27,8/5,6561/4096</td>
<td></td>
</tr>
<tr>
<td>55:</td>
<td>822.693</td>
<td>109</td>
<td>-0.0517 e</td>
<td>37/23</td>
<td></td>
</tr>
<tr>
<td>56:</td>
<td>837.785</td>
<td>111</td>
<td>-0.0496 e</td>
<td>34/21,81/50,13/8</td>
<td></td>
</tr>
<tr>
<td>57:</td>
<td>852.878</td>
<td>113</td>
<td>-0.0475 e</td>
<td>44/27,18/11,105/64</td>
<td></td>
</tr>
<tr>
<td>58:</td>
<td>867.970</td>
<td>115</td>
<td>-0.0455 e</td>
<td>28/17,33/20</td>
<td></td>
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<tr>
<td>59:</td>
<td>883.062</td>
<td>117</td>
<td>-0.0434 e</td>
<td>32768/19683,5/3</td>
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<tr>
<td>60:</td>
<td>898.155</td>
<td>119</td>
<td>-0.0413 e</td>
<td>5/3,42/25,27/16</td>
<td>Hüsényi</td>
</tr>
<tr>
<td>61:</td>
<td>913.247</td>
<td>121</td>
<td>-0.0393 e</td>
<td>27/16,39/23,17/10</td>
<td>Dik Hüsényi</td>
</tr>
<tr>
<td>62:</td>
<td>928.339</td>
<td>123</td>
<td>-0.0372 e</td>
<td>128/75,41/24,12/7</td>
<td>(Sarp Hüsényi)</td>
</tr>
<tr>
<td>63:</td>
<td>943.431</td>
<td>125</td>
<td>-0.0351 e</td>
<td>50/29,216/125,64/37</td>
<td></td>
</tr>
<tr>
<td>64:</td>
<td>958.524</td>
<td>127</td>
<td>-0.0331 e</td>
<td>125/72,40/23,47/27</td>
<td></td>
</tr>
<tr>
<td>65:</td>
<td>973.616</td>
<td>129</td>
<td>-0.0310 e</td>
<td>7/4,225/128</td>
<td></td>
</tr>
<tr>
<td>66:</td>
<td>988.708</td>
<td>131</td>
<td>-0.0289 e</td>
<td>23/13,16/9</td>
<td></td>
</tr>
<tr>
<td>67:</td>
<td>1003.800</td>
<td>133</td>
<td>-0.0269 e</td>
<td>16/9,25/14</td>
<td></td>
</tr>
<tr>
<td>68:</td>
<td>1018.893</td>
<td>135</td>
<td>-0.0248 e</td>
<td>9/5,59049/32768</td>
<td></td>
</tr>
<tr>
<td>69:</td>
<td>1033.985</td>
<td>137</td>
<td>-0.0227 e</td>
<td>29/16,20/11</td>
<td>Evc cluster</td>
</tr>
<tr>
<td>70:</td>
<td>1049.077</td>
<td>139</td>
<td>-0.0207 e</td>
<td>11/6</td>
<td></td>
</tr>
<tr>
<td>71:</td>
<td>1064.170</td>
<td>141</td>
<td>-0.0186 e</td>
<td>37/20,50/27,13/7</td>
<td></td>
</tr>
<tr>
<td>72:</td>
<td>1079.262</td>
<td>143</td>
<td>-0.0165 e</td>
<td>28/15</td>
<td></td>
</tr>
<tr>
<td>73:</td>
<td>1094.354</td>
<td>145</td>
<td>-0.0145 e</td>
<td>15/8,32/17,17/9</td>
<td>Evc</td>
</tr>
<tr>
<td>74:</td>
<td>1109.446</td>
<td>147</td>
<td>-0.0124 e</td>
<td>256/135,243/128,40/21</td>
<td>Mahur</td>
</tr>
<tr>
<td>75:</td>
<td>1124.539</td>
<td>149</td>
<td>-0.0103 e</td>
<td>21/11,23/12,48/25</td>
<td>Dik Mahur</td>
</tr>
<tr>
<td>76:</td>
<td>1139.631</td>
<td>151</td>
<td>-0.0083 e</td>
<td>27/14,29/15,31/16</td>
<td>(Mahurek)</td>
</tr>
<tr>
<td>77:</td>
<td>1154.723</td>
<td>153</td>
<td>-0.0062 e</td>
<td>37/19,39/20,125/64</td>
<td>(Mahur+irha)</td>
</tr>
<tr>
<td>78:</td>
<td>1169.815</td>
<td>155</td>
<td>-0.0041 e</td>
<td>49/25,55/28,6144/3125</td>
<td>(Dik Mahur+irha)</td>
</tr>
<tr>
<td>79:</td>
<td>1184.908</td>
<td>157</td>
<td>-0.0021 e</td>
<td>2025/1024,105/53</td>
<td>Nerm Gerdaniye</td>
</tr>
<tr>
<td>80:</td>
<td>1200.000</td>
<td>159</td>
<td>0.0000 e</td>
<td>2/1</td>
<td>Gerdaniye</td>
</tr>
</tbody>
</table>

Highest absolute difference between the initial procedure used to acquire the 79-tone tuning and 79/80 MOS 159-tET is a thoroughly inaudible 0.0951 cents, with the average absolute difference being a mere 0.0424 cents.

The greatest error in the approximation of outlined JI ratios is always less than 8 cents, which is a tolerable margin.
Perdes given the prefix “nerm” (soft) are flatter, “dik” are acute, “sarp” are steep. Bold names indicate diatonic naturals arrived at by a chain of perfect fifths:

F-(702¢)-C-(702¢)-G-(694¢)-D-(702¢)-A-(694¢)-E-(702¢)-B.

These tones form the principal ascending mode of Maqam Rast in Süpürde Ahenk (See, APPENDIX C).

A complete 3 octave range of Maqam Music perdes in degrees of 79/80 MOS 159-tET has been provided in Table 5.2 on the next page. This table is divided into 17 regions in conformity with historical classification and usage, where the middle octave signifies traditional perdes from yegah to neva in the following order:

0. yegah,
1. pest bayati,
2. pest hisar,
3. aşiran,
4. acem aşiran,
5. arak,
6. rehavi/gevešt,
7. rast,
8. şuri,
9. zengule,
10. dügah,
11. kürdi/nihavend,
12. segah,
13. buselik,
14. cargah,
15. hicaz/uzzal,
16. saba,
17. neva.
Table 5.2: Complete Range of Detailed Traditional *Perdes* in 79/80 MOS 159-tET

<table>
<thead>
<tr>
<th>Degree</th>
<th>I. Octave Perdes</th>
<th>II. Octave Perdes</th>
<th>III. Octave Perdes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>Pest Rast</td>
<td>Rast (7)</td>
<td>Gerdaniye</td>
</tr>
<tr>
<td>1:</td>
<td>Pest Dik Rast</td>
<td>Dik Rast</td>
<td>Dik Gerdaniye</td>
</tr>
<tr>
<td>5:</td>
<td>Pest Şuri</td>
<td>Şuri (8)</td>
<td>Şuri</td>
</tr>
<tr>
<td>6:</td>
<td>Pest Nim Zengule</td>
<td>Nim Zengule</td>
<td>Nim Şehnaz</td>
</tr>
<tr>
<td>7-11:</td>
<td>Pest Zengule cluster</td>
<td>Zengule cluster</td>
<td>Şehnaz cluster</td>
</tr>
<tr>
<td>12:</td>
<td>Pest Zengule</td>
<td>Zengule (9)</td>
<td>Şehnaz</td>
</tr>
<tr>
<td>13:</td>
<td>Pest Dğah</td>
<td>Dğah (10)</td>
<td>Muhayyer</td>
</tr>
<tr>
<td>14:</td>
<td>Pest Dik Dğah</td>
<td>Dik Dğah</td>
<td>Dik Muhayyer</td>
</tr>
<tr>
<td>16:</td>
<td>Pest Nim Kürdi</td>
<td>Nim Kürdi</td>
<td>Nim Sünbüle</td>
</tr>
<tr>
<td>18:</td>
<td>Pest Nerm Kürdi</td>
<td>Nerm Kürdi</td>
<td>Nerm Sünbüle</td>
</tr>
<tr>
<td>19:</td>
<td>Pest Kürdi</td>
<td>Kürdi (11)</td>
<td>Sünbüle</td>
</tr>
<tr>
<td>20:</td>
<td>Pest Dik Kürdi</td>
<td>Dik Kürdi</td>
<td>Dik Sünbüle</td>
</tr>
<tr>
<td>21:</td>
<td>Pest Nihavend</td>
<td>Nihavend</td>
<td>Sarp Sünbüle</td>
</tr>
<tr>
<td>22:</td>
<td>Pest Hicazi Segah</td>
<td>Hicazi Segah</td>
<td>Tiz Hicazi Segah</td>
</tr>
<tr>
<td>23:</td>
<td>Pest Uşşaki Segah</td>
<td>Uşşaki Segah</td>
<td>Tiz Uşşaki Segah</td>
</tr>
<tr>
<td>24:</td>
<td>Pest Sabai Segah</td>
<td>Sabai Segah</td>
<td>Tiz Sabai Segah</td>
</tr>
<tr>
<td>25:</td>
<td>Pest Segahçe</td>
<td>Segahçe</td>
<td>Tiz Segahçe</td>
</tr>
<tr>
<td>26:</td>
<td>Pest Segah</td>
<td>Segah (12)</td>
<td>Tiz Segah</td>
</tr>
<tr>
<td>27:</td>
<td>Pest Baseilik</td>
<td>Baseilik (13)</td>
<td>Tiz Baseilik</td>
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<td>28:</td>
<td>Pest Nişabûr</td>
<td>Nişabûr</td>
<td>Tiz Nişabûr</td>
</tr>
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<td>32:</td>
<td>Pest Nerm Çargah</td>
<td>Nerm Çargah</td>
<td>Tiz Nerm Çargah</td>
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<td>33:</td>
<td>Pest Çargah</td>
<td>Çargah (14)</td>
<td>Tiz Çargah</td>
</tr>
<tr>
<td>34:</td>
<td>Pest Dik Çargah</td>
<td>Dik Çargah</td>
<td>Tiz Dik Çargah</td>
</tr>
<tr>
<td>36:</td>
<td>Pest Nim Hicaz</td>
<td>Nim Hicaz</td>
<td>Tiz Nim Hicaz</td>
</tr>
<tr>
<td>38:</td>
<td>Pest Nerm Hicaz</td>
<td>Nerm Hicaz</td>
<td>Tiz Nerm Hicaz</td>
</tr>
<tr>
<td>39:</td>
<td>Pest Hicaz</td>
<td>Hicaz (15)</td>
<td>Tiz Hicaz</td>
</tr>
<tr>
<td>40:</td>
<td>Pest Uzzal</td>
<td>Uzzal</td>
<td>Tiz Uzzal</td>
</tr>
<tr>
<td>41:</td>
<td>Pest Saba</td>
<td>Saba (16)</td>
<td>Tiz Saba cluster</td>
</tr>
<tr>
<td>42-45:</td>
<td>Pest Saba cluster</td>
<td>Saba cluster</td>
<td>Tiz Saba cluster</td>
</tr>
<tr>
<td>46-47:</td>
<td>Yeğah (0)</td>
<td>Neva (17)</td>
<td>Tiz Neva</td>
</tr>
<tr>
<td>48:</td>
<td>Dik Yeğah</td>
<td>Dik Neva</td>
<td>Tiz Dik Neva</td>
</tr>
<tr>
<td>52:</td>
<td>Pest Bayati (1)</td>
<td>Bayati</td>
<td>Bayati</td>
</tr>
<tr>
<td>53:</td>
<td>Pest Nim Hisar</td>
<td>Nim Hisar</td>
<td>Tiz Nim Hisar</td>
</tr>
<tr>
<td>54-58:</td>
<td>Pest Hisar/Hüzûm cluster</td>
<td>Hisar/Hüzzûm cluster</td>
<td>Tiz Hisar/Hüzûm. cluster</td>
</tr>
<tr>
<td>59:</td>
<td>Pest Hisar(ek) (2)</td>
<td>Hisar(ek)</td>
<td>Tiz Hisar(ek)</td>
</tr>
<tr>
<td>60:</td>
<td>Asıran (3)</td>
<td>Hüseyni</td>
<td>Tiz Hüseyni</td>
</tr>
<tr>
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<td>Dik Asıran</td>
<td>Dik Hüseyni</td>
<td>Tiz Dik Hüseyni</td>
</tr>
<tr>
<td>63:</td>
<td>Nim Acem Asıran</td>
<td>Nim Acem</td>
<td>Tiz Nim Acem</td>
</tr>
<tr>
<td>65:</td>
<td>Nerm Acem Asıran</td>
<td>Nerm Acem</td>
<td>Tiz Nerm Acem</td>
</tr>
<tr>
<td>66:</td>
<td>Acem Asıran (4)</td>
<td>Acem</td>
<td>Tiz Acem</td>
</tr>
<tr>
<td>67:</td>
<td>Dik Acem Asıran</td>
<td>Dik Acem</td>
<td>Tiz Dik Acem</td>
</tr>
<tr>
<td>68:</td>
<td>Sarp Acem Asıran</td>
<td>Sarp Acem</td>
<td>Tiz Sarp Acem</td>
</tr>
<tr>
<td>69-71:</td>
<td>Arak cluster</td>
<td>Evc cluster</td>
<td>Tiz Evc cluster</td>
</tr>
<tr>
<td>72:</td>
<td>Nerm Arak</td>
<td>Nerm Evc</td>
<td>Tiz Nerm Evc</td>
</tr>
<tr>
<td>73:</td>
<td>Arak (5)</td>
<td>Evc</td>
<td>Tiz Evc</td>
</tr>
<tr>
<td>74:</td>
<td>Rehavi (6)</td>
<td>Mahur</td>
<td>Tiz Mahur</td>
</tr>
<tr>
<td>75:</td>
<td>Gevest</td>
<td>Dik Mahur</td>
<td>Tiz Dik Mahur</td>
</tr>
<tr>
<td>79:</td>
<td>Nerm Rast</td>
<td>Nerm Gerdaniye</td>
<td>Tiz Nerm Gerdaniye</td>
</tr>
<tr>
<td>80:</td>
<td>Rast (7)</td>
<td>Gerdaniye</td>
<td>Tiz Gerdaniye</td>
</tr>
</tbody>
</table>
The SCALA® “Farey rational approximation” command for 79/80 MOS 159-tET based on “minimax interval difference” yields a subset of 1006-ADO as shown in Table 5.3:

Table 5.3: 1006-ADO approximation of 79/80 MOS 159-tET

<table>
<thead>
<tr>
<th>Degree</th>
<th>79/80 MOS 159-tET</th>
<th>1006-ADO</th>
<th>Cents</th>
<th>Difference</th>
<th>Consecutive Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>0.000</td>
<td>1/1</td>
<td>0.000</td>
<td>0.000 e</td>
<td>(with previous)</td>
</tr>
<tr>
<td>1:</td>
<td>15.694</td>
<td>1015/1006</td>
<td>15.419</td>
<td>-0.325 e</td>
<td>15.419 e</td>
</tr>
<tr>
<td>2:</td>
<td>30.189</td>
<td>1024/1006</td>
<td>30.702</td>
<td>-0.513 e</td>
<td>15.283 e</td>
</tr>
<tr>
<td>3:</td>
<td>45.283</td>
<td>1033/1006</td>
<td>45.852</td>
<td>-0.569 e</td>
<td>15.150 e</td>
</tr>
<tr>
<td>4:</td>
<td>60.377</td>
<td>1042/1006</td>
<td>60.870</td>
<td>-0.493 e</td>
<td>15.018 e</td>
</tr>
<tr>
<td>5:</td>
<td>75.472</td>
<td>1051/1006</td>
<td>75.759</td>
<td>-0.287 e</td>
<td>14.889 e</td>
</tr>
<tr>
<td>6:</td>
<td>90.566</td>
<td>1060/1006</td>
<td>90.521</td>
<td>0.045 e</td>
<td>14.762 e</td>
</tr>
<tr>
<td>7:</td>
<td>105.660</td>
<td>1069/1006</td>
<td>105.158</td>
<td>0.502 e</td>
<td>14.637 e</td>
</tr>
<tr>
<td>8:</td>
<td>120.755</td>
<td>1079/1006</td>
<td>121.277</td>
<td>-0.522 e</td>
<td>16.119 e</td>
</tr>
<tr>
<td>9:</td>
<td>135.849</td>
<td>1088/1006</td>
<td>135.658</td>
<td>0.191 e</td>
<td>14.381 e</td>
</tr>
<tr>
<td>10:</td>
<td>150.943</td>
<td>1098/1006</td>
<td>151.497</td>
<td>-0.554 e</td>
<td>15.839 e</td>
</tr>
<tr>
<td>11:</td>
<td>166.038</td>
<td>1107/1006</td>
<td>165.630</td>
<td>0.408 e</td>
<td>14.133 e</td>
</tr>
<tr>
<td>12:</td>
<td>181.132</td>
<td>1117/1006</td>
<td>181.199</td>
<td>-0.067 e</td>
<td>15.569 e</td>
</tr>
<tr>
<td>13:</td>
<td><strong>196.226</strong></td>
<td><strong>1127/1006</strong></td>
<td>196.629</td>
<td><strong>-0.403 e</strong></td>
<td><strong>15.430 e</strong></td>
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<tr>
<td>14:</td>
<td>211.321</td>
<td>1137/1006</td>
<td>211.922</td>
<td>-0.601 e</td>
<td>15.293 e</td>
</tr>
<tr>
<td>15:</td>
<td>226.415</td>
<td>1147/1006</td>
<td>227.082</td>
<td>-0.667 e</td>
<td>15.160 e</td>
</tr>
<tr>
<td>16:</td>
<td>241.509</td>
<td>1157/1006</td>
<td>242.110</td>
<td>-0.601 e</td>
<td>15.028 e</td>
</tr>
<tr>
<td>17:</td>
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<td>1167/1006</td>
<td>257.009</td>
<td>-0.405 e</td>
<td>14.899 e</td>
</tr>
<tr>
<td>18:</td>
<td>271.698</td>
<td>1177/1006</td>
<td>271.781</td>
<td>-0.083 e</td>
<td>14.772 e</td>
</tr>
<tr>
<td>19:</td>
<td>286.792</td>
<td>1187/1006</td>
<td>286.428</td>
<td>0.364 e</td>
<td>14.647 e</td>
</tr>
<tr>
<td>20:</td>
<td>301.887</td>
<td>1198/1006</td>
<td>302.397</td>
<td>-0.510 e</td>
<td>15.969 e</td>
</tr>
<tr>
<td>21:</td>
<td>316.981</td>
<td>1208/1006</td>
<td>316.788</td>
<td>0.193 e</td>
<td>14.391 e</td>
</tr>
<tr>
<td>22:</td>
<td>332.075</td>
<td>1219/1006</td>
<td>332.481</td>
<td>-0.406 e</td>
<td>15.693 e</td>
</tr>
<tr>
<td>23:</td>
<td>347.170</td>
<td>1229/1006</td>
<td>346.626</td>
<td>0.544 e</td>
<td>14.145 e</td>
</tr>
<tr>
<td>24:</td>
<td>362.264</td>
<td>1240/1006</td>
<td>362.052</td>
<td>0.212 e</td>
<td>15.426 e</td>
</tr>
<tr>
<td>25:</td>
<td>377.358</td>
<td>1251/1006</td>
<td>377.342</td>
<td>0.016 e</td>
<td>15.290 e</td>
</tr>
<tr>
<td>26:</td>
<td><strong>392.453</strong></td>
<td><strong>1262/1006</strong></td>
<td><strong>392.498</strong></td>
<td><strong>-0.045 e</strong></td>
<td><strong>15.156 e</strong></td>
</tr>
<tr>
<td>27:</td>
<td>407.547</td>
<td>1273/1006</td>
<td>407.523</td>
<td>0.024 e</td>
<td>15.025 e</td>
</tr>
<tr>
<td>28:</td>
<td>422.642</td>
<td>1284/1006</td>
<td>422.418</td>
<td>0.224 e</td>
<td>14.895 e</td>
</tr>
<tr>
<td>29:</td>
<td>437.736</td>
<td>1295/1006</td>
<td>437.186</td>
<td>0.550 e</td>
<td>14.768 e</td>
</tr>
<tr>
<td>30:</td>
<td>452.830</td>
<td>1307/1006</td>
<td>453.155</td>
<td>-0.325 e</td>
<td>15.969 e</td>
</tr>
</tbody>
</table>

---

1. See footnote to the first page of APPENDIX B.

2. According to the SCALA® help file (under Farey), selecting this option replaces each pitch of the scale by an approximate fraction with a common denominator smaller than or equal to the input order (i.e., number constraint) that gives the smallest maximum logarithmic difference for all consecutive intervals.

3. Acronym for “arithmetical divisions of the octave” coined by Shaahin Mohajeri. It is akin to dividing the length up to 2/1 on an open gaut string based on ascending series of superparticular ratios. To find fret positions, subtract denominator from numerator.
Table 5.3: 1006-ADO approximation of 79/80 MOS 159-tET – Continued

<table>
<thead>
<tr>
<th>Degree</th>
<th>79/80 MOS 159-tET</th>
<th>1006-ADO</th>
<th>Cents</th>
<th>Difference</th>
<th>Consecutive Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>31:</td>
<td>467.925</td>
<td>1318/1006</td>
<td>467.664</td>
<td>0.261</td>
<td>14.509 e</td>
</tr>
<tr>
<td>32:</td>
<td>483.019</td>
<td>1330/1006</td>
<td>483.355</td>
<td>-0.336</td>
<td>15.691 e</td>
</tr>
<tr>
<td>33:</td>
<td><strong>498.113</strong></td>
<td>1341/1006</td>
<td><strong>497.615</strong></td>
<td><strong>0.498 e</strong></td>
<td>14.260 e</td>
</tr>
<tr>
<td>34:</td>
<td>513.208</td>
<td>1353/1006</td>
<td>513.038</td>
<td>0.170</td>
<td>15.423 e</td>
</tr>
<tr>
<td>35:</td>
<td>528.302</td>
<td>1365/1006</td>
<td>528.325</td>
<td>-0.023</td>
<td>15.287 e</td>
</tr>
<tr>
<td>36:</td>
<td>543.396</td>
<td>1377/1006</td>
<td>543.478</td>
<td>-0.082</td>
<td>15.153 e</td>
</tr>
<tr>
<td>37:</td>
<td>558.491</td>
<td>1389/1006</td>
<td>558.500</td>
<td>-0.009</td>
<td>15.022 e</td>
</tr>
<tr>
<td>38:</td>
<td>573.585</td>
<td>1401/1006</td>
<td>573.479</td>
<td>0.193</td>
<td>14.892 e</td>
</tr>
<tr>
<td>39:</td>
<td>588.679</td>
<td>1413/1006</td>
<td>588.157</td>
<td>0.522</td>
<td>14.765 e</td>
</tr>
<tr>
<td>40:</td>
<td>603.774</td>
<td>1426/1006</td>
<td>604.012</td>
<td>-0.238</td>
<td>15.855 e</td>
</tr>
<tr>
<td>41:</td>
<td>618.868</td>
<td>1438/1006</td>
<td>618.520</td>
<td>0.348</td>
<td>14.508 e</td>
</tr>
<tr>
<td>42:</td>
<td>633.962</td>
<td>1451/1006</td>
<td>634.101</td>
<td>-0.139</td>
<td>15.581 e</td>
</tr>
<tr>
<td>43:</td>
<td>649.057</td>
<td>1464/1006</td>
<td>649.542</td>
<td>-0.485</td>
<td>15.441 e</td>
</tr>
<tr>
<td>44:</td>
<td>664.151</td>
<td>1476/1006</td>
<td>663.675</td>
<td>0.476</td>
<td>14.333 e</td>
</tr>
<tr>
<td>45:</td>
<td>679.245</td>
<td>1489/1006</td>
<td>678.856</td>
<td>0.389</td>
<td>15.181 e</td>
</tr>
<tr>
<td>46:</td>
<td><strong>694.340</strong></td>
<td>1503/1006</td>
<td><strong>695.058</strong></td>
<td><strong>-0.718 e</strong></td>
<td>16.202 e</td>
</tr>
<tr>
<td>47:</td>
<td><strong>701.887</strong></td>
<td>1509/1006</td>
<td><strong>701.955</strong></td>
<td><strong>-0.068 e</strong></td>
<td>6.897 e</td>
</tr>
<tr>
<td>48:</td>
<td>716.981</td>
<td>1522/1006</td>
<td>716.806</td>
<td>0.175</td>
<td>14.851 e</td>
</tr>
<tr>
<td>49:</td>
<td>732.075</td>
<td>1536/1006</td>
<td>732.657</td>
<td>-0.582</td>
<td>15.851 e</td>
</tr>
<tr>
<td>50:</td>
<td>747.170</td>
<td>1549/1006</td>
<td>747.248</td>
<td>-0.078</td>
<td>14.591 e</td>
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<tr>
<td>51:</td>
<td>762.264</td>
<td>1563/1006</td>
<td>762.825</td>
<td>-0.561</td>
<td>15.577 e</td>
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<tr>
<td>52:</td>
<td>777.358</td>
<td>1576/1006</td>
<td>777.165</td>
<td>0.193</td>
<td>14.340 e</td>
</tr>
<tr>
<td>53:</td>
<td>792.453</td>
<td>1590/1006</td>
<td>792.476</td>
<td>-0.023</td>
<td>15.311 e</td>
</tr>
<tr>
<td>54:</td>
<td>807.547</td>
<td>1604/1006</td>
<td>807.653</td>
<td>-0.106</td>
<td>15.177 e</td>
</tr>
<tr>
<td>55:</td>
<td>822.642</td>
<td>1618/1006</td>
<td>822.698</td>
<td>-0.056</td>
<td>15.045 e</td>
</tr>
<tr>
<td>56:</td>
<td>837.736</td>
<td>1632/1006</td>
<td>837.613</td>
<td>0.123</td>
<td>14.915 e</td>
</tr>
<tr>
<td>57:</td>
<td>852.830</td>
<td>1646/1006</td>
<td>852.401</td>
<td>0.429</td>
<td>14.788 e</td>
</tr>
<tr>
<td>58:</td>
<td>867.925</td>
<td>1660/1006</td>
<td>868.106</td>
<td>-0.181</td>
<td>15.705 e</td>
</tr>
<tr>
<td>59:</td>
<td>883.019</td>
<td>1674/1006</td>
<td>882.637</td>
<td>0.382</td>
<td>14.531 e</td>
</tr>
<tr>
<td>60:</td>
<td><strong>898.113</strong></td>
<td>1690/1006</td>
<td><strong>898.072</strong></td>
<td><strong>0.041 e</strong></td>
<td>15.435 e</td>
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<tr>
<td>61:</td>
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<td>1705/1006</td>
<td>913.370</td>
<td>-0.162</td>
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<tr>
<td>62:</td>
<td>928.302</td>
<td>1720/1006</td>
<td>928.534</td>
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</tr>
<tr>
<td>63:</td>
<td>943.396</td>
<td>1735/1006</td>
<td>943.566</td>
<td>-0.170</td>
<td>15.032 e</td>
</tr>
<tr>
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<td>1750/1006</td>
<td>958.470</td>
<td>0.021</td>
<td>14.904 e</td>
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<tr>
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<td>1765/1006</td>
<td>973.245</td>
<td>0.340</td>
<td>14.775 e</td>
</tr>
<tr>
<td>66:</td>
<td>988.679</td>
<td>1781/1006</td>
<td>988.869</td>
<td>-0.190</td>
<td>15.624 e</td>
</tr>
<tr>
<td>67:</td>
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<td>1796/1006</td>
<td>1003.388</td>
<td>0.386 e</td>
<td>14.519 e</td>
</tr>
<tr>
<td>68:</td>
<td>1018.868</td>
<td>1812/1006</td>
<td>1018.743</td>
<td>0.125 e</td>
<td>15.355 e</td>
</tr>
<tr>
<td>69:</td>
<td>1033.962</td>
<td>1828/1006</td>
<td>1033.963</td>
<td>-0.001</td>
<td>15.220 e</td>
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<tr>
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<td>1844/1006</td>
<td>1049.050</td>
<td>0.007 e</td>
<td>15.087 e</td>
</tr>
<tr>
<td>71:</td>
<td>1064.151</td>
<td>1860/1006</td>
<td>1064.007</td>
<td>0.144 e</td>
<td>14.957 e</td>
</tr>
<tr>
<td>72:</td>
<td>1079.245</td>
<td>1876/1006</td>
<td>1078.835</td>
<td>0.410 e</td>
<td>14.828 e</td>
</tr>
<tr>
<td>73:</td>
<td><strong>1094.340</strong></td>
<td><strong>1893/1006</strong></td>
<td><strong>1094.453</strong></td>
<td><strong>-0.113 e</strong></td>
<td>15.618 e</td>
</tr>
<tr>
<td>74:</td>
<td>1109.434</td>
<td>1909/1006</td>
<td>1109.024</td>
<td>0.410 e</td>
<td>14.571 e</td>
</tr>
<tr>
<td>75:</td>
<td>1124.528</td>
<td>1926/1006</td>
<td>1124.373</td>
<td>0.155 e</td>
<td>15.349 e</td>
</tr>
<tr>
<td>76:</td>
<td>1139.623</td>
<td>1943/1006</td>
<td>1139.587</td>
<td>0.036 e</td>
<td>15.214 e</td>
</tr>
<tr>
<td>77:</td>
<td>1154.717</td>
<td>1960/1006</td>
<td>1154.668</td>
<td>0.049 e</td>
<td>15.081 e</td>
</tr>
<tr>
<td>78:</td>
<td>1169.811</td>
<td>1977/1006</td>
<td>1169.619</td>
<td>0.192 e</td>
<td>14.951 e</td>
</tr>
<tr>
<td>79:</td>
<td>1184.906</td>
<td>1995/1006</td>
<td>1185.310</td>
<td>-0.404 e</td>
<td>15.691 e</td>
</tr>
<tr>
<td>80:</td>
<td><strong>1200.000</strong></td>
<td>2/1</td>
<td><strong>1200.000</strong></td>
<td><strong>0.000 e</strong></td>
<td>14.690 e</td>
</tr>
</tbody>
</table>
The ADO numerator of the 46th degree is modified by +1 to avoid too low a fifth. Even so, highest absolute difference is only 0.7176 cents, with the average absolute difference being a mere 0.2760 cents.

Another valid method for deriving the 79-tone tuning is accomplished through cycling via:

1. 46 pure fifths, &
2. 33 fifths tempered by 19/53 of a syntonic comma,

\[
\left\{ \log_{10} \left( \frac{3:2}{} \right) \right\} x 1200 / \left\{ \log_{10} \left( \frac{2}{} \right) \right\} - \\
\left\{ \log_{10} \left( \frac{81:80}{} \right) x 1200 / \log_{10} \left( \frac{2}{} \right) \right\} x (19/53) = \\
701.955001 - (21.5062896 x 0.3584906) = \\
701.955001 \text{ cents (A)} - 7.709802 = \\
694.2451989 \text{ cents (B)},
\]

in the manner,

\[
\begin{array}{cccccccccccccccc}
& AB & & & & & & & & & & & & & & & \\
& AB & AB & AAB & & & & & & & & & & & & & & \\
& AB & AB & AAB & AB & & & & & & & & & & & & & & \\
& AB & AB & AAB & AB & & & & & & & & & & & & & & \\
& AB & AB & AAB & AB & & & & & & & & & & & & & & \\
& AB & AB & AAB & AB & & & & & & & & & & & & & & \\
\end{array}
\]
where,

\[(A^{46}) + (B^{33}) = \]
\[32289.93004 + 22910.09156 = \]
\[55200.0216 \text{ cents} = \]
\[46 \times 1200.00047 \text{ cents};\]

meaning that one returns to the same tone 46 octaves above – save for a miniscule fault of 0.216 cents, which amounts to an impossible to hear, therefore inconsequential, 0.00047 cents error per octave.

In the version above, there are two kinds of basic intervals sized 15.0923 (occurring seventy-nine times) and 22.8021 cents (occurring once) respectively.

For 80 tones, one simply needs to add a 19/53 syntonic comma tempered fifth next to pure above the tone of origin.

In that case, the larger step is reduced in size by 2/3 and becomes a “nanotone” of 7.7098 cents.

Here, a “nanotone” is taken to be an interval so miniscule that its addition to or subtraction from a pitch does not spoil the auditory perception of it.

Compared with 159 equal divisions of the octave, highest absolute difference of the 19/53 syntonic comma approach amounts to a trifling 0.0924 cents, with an average of 0.0417 cents.

Yet another way to achieve 79/80 MOS 159-tET has been discovered by the author during a quest for “proportional beat ratios” based on simple frequencies at concert pitch [285].

Although, too tedious to go into minutiae, a comparison of 79/80 MOS 159-tET and the simple frequencies approach to the 79-tone tuning is divulged in Table 5.4:
### Table 5.4: Simple Frequencies Approximation to 79/80 MOS 159-tET

<table>
<thead>
<tr>
<th>Degree</th>
<th>79/80 MOS 159-tET</th>
<th>Simple Frequencies</th>
<th>Cents</th>
<th>Difference</th>
<th>Consecutive Intervals</th>
<th>Fifth Beat Rates (hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>0.000</td>
<td>262 hz (C₀)</td>
<td>0.000</td>
<td>0.000 e</td>
<td>0.000 e</td>
<td>0</td>
</tr>
<tr>
<td>1:</td>
<td>15.094</td>
<td>264.5 hz</td>
<td>16.441</td>
<td>-1.347 e</td>
<td>16.441 e</td>
<td>-0.5</td>
</tr>
<tr>
<td>2:</td>
<td>30.189</td>
<td>266.75 hz</td>
<td>31.106</td>
<td>-0.917 e</td>
<td>14.665 e</td>
<td>-0.25</td>
</tr>
<tr>
<td>3:</td>
<td>45.283</td>
<td>269 hz</td>
<td>45.647</td>
<td>-0.364 e</td>
<td>14.541 e</td>
<td>0</td>
</tr>
<tr>
<td>4:</td>
<td>60.377</td>
<td>271.25 hz</td>
<td>60.068</td>
<td>0.309 e</td>
<td>14.420 e</td>
<td>0.25</td>
</tr>
<tr>
<td>5:</td>
<td>75.472</td>
<td>273.75 hz</td>
<td>75.951</td>
<td>-0.479 e</td>
<td>15.883 e</td>
<td>-0.25</td>
</tr>
<tr>
<td>6:</td>
<td>90.566</td>
<td>276.25 hz</td>
<td>91.689</td>
<td>-1.123 e</td>
<td>15.739 e</td>
<td>-0.75</td>
</tr>
<tr>
<td>7:</td>
<td>105.660</td>
<td>278.5 hz</td>
<td>105.733</td>
<td>0.073 e</td>
<td>14.043 e</td>
<td>0</td>
</tr>
<tr>
<td>8:</td>
<td>120.755</td>
<td>281 hz</td>
<td>121.204</td>
<td>-0.449 e</td>
<td>15.471 e</td>
<td>-0.5</td>
</tr>
<tr>
<td>9:</td>
<td>135.849</td>
<td>283.5 hz</td>
<td>136.538</td>
<td>0.689 e</td>
<td>15.334 e</td>
<td>-0.5</td>
</tr>
<tr>
<td>10:</td>
<td>150.943</td>
<td>286 hz</td>
<td>151.738</td>
<td>-0.795 e</td>
<td>15.200 e</td>
<td>-0.5</td>
</tr>
<tr>
<td>11:</td>
<td>166.038</td>
<td>288.5 hz</td>
<td>166.805</td>
<td>-0.767 e</td>
<td>15.067 e</td>
<td>-0.5</td>
</tr>
<tr>
<td>12:</td>
<td>181.132</td>
<td>291 hz</td>
<td>181.743</td>
<td>-0.611 e</td>
<td>14.937 e</td>
<td>-0.5</td>
</tr>
<tr>
<td>13:</td>
<td>196.226</td>
<td>293.5 hz</td>
<td>196.552</td>
<td>-0.326 e</td>
<td>14.810 e</td>
<td>-0.5</td>
</tr>
<tr>
<td>14:</td>
<td>211.321</td>
<td>296 hz</td>
<td>211.236</td>
<td>0.085 e</td>
<td>14.684 e</td>
<td>0</td>
</tr>
<tr>
<td>15:</td>
<td>226.415</td>
<td>298.75 hz</td>
<td>227.246</td>
<td>-0.831 e</td>
<td>16.010 e</td>
<td>-0.75</td>
</tr>
<tr>
<td>16:</td>
<td>241.509</td>
<td>301.25 hz</td>
<td>241.673</td>
<td>-0.164 e</td>
<td>14.427 e</td>
<td>0.25</td>
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Table 5.4: Simple Frequencies Approximation to 79/80 MOS 159-tET – Continued

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<th>Cents</th>
<th>Difference</th>
<th>Consecutive Intervals</th>
<th>Fifth Beat Rates (Hz)</th>
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<td>762.264</td>
<td>407 Hz</td>
<td>762.554</td>
<td>-0.290 ¢</td>
<td>14.952 ¢</td>
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<td>777.378</td>
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<td>792.077</td>
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<td>417.75 Hz</td>
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<tr>
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Highest absolute difference here is a meagre 1.347 cents, with the average absolute difference at only 0.455 cents.

A general comparison of all versions of the 79-tone tuning – the original “33 equal divisions of the pure fourth method”, the “159 equal divisions of the octave subset”, the “cycle via 19/53 syntonic comma tempered & just fifths”, and the “simple frequencies approach to 79/80 MOS 159-tET” – is shown in Table 5.5:
Table 5.5: Comparing Several Versions of 79/80 MOS 159-tET

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<th>19/53 Comma Temperament</th>
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<td>588.157</td>
<td>588.599</td>
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<td>604.012</td>
<td>603.691</td>
<td>603.389</td>
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<td>618.868</td>
<td>618.520</td>
<td>618.784</td>
<td>619.634</td>
</tr>
<tr>
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<td>633.962</td>
<td>634.101</td>
<td>633.876</td>
<td>634.583</td>
</tr>
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<td>649.405</td>
</tr>
<tr>
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<td>664.151</td>
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</tr>
<tr>
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<td>679.245</td>
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</tr>
<tr>
<td>46</td>
<td>694.245</td>
<td>694.340</td>
<td>695.058</td>
<td>694.245</td>
<td>694.597</td>
</tr>
<tr>
<td>47</td>
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<td>701.955</td>
<td>701.955</td>
<td>701.955</td>
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<tr>
<td>48</td>
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<td>716.981</td>
<td>716.806</td>
<td>717.047</td>
<td>717.305</td>
</tr>
<tr>
<td>49</td>
<td>732.140</td>
<td>732.075</td>
<td>732.657</td>
<td>732.140</td>
<td>732.520</td>
</tr>
</tbody>
</table>
Upon careful examination, the greatest difference between alternative approaches to the 79-tone tuning is observed to be not even a cent and a half – a deviation barely, if at all, noticeable. Although, any of the said methods may serve purposes for adapting the 79-tone tuning to an acoustic instrument, only the 159 equal octave division subset will be chosen for simplicity’s sake when discussing theory.

In expressing 79/80 MOS 159-tET on staff, an avant-garde microtonal notation system designed by George Secor and David Keenan titled “Sagittal Notation®” will be employed [286].
Decidedly, the ideal template for working with the 79-tone tuning is the Sagittal® set of symbols compatible at the same time with 65, 72, and 79 equal divisions of the octave and 13-limit JI.

Catalogued as SA79 under SCALA®, a mixed-symbol version ¹ of a slightly modified Sagittal Notation® ² delineating the whole tone sector of 79/80 MOS 159-tET is shown in Figure 5.4:

![Figure 5.4: Sagittal Notation® of the Whole Tone Sector of 79/80 MOS 159-tET](image)

One can see immediately that only 3 accidentals and their mirrored counterparts suffice when handling such immensity of microtones. These symbols, used also in combination with sharps/flats, are the comma, double comma, and the quarter-tone:

---

¹ *i.e.*, one of the two versions (the other being “pure”) for notating a score using Sagittal Notation®, where regular sharps and flats are retained, and only “single shaft symbols” are used in combination with them, resulting in fewer elements to deal with, and an easier learning curve for musicians accustomed to conventional ways.

² The modification involves the replacement of the “arcs” \( \uparrow \) & \( \downarrow \) (septimal or 7-comma, nominally at 64:63 and equalling 27.264 cents) with the “barbs” \( \uparrow \) & \( \downarrow \) (55-comma, nominally at 55:54 and equalling 31.767 cents), otherwise early symbols attributed to Archytas comma and 2 degrees of 72-tone equal temperament, which had been reassigned by Secor and Keenan to prevent lateral confusability.
1. Syntonic or “5-comma” nominally at 81:80 (21.506 cents), equalling 1° 79/80 MOS 159-TET, and expressed by the up and down half-arrows ↑ & ↓ dubbed “left-barb” (so-called Didymus’ Dibbler; ASCII codes ¹: /| & \).

2. “55-comma” nominally at 55:54 (31.767 cents), equalling 2° 79/80 MOS 159-TET, and expressed by the up and down half-arrows ↑ & ↓ dubbed “right-barb” (so-called Artemis’ Half-Arrow; ASCII codes: |\ & !/).

3. Undecimal comma or Al-Farabi’s ¼ tone, or “11-M diesis” nominally at 33:32 (53.273 cents), equalling 3° 79/80 MOS 159-TET, and expressed by the up and down arrows ↑ & ↓ named “double-barb” (so-called Apollo’s Arrow; ASCII codes: /\ \ \ & !/).

Coupled with customary sharps/flats (6 degrees of 79 MOS 159-tET) and double sharps/double flats (12 degrees of 79 MOS 159-tET, hence the consistency of nomenclature), Sagittal® symbols raise or lower each tone – except the pure and meantone fifths seperated by a nanotonal 2/3 Holderian comma in 80 MOS 159-tET which are ascribed the same note – as much as 1, 2, or 3 degrees.

The beauty of the Sagittal Notation® becomes apparent once it is observed that left-barb (81:80) or 1° 79/80 MOS 159-tET (one comma) + right-barb (55:54) or 2° 79/80 MOS 159-tET (two commas) is found to equal a double-barb (33:32) or 3° 79/80 MOS 159-tET (a quarter-tone).

Hence: ↑ + ↑ = ↑.

¹ Computer text typifications via the usage of characters pertaining to the “American Standard Code for Information Interchange”.


Moreover, this notation is backward-compatible with 65 and 72 equal divisions of the octave – the latter being an established microtonal standard, while the former is no less important a Pythagorean tuning.

Equally pleasing is the fact that electroacoustically measured “quarter-tones” of Turkish Maqam Music are represented splendidly at every step.

Figure 5.5 shows a Tone-Circle of 2/3 tones in 79 MOS 159-tET, and Figure 5.6, in 80 MOS 159-tET:
The three kinds of 2/3 tones in 79 MOS 159-tET are: 70 instances of 135.849 cents (13:12 - 2.724 cents, and/or 14:13 + 7.551 cents – sounding like a ‘diphthong’), 9 instances of 143.396 cents (13:12 + 4.823 cents), and 8 instances of 128.302 cents (14:13 – 0.004 cents); whereas 80 MOS 159-tET contains one more instance of each interval.

In 79 MOS 159-tET, the circle closes with occasional 143.396 cents, while in 80 MOS 159-tET, with occasional 128.302 cents. In either case, these intervals are reachable via traversing the long straight lines along the circular paths.
For a cycle devoted entirely to 13:12, the tridecimal 2/3 tone, 79 MOS 159-tET is the obvious choice.

The Tone-Circle of 3/4 tones in 79 MOS 159-tET is manifested in Figure 5.7 below:

![Figure 5.7: Tone-Circle of 3/4 Tones in 79 MOS 159-tET](image)

The three kinds of 3/4 tones are: 69 instances of 150.943 cents (12:11 + 0.306 cents), 10 instances of 158.491 cents (12:11 + 7.854 cents), and 9 instances of 143.396 cents (12:11 - 7.241 cents) that are attainable via the shortcuts along the circular path.
Since a continuance of 3/4 tones does not make a complete cycle in 80 MOS 159-tET, a Tone-Circle of minor thirds showing the criss-crossing of neutral seconds is produced below in Figure 5.8:

The trellis fabric involves 70 instances of 150.943 and 10 instances of 143.396 cent neutral seconds, while the 11 ancillary lines equate to 158.491 cents. However, the pattern is not cyclic, and since the 143.396 cent interval is best dedicated to the tridecimal 2/3 tone, 80 MOS 159-tET is not preferrable. Thus, 79 MOS 159-tET is the obvious choice when it comes to a circuit of neutral seconds.
A Tone-Circle of 4/5 tones in 79 MOS 159-tET may be scrutinized in Figure 5.9:

![Tone-Circle of 4/5 Tones in 79 MOS 159-tET](image)

Figure 5.9: Tone-Circle of 4/5 Tones in 79 MOS 159-tET

Here, there are 68 instances of 166.038 cents (11:10 + 1.0338 cents), 11 instances of 173.585 cents (11:10 + 8.581 cents), and 10 instances of 158.491 cents (11:10 - 6.513 cents) that are accessible via jumping across the long straight lines along the circular path.

A Tone-Circle of 4/5 tones in 80 MOS 159-tET may be seen in Figure 5.10:
In this figure, there are 69 instances of 166.038 cents, 11 instances of 158.491 cents, and 12 instances of 173.585 cents that are available via cruising the long straight lines along the circular path. But since 158.491 cents is best reserved for the unidecimal neutral second, it is clear that 79 MOS 159-tET should be preferred for cycling 4/5 tones.

So far, it has been verified that 11-limit & 13-limit intervals are best transposed in 79 MOS 159-tET.

Among other intervals that are fully transposed in 79 MOS 159-tET, are the Pythagorean minor third, limma, apotome, and their octave inversions.
Pythagorean minor third (19°) is cycled via 60 instances of 286.792 (32:27 - 7.343) and 19 instances of 294.34 (32:27 + 0.205) cents, limma (6°) via 73 instances of 90.566 (256:243 + 0.341) and 6 instances of 98.113 (256:243 + 7.888) cents, and apotome (7°) via 72 instances of 105.660 (2187:2048 - 8.025) and 7 instances of 113.208 (2187:2048 - 0.477) cents; always with a maximum absolute error of 8 cents.

However, when transposing the Pythagorean major third, as well as 5-limit & 7-limit intervals such as pure major and minor thirds, or their octave inversions, 80 MOS 159-tET is strictly more proper.

The Pythagorean major third (27°) is cycled via 53 instances of 407.547 (81:64 - 0.273) and 27 instances of 400.000 (81:64 - 7.82) cents, pure minor third (21°) via 59 instances of 316.981 (6:5 + 1.34) and 21 instances of 309.434 (6:5 - 6.207) cents, and septimal major third (29°) via 51 instances of 437.736 (9:7 + 2.652) and 29 instances of 430.189 (9:7 - 4.895) cents; again with a maximum absolute error of 8 cents.

Pure major third (26°) has been excluded from the list because it does not yield a complete cycle in 80 MOS 159-tET. Nevertheless, it can be expressed by 54 instances of 392.453 (5:4 + 6.139) and 26 instances of 384.906 (5:4 - 1.408) cents. Likewise, septimal minor third (18°) has been excluded for the same reason, but may be expressed by 62 instances of 271.698 (7:6 + 4.827) and 18 instances of 264.151 (7:6 - 2.72) cents.

The fact that these intervals are so well represented in 79/80 MOS 159-tET means beauteous harmonies are realizable at every key.

Another feature of 79 MOS 159-tET is its comprisal of a twelve-tone closed cycle suitable for chromaticism as shown in Figure 5.11:

Mode 6 7 7 6 7 6 7 6 7 6 7 6 7 of 79 MOS 159-tET equalling 91+106+106+91+106+91+113+91+106+106+91+106 consecutive cents extracts this subset. The cycle, as can be seen above, contains only one wolf fifth, which may be considered tame.
In this 12-tone closed cycle, temperings of pure fifths (3:2), pure major thirds (5:4), and pure minor thirds (6:5) are shown in Table 5.6:

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>C#</th>
<th>D</th>
<th>Eb</th>
<th>E</th>
<th>F</th>
<th>F#</th>
<th>G</th>
<th>G#</th>
<th>A</th>
<th>Bb</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-8</td>
<td>-7</td>
<td>-8</td>
<td>-8</td>
<td>-8</td>
<td>-8</td>
</tr>
<tr>
<td>5/4</td>
<td>6</td>
<td>21</td>
<td>6</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>29</td>
<td>6</td>
<td>21</td>
<td>6</td>
<td>6</td>
<td>21</td>
</tr>
<tr>
<td>6/5</td>
<td>-14</td>
<td>-14</td>
<td>-14</td>
<td>-29</td>
<td>-6</td>
<td>-21</td>
<td>-6</td>
<td>-14</td>
<td>-14</td>
<td>-29</td>
<td>-14</td>
<td>-14</td>
</tr>
</tbody>
</table>
Having provided some hints on transposition, it is now possible to begin formulating a new 79-tone theory for Turkish \textit{Maqam} Music.

5.3. 79-tone \textit{Maqam} Theory: A Trial

The author of this dissertation maintains that any attempt to overhaul the entire established theory of \textit{maqamat} is a Herculean task transcending the scope of a mere year’s work, and requires diligent commitment for decades, if not a lifetime, to musicological pursuits on Arabic, Turkish and Iranian practice.

Although, the end product of such an undertaking is sure to be rewarding, only a preliminary assay on the novel 79-tone \textit{maqam} theory can be presented at this juncture.

As such, only a handful of \textit{maqams} to demonstrate the virtues of 79/80 MOS 159-tET will be chosen, which shall be reduced to basic ascending-descending scales at the expense of sacrificing such sophistications as \textit{seyir} \footnote{i.e., the “procedure”, or characteristic melodic unfolding of a \textit{maqam}, which necessitates a good deal of \textit{a priori} knowledge on the performance tradition.} and \textit{tavir} \footnote{Vocal or instrumental virtuosity, relying on improvisational technique, artistry, and above all, “mood” associated with the \textit{maqam} being played.}.

Admittedly, this understanding may seem provocative, or even Eurocentric at first. Despite the quagmires involved with such an approach, the author hopes to elucidate the fine points of melody-making in Turkish \textit{Maqam} Music.

In dealing with scale complexity, selected \textit{maqams} shall be divided into two branches titled “main” and “composite”. The latter type is also known in historical usage as \textit{terkib} or \textit{mürekkeb} \footnote{Which one may roughly define as a combination of two or more \textit{maqam} scales.} \textit{maqam}.

In the author’s view, criteria for categorizing a \textit{maqam} as main should be three:

\begin{enumerate}
  \item[i] Three:\textit{maqam} scale.
  \item[ii] Vocal or instrumental virtuosity, relying on improvisational technique, artistry, and above all, “mood” associated with the \textit{maqam} being played.
  \item[iii] \textit{maqam} scale complexity.
A- That its principal scale is ranged within an octave,

B- That it is notated with the least number of accidentals,

C- That it contains a relatively small number of alterations.

In rapport with this conception, *Rast* becomes the first *maqam* as shown in Figure 5.12:

*Figure 5.12: Maqam Rast Notated in 79 MOS 159-tET*


More main *maqams* of moderate complexity are provided in Figure 5.13:

![Diagram of maqams](image)

Figure 5.13: Some Main Maqams of Moderate Complexity Notated in 80 MOS 159-tET

This time, for correct scale transpositions, 80 MOS 159-tET is employed.
\textit{Mahur} ascends with $[14 \ 13 \ 6 \ 14] \ [14 \ 13 \ 6]$ steps or $[211 + 196 + 91] + 204 + [211 + 196 + 91]$ cents and descends with $[7 \ 13 \ 13] \ [14 \ 7 \ 13 \ 13]$ steps or $[106 + 196 + 196] + 204 + [106 + 196 + 196]$ cents.

\textit{Pençoğah} ascends with $[14 \ 12 \ 13 \ 8] \ [14 \ 12 \ 7]$ steps or $[211 + 181 + 196 + 113] + [211 + 181 + 106]$ cents and returns in the same fashion.

\textit{Nihavend} rises with $[14 \ 7 \ 12 \ 14] \ [7 \ 19 \ 7]$ steps or $[211 + 106 + 181 + 204] + [106 + 287 + 106]$ cents and falls with $[12 \ 14 \ 7] \ [14 \ 12 \ 7 \ 14]$ steps or $[181 + 211 + 106] + [204 + 181 + 106 + 211]$ cents.

\textit{Hicaz} ascends with $[8 \ 18 \ 7] \ [11 \ 9 \ 13]$ steps or $[121 + 272 + 106] + 204 + [166 + 136 + 196]$ cents and descends with $[13 \ 12 \ 8] \ [14 \ 7 \ 18 \ 8]$ steps or $[196 + 181 + 121] + 204 + [106 + 272 + 121]$ cents.

Lastly, \textit{Hüseyni} rises with $[11 \ 9 \ 14 \ 13] \ [11 \ 9 \ 13]$ steps or $[166 + 136 + 204 + 196] + [166 + 136 + 196]$ cents, falling back in like manner.

In retrospect to above given examples, these will be catalogued as composite:

A- \textit{maqam}s whose scales exceed an octave,

B- which require considerable amount of sharps and flats at the simplest keys,

C- show great variance of pitch in their ascent/descent,

Some composite \textit{maqam}s are provided in Figure 5.14.

In this figure, \textit{Segah} ascends with $(7) \ [7 \ 14 \ 12] \ [14 \ 7 \ 19 \ 7]$ steps or $(106) \ [106 \ 204 \ 181] \ [211 \ 106 \ 287 \ 106]$ cents, using \textit{perde kürdi} in parenthesis as leading tone, and descends with $7 – [6 \ 13 \ 14] \ [7 \ 12 \ 14 \ 7]$ steps or $106 – [91 \ 196 \ 211] \ [106 \ 181 \ 204 \ 106]$ cents.

\textit{Hüzzam} resembles \textit{Segah}, but differs in that the leading tone, tonic, its fourth and its fifth are each lowered by a comma.

Saba is one of the most unusual and piquant composites in Maqam Music. It climbs with [11 9 10 17] [10 10 13] steps or [166 136 151 249] [151 151 196] cents, and declines from upper F with [7 18 8] 13 [7 19 8] 10 10 steps or [106 272 121] 196 [106 279 121] 151 151 cents.

These maqam samples are specifically chosen to prove the adequacy of 79/80 MOS 159-tET in dealing with the intonational inflexions demanded of certain traditional perdes such as kürdi/nihavend, segah, and saba that are otherwise impossible to describe with the established 24-tone equal and Pythagorean models.
In case the pitch detail of the 79-tone tuning proves to be too much of a burden for the casual reader, one can simply dismiss the combinatory Sagittal® symbols and work with regular sharps and flats.

The author is pleased to say that Sagittal Notation® may serve as a gateway to future maqam polyphony, and also, the integration of Turkish musicianship with international microtonal music circles.

It is manifest that this new “xenharmonic well-temperament” conforms admirably with *Maqam* Music practice, and fulfills expectations tremendously regarding the correct and accurate representation of myriad middle second intervals peculiar to the genre.
6. CHAPTER: CONCLUSION

In this thesis, the author defends the need for a novel tuning for Turkish *Maqam* Music, given the revealed rupture between executed intervals and the 24-tone Pythagorean tuning in effect.

First of all, it is important to understand how this rupture historically took place.

The idea that *Alla Turca* (*viz.*, Turkish *Maqam* Music) featured “quarter-tones”, and was therefore a descendant of Byzantine Music because of this trait, began to gain popularity among the Turkish intelligentsia during early 1920s. Not surprisingly, the notion became a cliché of Turkism ideology’s music programme, which the Republican regime started to carry out by 1926.

Consequently, *Alla Turca* was banned from schools, and even banished from state radios between 1934-36. This state of affairs lasted until the foundation of the first ‘Turkish Music State Conservatory’ in 1976.

With the outset of the prohibition of *Alla Turca*, a core group – aptly named the ‘Yekta-Arel-Ezgi School’ by the author – emerged to counteract the Music Reformation in Türkiye, and developed three counterarguments against the Turkism ideology of Ziya Gökalp. According to this group:

1- *Maqam* Music was a national entity conceived by scholars and practitioners of pure Turkic lineage since about a thousand years ago, and therefore, embraced the indigenous pastoral styles of Anatolia (whose harmonization through twelve equal Western tones was promoted by the regime);
2- The genre did not sport cumulative “quarter-tones” which would implicate it as being an offshoot of Byzantine Music; but instead, was based on “melodic intervals” distinguished by commatic differences misconstrued in the eyes of Westerners (and Westernists) as the divisions of the whole tone into four equal parts;

3- These subtle nuances of pitch not only were indispensable features of *maqamat*, but also were essential regarding native endeavours, if any, in harmony and polyphony.

Thus, the 24-tone Pythagorean tuning seems to be an outcome of, or simply a reaction to, the “quarter-tone” argument by which *Alla Turca* was deemed “Byzantine” and “Arabic”, hence, ‘vulgar to national taste’.

If one may speculate further, it may be said that the mission of the ‘Yekta-Arel-Ezgi School’ was to save the genre from the asperity of the westernizing regime and redeem it as an inextricable component of the maiden nationalization project, even if this meant misrepresenting crucial “quarter-tone” intervals and falsifying (or even condoning the distortion of) the heritage.

In brief, the current theory appears to be ethnocentrically tailored, which, in the author’s opinion, is the main reason for the conflict between theory and practice today.

Here, the author would like to comment on the fact that not only is *Arel-Ezgi-Uzdilek* and *Yekta-24* essentially the same tuning, but also, respective notations for each are similarly dysfunctional.

Analyses indeed confirm that multifarious electroacoustically measured middle seconds categorized as 2/3, 3/4, and 4/5 tones and characteristic of *Maqam* Music – which are often referred to by the protagonists of the Music Reformation in Türkiye as “quarter-tones” – are overall absent in the 24-tone Pythagorean model.
Already, the illustration of the current model as a 24-tone subset of 53 equal divisions of the octave, efforts to cover up vagrant pitches via glissandi & portamenti, and the illicit, yet, occasional allowance to overstep by commas the boundaries of this cast depending on the maqam, are indications enough that several seemingly anchored perdes are in fact quite flexible, and that Turkish music theory can no longer shelve to account for clustering microtonal savours supersaturated with harmonically complex intervals of varying hues.

The author debunks the current model for falling short of accommodating indispensable middle seconds, and shows that, the 24 tone Pythagorean tuning used in notation and music education embodies only five 2/3 tones and two 3/4 tones between uncommon, hence, unrecognized perde pairs – that is to say, at untraversed and inconvenient locations – rendering it a model far from representing actual practice.

It has been further shown that none of the existing historical or contemporary approaches could be considered a remedy to the problem although all Turkish tunings, the Abjad scale, Arel-Ezgi-Uzdilek, Yekta-24, Oransay-29, and Töre-Karadeniz, settle neatly into a rather elaborate, yet quite unwieldy, 106-tone equal temperament which has no applicability to any instrument as a whole.

Moreover, the Arabic habit of taking “quarter-tones” literally (as in the division of the octave into 24 equal parts) is considered to be detrimental to the vocal and instrumental tradition of Maqam Music, as observed in some unusual renditions (or rather, distortions) of Classical Turkish pieces.

As a side note, Phonetic Notations known as Kantemir and Osman Dede are thought to suggest 50-tone equal temperament, and Kantemir’s tanbur fretting allows room for perde flexibility in hinted directions, although nothing is absolutely certain. If one were to decide on a Phonetic Notation for Maqam Music, the best choice in the author’s view would be Hamparsum.
Given the fact that qanun-makers in Türkiye nowadays affix mandals at “equal semitones” due to their increasing preference of imported Western tuners originally meant for 12 equal divisions of the octave, and proceed to casually divide the remaining length to the nut into 6 equal parts (for the lower courses, at the expense of octave equivalences) arriving at 72 equal divisions of the octave (a “derailleur” or “bike-chain” – hence a multiple – of the twelve equal tone cycle), it is no wonder such instruments wreak havoc with a performance tradition orally founded on the “comma system”.

Since 53-tone equal temperament does not appear to be applied to qanuns, and dividing the octave into 72 parts is none other than the sixfold enhancement of “twelve equal steps per octave” methodology of Western Music, it henceforth becomes a necessity to devise a tuning which is more compatible with the maqam tradition.

In light of all this information, 79/80 Moment of Symmetry (MOS) 2°159-tET has been proposed by the author as an ultimate solution to overcome non-conformance issues in Turkish Maqam Music.

The tuning is virtually a 79 or 80 member subset of 159-tone equal temperament, where all, but one, of the steps correspond to 2 degrees of it. The subsets are called “Moment of Symmetry” – a term coined by Ervin Wilson in 1975 – because of the coherent pattern arising from the employment of only one generator and two basic step sizes.

It should be noted that Renaissance Music expert Margo Schulter has commented extensively on the merits of this tuning.

The 79-tone tuning is observed to follow pattern or mode 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2}
A concrete demonstration of the 79-tone tuning was achieved through a unique Turkish qanun specifically designed by the author for the purpose. This qanun was presented to music circles on various occasions and received wide acclaim.

The greatest error in the approximation of popular JI ratios is always less than 8 cents, which is a tolerable margin. Not only does the 79-tone tuning incorporate a plethora of target intervals required of maqamat, but also facilitates the transposition of maqam scales over every degree and encourages microtonal polyphony.

The highest difference between explained procedures to attain the 79-tone tuning is observed to be not even a cent and a half – a deviation barely, if at all, noticeable. Although, any of the procedures could serve purposes for adapting the 79-tone tuning to an acoustic instrument, only the 159 equal octave division subset was chosen for simplicity’s sake when discussing theory.

A complete 3 octave range of Maqam Music perdes in degrees of 79/80 MOS 159-tET has been provided. This has been divided into 17 regions in conformity with historical classification and usage.

A virgin “Sagittal Notation®” developed by George Secor and David Keenan was applied for the first time to notate the 79-tone tuning. Decidedly, the ideal template for working with the 79-tone tuning is the Sagittal® set of symbols compatible at the same time with 65, 72, and 79 equal divisions of the octave and 13-limit JI. These symbols, used also in combination with sharps/flats, are:

1- Syntonic or “5-comma” nominally at 81:80 (21.506 cents), equalling 1° 79/80 MOS 159-TET, and expressed by the up and down half-arrows ↑ & ↓ dubbed “left-barb” (so-called Didymus’ Dibbler; ASCII codes: /| &\).
2- “55-comma” nominally at 55:54 (31.767 cents), equalling 2° 79/80 MOS 159-TET, and expressed by the up and down half-arrows ↑ & ↓ dubbed “right-barb” (so-called Artemis’ Half-Arrow; ASCII codes: \| & \) / .

3- Undecimal comma or Al-Farabi’s ¼ tone, or “11-M diesis” nominally at 33:32 (53.273 cents), equalling 3° 79/80 MOS 159-TET, and expressed by the up and down arrows ↑ & ↓ named “double-barb” (so-called Apollo’s Arrow; ASCII codes: /\ & \}/).

An exhaustive array of tone-circles showing the locations, numbers, and values of all middle seconds in 79/80 MOS 159-tET have been provided using Sagittal Notation®. Several other intervals were also tried and successfully represented with this new tuning.

As a preliminary step toward the formulation of the 79-tone maqam theory, ten maqams, reorganized as simple and composite, have been selected to display the capabilities of the 79/80 MOS 159-tET.

It is significant that the principal diatonical scales for Rast and Mahur were achieved without breaking the chain of fifths:

Rast, F-(702¢)-C-(702¢)-G-(694¢)-D-(702¢)-A-(694¢)-E-(702¢)-B.

Mahur, F-(702¢)-C-(702¢)-G-(710¢)-D-(702¢)-A-(694¢)-E-(702¢)-B.

Most importantly, problematic maqams such as Hüzzam and Saba were notated in such a way as to reflect their actual execution on acoustical instruments.

Compared to the alternatives, 79/80 MOS 159-TET was demonstrated to be a highly suitable device to express subtle pitch nuances in Turkish Maqam Music.
APPENDIX A: QUOTES FROM CHAPTER TWO

This appendix is dedicated to the English translations of Turkish quotes cited in chapter two of this dissertation.

Quote A.1: Mustafa Kemal’s Speech at the 1928 Sarayburnu Concert

«Here tonight, by a fair lucky incident, I listened to the two most outstanding music ensembles of the orient. Madame Munirah al-Mahdiyyah, who adorned the stage first, was particularly successful in her artistry.

Nevertheless, over my Turkish feelings, this music, this plain music, cannot suffice any longer to satiate the liberated soul and sentiments of the Turk. Now, in contrast, the music of the modern world has been heard. The people, who until this moment seemed numb facing the lingering notes of what is called Oriental music, started and came into action. All of them are dancing and merry, cheerful, doing what nature necessitates. This is to be expected. For indeed, the Turk is innately merry, cheerful. If this good disposition of his was not noticed for a time being, it is not his fault. Wrongful deeds have bitter, disastrous results. It was a fault to not have been aware of it.

Lo, for this reason Turkish Nation grieved. But now, the nation has rectified her mistakes with her blood, and now she is emancipated. Henceforth, the Turk is merry, just as in his nature. Henceforth, the Turk is merry, because he is of the conviction that it requires no re-proving that it is perilous to meddle with him. At the same time, this conviction is an earnest desire.» (Istanbul, August 9th, 1928.)
Quote A.2: Ziya Gökalp’s Ideas on the Creation of Turkish National Music

«Before European music entered our country, there were two types of music: One of these was Oriental music borrowed from Byzantine by Al-Fârâbî, the other consisted simply of folk melodies that were the continuance of ancient Turkish music.

Oriental music arose, just as Western music, from ancient Greek music. Finding whole and half tones in their folk melodies inadequate, the Hellenes added to them one fourth, one eight, one sixteenth tones, and named these “quarter-tones”. Quarter-tones were not natural. For that reason, quarter-tones are not chanced upon in folk melodies of any nation. Accordingly, Greek music was an artificial music based on unnatural sounds. Other than that – although, there is no monotony in life – there was a sad monotony in Greek music due to the constant repetition of the same melody. The opera that appeared in the Europe of Middle Ages remedied these two defects in Greek music. Quarter-tones did not conform to the opera. Besides, opera composers and performers could not comprehend quarter-tones at all, for they came from among common people. By influence of these reasons, Western opera removed quarter-tones from Western music. At the same time, because opera was basically the consecution of emotions, excitements, passions, it freed Western music from monophony by introducing harmony, wherefore this novelty led to the birth of full-fledged Western music.

As for Oriental music, it remained entirely in its pristine form. On the one hand, it maintained quarter-tones; on the other, it was as yet bereft of harmony. After having been translated into Arabic by Al-Fârâbî, this sickly music was transmitted into Persian and Ottoman by popular demand of courts. Conversely, Orthodox, Armenian, Chaldean, and Assyrian Christian churches, and the Jewish Synagogue also, acquired this music from Byzantine. Because it was the sole institution uniting all Ottoman elements in the Ottoman realm, it was truly fitting to name it ‘The Music of the Ottoman Commonwealth of Nations’.

Today, behold, we stand before these three musics: Oriental music, Western music, Folk music.

Now, which one among these is ‘national’ for us?

We saw that Oriental music was not only sick, but also not national. Seeing as Folk music is the music of our national culture, and Western music of our new civilization, they are both familiar to us. Therefore, our national music shall be born from the confluence of Folk music with Western music in our country. Our Folk music has provided us with diverse melodies. If we collect and “harmonize” them according to Western music forms, we shall be in possession of a music both national and European. Among those who will undertake this mission are music ensembles of Turkish Lodges. Voilà, this is the entirety of the programme of Turkism in the field of music, and the rest is up to our national musicians.» (Diyarbakır, 1923.)
Quote A.3: Excerpt from Emil Ludwig’s interview with Mustafa Kemal dated 1930 on the need and urgency of westernization in Turkish Music

« ... I mentioned the aspect of the oddness, according to us Westerners, of Eastern music as perceived by our ears, and said:

“If there is one art of the East that we cannot comprehend, that is its music.”

Whereby, Ghazi objected and said: “These are all remnants from Byzantine. Our true music can be heard in the folk of Anatolia.”

“How much time had elapsed until Western musicianship came to its present level?

“Four-hundred years have elapsed since.”

“We do not have the luxury to wait that long. You can see that we are borrowing Western musicianship because of this.”» (March 21st-24th, 1930.)

\[i.e., \text{“temper to twelve equidistant tones per octave and orchestrate them?”}\]
Quote A.4: Adnan Saygun’s thoughts on the abandonment of microtones in Traditional Turkish Music

« ... Is the leading among vehicles, in whose sound the soul of a nation is reflected, the division of an octave into twelve or twenty-four parts? Turkish art music has thus far been using twenty-four [unequal divisions of the octave] ¹; whereas, could it be said “no” to the assertion that they produced the necessary temperament in order to also conform to polyphony by adopting the folk music perde system? Be they twenty-four or twelve; musical tones are nothing other than letters of the alphabet and ought to be utilized as such. Previously, in our language, there were such letters as ’ht, he; zel, ze, zl; elif, ayin; dat, dal; etc…” ². These letters, which did not suit the Turkish language, were written during the ages when the Arabic alphabet was used, but in colloquy, they would not be treated differently in the slightest. That was because we had segregated long since from the [Quranic] reciter’s path of the old Madrassah. After assenting to the [Latin] Turkish letters, we were spared from this oddity, and did not lose anything due to the riddance of these [Arabic] letters. When we turn our eyes to the new [Alla Franca] Turkish music, we see that the same job has been done in that direction. New [nationalist] Turkish composers, by taking the twelve tones of Anatolia instead of twenty-four [tones per octave of the Arel-Ezgi-Uzdilek System], have purified the alphabet of our musical language. On the path to polyphony, the perdes that are a comma lower or higher according to so and so a maqam have been unified, and an alphabet suitable for us has been obtained.

The real issue rests with the words formed by the juxtaposition of letters being Turkish words, phrases being Turkish phrases, and the soul being the Turkish soul.» (Ankara, April 1948.)

¹ 24-tone tuning and theory in effect known simply as Arel-Ezgi-Uzdilek that shall be examined thoroughly in the third chapter.

² These are crude representations, in Latin, of special pairs of phonemes, gutturals and spirants of the Arabic language and alphabet.
Quote A.5: Cemal Reşit Rey’s thoughts on the westernization of Turkish Music

« ... [In the report I presented this past summer to the General Director of the Presses, Publications, and Tourism] I had – after summarizing the shape that our [Istanbul] radio should initially assume – had settled my ideas on three foundations. The first of these, I said, is to broadcast and endear the monophonic old [Alla Turca] and polyphonic new [Alla Franca] genuine music of Türkiye to Western countries, second, Western music to our country, and third, our own music, through domestic [airwave] transmission, to ourselves. ... 

Until about 25 years ago, our country could only have created monophonic music. But, for some years now, thanks to a group of young composers, we have been included in the league of nations which produce polyphonic music. It is hard to make the West appreciate monophonic [Alla Turca] music; for Westerners do not like this music, and moreover, find it somewhat primitive. In order to rouse Westerners to appreciate this music, it is necessary to make them hear on the radio the best samples exemplified through Western [twelve-tone] parlance in an appealing way and prepared in accordance with the [instrumentative] meticulousness characteristic of the West.

In order to succeed in this, we have need of several music savants and artists. ... To hear deservedly, for instance, the art and style of Itri and Hafiz Post ¹ [287], it is imperative to have penetrated worthily into the works of [J. S.] Bach, [L. v.] Beethoven, [W. A.] Mozart, [F. F.] Chopin, [W. R.] Wagner, [A. C.] Debussy and [G. U.] Fauré [288]; to be able to execute their works on a modern [Alla Franca] musical instrument; to have digested the music history of the entire world; and even, to have brought into being works by the furthest perceptivity; in other words, one must have written a symphony, a sonata, an opera!

... 

In one word, we must rescue our monophonic [Alla Turca] music from the tyranny of those – I shall not even say, single-eared – earless people who are so narrow-minded as to have spent all their lives engaging in monophonic music and failed to apprehend anything from it. ... Think that we have not yet established the principle of properly notating our old music. Furthermore, we have not even bound our old music as yet to the notion of a diapason. It is time to save our old and genuine art from this lethargy; or else, the results might be grave. Even as of this very moment, we witness that the works of Itri and Hafiz Post, whom I just mentioned a while ago, and similar precious and noble-souled musicians are purportedly executed and listened to in restaurants where alcoholic beverages are served. Is there any possibility that a person who is aware of what art and culture is would not feel indignation over an incident such as this?

... 

¹ Tanburi/Hanende Mehmed Çelebi – Hafiz Post (1630?-1694) and Buhurizâde Mustafa Itri Efendi (1640-1712) were famous Mevlevi composers of the Ottoman Court in late 17th century (the so-called “Classical Period”), and were fecund during the reign of Sultan Mehmed IV. (See, accompanying endnote.)
Unfortunately, I might say that the knowledge and feeling of art with respect to the collective opinions of the globe does not very much exist in our country. Seen from this aspect, I realize that it would be unrealistic to expect the approval of our contemporaneous citizens in regards to the rectitude and grandeur of deeds (in westernization) done.

... 

Indeed, today’s Turkish composer is bringing into existence works for piano, violin, cello, flute, clarinet, horn, and so on, that the modern [Western] world is accustomed to hear. His technique is based on harmony and counterpoint, hence, polyphony. The forms of his works are those of symphony, sonata, lied, concerto, etc... which are accepted and enjoyed for centuries by the modern [Western] world. Thus, Westerners do not feel estranged when facing this music. In short, today’s Turkish composer has delivered our music from the class of music that Westerners categorize as Oriental music or Ethnic music, and have already succeeded in exporting it to the community of the international art music family. …» (Istanbul, May 1st-3rd, 1950)
Quote A.6: Excerpt from Atatürk’s Opening Speech of the Fourth Convening of the Grand National Assembly

« … Friends! I know how you desire the youth of the nation to be advanced in all the fine arts. This is being done. But, in my opinion, fastest and foremost to be carried forward among them is Turkish Music. The measure of the new change in a nation is her acceptance and comprehension of the change in music. The music that is being dared to make us listen to is far from having worth to imbue pride. We must know this in all conscience. It is necessary to collect sublime folk idioms – sayings that depict national affections, and embroider them according to the general principles of music from a day ago. Only then may Turkish National Music rise, and take its place within Universal Music. I request that the Ministry of Cultural Affairs render due consideration to this, and that the public assist her in it. …» (Ankara, November 1st, 1934.)

1 According to another account: “The music that is attempted to make the world hear is not ours. For that reason, it is far from having a worth to imbue pride…” (See, accompanying endnote.)

ii i.e., 12-tone ‘high society’ metropolitan opera, concert, stage and big band music of Europe and the Americas.

iii According to a more substantial account: “the law” (due to the variant reading of “kamunun/kanunun”). (See, accompanying endnote.)
Quote A.7: Mildan Niyazi Ayomak’s support of the prohibition of Alla Turca Music broadcasts

« ... On the faces of those who are occupied with or like to listen to this music, which is ‘Alla Tekke’ and ‘Alla Sultanate’ music rather than Alla Turca, can be seen signs of gloom and consternation; we deem it understandable. Let us refresh our memory. We endured the same gloom and consternation the while we were modernizing our letters. Moreover, even as we were donning hats, languor partly sank in. Now, if we are to see someone wearing a fez, we cannot suppress our snigger. The juveniles jeer at the frizzy curls and tails of the old scripts. I assure my readers with certitude that anyone adhering to and trying to embrace, since not a year, but a few months, the new [Alla Franca] music, shall never make mention of the old [Alla Turca] music again.» (Istanbul, 1934.)
Quote A.8: An anecdote by Sadi Yaver Ataman regarding Atatürk’s feelings on Turkish Music

« ... One night, in Dolmabahçe Palace [1] [291], during the time Turkish [Maqam] Music was banned and removed from the radios, Yunus Nadi Bey [2] [292] made a request from Atatürk, and said:

“My dear Pasha, let them not deprive us of Alla Turca şarkis and türkü; we are hurt because of the interjection against our taste and feelings.”

To which Atatürk answered:

“I too am fond of them; however, a generation carrying out reforms is obligated to endure deprivation and sacrifices. Only our national [folk] culture ought to be prized.”

This saying of Atatürk too shows explicitly that it does not mean the prohibition or removal from the radios altogether of Turkish Music [so long as “national folk ayres” approved by the state are meant] [3] [293].

...

One day, he goes on to say:

“What is the matter with this radio? Always lamenting, wailing şarkis... Remove them... this nation deserves joy and merriment.”

Atatürk was totally justified in this. If, at an unearthly hour, a sigh is heaved eighteen times in a şarki, can someone listening to it rise to a new day and go to work with fresh strength and vigour?

One evening, Atatürk requests from the ‘Presidency Saz Ensemble’ [4] [294] a türkü among the türküs he adored: “Manastırın ortasında var bir havuz” ['Amidst the monastery lies a fountain'].

His childhood and adolescence friend Nuri Conker [5] [295] says:

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1 Built by Sultan Abdülmecid between 1843-1856; located in Beşiktaş, Istanbul. Atatürk used the palace as his primary residence during his stays in Istanbul, and spent his final days there until his death in 1938. (See, accompanying endnote.)

2 Yunus Nadi Abalıoğlu (1880-1945); journalist, writer, and parliamentarian. (See, accompanying endnote.)

3 Hence, the February 5th, 1936 column in Akşam Gazette: “The General Directorate For The Presses has dispatched a license to the radio company for the inclusion of national ayres in the programme of Istanbul Radio. As per this license, it has been reported that the execution and singing of Turkish folk ayres by Tamburacı Osman Pehlivan are approved. The artist shall sing folk ayres by providing national music examples and with national flavours. However, he shall not venture in fasıl and Enderun music.” (See, accompanying endnote.)

4 ‘Presidency Fasıl/Saz Ensemble’ was a congregation of reputed musicians who catered to Atatürk’s Maqam Music needs during his lifetime. (See, accompanying endnote.)

5 Mehmet Nuri Conker (1882-1937); comrade-in-arms of Atatürk, Turkish military-man, administrator, and parliamentarian. (See, accompanying endnote.)
“‘İmam verir talkımı, kendi yutar salkım.’¹ You removed Alla Turca [music] from the radio, let us see you not have it played then.”²

The answer given by Atatürk is as follows:

“Just because we are drinking raki here, is it acceptable for the state to set up a tavern in every village? We have been accustomed to this due to coarse upbringing and negligence, we may not save ourselves; still, we do not have the right to instil future generations with our dissolute intemperance. Just as, for instance, we cannot open opium dens because the public is so accustomed, likewise, we may not spread lamenting, wailing ayres in state radios.”³ (Ankara, ca.1935.)

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¹ A famous Turkish proverb, which can be translated as: “Imam to others preaches, devours himself the peaches.”

² Devoted to the memory of Atatürk as he is, Ataman makes a glaring oversight here, and unknowingly confesses the very fact he tried to conceal in the preceding paragraphs. Also significant is the fact that Rumeli (Thracian) folk türküs cherished by Atatürk are actually part of Turkish Maqam Music répertoire, rendering the unnatural division between Turkish Folk music and Art Music pointless.
Quote A.9: An anecdote, regaled by Sadi Yaver Ataman, of Vasfi Riza Zobu showing Atatürk’s remorse for prohibiting Alla Turca music

« ... Turkish [Maqam] Music was cancelled from the radios because of a misunderstanding based on Atatürk’s words: “This music is far from expressing our enthusiasm.” that he said under the effect of having listened to a foul music ensemble in Sarayburnu ¹.

Respected Vasfi Riza Zobu ² [296] has told these on this matter:

“A race of fundamental denial was begun over Turkish [Maqam] Music – which, throughout centuries, had been passed down generation to generation to take its paramount shape in Istanbul – so much so that Turkish [Maqam] Music was removed from Atatürk’s dinner tables since the day this commotion started. Neither did he sing it, nor suggested that anyone else do so. I do not remember how much time elapsed since then... One day, word came to me from Muhittin Üstündağ, governor of Istanbul at the time, telling me to take the train to Ankara, and that I was expected at the Kiosk ³ [297]. The next day, I was in Ankara. I informed the Kiosk of my arrival from the hotel that I lodged in. It was toward the evening, a youngster came to the hotel and said that he took orders to take me to the Farm Kiosk ⁴.

When we arrived at the kiosk, I found him standing in the midst of several statesmen and some generals conversing on an important subject. I kissed his hand and received his compliments of welcome.

Night fell; it was dinner-time. Hours passed by at the table. He did not seem cheerful in the least. Generally, our presence at this table would take place along with the late Hâzım ⁵ [298]. Whether I was with him or not, Atatürk liked to jest with us both. But he did not seem at all inclined to do so that night.

¹ In a later chapter, Ataman goes on to explain why Atatürk said those words in Sarayburnu on August 9th, 1928, and tells a slightly different story: According to Ataman, first the orchestra performed arias from Puccini’s Tosca, then appeared the Egyptian singer with her own ensemble, and lastly, an amateur group took stage in disarray, and made a hash of the Sultanâyêgâh fasîl, causing Atatürk to depart in anger. (See, ibid. pp. 70-1.) For a correct chronology of the events leading to the prohibition, see, pages 8-15.

² Vasfi Riza Zobu (1902-1992); Turkish theatre and cinema artist. (See, accompanying endnote.)

³ The ‘Çankaya Kiosk’ is the official residence, since Atatürk, of Presidents of Türkiye. (See, accompanying endnote.)

⁴ One of the two mansions built inside ‘Atatürk Arboretum Farm’. It is known that Atatürk sometimes spent weeks recreating and pursuing leisurely activities there. (See, ibid.)

⁵ Hâzım Körmükçü (1898-1944); Turkish theatre and cinema artist. (See, accompanying endnote.)
'Twas way past midnight. All of a sudden, I heard his voice calling my name, I pulled myself together and said:

[Zobu]-Yes, sire.

[Atatürk]-You will remember, in the beginning of a play, just before the curtains were drawn aside, you would sing a şarkı, what was the name of that play?

[Zobu]-I remember, sire, it was Molière's comedy, Bourgeois Gentilhomme adapted by “küçük” Kemal. 

[Atatürk]-A fine work, it was.

[Zobu]-Yes, sire, It was a successful adaptation.

[Atatürk]-No, I did not mean the play. Although, it was good also, I mean, however, the beauty of that composition.

I have to confess, I was frightened. For the first time, I was hesitant to answer a question. My mind was so filled with him being against Turkish Maqam Music that if I were to approve of its beauty and said 'yes', what if he was trying to sound me out? If I said 'no' and were to reject its beauty, then it was impossible for him not to realize the fulsome lie.

[Atatürk]-Could you not remember?

[Zobu]-I remembered, sire, It was Dellâlzâde Ismail Efendi's Isfahan...

I could not complete my sentence.

[Atatürk]-No, I am asking its composition, is it not in your memory?

Could you not sing it?

[Zobu]-It is in my memory, I would sing it, sire.

Astonishment came over not just me, but also everybody else seated at the table. Taking refuge in the Maker and mustering all my strength, I shrugged, gathered myself in my seat, and, assuming all of my acting, began to sing, in due manner and harmony, the Isfahan yörük semai that started with the line ‘Aaah o güzel gözlerine hayran olayım.’ [Ah, may I be filled with admiration of your beautiful eyes.] and finished in a bloody sweat.

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i In another source, Zobu continues: “Probably due to my disinterest, they were exchanging words on some subject in economy that I could not understand. Occasionally, my mind would wander; possibly, I was thinking of other things.” (See, accompanying endnote.)

ii i.e., ‘younger’, ‘junior’.

iii Kemal Küçük (1902-1936); Turkish theatre artist. (See, accompanying endnote.)

iv In another source, Zobu continues: “Obviously, nobody could imagine the possibility that he would make such a suggestion. Whatever was to happen would happen now.” (See, accompanying endnote.)

v In another source, Zobu continues: “I went quiet. Silence permeated the ambience after me.” (See, ibid.)
Because no stirring at all was seen in Atatürk, everyone cast their faces down as if having committed a crime, and waited as to what he would say.

After a while:

[Atatürk]-Regrettably, they misunderstood my words. What a beautiful work this is that was sung, I listened to it with delight; so have you. But is there any chance that by chanting this work in such a manner, a European might be given pleasure? What I meant was that a solution be found to have them appreciate also Turkish compositions which we so relish to hear; with their technique, their knowledge, their instruments, their orchestras, whatever it takes. i Let us also turn Turkish [Maqam] Music into an international art. I did not say we depose of the ayres of the Turk, seize only the ready-made music of Western nations, and arrogate it as our own ii. They misconceived my saying, and cried such a blue murder that I could not speak of it again.” iii

…

As I have stated before, Atatürk was yearning for a westwardly, national, and advanced Turkish music. His wish to quench this longing by having respected Vazif i Riza Zobu sing that night in the farm kiosk clearly indicates this iv. …» (Ankara, ca.1936.)

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i In another source, according to Zobu, Atatürk goes on to say: “Just as, for example, the Russians did…” (See, ibid.)

ii In another source, according to Zobu, Atatürk goes on to say: “…and listen to them alone.” (See, ibid.)

iii In another source, according to Zobu, Atatürk goes on to whisper as if to impart a secret: “Do you know why I have not called on you for so long? Because of my fear… it is the drink... could be that I might succumb and say: ‘come, let us sing’ and become the subject of gossip, that is why. But tonight, we have forsaken the diet.” (See, ibid.)

iv Considering that Atatürk requested the presence of a theatre artist all the way from Istanbul rather than a qualified commensal musician among his ‘Presidency Fasıl Ensemble’, is sufficient to render Ataman’s statement invalid. One cannot help but wonder what the aim of this ploy was, if not to remove blame from Atatürk’s shoulders. For alternate stories concocted to alleviate the prohibition of Alla Turca music, see, ibid. pp. 93-106.
Quote A.10: Excerpt from Ankara State Conservatory’s intransigent response to the Ministry of National Education

« ... The people who – tied to their habits and remembrances as they are – attempt to badmouth the new trend which, for over a hundred years, truly made giant strides on the road to polyphony, are, of course, more numerous in our music compared to other branches of art. Undoubtedly, such people, by turning a blind eye to historical occurrences – and with the purpose of making the greatest effort to prevent the advance – shall use even their positions to their advantage. …

...For this reason, we, emphatically and without question, are in opposition to the education of monodic Turkish [Maqam] Music instruments in [state] conservatories, and in Istanbul Conservatory which made the request.» (Ankara, June 1952.)
Quote A.11: Rauf Yekta’s refutation of Ziya Gökalp’s views on Traditional Turkish Music

« ... I could not believe my eyes; because the master was professing ideas so contrary to positive facts manifested by the history of music, and deriving from them results so unexpected and peculiar, truly, it was impossible not to be astonished.

As in the past, this was not the first time I was hearing ideas like this; I had been the addressee, more than once, of such of even greater superficiality – barring the difference that those I faced were salon dandies who partook in smattering sophistry on every subject, and delighted particularly in passing as lovers of the West.

... We do not for a moment suppose that the ideas on music written by the late Gökalp, who had dedicated his whole time to “sociology”, could be the product of his own research and investigation. ... Then from what sources did the deceased get these ideas? Without any hesitation, we can conjecture that, one of the salon dandies – whose true nature on knowledge had been described in part above – had contacted the esteemed master, and, through the inculcation into the master’s head of these ideas that have no bearing whatsoever of historical foundation, had fabricated opinions which resulted in the mutilation, and conversion altogether into another shape, of the most important segments of the staple features of the history of our national music.

... In the era of Sultan Selim III, just as the Janissary band named “Mehterhâne” was the sole military ensemble with its davul, zurna, nakkâre and boru, so too was “Turkish [Maqam] Music” singularly practiced among both the upper classes and the common people. ...

... To split the “music” present [by and] before that date in our country – forsooth, the straightest name for it, in our opinion, is “Turkish Music” – into two portions by calling the first “Oriental Music”, and the latter, “Folk melodies that are the continuation of ancient Turkish Music”, is, from many points of view, false. First of all, what is the meaning of the term “Oriental Music”? Let us understand this. While distant from the rules of the music that Europeans christen “Musique Moderne”, “Musique Européenne”, “Musique Occidentale”, “Musique Contemporaine”, history of music categorized the music practiced in general by Eastern nations and leaning upon quite logical as well as subtle rules and theory under the generic name of “Oriental Music”, so much so that, the music of us Turks is one in this aggregation. For this reason, the music in use in our country is [best] said to be “Turkish Music”, not “Oriental Music”, because, even though the musics in use in Iran, India [etc...] are branches like ours of Oriental music, doubtless, it is necessary to say Persian music, Hindustani music [etc...] when clarification is required.
...For one thing, there is neither truth nor basis to “Al-Fârâbî” having borrowed music from Byzantine. ... European music historians imagine Al-Fârâbî to be an “Arab”, and accordingly, [make] mention of our great Turkish scholar ... as the “famous Arab theorist” ... [who, allegedly, tried to import Hellenic music into his native land against the better judgment of his contemporaries.]

Even if we may absolve a German historian of not knowing Al-Fârâbî to be a purebred “Turk”, what, in retrospect, shall we say to those [poseurs] who, as soon as they have set eyes on such baseless words by Europeans, contrived the notion that Al-Fârâbî borrowed music from Byzantine?...

...During the 3rd and 4th centuries after the Hegira, signs of revival having been seen among Muslims, the theory of “musical science” was transmitted via “Al-Fârâbî” also at a time when sciences and technologies were being translated from the books of Greek scholars [of Antiquity] ii to the common language that was Arabic for the various nations who accepted the religion of Islam in those ages.

This theory ... comprised the unchanging criteria, in East and West, that examines and establishes the natural laws governing the hymnody of all humans. Because it doubtless never occured to music theorists of those ages that, in some distant future, the science of “Music” would actually bifurcate into that of the East and the West, not a single word is chanced upon in the theoretical topics conveyed by Al-Fârâbî that the multitude of nations do or might possess musics subject to different rules.

It is ascertained by those who are knowledgable in the history of music that music started among primeval humanity in a primitive fashion, became an “art” upon having progressed collaterally and gradually with the advance of civilization, then appeared theorists who deduced and collocated from this “art” the “science” otherwise called the “theory of music”.

Verily, Al-Fârâbî had adhered to these principles, and translated and excerpted from the works of Greek scholars the “theory of music” since so many ages compiled. Besides, seeing as the names of authors adduced by Al-Fârâbî in his book [Kitab al-Musiqa al-Kabir / The Great Book of Music] exclusively consist of Greek scholars of Antiquity such as Pythagoras, Aristoxenus, Ptolemaeus, Euclid, Nicomachus, the allegation by the aforesaid [poseurs] that he <borrowed Oriental Music from Byzantine> is utterly baseless, and, more to the point, meaningless.

As for our thoughts regarding the music that Ziyâ Gökalp Bey calls <folk melodies that are the continuation of ancient Turkish music> ... our folk şarikts are chanted today, just as was the case in the age of Al-Fârâbî, in Anatolia and other areas where Turks reside. However, there is, at the same time, another dignified music of ours, written in a sublime style peculiar to the upper classes, and embroidered with all the finesse of the art created by

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i Yekta cites here the reputed German musicologist Karl Wilhelm Julius Hugo Riemann’s [1849-1919] Musiklexicon, the related sections of which he sternly criticizes in his single-handed contribution (chapter “Turquie”) to the 1922 edition of the fifth volume entitled La Histoire de la Musique of Encyclopédie de la Musique et Dictionnaire du Conservatoire founded by Prof. Albert Lavignac of Paris Conservatory. (See, accompanying endnote.)

ii Yekta interjects here with the observation that such knowledge was not privy to Hellenes, but was taken from the civilizations that antecedent them, e.g. Pharaonic Egypt.
Turkish ingenuity, which – just as it cannot be doubted that it existed in the era of Al-Fārābī – we also see in existence today. Although, many of the precious works of the preceding maestri have been lost due to a lack of appeal for music transcription among Turks, the extant works by Abdülkadir Merâgis, Hâfiz Posts, İtrîs [etc…] – who occupy an illustrious place in the history of Turkish music – are part of the testimony proving the existence, through several centuries, of the [classical] music of the upper classes.

In brief, for the master [Gökalp] to show our lofty and dignified music as a foreign music taken from Byzantine, and our folk songs as our real national music, is a claim unconforming to historical reality; so much so that there is no difference between this assertion and someone talking about the history of our literature say:

<Turkish literature consists of the poems of Âşık Ömer and Yunus Emre; the writings of Nedîm and suchlike poets are not national.>

There is not a single speck of truth in these words of Ziyâ Bey [regarding Oriental music being born of Greek music, to which, at one point, Hellenes felt the need to add “quarter-tones”]. Those who behold the phraseology of the deceased, would suppose that some theorists sprouted at a time when folk songs of the Hellenes of Antiquity were made up solely of whole and half tones; and that these individuals said to the public:

<These whole and half tones you use when chanting are not enough! We determined from investigations that we carried out in our study alcove that you will have a richer music if you add to your musical alphabet some extra pitches – viz., if you employ one tone by dividing it into four, eight, sixteen; therefore, use such pitches from now on when you chant…>

...I am truly amazed at how an invalid and meaningless statement such as <one sixteenth of a tone was added to Greek music and it was named a “Quarter-tone”> could come out from the pen of a major scholar of ours. Let me mention briefly here that the term “quarter-tone” is not actually a scientific concept. It is a term put forth by [Western] practitioners as an allusion to the division of the whole tone into “four” parts by “three” accidented notes that we demonstrate, in various ways as the need arises, by “sharp” and “flat” signs atwixt the natural melodies of Oriental music ¹ [302]. Although, Westerners, upon seeing the three types of accidentals between the natural notes of the Oriental music scale ² [303], dub these pitches “Quart de ton”; some Westerners even commit the quaintness of assuming that Easterners use in their music one fourth tones acquired by dividing one pure [whole] tone into four [equal] parts consecutively!

¹ Yekta refers here to his solid systematization, on staff notation, of his own 24-tone tuning and theory for scrutiny by Western erudites in the related sections of his monograph appearing in La Histoire de la Musique. (See, accompanying endnote.)

² The three types of accidentals used by Yekta within the major tones of his twenty-four note scale are the Pythagorean diatonic semitone/ limma-sharp [♯], Pythagorean chromatic semitone/ apotome-sharp [♯], and Pythagorean diminished third/ minor tone-sharp [♯] respectively. (See, accompanying endnote.)
However, these are all delusions. There are no “Quarter-tones” in Oriental music; in scientific terms, there is a set of “Intervalles Mélodiques”, and these intervals do not equate to the [tempered] whole and half tones of Westerners. The main reason for the difference between the musics of East and West is that: Alla Franca music is solely composed of [tempered] whole and half tones, whereas Oriental music is composed, next to whole tones, of these “Intervalles Mélodiques”.

If, by the quarter-tones that he calls “artificial”, Ziyâ Bey meant these melodic intervals, these are most “natural” tones to Easterners; and in spite of the formidable invasion of [our country by] Western music, the common body of Easterners use these “Intervalles Mélodiques” in their folk şarkis even today. Let us be sure that if we are to analyze the cantillations of boys shepherding in the meadows of a village of Anatolia not even in the possession of an elementary school, we shall witness the embodiment, in natural form, of the melodic intervals that Ziyâ Bey calls “artificial”. …»

(Istanbul, 1925.)
Quote A.12: Rauf Yekta’s deprecation of the ban on Turkish Maqam Music

« ... Upon returning from the investigative journey that has been ongoing since two months, I found our city’s presses in a hubbub of vehemence as well as justified criticism and complaint – the newspapers were all shouting: Turkish Music cannot be abolished! If this were happening in other countries, nobody could understand a word from this enunciation in the first place. Really! How can the music of a nation be abrogated by the decision of an official council?» (Istanbul, October 1st, 1926.)
Quote A.13: Osman Zeki Üngör’s retort against Rauf Yekta

-In our country, the life of music has a peculiar manifestation: Every three to five years, such boisterous polemics erupt, everyone, whether in the know or not, gets involved testing their pen or garrulity. A bit of swaggering is done, and then they hush up. Nevertheless, affairs proceed and continue to execute their ascendancy. Note that, fifteen to twenty years ago, those who favoured Alla Franca music were both few and on the defensive; among them, those who were courageous enough to voice their opinion, would be inculpated with irreligion and lack of nationality. Since ten to fifteen years, the myriad of incidents affecting our country, and especially the latest monumental and exultant reformation, has sufficed to turn the tables upside down. Today, seventy-five percent of the enlightened who are occupied with music prefer Western music. When I arrived in Ankara three years ago, there were only six pianos here. Today, There are eighty to ninety pianos in Ankara. During the first of a series of concerts we have given in Istanbul as charity for emigrants in Union Française, there were only five or six people wearing the fez. In the last one of them – with the exception of some aesthete foreigners – the hall was completely filled with Turkish madames and monsieurs. Likewise, at the first of the antecedent concerts in the Ankara Turkish Lodge, the hall was partially empty. Afterwards, we could not find enough space to seat the public. This rapid transformation of the nation should serve as an example. The disputations we mentioned are cooked up and machinated by those who, by some means or other, refuse to appreciate the mature Western art that has begun to take hold in our country.

As for the annulment of Alla Turca music: This decision has nothing to do with schools; because the Ministry of Culture has reached this verdict, not today, but three years ago by opening the Musiki Muallim Mektebi. Students, who are sent to Europe for music education, are sent to receive, not Alla Turca, but Alla Franca education. The reason for the installation of Musiki Muallim Mektebi too is to cultivate contemporaries who will successfully provide the education for Western, that is to say, civilized music. At any rate, tekkes and sarays, which were the main fields for the application of Oriental music, no longer exist. As an outcome and a condition of this, Alla Turca ensembles – due assuredly to the voluptuous necessitations of our great reformation – are gradually diminishing and abandoning the scene to the mature ensembles of the West. Therefore, dismay in the form of “Alla Turca music is being abolished from my school” is overdue.

In this regard, it is plain that the aforesaid decision targets Dar‘ül-Elhan alone. If Dar‘ül-Elhan agreed to shape up as a conservatory, there is nothing it can do other than submit to this fait accompli. Conservatories everywhere are institutions that subsist on science, technique, and especially, method. No credibility can be assigned to an establishment where a soaring art that is engrained to the least form and detail is taught in one of the rooms, while a music not even the simplest rules of which are determined is, let us not say taught, but, scamped in another.

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\[1\] Association for amity and collaboration of between Gallophile/Francophone Turks and Turkophile French. (See, accompanying endnotes.)
Those who have devoted their lives to the defense of Oriental music could not explain to us as yet what it is. Works written in this field up to now are very far from being scientific and technical. I am amazed at how something that still cannot be disambiguated occupies a place in a huge art institution. As of today, the leading presence, owing to various effectuations, of a dead art occupying a position in the aforesaid institution cannot be warranted.

Even today, *Alla Turca* music is learned through the apprentice’s imitation of the master, hence, the method of “passing on” [*meşk*]. Therefore, its “education” is not an inherent feature that a technical examination and explanation of it in schools or music institutions can be made practicable.

As for my thoughts on our prospective music; our future music will be the music that is in the hands of all civilized nations. In your newspaper, some persons I prize have compared music with language. They cut short by saying: “Just as every nation has a language unique to itself, they too have a music each. Therefore, the music of us Turks will be Oriental music!” I did not find the comparison accurate; In the West, every nation has a separate tongue, but all these nations have one single music. The differences in between them are that of style and dialect. Naturally, in all of them – just as Turkish has, for instance, *Rumeli, Kastamonu, İzmir, Erzurum* dialects – the basic building blocks like tone, rhythm, etc... are the same.

Therefore, our music too shall be the same as the music of the nations whose civilization we are attaining; Certainly, this music, in time, will generate features peculiar to Turkish identity, and so, the music that is sought after shall come into existence.

Let me say this as my concluding words; I truly wish that a hardworking and courteous scholar like *Rauf Yekta Bey*, who has dedicated his whole life to music, reverts from the course which he somehow and through the incitation of recent happenings entered, and accedes to us. This attitude would be the greatest of all virtues imaginable in the case of *Rauf Yekta Bey*. Such a valuable and diligent person has a lot more to do for this country’s music. By so doing, constantly recurring futile arguments will cease, and the possibility to labour productively hand in hand for the sake of this beloved art shall accrue.» (Istanbul, October 14th, 1926.)
Quote A.14: Süleyman Cevad’s interview with Rauf Yekta on Turkish Music

« ... [Cevad]-Can and should our old music be renewed?

[Yekta]-...Now, if the intent by the question ‘can works of art be renewed?’ is to say, ‘can they once again be in demand?’, as violinist [Osman] Zeki [Üngör] Bey understands, it must not be very true that, for this, <great works are needed, people [to realize them] are needed> as the aforementioned gent thinks. In my opinion, it is sufficient for the present generation to be “appreciative” and not look down upon the works of our national doyens with scorn in order for our old music to be in demand. And why should we be, as Zeki Bey claims, indigent in the training of persons capable of producing kârs and murabbas at the level of Dedes and Dellâlzâdes in order that the works of “[Hammâmizâde İsmâil] Dede Efendi” et cetera may be in vogue once more? Does, perhaps, a composer writing in the style of “[W. A.] Mozart” appear every century in Europe to ascertain that works by “Mozart” always remain in favour and demand? ... Just as “Mozart’s” works are never worn out of use in Europe, likewise, our “Dede Efendi”’s works must not be reckoned as derelict, and should be played to the public by music lovers, and especially, by virtuosos like Zeki Bey. After then, there shall remain no ground for complaints like <so too has the public’s taste decayed, old works are not listened to anymore, those in the know are gradually diminishing>. How can the public listen when there is no one to play? ... Seriously, we Turks ought to exalt our national doyens by applying to our music the commendable penchant of patriotism that we have begun to display in daily affairs and other matters. We must be sure of this: that, just as “[Jean] Racine”s most eloquent verse will not tug at the heartstrings of a Turkish soul as much as an eulogy of “Nedîm”, so too will a “Nocturne” by “[Frederick] Chopin” not satisfy Turkish delectation in music up to the extent of a “Ferahfezâ Kâr” by “Dede Efendi”. ... We must be sure of this: that the Turks who have gone to Europe to receive music education may only learn Western music, and, no matter how much they toil, may never become composers who can appeal to the Turkish soul.

... Also, what perchance is the purpose of those who say that <our music has fulfilled her age>? I conceive the mentality of those holding unto this idea in this fashion:

According to these people, ... – just as, for instance, a squash seedling shall, after first having blossomed and given all the produce it can, dry up and putrefy no matter how much it is watered – our music too ... – having given her most beautiful works, and after that, finally gone defunct – will have fallen into hopeless obscurity! Truly, a most bizarre mentality! On the other hand, if this apathy of ours goes on much longer, and our one or two surviving venerable doyens depart from this world to reach the grace of Compassionate God, then behold, like the “natural” drying up of the squash sapling – not maybe, but simply as an “ineluctable” corollary of our neglect – our national music will reach the level of extinction. After that, Alla Franca music fanciers can thrum and ululate all they want; since, they shall not find foreanent them defenders of national music to spoil their mood. ...

[Cevad]-There are, among our musicians, traditionists and innovationists, whose ideas are correct?
When it is said “traditionists”, I conceive the perception, among us, of this term thusly: A pseudo-profession of reading and performing old works alone, and – by bringing into existence certain pieces in forms contained in [those] works only – considering composing all else and [composing] in rapport with the national manner that our literature has been pouring out for some years now, profane; to the effect that, as the ideas by those who belong to this coterie are flawed, equally so is the idea by those who wish to apply to our national music the rules, under the guise of “innovationism”, of Alla Franca music; or in plainer terms, those who are desirous of impropriating Western music as is. The most suitable profession, in my opinion, is simply to have the paths leading to the elevation of our music to degrees conforming to the necessitudes of the era researched – on condition that not even a single one of the perdes expressing befittingly our national melodies is sacrificed – in the light of scientific principles and assiduously by proficient individuals without lumping together Turkish music – which is a unique music by virtue of her omnifarious theoretical rules and structural foundations – with Western music – [otherwise] based on altogether different rules and conventions.

[Çevad]-Your opinion on the innovation that Ali Rifat [Çağatay] Bey wishes to implement?

[Yekta]-…It was later understood that the reform to be carried out was nothing other than the addition, to the organized instrumental ensemble, of Alla Franca musical instruments – aside from “violoncello” – of fixed-pitch such as the “harmonium”! Surely, the placement, next to an instrument like “tanbur” that produces melodic pitches peculiar to Oriental music, of “harmonium” which emits “artificial” – and, in reference to our music, “discordant” – sounds of “tempérament égal” ought to be named something other than “reform”!

[Çevad]-Can our old music satisfy the new generation? If not, what is the remedy?

[Yekta]-…In no other country has the new generation born malice to the old music as much as in ours. If, like Zeki Bey says, our adolescents are preferring, for instance, a figurine they acquired from “Decugis”¹ [306,307] to an ages-old work of art, it would be concluded, before all else, that the sense of aesthetics of our youth has degenerated. The reason for that, in our opinion, is the error in our evaluations of science and enlightenment on the one hand, and our [Alla Franca] musicians – by remaining entirely heedless of our national maestri – filling our ears with the compositions of Western maestri on the other. Let us be certain that a new music which will satisfy the new generation will once more arise from our old music, not, otherwise, Western music. …

…

[Çevad]-Can we forge a national music from Western technique?

¹ Henri Hippolyte Decugis (d. 1940); a famous antique, porcelain, and crystal dealer of Pera, whose business and residence – originally built in 1881 by the French Levantine architect Alexander Vallaury – was converted to a hotel in 1960 upon the departure of the Decugis family from the country, which later underwent restoration in 2001 to become the ‘Galata Antique Hotel Istanbul’. (See, accompanying endnotes.)
A word is circulating around, and it is said: “Russians have brought into being an original music by applying their national style to *Alla Franca*; cannot we do likewise?” Whereas, what the Russians did is nothing other than straightforwardly accept Western music with all its method and rules to the letter. …

Now, our compatriot Zeki Bey too reinvigorated this issue once more. He gave the answer to your inquiry: “Perhaps… But whenever quarter-tones are removed…”, and, shaking his hands with a definitive gesture whilst stating the need for the removal of quarter-tones, banged the table!

First of all, Mr. Zeki ought to know that there is no “quarter-tone” in our music; there are *perdes* [determined by ratios] called “*Intervals Mélodiques*”, and the equivalents of these melodic intervals are absent in the *Alla Franca* music that his reverend grace considers singularly worthy of conferring the title “technical music” – as though our music was not endowed with a technique. Between the two pitches that Europeans refer to as “tone”, and we as “taninî” – such as “ut” and “re” – shown by the ratio 9/8, there are three intervals in our music among these [whole tone] melodic intervals as shown below:

1. *Bakiyye* / ”Limma” = 256/243 [90.225 cents \( \{308,309\} \)]
2. *Mücenneb-i Sağır* / ”Apotome” = 2187/2048 [113.685 ¢]
3. *Mücenneb-i Kebîr* / ”Ton Mineur” = 65536/59049 \( ^{a} \) [180.449 ¢]

Aside from these, also used [in the past] in Turkish [*Mâqam*] Music are a variety of melodic intervals such as 7/6 [266.871 ¢], and 22/21 [80.537 ¢], and 12/11 [150.637 ¢] \( ^{ii} \) [310], to the effect that, they too are absent in *Alla Franca* [music]. … To say that these melodic intervals – speciously termed “quarter-tones” – ought to be removed, is analogous to saying “let us remove the body of Turkish [Mâqam] Music”. Let not Zeki Bey Efendi make futile attempts towards absurd wishfulness. Turkish [Mâqam] Music is

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\(^{i}\) A unit of measurement, first proposed by Alexander J. Ellis in 1885 in his revised translation of Helmholtz’s *Die Lehre von den Tonempfindungen*, for determining the relative distance between two distinct pitches. It is defined as the 1200\(^{th}\) root of 2, or \(2^{(1/1200)}\), yielding the ratio 1:1.0005777895. It follows that there are 1200 cents to an octave (\(\sim 1.000578 \times 1200 = 2\)). The equation for calculating the cent value of a given frequency ratio is \(\{\log_2 R \times 1200 = \text{cents}\}\), or \(\{\log_{10} R \times (1200 / \log_{10} 2) = \text{cents}\}\). The reverse operation is carried out by the formula \(\{2^{(\text{cent} / 1200)}\}\). A hundred cents makes an “equal tempered semitone” (one degree of 12-tone equal temperament), hence the origin of the term. Cents are represented by the “¢” sign. (See, accompanying endnotes.)

\(^{ii}\) Actually, the ratio specified here by Yekta is the interval of a “Pythagorean diminished third”, and is the “3-limit” (denoting the mathematical constraint by the highest prime in the factorization of both the numerator and denominator of a given frequency ratio) complement of the original “5-limit” Just Intonation (small-integer) interval for the minor tone, which is 10:9 (182.404 cents), that Yekta regards only as an approximation.

\(^{iii}\) It is very paradoxical for Yekta to point out the interval of a 3/4 tone in what appears to be Ptolemy’s “tense chromatic genus” while extolling the pitch subtleties of Turkish *Mâqam* Music over Western common-practice theory, when, at the same time, opposing quarter-tones. (See, accompanying endnote.)
prevalent with these melodic intervals, and, as long as Turkish nation endures till the day of resurrection, these melodic intervals shall not lapse either. ... The difference between listening to our national Turkish music from our own instruments and listening [to them] on the “piano”, is similar to the grand difference between having a work from a most fastidious poet of ours – respected Yahyâ Kemân [Beyatlı] Bey for instance – articulated by him, and – by transliterating that [same] work with Latin letters – having a foreigner spell it out loud. ...» (Istanbul, November 5th, 1922.)
Quote A.15: Hüseyin Saadettin Arel’s resolution to shun foreign influences in Turkish Maqam Music theory

« ... Everyone knows that, once upon a time, the language of science was Latin in the Western world, and Arabic and Persian in the Eastern world. Just as [Isaac] Newton, an English scientist, [Baruch] Spinoza, a Dutch philosopher, [Immanuel] Kant, a German polyhistor, cannot be deemed Latin because they had written works in Latin i, so too will the transcription by such Turks as Al-Fârâbî, Ibn Sină, Abdülkadîr [Merâgî], Safiyuddin [Urmavi] of works in Arabic and Persian not expatriate them from Turkness. I am nearly embarrassed of reminding this perspicuousness here. However, it must indeed be more shameful for foreign authors to regard those like Al-Fârâbî as Arab, and those like Abdülkadîr as Persic ii [311-321].

Resorting immediately to Arabic and Persian when the need for new words arose had become such a habit in us that our musicians never reprehended the attribution of such Persian names as Sûzinâk, Sûzidilârâ, Râhatfezâ, Şevkefzâ, Ferahmâk, Ferahfezâ, Sûzidîl [etc...] and Arabic names as Râhatülevrah, Şevkutarab, Zevkutarab [etc...] to maqams of sheer Turkish contrivance.

As it turns out, when I saw in books by foreign authors I acquired fifteen to twenty years ago that the aforementioned maqams were ascribed to Arabs and Persians due to their Arabic and Persic labels, I smouldered that we could not at the very least rescue these Turkish inventions from usurpation, and decided to name everything within my power in Turkish from that day onward.

...it is a patriotic debt for us to distinguish our whole assets by an inerasable seal of Turkness from those who avow it a national duty to not surrender even a scrap of art to us.

...

There is one case very much worthy of interest: Whenever the Turkish nation invaded a country and occupied it for a lengthy period, for certain, either she, by deracinating the native music, installed her own music in its place, or left behind inerasable signs of her music on the native music. You see this truth all the time in countries such as Hungary, Egypt, Iraq, Syria, Bulgaria, Yugoslavia, India, Algeria, Tunisia, Romania. Turn your radio on one night and listen please one by one to the national musics of those countries. In each one, you will identify distinctly – as if in a mirror – the countenance of Turkish [Maqam] Music. Wherever Turkish invasion

---

i Arel cites Newton’s “Tabula Quantitatum et Graduum Caloris”; “De Natura Acidorum”, Spinoza’s Tractatus De Intellectus Emendatione; Cognita Metaphysica, and Kant’s De Mundi Sensibilis atque Intelligibilis Forma et Principiis as examples.

ii There is an intense ongoing debate concerning the ethnicity of great Islamic scholars such as Al-Farabi and Ibn Sina. Turks, Arabs, and Persians – perplexed by the garblings of Western researchers – have made it an issue of national pride in trying to prove to the world that it was their gene pool that fecundated the intellect of those men. The author deems such racial discussions quite invalid and immaterial, for it is a folly to suppose that genius is purebred, and an anachronistic perversion that the parochial administration of the Muslim community during the rational age of Mu’tazilah depended on tribal consanguinity rather than moral universalism. (See, accompanying endnotes)
did not occur or last for a lengthy period, this state of affairs is not chanced upon regarding its [indigenous] music. …» (Istanbul, March 1939.)
Quote A.15: Suphi Ezgi’s resolution to shun foreign influences in Turkish Maqam Music theory

« ...Maqams [such as] Çarigâh, kürdîli çarigâh, puselik, kürdî, uşak, hüseyni, rast, acemî rast, hicazlar, karcîgar and nikriz are cantillated in western and eastern and central Turkestan, Iran, Iraq, and by and large in Anatolia and Thrace by Turks. Because these maqams are originations of their antecedents from tens of thousands of years ago, their melodic constitutions required the employment of twenty-five [Pythagorean] intervals within an octave the way we imparted above [i.e., AEU], and, it is conjectured and accepted that those pitches were known through practice, and put to use by Turks in Turkestan 5-6 millennia ago.

...Those of late who scrutinized the ratios and pitches of these twenty-four unequal intervals are sheik Ataullah Efendi of the Galata Mevlevihane, sheikCelalettin Efendi of the Yenikapı Mevlevihane, and departed Rauf Yekta ([1]309 AH [i]). Rauf Yekta reported their said labours to Sadettin Arel and Doctor Suphi Ezgi, whereas the latter [two] approved of its soundness after studying it ([1]324 AH [ii]). The three individuals whose names have been disclosed above – inspired by the existence of perdes strapped within an octave to tanburs and their employment in our music – have ascertained the intervals and ratios of [twenty-four Pythagorean] tones through the aid of ancient books. However, they did not know the tentative and scientific reasons for the division of the octave to twenty-four unequal intervals; when we asked Rauf Yekta Bey the reason and necessity of this division, he had [unsatisfactorily] replied by showing as evidence the existence [in one octave] of twenty-five frets on the neck of tanburs and the [current] usage of those tones. ...

...Due to the fact that Sadettin Arel and Doctor Suphi Ezgi discovered ([during] 1936-1937) the real and scientific reason [for the unequal division of the octave to twenty-four tones] – this once for a second time – we have provided it [further] above explicitly and in extensive detail to our readers [iii] [181,322].

---

[i] The date given in Ottoman Mali/Rûmî Calendar equates to the year 1893 of the Gregorian/Julian Common Era.

[ii] Ditto, 1908 C.E.

[iii] Evidences related elsewhere in the text (pp. 171-86) by Ezgi are:

1- Abstruse mention of an arrangement based on twenty-four sounds called “düzen-i muhalîf” (averse tuning) by Bedr-i Dîşad (ca.1440), court scribe and encyclopaedist to Sultan Murad II; which is dismissed as ambiguous and peripheral by Yalçın Tura. (See, accompanying endnote).

2- Presence, at that date, of twenty-four unequal intervals within an octave on the neck of the Turkish tanbur that Ezgi traces down to the era of Sultan Selim III through a line of tanbur exponents culminating with himself.

3- Observations by a Jesuit priest visiting Istanbul between 1781-6 named Giambattista Toderini (1728-1799), from whose explanations and sketch of a tanbur little that hints the application of the 24-tone Pythagorean tuning can be inferred contrary to what Ezgi assumes. (See, concomitant endnote).
[As regards the assertion by Yekta in his article to İkdam Gazette dated May 18th, 1323 AH (May 31st, 1907) that Aristides Quintilianus was the first to point out the 24-tone unequal division of the octave – whereas, according to Fétis i (323), he had said: “The first octave is shown by twenty-four dieses, hence one fourth tones; the second octave is composed of semitones.”] ...Rauf Yekta Bey had committed a grave error in this important matter from beginning to end with his utterances above, which are unwholesome and devoid of logical proof. …

Rauf Yekta is cognizant of the fact that our twenty-four [tone] division [of the octave] is unequal. He has written this both in his monograph [to La Histoire de la Musique] and in the [related] page of his Turkish Music Theory ii [324]. His great fault is his saying that our unequal division was in the possession of the Hellenes [of Antiquity], and that the perdes of the tanbur depended on their [musical] rules. Because [both] the division whose presence with Greeks is mentioned above by Aristides Quintilianus and the division referred to by all the Western music historians is equal, it is for certain that Hellenes [of Antiquity] did not know of our unequal twenty-four [tone] division [of the octave], and that Turks did not borrow this unequal twenty-four [tone] division from Greeks.

On the other hand, there is no doubt that this twenty-four [tone] unequal division [of the octave] was, through discovery, strapped – just the way we have stated its scientific reasons for aloft – to the necks of tanburs by a Turkic music pundit as the requirement of the constitutions of diverse maqams used by Turks, and that, twenty-five intervals [within the octave] were made use of. Again, it is beyond doubt that this discovery was made 800-900 years ago iii since we lack at hand any evidence intimating that Turks pursued music theory 5-6 millennia ago.» (Istanbul, 1940.)

---

i François-Joseph Fétis (1784-1871); Belgian critic, composer, and musicologist. His quotation from Aristides Quintilianus is said to occur, if we are to put faith in Ezgi, in the 30th page of his Histoire Générale de la Musique depuis les temps les plus Anciens jusqu’à nos Jours. (See, accompanying endnote).

ii Written between 1924-1929; this work, though incomplete, is so far transliterated and published gradatim by Gönül Paçacı in the I., II., V., VI., VII. & VIII. issues (1997-2006) of “Mûskîşiñas”. (See, accompanying endnote).

iii i.e., during the ingress into Anatolia of the Seljuk Empire.
APPENDIX B: COMPLETE SET OF INTERVALS WITHIN AN OCTAVE OF THE 24-TONE PYTHAGOReAN MODEL

This appendix embodies the frequency ratios and cent values for all octave-bound dyads in the 24-tone Pythagorean System.

A snapshot of SCALA© 1 [325] Tone-Circle in Figure B.1 shows the locations of 12 Pythagorean commas (533441:524288) in AEU/Yekta-24:

![Figure B.1: Tone-Circle Showing 12 Pythagorean Commas in AEU/Yekta-24](image)

---

1 A powerful tool programmed by Manuel op de Coul, for the experimentation, creation, editing, comparison, analysis, storage, digital adjustment, and MIDI sounding and recording of Western & non-Western, just intonation, equal, microtonal, and macrotonal tunings. SCALA© is accompanied by a library of more than three thousand scales, is free of charge, and is downloadable from the internet. (See accompanying endnote.)
The octave inversion of this interval expressed as $1048576:531441$ and equalling 1176.54 cents, which is the Pythagorean diminished ninth, also occurs in the same places by the same number.

Figure B.2 displays 7 instances of $134217728:129140163$ (Pythagorean double diminished third) equalling 66.765 cents each:

![Figure B.2: Tone-Circle Showing 7 Pythagorean Double Diminished Thirds in AEU/Yekta-24](image)

The octave inversion of this interval expressed as $129140163:67108864$ and equalling 1133.235 cents, which is the Pythagorean double augmented sixth, also occurs in the same places by the same number.

To avoid visual confusion by the tight overlapping of lines in the Tone-Circle, the generator for deriving pitches in some of the subsequent figures is chosen to be 7 steps.

19 instances of $256:243$ (limma, Pythagorean minor semitone) equalling 90.225 cents each are made manifest in Figure B.3:
The octave inversion of this interval expressed as 243:128 and equalling 1109.775 cents, which is the Pythagorean major seventh, also occurs in the same places by the same number.

17 instances of 2187:2048 (apotome) equalling 113.685 cents each are disclosed in Figure B.4:

The octave inversion of this interval expressed as 4096:2187 and equalling 1086.315 cents, which is the Pythagorean diminished octave, also occurs in the same places by the same number.

Figure B.5 displays 5 instances of 1162261467:1073741824 (a 3-limit 2/3 tone interval classified in SCALA® as “Pythagorean-19 comma”) equalling 137.145 cents each:

The octave inversion of this interval equalling 1062.855 cents also occurs in the same places by the same number.
Figure B.4: Tone-Circle Showing 17 Apotomes in AEU/Yekta-24

Figure B.5: Tone-Circle Showing 5 Two Third Tones in AEU/Yekta-24
Unfortunately, the remote positioning and scarcity of these 2/3 tones preclude their mindful employment in such a way as to reflect Maqam Music practice. Hence, they remain unbeknownst – melodic paths crossing them as yet untrodden – in 24-tone Pythagorean theory.

2 instances of a 3/4 tone interval sized 156.99 cents may be seen in Figure B.6:

![Figure B.6: Tone-Circle Showing 2 Three Fourth Tones in AEU/Yekta-24](image)

The octave inversion of this interval equalling 1043.01 cents also occurs in the same places by the same number.

Same criticism for aforesaid 2/3 tones applies with greater stress to these 3/4 tones.

Nonetheless, AEU/Yekta-24 middle seconds come close to two JI ratios electroacoustically measured in the performance of Turkish Maqam Music:
A- 137.145 cents (5 times) = 13:12 - 1.428 cents;
B- 156.99 cents (2 times) = 12:11 + 6.353 cents.

Figure B.7 displays 14 instances of 65536:59049 (Pythagorean diminished third) equalling 180.45 cents each:

Figure B.7: Tone-Circle Showing 14 Pythagorean Diminished Thirds in AEU/Yekta-24

The octave inversion of this interval expressed as 59049:32768 and equalling 1019.55 cents also occurs in the same places by the same number.

22 instances of 9/8 (major whole tone) equalling 203.91 cents each are portrayed in Figure B.8:

The octave inversion of this interval expressed as 16:9 and equalling 996.09 cents, which is the Pythagorean minor seventh, also occurs in the same places by the same number.
Figure B.8: Tone-Circle Showing 22 Major Whole Tones in AEU/Yekta-24

10 instances of 4782969:4194304 (Pythagorean double augmented prime) equalling 227.37 cents each are given in Figure B.9 on the following page.

After that in Figure B.10 are 9 instances of 16777216:14348907 (Pythagorean double diminished fourth) equalling 270.675 cents.

The octave inversion of the first interval expressed as 8388608:4782969 and equalling 972.63 cents, which is the Pythagorean double diminished octave, also occurs in the same places by the same number.

Similarly, the octave inversion of the latter interval expressed as 14348907:8388608 making 929.325 cents, which is the Pythagorean double augmented fifth, also occurs in the same places by the same amount.

21 instances of 32:27 (Pythagorean minor third) equalling 294.135 cents each are provided in Figure B.11:
Figure B.9: Tone-Circle Showing 10 Pythagorean Double Augmented Primes in AEU/Yekta-24

Figure B.10: Tone-Circle Showing 9 Pythagorean Double Diminished Fourths in AEU/Yekta-24
Figure B.11: Tone-Circle Showing 21 Pythagorean Minor Thirds in AEU/Yekta-24

The octave inversion of this interval expressed as 27:16 and equalling 905.865 cents, which is the Pythagorean major sixth, also occurs in the same places by the same number.

15 instances of 19683:16384 (Pythagorean augmented second) equalling 317.595 cents each are shown in Figure B.12:

The octave inversion of this interval expressed as 32768:19683 and equalling 882.405 cents, which is the Pythagorean diminished seventh, also occurs in the same places by the same number.

Figure B.13 displays 3 instances of 341.055 cent comma-augmented sesqui-tone intervals – which basically are nothing more than whole tone added 2/3 tones:

The octave inversion of this interval sized 858.945 cents also occurs in the same places by the same number.

4 instances of 360.9 cent middle third intervals – which basically are none other than whole tone extended 3/4 tones – are provided in Figure B.14:
Figure B.12: Tone-Circle Showing 21 Pythagorean Augmented Seconds in AEU/Yekta-24

Figure B.13: Tone-Circle Showing 3 Comma-augmented Sesqui-tones in AEU/Yekta-24
The octave inversion of this interval sized 839.1 cents also occurs in the same places by the same number.

Because they are extensions of 2/3 and 3/4 tones by a major whole tone, these intervals deserve no further attention.

16 instances of 8192:6561 (Pythagorean diminished fourth) equalling 384.360 cents each are made manifest in Figure B.15 on the next page:

Following that in Figure B.16 are 20 instances of 81:64 (Pythagorean major third) equalling 407.82 cents each.

The octave inversion of the first interval expressed as 128:81 and equalling 792.18 cents, which is the Pythagorean minor sixth, also occurs in the same places by the same number.

Similarly, the octave inversion of the latter interval expressed as 6561:4096 making 815.64 cents, which is the Pythagorean augmented fifth, also occurs in the same places by the same amount.
Figure B.15: Tone-Circle Showing 16 Pythagorean Diminished Fourths in AEU/Yekta-24

Figure B.16: Tone-Circle Showing 20 Pythagorean Major Thirds in AEU/Yekta-24
8 instances of 43046721:33554432 (Pythagorean double augmented second) equalling 431.28 cents each are given in Figure B.17:

The octave inversion of this interval expressed as 67108864:43046721 and equalling 768.72 cents, which is the Pythagorean double diminished seventh, also occurs in the same places by the same number.

11 instances of 2097152:1594323 (Pythagorean double diminished fifth) equalling 474.585 cents each are laid bare in Figure B.18 on the next page:

The octave inversion of this interval expressed as 1594323:1048576 and equalling 725.415 cents, which is the Pythagorean double augmented fourth, also occurs in the same places by the same number.

After that, Figure B.19 displays 23 instances of 4:3 (perfect fourth) equalling 498.045 cents each:
Figure B.18: Tone-Circle Showing 11 Pythagorean Double Diminished Fifths in AEU/Yekta-24

Figure B.19: Tone-Circle Showing 23 Perfect Fourths in AEU/Yekta-24
The octave inversion of this interval expressed as 3:2 and equalling 701.955 cents, which is the perfect fifth, also occurs in the same places by the same amount.

13 instances of 177147:131072 (Pythagorean augmented third) equalling 521.505 cents each are provided below in Figure B.20:

Following that in Figure B.21 is an instance of a 544.965 cent semidiminished fifth.

![Figure B.20: Tone-Circle Showing 13 Pythagorean Augmented Thirds in AEU/Yekta-24](image)

The octave inversion of the first interval expressed as 262144:177147 and equalling 678.495 cents, which is the Pythagorean diminished sixth, also occurs in the same places by the same number.

Likewise, the octave inversion of the latter interval of 655.035 cents also occurs in the same places by the same amount.

6 instances of 536870912:3874204 (Pythagorean double diminished sixth) equalling 564.81 cents each are shown in Figure B.22:
Figure B.21: Tone-Circle Showing a Semi-Diminished Fifth in AEU/Yekta-24

Figure B.22: Tone-Circle Showing a Pythagorean Double Diminished Sixth in AEU/Yekta-24
The octave inversion of the first interval expressed as 387420489:2684354 and equalling 635.19 cents, which is the Pythagorean double augmented third, also occurs in the same places by the same number.

Lastly, Figure B.23 displays 18 instances of 1024:729 (Pythagorean diminished fifth) equalling 588.27 cents each:

![Figure B.23: Tone-Circle Showing a Pythagorean Diminished Fifth in AEU/Yekta-24](image)

The octave inversion of the first interval expressed as 729:512 and equalling 611.73 cents, which is the Pythagorean tritone, also occurs in the same places by the same number.

A complete list of dyads within one octave of the 24-tone Pythagorean System is presented in Table B.1:
Table B.1: Complete List of Dyads in the 24-tone Pythagorean System

<table>
<thead>
<tr>
<th>Interval Class+</th>
<th># of occurrence</th>
<th>Dyads up to Period</th>
<th>Cents</th>
<th>Mirrored $^i$</th>
<th>Cents</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>1 time</td>
<td>(1/1)</td>
<td>0.000</td>
<td>2/1</td>
<td>1200.000</td>
</tr>
<tr>
<td>1:</td>
<td>12 times</td>
<td>531441/524288</td>
<td>23.460</td>
<td>1048576/531441</td>
<td>1176.540</td>
</tr>
<tr>
<td>1:</td>
<td>7 times</td>
<td>134217728/129140163</td>
<td>66.765</td>
<td>129140163/6710886</td>
<td>1133.235</td>
</tr>
<tr>
<td>*:</td>
<td>19 times</td>
<td>256/243</td>
<td>90.225</td>
<td>243/128</td>
<td>1109.775</td>
</tr>
<tr>
<td>*:</td>
<td>17 times</td>
<td>2187/2048</td>
<td>113.685</td>
<td>4096/2187</td>
<td>1086.315</td>
</tr>
<tr>
<td>3:</td>
<td>5 times</td>
<td>1162261467/1073741824</td>
<td>137.145</td>
<td>n/a</td>
<td>1062.855</td>
</tr>
<tr>
<td>3:</td>
<td>2 times</td>
<td>n/a</td>
<td>156.990</td>
<td>n/a</td>
<td>1043.010</td>
</tr>
<tr>
<td>*:</td>
<td>14 times</td>
<td>65536/59049</td>
<td>180.450</td>
<td>59049/32768</td>
<td>1019.550</td>
</tr>
<tr>
<td>*:</td>
<td>22 times</td>
<td>9/8</td>
<td>203.910</td>
<td>16/9</td>
<td>996.090</td>
</tr>
<tr>
<td>5:</td>
<td>10 times</td>
<td>4782969/4194304</td>
<td>227.370</td>
<td>8388608/4782969</td>
<td>972.630</td>
</tr>
<tr>
<td>5:</td>
<td>9 times</td>
<td>16777216/14348907</td>
<td>270.675</td>
<td>14348907/8388608</td>
<td>929.325</td>
</tr>
<tr>
<td>*:</td>
<td>21 times</td>
<td>32/27</td>
<td>294.135</td>
<td>27/16</td>
<td>905.865</td>
</tr>
<tr>
<td>*:</td>
<td>15 times</td>
<td>19683/16384</td>
<td>317.595</td>
<td>32768/19683</td>
<td>882.405</td>
</tr>
<tr>
<td>7:</td>
<td>3 times</td>
<td>n/a</td>
<td>341.055</td>
<td>n/a</td>
<td>858.945</td>
</tr>
<tr>
<td>7:</td>
<td>4 times</td>
<td>n/a</td>
<td>360.900</td>
<td>n/a</td>
<td>839.100</td>
</tr>
<tr>
<td>*:</td>
<td>16 times</td>
<td>8192/6561</td>
<td>384.360</td>
<td>6561/4096</td>
<td>815.640</td>
</tr>
<tr>
<td>*:</td>
<td>20 times</td>
<td>81/64</td>
<td>407.820</td>
<td>128/81</td>
<td>792.180</td>
</tr>
<tr>
<td>9:</td>
<td>8 times</td>
<td>43046721/33554432</td>
<td>431.280</td>
<td>67108864/43046721</td>
<td>768.720</td>
</tr>
<tr>
<td>9:</td>
<td>11 times</td>
<td>2097152/1594323</td>
<td>474.585</td>
<td>1594323/1048576</td>
<td>725.415</td>
</tr>
<tr>
<td>*:</td>
<td>23 times</td>
<td>4/3</td>
<td>498.045</td>
<td>3/2</td>
<td>701.955</td>
</tr>
<tr>
<td>*:</td>
<td>13 times</td>
<td>177147/131072</td>
<td>521.505</td>
<td>262144/1717147</td>
<td>678.495</td>
</tr>
<tr>
<td>11:</td>
<td>1 time</td>
<td>n/a</td>
<td>544.965</td>
<td>n/a</td>
<td>655.035</td>
</tr>
<tr>
<td>11:</td>
<td>6 times</td>
<td>536870912/387420489</td>
<td>564.810</td>
<td>387420489/268435456</td>
<td>635.190</td>
</tr>
<tr>
<td>*:</td>
<td>18 times</td>
<td>1024/729</td>
<td>588.270</td>
<td>729/512</td>
<td>611.730</td>
</tr>
</tbody>
</table>

$^i$ Inverted by the interval of repetition, which is the octave.

$^{ii}$ Asterisks denote ambiguity of interval class (step number making the interval).
APPENDIX C: TRADITIONAL PERDES OF NEY

This appendix features pertinent information on traditional ney perdes of Abdulbaki Nasır Dede, their fingering, dedicated key-transposing staff notation, harmonics of the ney in terms of Nasır Dede’s denominations, a preview of neymaking, available ney types, an attempt at instrumental standardization in reference to the concert pitch, and transposition of the principal mode of the most basic Maqam Rast.

In Figure C.1 [326] a panoply detailing the ney and its perdes as described by Nasır Dede is provided.

The compass of the instrument is taken to be two octaves plus a tone from perde yegah to tiz hüseyni. Diatonic naturals are typed in capital letters. Yegah and pes beyati are the only two pedal tones mentioned here.

In Figure C.2, a complete ney fingering chart with dedicated key-transposing staff notation is prepared.

In this schema, lower series displays the ordinary, higher series, alternate fingering. Perde rast begins at the second harmonic and is notated as C4 on the stave. Aside from being key-transposing, the notation is also octave transposing (C4=>C5); because of that, it is permissable to place an “8va” indicator above the G-clef.

Unconventional pedal tones – which are perdes below yegah – receive the prefix “kaba” (bass). Similarly, unconventional high notes – which are perdes above tiz hüseyni – receive the prefix “tiz” (treble). Darkened fingerholes are closed, half-darkened half-closed, thick-ringed and half-shaded closed without any vitally noticeable effect.

The reason for the shifting of the last two perdes from the fourth to the fifth register comes from the order of harmonics produced from the apertures of the ney [327], as shown in Table C.1 on the next page:

The ‘key transposition’ feature of the ney is due to the fingerhole proportions (therefore the fingering) remaining the same in spite of a change in the size, hence, the Ahenk (pitch-height, or in other words, the diapason) of the instrument.

1 The ney drawing in Figure C.1 is the art of Turkish Neymaker Mehmet Yücel and is borrowed from his website. (See, accompanying endnote.)
Figure C.1: Ney Perdes According to Nasır Dede

<table>
<thead>
<tr>
<th>Perdes of 1st Fifth</th>
<th>Perdes of 2nd Fifth</th>
<th>Perdes of 3rd Fifth</th>
<th>Perdes of 4th Fifth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 YEGAH</td>
<td>11 DUGHAN</td>
<td>21 HUSEYN</td>
<td>30 T. BUSE</td>
</tr>
<tr>
<td>2 P. Beyati</td>
<td>12 KURDI</td>
<td>22 ASEM</td>
<td>31 T. CAR.</td>
</tr>
<tr>
<td>3 P. Hisar</td>
<td>13 SEGAH</td>
<td>23 EVC</td>
<td>32 T. SABA</td>
</tr>
<tr>
<td>4 ASHIRAN</td>
<td>14 BUSELIK</td>
<td>24 MAHUR</td>
<td>33 T. HICAZ</td>
</tr>
<tr>
<td>5 ASEM</td>
<td>15 CARGAH</td>
<td>25 GERD.</td>
<td>34 T. NEVA</td>
</tr>
<tr>
<td>6 ARAK</td>
<td>16 SABA</td>
<td>26 SHEIN</td>
<td>35 T. BAYATI</td>
</tr>
<tr>
<td>7 GEVAŞT</td>
<td>17 HICAZ</td>
<td>27 BEYATI</td>
<td>36 T. HISAR</td>
</tr>
</tbody>
</table>

| 8 RAST             | 18 NEVA            | 27 MUHAY.          | 37 T. HÜS.          |
| 9 ŞURI             | 19 BEYATI          | 28 SÜNBULE         |                    |
| 10 ZİRGÜLE         | 20 HISAR           | 29 T. SEG.         |                    |

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>'AŞİRAN</td>
<td>ARAK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASEM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pes Beyati</td>
<td>YEGAH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pes Hisar</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NEVA</th>
<th>TIZ NEVA</th>
<th>TIZ BEYATI</th>
</tr>
</thead>
<tbody>
<tr>
<td>SABA</td>
<td>SHEIN</td>
<td>TIZ SABA</td>
</tr>
<tr>
<td></td>
<td>TIZ HICAZ</td>
<td></td>
</tr>
<tr>
<td>ÇARGAH</td>
<td>CARGAH</td>
<td>T. CAR.</td>
</tr>
<tr>
<td></td>
<td>BUSELIK</td>
<td>58 BUSELIK</td>
</tr>
<tr>
<td></td>
<td>MAHUR</td>
<td></td>
</tr>
<tr>
<td>SEGAH</td>
<td>SEGAH</td>
<td>T. SEGAH</td>
</tr>
<tr>
<td>KURDI</td>
<td>KURDI</td>
<td>SÜNBULE</td>
</tr>
<tr>
<td></td>
<td>ASEM</td>
<td>(SHEIN)</td>
</tr>
<tr>
<td>DUGHAN</td>
<td>DUGHAN</td>
<td>HÜSEYNİ</td>
</tr>
<tr>
<td></td>
<td>HÜSEYNİ</td>
<td>MUHAY.</td>
</tr>
</tbody>
</table>

5th Register Perdes

| RAST  | 1st Reg. Gevaşt, RAST, ŞURI |

Metal ring (Parazvâne)

Embouchure (Bashpâre)

Metal ring (Parazvâne)
Figure C.2: Fingering Chart for Ney Perdes with Key-Transposing Staff Notation
<table>
<thead>
<tr>
<th>First Harmonic</th>
<th>Second Harmonic (1. Register)</th>
<th>Third Harmonic (2. Register)</th>
<th>Fourth Harmonic (3. Register)</th>
<th>Fifth Harmonic (4. Register)</th>
<th>Sixth Harmonic (5. Register)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RAST</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Kaba Gevašt)</td>
<td>Gevašt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kaba Şuri</td>
<td>Şuri</td>
<td>Beyati</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DÜGAH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K. Zirgule</td>
<td>Zirgule</td>
<td>Hisar</td>
<td>Şehnaz</td>
<td>11. T. ÇAR.</td>
<td>Tiz Hisar</td>
</tr>
<tr>
<td><strong>Kürdî</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K. Kürdî</td>
<td>Kürdî</td>
<td>Acem</td>
<td>Sünbülé</td>
<td>12. T. NEVA</td>
<td>Tiz Acem</td>
</tr>
<tr>
<td><strong>SEGAH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ÇARGAH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K. Buselik</td>
<td>Buselik</td>
<td>Mahur</td>
<td>T. Buselik</td>
<td>Tiz Hisar</td>
<td>Tiz Mahur</td>
</tr>
<tr>
<td><strong>Saba</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K. Hicaz¹</td>
<td>Hicaz</td>
<td>Şehnaz</td>
<td>Tiz Hicaz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K. Saba/Uzzal</td>
<td>Saba/Uzzal</td>
<td></td>
<td>Tiz Saba/Uzzal</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NEVA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-4. YEGAH</td>
<td>5. NEVA</td>
<td>9. MUHAY.</td>
<td>12. T. NEVA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pes Beyati</td>
<td>Beyati</td>
<td>Kürdî</td>
<td>Tiz Beyati</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>(ACEM) AŞİRAN</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pes Hisar</td>
<td>Hisar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-3. AŞİRAN</td>
<td>6. HÜSEYNİ</td>
<td>T. Buselik</td>
<td>13. T. HÜS.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acem Aşiran</td>
<td>Acem</td>
<td>11. T. ÇAR.</td>
<td>Tiz Acem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2. ARAK</td>
<td>7. EVC</td>
<td>Hicaz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f1</td>
<td></td>
<td>f2</td>
<td>f3</td>
<td>f4</td>
<td>f5</td>
</tr>
</tbody>
</table>

This is in accordance with drilling fingerholes at points determined by dividing the *ney* shaft into 26 equal segments regardless of its length [328]. Table C.2 offers an insight into the relative positions, with minute calibrations, of the fingerholes of *ney*:

¹ The reason for the precedence of hicaz over saba is due to its being a lower pitch in alignment with Nasr Dede’s derivation of these perdes from the *ney* despite the order by which they are customarily listed in his treatise. Note that uzzal is equivalent to or lower than saba.
Table C.2: Relative Positions of Ney Fingerholes

<table>
<thead>
<tr>
<th>Fingerholes</th>
<th>Ratios</th>
<th>Deviations 1</th>
<th>Deviations 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Düğah</td>
<td>26/4</td>
<td>1 mm down</td>
<td>1 to 2 mm down</td>
</tr>
<tr>
<td>Kürdi</td>
<td>26/5</td>
<td>(N/A)</td>
<td>1 to 2 mm down</td>
</tr>
<tr>
<td>Segah</td>
<td>26/6</td>
<td>1 mm up</td>
<td>1 to 2 mm up</td>
</tr>
<tr>
<td>Çargah</td>
<td>26/8</td>
<td>2 mm down</td>
<td>1 to 2 mm down</td>
</tr>
<tr>
<td>Hicaz (Saba)</td>
<td>26/9</td>
<td>(N/A)</td>
<td>1 to 2 mm up</td>
</tr>
<tr>
<td>Neva</td>
<td>26/10</td>
<td>1 mm up</td>
<td>2 to 3 mm up</td>
</tr>
<tr>
<td>Âcem (Âcem Aşiran)</td>
<td>26/13</td>
<td>3 mm up</td>
<td>1 to 2 mm up</td>
</tr>
</tbody>
</table>

One can see at a glance that the pitch produced by the hole reamed at half the length of the reed does not yield the octave equivalent (gerdaniye) of the perde sounded by insufflating normally with all fingerholes closed (rast). Instead, the difference is the interval of a minor seventh – a major tone short of an octave (acem) iii [330].

The reason for that appears to be related to the acoustical dynamics of open-ended pipes, which causes a dilation of the wavelength at both extremes as much as ~0.6 times the radius of the cylinder [331-333]. However, this “end correction” amount does not appear to be sufficient in the case of ney, possibly because the isthmus of the voice box (first node) of the ney serves to attenuate the energy of the sound wave and expand drastically the wavelength of the vibrating air column.

At any rate, the physical proportions of this mellifluous instrument are made manifest in Table C.3 through three common sizes of reed complying with the measurements of Turkish Neymaker Yılmaz Kale iv:

---

iv Calibrations according to Turkish Neymaker Gökhan Özkök (through private communication).

ii Calibrations according to Turkish Neyzen Süleyman Erguner. (See, accompanying endnote.)

iii Was fingerhole of aṣiran according to Nasır Dede. It is referred to as acem since at least the past century due presumably to its being the next perde at the same register and inclination of blowing after neva. (See, accompanying endnote.)

iv As forwarded to the author by Can Akkoç.
Table C.3: Measurements of Three Common Sizes of Ney according to Turkish Neymaker Yılmaz Kale

<table>
<thead>
<tr>
<th></th>
<th>ŞAH</th>
<th>MANSUR</th>
<th>KIZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length 1:</td>
<td>26 x 33 mm (858mm)</td>
<td>26 x 31 mm (806mm)</td>
<td>26 x 27 mm (702mm)</td>
</tr>
<tr>
<td>F.hole radius:</td>
<td>9 to 9.5 mm</td>
<td>9 to 9.5 mm</td>
<td>9 mm</td>
</tr>
<tr>
<td>Embouchure</td>
<td>(dimensions may vary)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isthmus bore:</td>
<td>11 mm</td>
<td>10 mm</td>
<td>10 mm</td>
</tr>
<tr>
<td>Neva</td>
<td>33 mm</td>
<td>31 mm</td>
<td>27 mm</td>
</tr>
<tr>
<td>Saba/Hicaz</td>
<td>33 mm</td>
<td>31 mm</td>
<td>27 mm</td>
</tr>
<tr>
<td>Çargah</td>
<td>66 mm</td>
<td>62 mm</td>
<td>54 mm</td>
</tr>
<tr>
<td>Segah</td>
<td>33 mm</td>
<td>31 mm</td>
<td>27 mm</td>
</tr>
<tr>
<td>Kürdi</td>
<td>33 mm</td>
<td>31 mm</td>
<td>27 mm</td>
</tr>
<tr>
<td>Düğah</td>
<td>33 mm</td>
<td>31 mm</td>
<td>27 mm</td>
</tr>
</tbody>
</table>

Emphasis must be placed on the esoteric practice which takes the square of the diameter of the pipe to yield the distance between two neighbouring fingerholes; and times 26 this value the length proper of the ney. This is so, lest the breadth of the ney stalk is greater than 25 mm; in which case, Kale refers to the archetype instrument of Neyzen Emin Yazıcı Dede (1883-1945) ii [334], and shortens the reed accordingly.

While the abovesaid empirical method beckons further investigation, such a pursuit would fall outside the compass of this dissertation. In its stead, let us be contented with the fact that the art of neymaking subsumes a certain element of secrecy – possibly even mystery – that remains as yet untouched by the inquisitive hands of priers as a result of the inveteracy by which the skill, through clandestine observance, has passed and continues to pass down from generation to generation.

As the case may be, the frequencies given by Rauf Yekta on seven common types of ney from neva to tiz neva [335] are listed in Table C.4 below:

---

1 Always 26 times the square of the width. The fingerhole of acem is posited at exactly half the length just under the thumb.

ii Ney master and tutor, among others, of Emin Kılıç Kale, father to Yılmaz Kale. (See, accompanying endnote.)
Table C.4: Rauf Yekta’s Perde Frequencies on Seven Common Ney Types

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolâhenk</td>
<td>486</td>
<td>540</td>
<td>576</td>
<td>648</td>
<td>720</td>
<td>768</td>
<td>864</td>
<td>972</td>
</tr>
<tr>
<td>Davud</td>
<td>486</td>
<td>540</td>
<td>576</td>
<td>648</td>
<td>720</td>
<td>768</td>
<td>864</td>
<td>972</td>
</tr>
<tr>
<td>Şah</td>
<td>581.2</td>
<td>691.2</td>
<td>777.6</td>
<td>864</td>
<td>921.6</td>
<td>1058</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MANSUR</td>
<td>518.4</td>
<td>583.2</td>
<td>648</td>
<td>691.2</td>
<td>777.6</td>
<td>864</td>
<td>921.6</td>
<td>1058</td>
</tr>
<tr>
<td>Kiz</td>
<td>648</td>
<td>720</td>
<td>768</td>
<td>864</td>
<td>1024</td>
<td>1152</td>
<td>1296</td>
<td></td>
</tr>
<tr>
<td>Müstahsen</td>
<td>598</td>
<td>684</td>
<td>864</td>
<td>1058</td>
<td>1152</td>
<td>1288</td>
<td>1382.4</td>
<td></td>
</tr>
<tr>
<td>Süpürde</td>
<td>572</td>
<td>652</td>
<td>696</td>
<td>864</td>
<td>1024</td>
<td>1152</td>
<td>1365.333</td>
<td>1536</td>
</tr>
</tbody>
</table>

Scale is based on the just ratios: 1, 9/8, 5/4, 4/3, 3/2, 5/3, 16/9, 2

Perdes conforming to concert pitch on nine common types of Ney enumerated by nzejen Süleyman Erguner are displayed in Table C.5 below [336]:

Table C.5: Süleyman Erguner’s Nine Common Types of Ney with Perdes yielding Concert Pitch

<table>
<thead>
<tr>
<th>NEY TYPE / AHENK</th>
<th>LENGTH (mm)</th>
<th>D² (mm)</th>
<th>A₄=440 cps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolâhenk ¹</td>
<td>1014-1040</td>
<td>39-40</td>
<td>neva</td>
</tr>
<tr>
<td>Davud ¹</td>
<td>925-936</td>
<td>35.5-36</td>
<td>çargah</td>
</tr>
<tr>
<td>Şah-Dik ² Şah</td>
<td>858-884</td>
<td>33-34</td>
<td>segah – buselik</td>
</tr>
<tr>
<td>Mansur</td>
<td>780-806</td>
<td>30-31</td>
<td>düğah</td>
</tr>
<tr>
<td>Kiz</td>
<td>702-715</td>
<td>27-27.5</td>
<td>rast</td>
</tr>
<tr>
<td>Yldiz ³</td>
<td>650-663</td>
<td>25-25.5</td>
<td>arak</td>
</tr>
<tr>
<td>Müstahsen</td>
<td>598-611</td>
<td>23-23.5</td>
<td>acem aşiran</td>
</tr>
<tr>
<td>Süpürde</td>
<td>572-585</td>
<td>22-22.5</td>
<td>aşiran</td>
</tr>
<tr>
<td>Bolâhenk Nisfiye ⁴</td>
<td>520-533</td>
<td>20-20.5</td>
<td>yegah</td>
</tr>
</tbody>
</table>

¹ It is almost impossible to perform on this size of Ney, and it thus remains merely as a theoretical device.
² i.e., “acute” by at least a comma’s worth.
³ Also called “Kiz-Müstahsen Mabeyn” (“in between Kiz-Müstahsen”).
⁴ i.e., “half”. It is practicable, though uncommon, to manufacture similar hemi-neys of all the Ahenks listed in the table including their Mabeyns (medians).
Qanun virtuoso Ruhi Ayangil suggests †, however, that the naming conventions of the Ahenks are incorrect. It would appear that Yıldız ought to be the namesake of Bolahenk Nişfıye, not Kız-Müstahsen Mabeyn, while Ahteri the synonym thereof, not Süpürde, and Mehtabiye a sobriquet for Süpürde [337,338]. Edited in Table C.6 are the “superlative” (in capital letters) and “median” Ahenks based on the measurements (optimals in bold) of Turkish Neymaker Gökhan Özkök:

<table>
<thead>
<tr>
<th>NEY TYPE / AHENK</th>
<th>perde rast</th>
<th>( A_x = 440 \text{ cps} )</th>
<th>LENGTH (mm)</th>
<th>( D \ (\text{mm}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOLAHENK</td>
<td>( D_1 ) (Re)</td>
<td>neva</td>
<td>1,027-1,040-1,053</td>
<td>39,5-40-40,5</td>
</tr>
<tr>
<td>Bolahenk-Davut Mabeyn</td>
<td>D# / Eb</td>
<td>hicaz</td>
<td>949-962-988</td>
<td>36,5-37-38</td>
</tr>
<tr>
<td>DAVUD</td>
<td>( E_4 ) (Mi)</td>
<td>çargah</td>
<td>897-910-936</td>
<td>34,5-35-36</td>
</tr>
<tr>
<td>ŞAH</td>
<td>( F_4 ) (Fa)</td>
<td>segah</td>
<td>858-871-884</td>
<td>33-33,5-34</td>
</tr>
<tr>
<td>Şah-Mansur Mabeyn</td>
<td>F# / Gb</td>
<td>kürdi</td>
<td>819-832-845</td>
<td>31,5-32-32,5</td>
</tr>
<tr>
<td>MANSUR</td>
<td>( G_4 ) (Sol)</td>
<td>düğah</td>
<td>767-780-793</td>
<td>29,5-30-30,5</td>
</tr>
<tr>
<td>Mansur-Kız Mabeyn</td>
<td>G# / Ab</td>
<td>zirgule</td>
<td>728-741-754</td>
<td>28-28,5-29</td>
</tr>
<tr>
<td>KIZ</td>
<td>( A_4 ) (La)</td>
<td>rast</td>
<td>689-702-715</td>
<td>26,5-27-27,5</td>
</tr>
<tr>
<td>Kız-Müstahsen Mabeyn</td>
<td>A# / Bb</td>
<td>arak</td>
<td>637-650-663</td>
<td>24,5-25-25,5</td>
</tr>
<tr>
<td>MÜSTAHSEN</td>
<td>( B_1 ) (Si)</td>
<td>acem aşıran</td>
<td>598-611-624</td>
<td>23-23,5-24</td>
</tr>
<tr>
<td>SÜPÜRDE (Mehtabiye)</td>
<td>( C_5 ) (Ut)</td>
<td>asıran</td>
<td>559-572-585</td>
<td>21,5-22-22,5</td>
</tr>
<tr>
<td>Süpürde-Yıldız Mabeyn</td>
<td>C# / Db</td>
<td>pes hisar</td>
<td>533-546-559</td>
<td>20,5-21-21,5</td>
</tr>
<tr>
<td>YILDIZ (Ahteri)</td>
<td>( D_5 ) (Re)</td>
<td>yegah</td>
<td>507-520-533</td>
<td>19,5-20-20,5</td>
</tr>
</tbody>
</table>

Because Maqam Music perdes are relative frequencies detached from a fixed diapason, and because the apertures of ney are always opened uniformly in proportion to the length of the reed, a key-transposing staff notation – much like for clarinets and trumpets in the scoring of Western common-practice music [339,340] – is a requisite, where every perde countersails an embedded note whose frequency is readily transposed by a change of the Ahenk (e.g., swapping one type of ney for another).

† Through personal correspondence with the author.
Since *perde yegah* is, by default, the fundamental tone with which the diatonic naturals commence, and *Süpürde* the only *Ahenk* which allows the notation of these *perdes* senza accidentals at concert pitch, it is only logical that *Nasır Dede*’s System is notated in conformity with the compass of this *Ahenk* instead of *Bolahenk* as divulged in Figure C.3:

![Diagram of Tiz Perdes](image)

**Figure C.3: Key-Transposing Staff Notation of Nasır Dede’s Natural Perdes Conforming to Concert Pitch in Süpürde Ahenk**

The principal mode in ascending order of *Maqam Rast* would thence be transcribed for all *Ahenks* the way extrapolated in Figure C.4:

![Diagram of Key-Transposing Staff Notation](image)

**Figure C.4: Key-Transposing Staff Notation of the Principal Rast Mode in Ascending Order in Reference to the Concert Pitch**

This notation is not applicable – in any *Ahenk* other than *Süpürde* – to standard diapason instruments of *Maqam* Music such as the *tanbur*, *ud*, *kemençe*, *kanun*, and the like that are devoid of the capability of linear pitch-mapping whilst preserving their particular fingering technique. For these instruments, works must be rescored in reference to the default *Ahenk*, which is henceforth *Süpürde*, as demonstrated in Figure C.5:

---

1 *Astiran* – sounded with all fingerholes open – is at 440 hertz.

2 Microtonal accidentals in parantheses indicate a possible flattening of the 3rd and 7th degrees of the scale as much downward as 56/45 (378.602 cents) and 28/15 (1080.557 cents) respectively.
Figure C.5: Scoring of the Principal Rast Mode in Ascending Order for Key-Transposing vs Standard Diapason Instruments
Conversely, the sounds, at concert pitch, of the Rast scale in ascent may be heard in unison from all Ahenks if the gamut is transposed chromatically unto a perde in each Ahenk that resonates at about 261 hertz, as shown in Figure C.6:

![Figure C.6: In Unison Scoring of the Principal Rast Mode in Ascending Order at Concert Pitch for all Ney Ahenks](image)

The reader must be reminded that this methodology is not yet accepted in Turkish Maqam Music circles.
REFERENCES


[38] *ibid.* p. 30.


[40] *ibid.* p. 216.


[73] ibid. Vol. II.


[240] *ibid*. Vol. II.


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[310] Yekta, R. 1922. *op. cit.* p. 60


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İstanbul Kültür ve Sanat Vakfı. Modern Education & Modern Performance in Turkish Music Symposium (compilation of articles delivered 4-6 July 1988). İstanbul.


Articles & Papers


Dissertations & Graduate Studies


Presentations


Karaosmanoğlu, M. K. 2004. “Türk Musikisi Perdelerini Ölçüm, Analiz ve Test Teknikleri” Presentation to Project for a Piano Capable of Sounding the Traditional Perdes of Turkish Music (delivered 6 May). Faculty of Art & Design, Yıldız Technical University [Türkiye].


Web Sources


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GLOSSARY OF TERMS

Accordance: A measure of the relative degree of concordance/discordance of a musical interval in a single continuum of sensation.

Ahenk: Pitch-height or compass of an instrument such as the Ney; diapason.

Anatolian revolution: The movement between 1919-1938, marked by the military, political, and ideological leadership of Mustafa Kemal Atatürk.

Cent: A unit of measurement, first proposed by Alexander J. Ellis in 1885 in his revised translation of Helmholtz’s Die Lehre von den Tonempfindungen, for determining the relative distance between two distinct pitches. It is defined as the 1200th root of 2, or \(2^{(1/1200)}\), yielding the ratio 1:1.0005777895. It follows that there are 1200 cents to an octave (~1.000578^1200=2). The equation for calculating the cent value of a given frequency ratio is \(\log_2 R \times 1200=\text{cents}\), or \(\log_{10} R \times (1200 / \log_{10} 2)=\text{cents}\). The reverse operation is carried out by the formula \(2^{(\text{cent} / 1200)}\). A hundred cents makes an “equal tempered semitone” (one degree of 12-tone equal temperament), hence the origin of the term. Cents are represented by the “¢” sign.

Edvar (pl. of Devir): cycles; modes/octave species.

Enderun: Palace school founded by Sultan Murad II, where Turkish and Christian boys of high intelligence and special talent were chosen to receive advanced education. The pupils of Enderun could rise to high status and occupy positions in Ottoman military, bureaucracy, and administration. The school began to degenerate during the 18th century, lost its importance during the 19th century, and was abolished entirely in 1908.

Fasl: A Maqam Music concert where it is customary to perform two bestes (or one beste and one kâr) and two semâîs composed in a single maqam. Crudely, a parallel may be drawn between the Turkish Fasıl and Western Suite.

International Diapason: Pitch standard where A is commonly somewhere about or made equal to 440 cycles per second.

Intonation Shift: Shifting of chords due to “comma-pumps” in Just Intonation, hence, pitch drift due to the accumulation of commas.

İka’: Foot; any metrical pattern such as phryric, iamb, trochee, anapaest, or dactyl.
**Just Intonation**: Tuning intervals by simple-integer ratios; any tuning system related to the harmonics of a fundamental frequency.

**Maqam** (pl. *maqamat*): Originally, *maqam* means office, high post; in music, it roughly means scale or key, with strong monophonic implications as to the relationships between scale degrees. Therefore, “melodic context” would be a more suitable definition of *maqam*.

**Maqam Music**: In Türkiye and many Middle Eastern countries including Egypt, Syria, Iraq and Iran, a genre commonly performed on *tanbur, ud, kemençe, violin, ney, rebab, qanun*, etc…, and based on forms that utilize *maqamat*.

**Maqam polyphony**: A speculative model of polyphony based on the embroidery of *maqamat* instead of Western tonality.

**Mehter**: (Persian for “majestic”, “most sublime”) It is the name given to the military music ensemble of the Janissary corps. Historically, *Mehter* was one of the distinguishing regal symbols and a prerequisite for the legitimacy of the Turkish Sultanate. In its heyday, it was common for the *Mehter* to strike *nevbet* (lit. “turn”, “watch”, “sentry duty”; fig. “to perform a stately service”) at regular intervals, ceremonial occasions, and festivities. For this reason, the ensemble was also referred to as *Nevbet*. Aside from rulers, so too did prince heirs, viziers, and landlords of high stature maintain *Mehteran* (pl.). The size of the ensemble depended on rank, where “nine-fold” (the multiple signified how many of each instrument was present) reserved for the Grand Turk only. In the battlefield, three hundred musicians accompanied by steeds and elephants carrying great drums coalesced to form “*Mehterhane-i Hümayûn*” (Imperial Mehter). The ensemble is known to have inspired European composers and motivated them to incorporate Turkish elements into Western orchestras and music.

**Mevlevi**: A follower of *Jalal al-Din Muhammed Rumi*; an adherent of the sufi order founded by Rumi’s acolytes following his death. *Mevlevis* are also known as “The Whirling Dervishes”.

**Microtone**: Any interval smaller than, or deviating from the semitone of 12-tone equal temperament.

**Microtonal Polyphony**: Polyphony based on microtones.

**Middle second**: A variety of melodic intervals peculiar to *Maqam* Music which are loosely 2/3 tone, 3/4 tone, and 4/5 tone.

**Music Reformation**: Trend of westernization in music in Türkiye starting from 1826, with particular emphasis on the period of modernization between 1926-1936.
(n)-limit: For any interval in a Just Intonation system, the mathematical constraint by the highest prime in the factorization of both the numerator and denominator of a given frequency ratio.

Nanotone: An interval so miniscule that its addition to or subtraction from a pitch does not spoil the auditory perception of it.

(n)-tone equal temperament: A tuning system whereby the octave is divided equally to a number of tones, resulting in the vanishing of certain intervals.

Pentatonism: The idea or movement spearheaded by Ahmet Adnan Saygun, claiming that Anatolian Folk melodies are based on the pentatonic scale and that this is an attribute of the Turkish race and culture across the globe.

Perde: Tone, pitch; fret.

Pitch-cluster: A band or range of frequencies in a sound spectrum.

Quarter-tone: Ordinarily, 1/4 tone. However, it has been used to refer to middle seconds of Maqam Music.

Tekke/Dergâh: Place of gathering for, or brotherhood of muslim mystics; Islamic convent.

Terkıb: composition; a composite maqam.

Triadic (Tertian) harmony: Interrelation of chords based on major, minor, augmented, and diminished thirds.

Usûl: bar, measure; rhythm.

Well-temperament: A circulating irregular temperament where simpler keys are made to yield better major and minor chords.

Xenharmony: Harmony based on microtones.
CURRICULUM VITAE

Ozan Yarman was born in Istanbul on 18 April 1978. He was inclined towards music and composition at an early age. During primary school, he received piano lessons at Kadiköy Municipality Conservatory.

Following a successful audition in 1992, he began his formal piano education in Moscow Gnessin State Conservatory.

He concluded the course a year later. Due to circumstances arising from the collapse of the Soviet Union, he returned to Istanbul. He then gained entrance to Mimar Sinan State Conservatory. Here, he continued his piano education under the supervision of Professor Ergican Saydam.

In 1994, having gained admittance, with special permission, to the entrance exam of Brussels Royal Conservatory, he was accepted, at university level, to a 5-year piano course. Here, he studied with Professor Yevgeny Moguilevsky and his wife Professor Olga Roumshevich. At the end of the third academic year, he graduated from this school with high distinction. He also passed the master’s degree entrance exam during the same year.

In 1998, he was admitted to the Composition Principle Art Branch Master’s Programme at Istanbul University Kadikoy State Conservatory.

After successfully defending his master’s thesis entitled “Turkish Art Music and Polyhony”, he graduated from this school in 2001.

In 2003, he was enrolled in the Musicology and Music Theory Doctorate Programme at Istanbul Technical University Turkish Music State Conservatory. He received his PhD degree toward the end of 2007.

Throughout his career, he cultivated himself in the field of piano, composition, and microtonality. He has performed his own piano works in several entrance exams of the aforementioned schools. Aside from compositions for piano and pieces with piano accompaniment, he also wrote works for orchestra that have been performed.

He is a member of Belgium Writers and Artists Association (SABAM). He commands an advanced level of English.
~Updates to the CV

To detail, the author of this dissertation had been accepted in the aforementioned Musicology Doctorate Programme of İTÜ Conservatory as of 2002-2003 Training-Education Fall Semester.

In 2008 (instead of late 2007 owing to inexpedient developments), he successfully defended his thesis titled “79-tone Tuning & Theory For Turkish Maqam Music” and achieved his Doctorate degree with the unanimous decision of the re-organized Jury.

In 2011, he earned the title of “Associate Professor in Musicology and Music Theories” upon the unanimous decision reached by the Academic Evaluation Board gathered in Gazi University, Ankara – consisting of Prof. Dr. Cihat Can, Prof. Dr. Gülper Refiğ, Prof. Dr. Gülçin Yahya Kaçar, Prof. Dr. Yılmaz Şendurur, and Prof. Dr. Sadık Özçelik.

Afterwards, he served as Art Counsellor to the General Secretariat of İşık University between October 2011 – May 2012, and as Science & Art Counsellor to the Rectorate of Başkent University between May 2013 – August 2014.

He is currently enrolled, since 2014, as Associate Professor in the Musicology Department of İstanbul University State Conservatory (his old Kadıköy Municipality school).

Ozan Yarman also plays the qanun, bowed tanbur, and ney as an amateur, and is professionally interested in the theory and practice of Middle Eastern maqam under microtonal polyphony settings aided by computer technologies. Besides his music career and related scholarly pursuits, he partakes, since the past few years, in an intellectual team composed preeminently of Prof. Dr. Tolga Yarman (his father), Prof. Dr. Metin Arık, and Prof. Dr. Alexander Kholmetskii; to the extent that he co-authored with them several pioneering articles on physics and cosmology on account of his recognized comprehension of, and long-standing autodidactic background in, many relevant areas and topics of science.

Kendisini Doktora dersleri sürecinde, özellikle benden aldığı dersler sırasında daha da yakından tanıma imkanı elde ettim. Ozan, gerek eğitim-öğretim süreçte derse katılanları, gerek de derste işlenilen başlıklar üzerinden aktığı tartışmalar ile, hem bana, hem de tüm sınıfın için ve kavramları yeniden ele alıp derlendirilmesi gerektiğini düşündürttü. Hazırladığı ödevlerdeki titiz yaklaşımları, karşıştırmalı veya eleştirel baksı, ayrıca derinlemesine ve detaylı araştırmaları ile, her zaman diğer Doktora öğrencilerinden farklı bir seviye gösterdi.

Tez konusu seçimi ve bunun tamamen bilimsel verilere dayalı kendi önerisi olan bütünsel bir perde sistemi olması kararı; ayrıca bu sistemin Makam müziğinin temel çalgılarından biri olan, benim de çaldığım, Kanun sazına matematiksel kesinlikte yeni bir mandal çakımlarıyla uygulanması düşününtü, hayli dikkat çekiciydi.

Buradan hareketle geliştirildiği çalışmaların Tez Jürisi aşamalarında, İzleme Komitesi’nde yer alan Mutlu Torun ve (daha sonra redir ki Komite′den çekilmiş olan) Ruhi Ayangil ile Süleyman Erguner gibi alanın uzman isimlerinden faydalandığı gibi, onlara oluşturdugu farklı düsünceler zemininde tartışmaları girerek, Tezini kanıtladı.

Ozan ayrıca, metodik ve detaylı yaklaşımları sonucu, Tezinin baş kısmına icra-teori uyumluğunu ve tarihteki Makam müziği teorileri üzerine kapsamlı bir analiz keşçi de ekledi. İstanbul Teknik Üniversitesi Türk Musikisi Devlet Konservatuvarı’na bağlı Müzikoloji Bölümü’nde, Okulumuzun (İTÜ TMDK’sın) kuruluş politikaları doğrultusunda “genel doğru” bellenerek öğretilen Arel-Ezgi-Uzdilek Sisteminde karşılk, Müzikoloji Bölümümüz’ün kurucusu Yalçın Tura’nın kadın teorik önermelere dayalı yeni önerileriyle şekillenen akademik anlayış gereği, bir perde sisteminin benimsenmeden önce sorgulanması büyük önem taşımaktadır. Bu açından, değişik sistem arayışları içerisindeki Birimizin vizyonu ile uyumlu olarak, bilimsel bulgulara dayalı yeni öneriler getiren Tezi ile Ozan Yarman, Müzikoloji
Bölümümüz ilkelerinin yeni kuşaklar tarafından anlaşıldığını ve herhangi bir sistem önerisi kabullenilmeden önce bunu sorgulamanın, tartışmanın ve gerekirse yeni fikirler üretemenin önemini, yaptığını örnek çalışmalar ışığında, vurgulamış oldu.

Ayrıca, bu Tezin İngilizce yazılmış olması, ulusal tartışmaların uluslararası platforma taşınmasında ve yurtdışından gelecek farklı bakış açılarının yerel meselelerin çözümüne yeni boyutlar katmasında köprü vazifesi gözecek düşüncesi deyim.
I met with Ozan Yarman for the first time at the event of his application to the Musicology and Music Theory Doctorate Programme launched under the İTÜ Social Sciences Institute by the 2002-2003 Academic Year. Given his successes and accumulations throughout the course of his learning up until that point, I was truly impressed with his enthusiasm to do a Doctoral study in the field of theory on Maqam music.

I had the oppurtunity to get to know him more closely all through his Doctorate courses, and especially during the lectures he received from me. Ozan made both myself and his whole class think on the need to re-visit and re-evaluate certain subjects and concepts either through his contributions to the lesson for the duration of the training-education period, or by opening up discussions over the topics assessed in class. Compared to the other Doctorate students, he always showed a distinctive level by virtue of the meticulousness he exercised in preparing his assignments, his comparative or critical outlook, and moreover, his thorough and detailed research.

The choice of the subject matter of his Dissertation, and the fact that he decided it to be a comprehensive tone-system of his own proposing based entirely on scientific data – in addition to his idea to implement it on the Qanun, which is one of the cardinal instruments of Maqam music that I also play, using a mathematically rigorous neoteric affixure of mandals, was exceedingly intriguing.

In the stages of the gathering of the Thesis Jury to oversee the work that he developed subsequent to this, not only did Ozan benefit from such expert names in the field who took part in the Examining Committee like Mutlu Torun besides Ruhi Ayangil and Süleyman Erguner (both of who, however, later opted to withdraw from the Committee), but he also affirmed his Thesis after engaging with them in discussions based on various ideas formed at their bequest.

Furthermore, Ozan – as a result of his methodical and thoroughgoing approach – incorporated an exhaustive analytical section at the start of his Thesis with regard to the conflict between theory vs. practice and historical tractates on Maqam music. In the Musicology Department connected to Istanbul Technical University Turkish Music State Conservatory, it is deemed very important to critically investigate a tone-system before adopting
it, and this is in keeping with the academical understanding forged in the light of novel propositions, hinging on ancient theoretical postulates, by our Musicology Department’s founder Yalçın Tura – in contradistinction to the “Arel-Ezgi-Uzdilek” System adhered to and taught as the “generally accepted norm” in accordance with the foundational policies of our school (ITU TMSC). From this perspective, and in conformity with the vision of our Division in search of different (tuning) systems, Ozan Yarman – with his Thesis that brings forward novel suggestions based on scientific findings – has emphasized by example of his works the fact that the principles of our Musicology Department are grasped by younger generations, and that it is of major import, before the acceptance of any particular system proposal, to question it, discuss it, and if necessary, to innovate.

Additionally, I believe the writing of this Dissertation in English will serve as a bridge for carrying over national disputes to the international platform, and for the introduction of new dimensions by miscellaneous viewpoints coming from abroad to the solution of local problems.

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İTÜ Turkish Music State Conservatory
Head of Musicology Department
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http://www.miam.itu.edu.tr
Quodlibet
A

Abbasid
42
ABCD (see: Abjad)
Abjad
42, 45, 47, 48, 49
50, 51, 54, 62, 71
72, 83, 84, 85, 86
125
Abolish (see: Ban)
Abu Ali Al-Husayn (see: Individuals - Ibn Sina)
Abu Nasr Muhammed (see: Individuals - Al-Farabi)
Abu Yusuf Yaqub ibn Ishaq (see: Individuals - Al-Kindi)
Academy/Academia
1, 9, 19, 91
Accidentals
4, 18, 39, 40, 58
72, 107, 118, 145, 184
Accidented (see: Accidentals)
Accordance
41, 55, 63, 83, 133

Acculturated/Accustomed
13, 107, 134, 138
Accurate
4, 87, 89, 92, 122
149
Acem
29, 31, 32, 33, 36
37, 41, 49, 51, 53
56, 57, 58, 63, 64
65, 67, 69, 73, 74
75, 80, 81, 84, 96
97, 98, 118, 156, 177
179, 180, 181, 182, 183
Acemaşırân
36, 37
Acem’li (see: Acem)
Acolytes (see: Disciples)
Acoustic (see also: Electroacoustic)
86, 106, 127, 128, 180
201, 205, 212, 213
Acute (see also: Dik)
97, 182
Adaptation
4, 106, 127, 140
Adequacy (see also: Sufficient) 5, 121
Adherent 18, 136, 144, 223
Adjunct (see also: Leading tone) 63
Adjustment (pitch) 89, 90, 158
Administration(-tor) 19, 137, 154, 222
ADO (arith. div. oct.) 79, 99, 100, 101, 105 106
Adoption 7, 22, 24, 90, 132
Advantage 4, 23, 142
Advocate (theoretical) 13, 43
Aesthetics 148, 151
AEU (see: Arel-Ezgi-Uzdilek (theoretical))
Affix (see: Mandals (instrumental))
Agàze (see also: Leading tone) 63, 64, 65
Ahenk 97, 176, 182, 183, 184 186, 222
Ahteri 183
Bolâhenk 182, 183, 184
Bolâhenk Nisfiye (halved) 182, 183
Bolâhenk-Davut mabeyn 183
Davud 182, 183
Kiz 181, 183
Kiz-Müståhsen mabeyn 183
Mansur 181, 182, 183
Mansur-Kiz mabeyn 183
Mehtabiye 183
Müståhsen 182, 183
Süpürde 97, 182, 183, 184
Süpürde-Yıldız mabeyn 183
Şah 182
Şah-Mansur mabeyn 183
Yıldız 182, 183
Ajam (see: Acem)
Al-Musiqa (see: Music)
Alignment 56, 179
Alla Franca 8, 9, 10, 13, 14 17, 20, 23, 132, 133 136, 146, 148, 150, 151 152
Alla Turca 8, 10, 12, 13, 14 17, 18, 20, 22, 123 124, 133, 136, 137, 138 139, 141, 148, 149, 189 190, 213, 216
Allowance (musical/theoretical) 4, 12, 26, 91, 125 184
Alphabet 10, 12, 42, 132, 145
Alterations (intervallic) 2, 41, 54, 118
Alternate(-ive) 3, 5, 6, 26, 42 53, 94, 106, 128, 141 176
Amalgamation (see also: Merger) 11
Amateur 17, 139
Ambiguity (perde/intervallic) 4, 156, 175
Amount
  2, 41, 120, 164, 168
  172, 180
Anachronistic
  154
Analysis
  2, 6, 9, 26, 27
  30, 42, 44, 124, 146
  158, 187, 196, 197, 199
  210, 211, 215, 216, 219
Anchored (perde)
  26, 125
Ancient
  21, 42, 130, 143, 144
  156, 157, 196, 213
Anecdote
  7, 137, 139
Anniversary
  14, 20, 194, 210, 211
Annulment (see also: Ban)
  14, 148
Antecedent
  144, 148, 156
Anterior (perde/intervallic)
  25
Antiquity
  9, 43, 144, 145, 151
  157, 203, 220
Apertures (instrumental)
  53, 176, 183
Apotome (see also: Mücenneb-i Sağır)
  31, 32, 34, 35, 114
  115, 145, 152, 160, 161
Appendix
  11, 12, 13, 14, 16
  20, 41, 54, 58, 68
  97, 99, 129, 158, 176
Approximation (math)
  4, 38, 39, 76, 79
  86, 95, 96, 99, 100
  103, 104, 105, 106, 127
  152
Arab
  1, 6, 7, 10, 15
  17, 21, 24, 73, 75
  76, 90, 91, 144, 154
  195, 202, 204, 207, 209
  215
Arabesque
  15, 23, 192, 209
Arabic
  10, 12, 15, 16, 22
  24, 42, 43, 45, 62
  63, 66, 73, 74, 75
  89, 91, 92, 117, 124
  125, 130, 132, 144, 154
  193, 195, 198, 199, 210
  212, 213
Arabian (see: Arab - Arabic)
Arak (Irak)
  30, 31, 33, 35, 36
  37, 49, 51, 52, 56
  58, 63, 65, 66, 67
  69, 70, 72, 73, 74
  75, 81, 85, 97, 98
  177, 179, 182, 183
Aralk (interval)
  28, 196, 197, 214, 215
  218
Architect (see: Individuals - Alexander Vallaury)
Archytas comma (see: Sagittal)
Arel (see: Individuals - Hüseyin Sa(a)dettin Arel)
Arel-Ezgi (see: Arel-Ezgi-Uzdilek (theoretical))
Arel-Ezgi-Uzdilek (theoretical)
  2, 3, 7, 15, 18
  19, 20, 23, 29, 31
  32, 33, 34, 35, 37
  38, 39, 40, 41, 49
  83, 84, 85, 86, 90
  124, 125, 132, 156, 158
  159, 160, 161, 162, 163
  164, 165, 166, 167, 168
  169, 170, 171, 172, 173
  174, 188, 197, 198, 212
  214, 217
Arithmetical
  44, 99, 196, 216
Armenian
  44, 45, 62, 70, 130
<table>
<thead>
<tr>
<th><strong>Army</strong></th>
<th>8, 15, 223</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asâkir-i Mansûre</td>
<td>8</td>
</tr>
<tr>
<td><strong>Generals</strong></td>
<td>139</td>
</tr>
<tr>
<td><strong>Janissary</strong></td>
<td>1, 8, 13, 143, 223</td>
</tr>
<tr>
<td><strong>Mehter (Mehterhane)</strong></td>
<td>1, 8, 13, 143, 189, 209, 223</td>
</tr>
<tr>
<td><strong>Military</strong></td>
<td>8, 10, 20, 137, 143, 222, 223</td>
</tr>
<tr>
<td><strong>Musikâ-i Hümâyûn</strong></td>
<td>8, 9, 13, 16</td>
</tr>
<tr>
<td><strong>Arrangement</strong></td>
<td>2, 58, 156</td>
</tr>
<tr>
<td><strong>Array</strong></td>
<td>2, 18, 88, 128</td>
</tr>
<tr>
<td><strong>Art</strong></td>
<td>1, 10, 15, 24, 43, 91, 131, 132, 133, 134, 135, 138, 141, 142, 144, 148, 149, 150, 151, 154, 176, 181, 188, 195, 196, 197, 202, 207, 208, 209, 214, 219</td>
</tr>
<tr>
<td><strong>Article</strong></td>
<td>13, 16, 19, 157</td>
</tr>
<tr>
<td><strong>Artificial (musical/theoretical)</strong></td>
<td>130, 146, 151</td>
</tr>
<tr>
<td><strong>Artin (see: Individuals - Tanburi (Küçük) Harutin)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Artist(ic)</strong></td>
<td>13, 89, 117, 129, 133, 137, 139, 140, 141</td>
</tr>
<tr>
<td><strong>Asar'ül-eslaf (see: Tasnif ve Tespit Heyeti)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ascending (scale)</strong></td>
<td>40, 50, 52, 97, 99, 117, 118, 120, 121, 184, 185, 186</td>
</tr>
<tr>
<td><strong>Ash'ariyya</strong></td>
<td>204, 215</td>
</tr>
<tr>
<td><strong>Asia Minor (see: Places - Anatolia)</strong></td>
<td></td>
</tr>
</tbody>
</table>
Band
  8, 10, 27, 135, 143
  224
Banished (see: Ban)
Bashpâre (see: Embouchure)
Basic
  50, 54, 83, 90, 93
  102, 117, 126, 130, 149
  166, 176
Bass (see: Kaba)
Bati (see: West)
Beat (rate/ratio)
  102, 103, 104
Bey (titular)
  9, 15, 17, 137, 144
  145, 146, 149, 150, 151
  152, 153, 156, 157, 189
  190, 193, 207, 213
Beyâtî (Bayati)
  49, 51, 52, 53, 56
  57, 58, 64, 65, 66
  67, 69, 96, 97, 98
  176, 177, 179
Bike-chain (theoretical)
  92, 126
Bizans (see: Byzantine)
Blowing (instrumental)
  51, 52, 53, 65, 179
  180
Bohlen-Pierce
  30, 197, 220
Borrowing (musical/theoretical)
  39, 92, 130, 131, 144
  157, 176
Boundaries (intervallic)
  26, 28, 125
Bourgeois
  11, 140
Broadcasts (music)
  12, 15, 133, 136
Bureaucracy
  15, 24, 222
Bûsalîk (see: Buselik)
Buzurk
  74
Byzantine
  6, 7, 10, 16, 21
  22, 24, 90, 123, 124
  130, 131, 144, 145, 195
  215

C

Cadence
  63, 64
Cadre (see also: Elite)
  11
Calculation
  3, 15, 28, 42, 44
  152, 222
Calendar (see: Date)
Calibration (see also: Adjustment)
  92, 179, 180
Campaign
  23
Cancellation
  17, 139
Cantemir (see: Individuals - Dimitrie Kantemir)
Cantillations (see also: Forms - Şarkı)
  146, 156
Capability
  5, 6, 87, 128, 150
  184, 196, 219
Capacity (see: Capability)
Catalogue
  55, 56, 57, 90, 107
  120, 189, 219
Categories
  1, 5, 10, 45, 94
  117, 124, 134, 143
Cedîd (new)
  8, 63, 65, 67
Cello (see: Instrument(s) - Violoncello)
Censored (see: Ban)
Cent(s) (intervallic)
27, 28, 29, 30, 31
32, 37, 38, 39, 40
41, 47, 48, 49, 50
55, 62, 66, 67, 73
75, 76, 78, 79, 81
83, 84, 88, 90, 91
93, 94, 95, 96, 99
100, 101, 102, 103, 104
106, 107, 108, 110, 111
112, 113, 114, 115, 116
118, 120, 121, 126, 127
128, 152, 158, 159, 160
162, 163, 164, 166, 168
170, 172, 174, 175, 184
203, 220, 222
Centre
43, 94, 195, 197, 207
220
Century
1, 2, 7, 8, 10
20, 21, 43, 44, 62
68, 72, 73, 133, 134
139, 144, 145, 150, 180
189, 198, 200, 208, 213
222
Chain (of fifths)
34, 35, 39, 40, 42
46, 50, 97, 128
Chaldean
130
Chant (see also: Cantillations)
141, 144, 145
Chapter
6, 7, 25, 26, 28
42, 45, 87, 123, 129
132, 139, 144
Characteristic
1, 3, 6, 25, 117
124, 133
Chart (see: Fingering (instrumental))
Chauvanistic
21
Choir
44
Chords
222, 224
Christian
130, 156, 222
Chromatic
4, 43, 115, 145, 152
186
Chronicles/Chronology
7, 21, 139
Church
44, 130
Cinema (see also: Films)
139
Circa (ca.)
15, 42, 43, 44, 138
141, 156, 191, 192, 194
196, 199, 201, 206, 207
208, 209, 215
Circles (musicians)
4, 83, 122, 127, 186
Circulating
9, 152, 224
City (see also: Metropolitan)
19, 43, 147
Civilization
1, 8, 11, 22, 43
130, 144, 148, 149, 199
203, 211, 215
Class (interval)
62, 175
Classic interval names
31, 32, 34, 35, 46
55
Class (see: Upper class (see also: Elite))
Classical (music)
1, 10, 17, 18, 76
125, 133, 145
Classification
17, 91, 97, 127, 160
Cliché
91, 123
Clue (see also: Hints)
24, 45
Cluster (see also: Pitch-cluster)
26, 95, 96, 98, 125

Collection
144, 187, 188, 189, 190
191, 197, 199, 204, 210
211, 213, 214, 215, 217

Combination
23, 107, 117, 122, 127

Comma
3, 12, 13, 21, 26
29, 35, 38, 39, 40
76, 80, 83, 86, 89
90, 91, 92, 93, 94
101, 102, 104, 105, 106
107, 108, 120, 124, 125
126, 127, 128, 132, 158
160, 166, 167, 182, 222

Commission (Music)
18

Committee (see: Tasnif ve Tespit Heyeti)

Common-practice (Music)
8, 9, 22, 152, 183

Commonwealth (political)
130

Community
1, 134, 154

Comparative (analysis)
5, 6, 42, 44

Comparison
(theoretical/intervallic)
6, 28, 29, 35, 37
40, 49, 83, 84, 85
86, 91, 102, 104, 105
106, 128, 142, 149, 158

Compass (theoretical/intervallic)
66, 87, 176, 181, 184
222

Compatible (theoretical)
3, 93, 107, 126, 127

Compilation (see: Collection)

Complaint (political)
17, 147, 150

Complement(ary)
(theoretical/intervallic)
4, 16, 48, 50, 66
152

Complex/Complicated
22, 26, 55, 125

Complexity
(theoretical/intervallic)
28, 117, 119

Component (ideological)
24, 124

Composer
8, 9, 11, 12, 13
14, 15, 16, 43, 130
132, 133, 134, 150, 157
191, 208, 223

Composite (see also: Terkib)
117, 120, 121, 128, 224

Composition
1, 12, 17, 72, 140
141, 146, 151, 157, 222
224

Comprehensive (theoretical)
41, 83

Compromise (see also:
Revisionism)
24

Computer
2, 5, 6, 26, 27
108

Concatenation (see: Chain (of fifths))

Concept(ualization)
90, 145

Conception (theoretical)
7, 118

Concert
8, 10, 16, 41, 54
102, 129, 135, 148, 176
182, 184, 186, 222

Concordance
222

Conductor
16, 44

Configuration (perde/intervallic)
2, 70

Conflict (theoretical)
3, 5, 6, 21, 25
76, 124
Conformance/Conformity
3, 4, 18, 24, 97
122, 127, 130, 132, 151
182, 184
Congress (Music)
17, 22, 193, 212
Conservatory
7, 10, 13, 14, 15
18, 19, 20, 23, 90
123, 142, 144, 148, 189
218
Consistency (perde/intervallic)
4, 25, 70, 83, 108
Consonance
54, 55, 56, 57, 58
59, 60, 61, 72
Contemporary(-aneous)
5, 6, 11, 44, 66
73, 125, 134, 143, 144
148, 191, 208
Continuance/Continuation
10, 13, 112, 130, 143
144
Continuum (see also: Pitch-cluster)
26, 30, 91, 222
Contribution (theoretical)
3, 44, 93, 144, 204
215
Controversy
7, 15
Convent (Sufi Order)
1, 24, 136, 148, 223
224
Corps (see: Army)
Counterpart (see also: Complement)
11, 39, 53, 54, 107
Counterpoint
11, 134
Country
9, 14, 18, 20, 23
130, 133, 134, 143, 146
147, 148, 149, 151, 154
223
Coup
8, 13, 20
Course (instrumental)
2, 88, 92, 126
Court (imperial)
1, 8, 43, 130, 133
156, 187, 207
Cps (see: Hertz)
Criteria
28, 117, 144
Critic(ism)
30, 75, 144, 147, 157
162
Culture
1, 9, 11, 14, 130
133, 137, 148, 224
Cultural
20, 21, 22, 23, 135
Cumulative (intervallic)
21, 124
Curriculum (music)
20
Custom-built/Cutomized
6, 87
Customary (music/notational)
9, 51, 52, 56, 108
179, 222
Cycle (intervallic)
4, 40, 41, 66, 76
92, 101, 104, 111, 112
114, 115, 116, 126, 222
Cylinder (instrumental)
180
Ç
Çağatay (see: Individuals - Ali Rifat Çağatay)
Çârgâh
27, 29, 30, 31, 32
33, 34, 36, 37, 40
49, 50, 51, 52, 53
56, 57, 58, 63, 64
65, 67, 69, 73, 74
75, 80, 81, 84, 86
95, 97, 98, 156, 177
179, 180, 181, 182, 183
184, 198, 214
D

Dark Ages (of Maqam theory) 44
Dar΄ül-Bedai (House of Innovations) 10
Dar΄ül-Elhan (House of Melodies) 10, 17, 18, 148
Dastgâh 89, 90, 92
Data (base) 27, 28, 30, 87
Date 9, 14, 16, 19, 42 44, 89, 131, 143, 156 157
Debate (see also: Controversy) 2, 154
Debunking 31, 125
Decade 7, 19, 117
Decision (see: Ban) Declaration/Decree 8, 11, 13, 16
Declination (see: Inclination (instrumental)) Decline (see: Degeneracy) Dede Efendi (see: Individuals - Hammâmizâde İsmail) Deg. (see: Degree (scale)) Degeneracy 8, 11, 23, 151, 222 Degree (scale) 4, 6, 28, 29, 35 42, 47, 48, 49, 50 58, 67, 68, 81, 82 84, 85, 86, 87, 93 95, 96, 97, 98, 99 100, 101, 103, 104, 105 106, 107, 108, 126, 127 152, 158, 159, 160, 161 162, 163, 164, 165, 166 167, 168, 169, 170, 171 172, 173, 174, 184, 222 223
Delitescent (see: Obfuscate (perde/intervallic)) Dem (see: Pedal tone) Democratization 23
Demonstration 4, 5, 6, 26, 27 45, 83, 117, 127, 128 145, 184
Denaturalization (see also: Revisionism) 24
Denomination (perde) 25, 63, 64, 70, 79 176
Denominator (math) 28, 99, 152, 224
Department 20, 92
Derailléur (see: Bike-chain (theoretical)) Dergâh (see: Convent (Sufi Order)) Derivation (perde/intervallic) 51, 56, 73, 93, 101 143, 159, 179
Dervishes (see: Mevlana - Mevlevi) Descendant 21, 123, 124
Descending (scale) 52, 63, 118, 120, 121
Design (instrumental/theoretical) 4, 5, 86, 106, 127
Detail (pitch) 28, 44, 54, 78, 87 98, 122, 148, 156, 176
Determine 73, 145, 148, 152, 179 222
Detriment(al) (intonation) 2, 75, 125
Development (ideological/music)  
22, 44, 87, 89, 92  
123, 127, 202, 217  
Deviation (intervallic)  
55, 106, 127, 180, 223  
Device (theoretical)  
6, 128, 182  
Devir (see: Edvar (see also: İm-i Edvâr))  
Devise  
4, 7, 93, 126  
Dialect (see also: Language)  
149  
Diamond-shaped (notes)  
58  
Diapason  
2, 41, 72, 133, 176  
183, 184, 185, 222  
Diatonic  
40, 43, 47, 50, 51  
58, 63, 64, 87, 88  
97, 128, 145, 176, 184  
Dichotomy (ideological/music)  
8, 9, 10, 13, 20  
Diesis (see also: Quarter-tone)  
54, 95, 96, 108, 128  
157  
Difference (intervallic)  
21, 38, 39, 49, 50  
54, 63, 75, 76, 78  
81, 95, 96, 99, 100  
101, 102, 103, 104, 106  
124, 127, 143, 145, 146  
149, 153, 180  
Digital (see also: MIDI)  
158  
Dik (acute)  
31, 32, 33, 36, 37  
41, 49, 73, 75, 80  
81, 83, 84, 85, 86  
95, 96, 97, 98  
Dikçe (slightly acute)  
30, 80, 81, 83, 84  
85, 86  
Dilation (sound)  
180  
Dilârâ  
80, 81, 83, 85  
Dilâviz  
80, 81, 83, 84  
Diminished  
30, 31, 32, 34, 35  
46, 50, 90, 145, 152  
159, 160, 163, 164, 165  
166, 168, 169, 170, 171  
172, 173, 174, 224  
Dinner reception  
15, 139  
Director  
13, 14, 16, 17, 18  
19, 23, 133  
Directorate (see: Presses)  
Disciples  
14, 19, 23, 223  
Discordance  
151, 222  
Discovery (theoretical)  
5, 41, 102, 156, 157  
Discrepancy (see also: Non-conformance)  
2, 30  
Disjunct (tone)  
50  
Dismiss(al)  
17, 79, 83, 122, 156  
Disparity (see also: Schisma)  
50  
Dispatch (directive)  
12, 137, 147, 148  
Disputations (see also: Conflict)  
2, 148  
Dissident (ideological/music)  
10, 14  
Distance (intervallic)  
40, 54, 152, 181, 222  
Distinct (pitch)  
44, 65, 66, 70, 152  
222  
Distinguish(ed)  
1, 8, 21, 63, 89  
91, 118, 124, 154, 223  
Distortion (see also: Revisionism)  
7, 124, 125
Diva (see: Individuals - Munirah al-Mahdiyyah)
Diverse (aesthetic)
92, 130, 157
Division (intervallic)
2, 3, 4, 6, 21
26, 29, 35, 38, 39
41, 43, 45, 55, 66
72, 75, 76, 79, 81
83, 86, 87, 90, 91
92, 93, 97, 99, 102
104, 106, 107, 109, 124
125, 126, 127, 132, 145
156, 157, 179, 198, 206
224
Djami (see: Individuals - Abdurrahman Cami)
Doctor (see: Individuals - Suphi (Zühdü) Ezgi)
Dodecaphony (see also: Twelve)
70
Domestic (see: Nation - National(ist))
Double (intervallic)
35, 40, 41, 88, 107
108, 128, 159, 164, 165
170, 171, 172, 173, 174
Doyens (see also: Savants)
150
Drone (pitch)
34, 63
Dutch
154
Dügâh
27, 29, 30, 31, 33
36, 37, 49, 50, 51
52, 53, 56, 58, 63
65, 66, 67, 69, 80
81, 85, 95, 97, 98
177, 179, 180, 181, 182
183, 184
Düzen-i Muhalif (see: Tone - Tone-system (see also: Tuning))
Dyad (intervallic)
54, 56, 57, 62, 94
158, 174, 175

E

Early
8, 11, 43, 62, 72
73, 107, 123
East
73, 131, 144, 146
Eastern
1, 10, 23, 24, 76
131, 143, 154, 156, 223
Easterners
145, 146
Eclectic (see also: Fusion)
2
Eclysis (intervallic)
26
EDO (eq. div. oct.)
67, 68, 81, 84, 85
86, 90, 91, 92, 105
106
Education
7, 8, 10, 12, 14
16, 19, 20, 23, 35
125, 142, 148, 149, 150
222
Edvar (see also: İlm-i Edvâr)
1, 44, 190, 198, 199
200, 206, 209, 219, 222
Effect
17, 139, 151, 152, 176
Effect(ive) (in force)
2, 3, 5, 6, 12
14, 20, 24, 25, 26
28, 30, 42, 92, 123
132, 149
Effort (ideological)
9, 13, 14, 19, 24
26, 125, 142
Egyptian
75, 76, 91, 139
Eksik (see: Diminished)
Electroacoustic
3, 25, 109, 124, 162
Elegant (see also: Refined)
1, 72, 92
Elementary (see also: Rudimentary)  
91, 146
Elements (music/notational)  
107, 130, 223
Elevation (musical/theoretical)  
7, 151
Elite (political)  
6, 10, 11
Ellis (see: Individuals - Alexander J. Ellis)
Eloquent (see also: Refined)  
150
Elusive (pitch)  
26, 45
Emancipation (see also: Independence)  
72, 129
Embodiment (theoretical/intervallic)  
3, 37, 76, 82, 86  
125, 146, 158
Embouchure  
51, 177, 181
Embrace (musical/theoretical)  
20, 21, 83, 90, 92  
123, 136
Embroidery (aesthetic)  
135, 144, 223
Emigration (see also: Urbanization)  
15, 23, 148
Emphasis (ideological/music)  
10, 181, 223
Empire (see also: Imperial)  
7, 8, 9, 21, 157
Empirical (see also: Experimentation)  
5, 26, 181
Employment (theoretical)  
4, 5, 6, 9, 50  
79, 93, 106, 119, 126  
145, 156, 162
Emulation (see: Imitation (aesthetic))

Encapsulate/Encompass (intonation)  
5, 26, 42

Encyclopedia  
144, 189, 192, 195, 196  
199, 201, 202, 203, 204  
207, 208, 209, 210, 211  
212, 214, 215, 217, 220  
221
Encyclopædist (see: Individuals - Bedr-i Dilşad)
End Correction (instrumental/theoretical)  
180, 205, 212
Endeavours  
2, 6, 13, 21, 87  
124
Enderun (institutional)  
1, 9, 137, 222
Energy (sound)  
180
Enhancement (microtonal)  
3, 93, 126
Enharmonic  
21, 43, 58, 72
Enlightenment  
148, 151
Enrichment (see: Enhancement (microtonal))
Ensemble  
1, 2, 8, 11, 17  
129, 130, 137, 139, 141  
143, 148, 151, 223
Enthusiasm (ideological)  
83, 139
Entity (national)  
21, 123
Enumerate  
5, 182
Enunciation (see: Dispatch (directive))
Epic (see: Poem)
Epimoric (see: Superparticular (math))
Epithets (see also: Names)  
18
Epoch (see: Era)
**Equal (intervallic)**

2, 3, 4, 6, 9
12, 15, 21, 24, 26
28, 29, 35, 37, 38
39, 41, 45, 50, 55
66, 72, 75, 76, 79
81, 82, 83, 86, 87
90, 91, 92, 93, 99
102, 104, 105, 106, 107
108, 109, 121, 123, 124
125, 126, 127, 145, 152
157, 158, 179, 222, 223
224

*Equal Temperament*

3, 9, 15, 28, 37
50, 76, 82, 83, 86
93, 107, 125, 126, 151
152, 222, 223, 224

*Equalling (intervallic)*

39, 107, 108, 115, 118
127, 128, 159, 160, 162
163, 164, 166, 168, 170
172, 174

*Equate (intervallic)*

9, 112, 146, 152, 222

*Equidistant (intervallic)*

13, 131

**Equivalences (oct.)**

2, 54, 58, 64, 66
92, 126, 180

*Equivalents (intervallic)*

39, 152

Equivocal (see: Ambiguity (perde/intervallic))

Era

8, 44, 143, 145, 151
156

Error (intervallic)

28, 29, 30, 39, 76
79, 81, 96, 102, 115
127, 157

Erudite (see: Scholar)

Eschew (see: Obfuscate (perde/intervallic))

**Ethnic**

134, 154

**Ethnocentric**

21, 22, 124

Euelogy (see: Poem)

**European**

8, 9, 11, 13, 23
130, 141, 143, 144, 152
204, 206, 223

**Eurocentric**

117

Evc/Eviç

30, 32, 33, 36, 50
53, 56, 57, 58, 64
65, 69, 70, 72, 74
80, 81, 96, 98, 118
177, 179, 182, 184

Evidence (theoretical)

2, 156, 157

Examination (theoretical)

6, 106, 132, 144, 149

Examples (musical/theoretical)

120, 121, 133, 137, 148
154

Excerpt (see also: Quote)

131, 135, 142, 144

**Execution (music)**

2, 4, 6, 26, 30
55, 123, 128, 133, 137

*Executants (music)*

1, 30, 41, 75, 86
156

Executive (see: Director)

Existence (musical)

2, 22, 30, 48, 50
66, 125, 134, 145, 148
149, 151, 156

Expatriate

154

Expedition (musical)

16, 147

Experience (music)

5, 18

Experimentation (musical)

5, 158

Expert (see: Individuals - Margo Schulter)

Explanations (theoretical)

3, 4, 13, 31, 42
45, 54, 62, 92, 127
139, 149, 156
Exponents (see: Execution (music) - Executants (music))

**Expression (intervallic)**
- 5, 25, 30, 39, 47
- 108, 115, 127, 128, 159
- 160, 163, 164, 166, 168
- 170, 172, 174, 179

*Expressiveness (musical)*
- 4, 6, 25, 87, 91
- 106, 128, 139, 151

Expulsion (see: Ban)

Extant (works)
- 64, 145

**Extension (intervallic)**
- 42, 79, 168

*Extended (theoretical)*
- 32, 45, 47, 70, 166

Extra (pitch)
- 94, 145

Extraction (theoretical)
- 4, 6, 77, 115

Eyüp Musiki Derneği (Music Society)
- 10

F

Fabian (political)
- 23

Facilitate (ideological/music)
- 4, 24, 28, 127

Factions (ideological)
- 9, 19

Factorization (math)
- 28, 152, 224

Fahrettin Dede (see: Individuals - Hüseyin Fahrettin Dede Efendi)

Fait accompli (see: Ban)

Faithful (musical/theoretical)
- 4, 14, 40, 91, 92

False (see: Falsifying (ideological))

Falsifying (ideological)
- 7, 124, 143

Familiar
- 15, 30, 92, 130

Famous
- 3, 15, 43, 44, 87
- 133, 138, 144, 151

Farey sequence (math)
- 99

Fashion
- 8, 51, 120, 144, 150

**Fas(i)l**
- 8, 137, 139, 141, 222

*Fasl-i atik*
- 8

*Fasl-i cedid*
- 8

Fault (aesthetic)
- 102, 129, 151, 157

Favour(able)
- 6, 10, 12, 18, 148
- 150

Feature (musical/theoretical)
- 1, 6, 10, 15, 21
- 40, 88, 115, 123, 124
- 143, 149, 176

Federation (Turkish Music)
- 17

Ferahfezâ
- 150, 154

Ferahânâk
- 154

Festivity
- 10, 223

Fiasco (music)
- 18

Field (music)
- 21, 130, 148, 149

Fifth (intervallic)
- 34, 35, 39, 40, 42
- 46, 50, 51, 52, 53
- 55, 56, 57, 58, 59
- 66, 76, 94, 97, 101
- 102, 103, 104, 108, 115
- 116, 120, 126, 128, 164
- 168, 170, 171, 172, 173
- 174, 176, 177, 179

Figure(s) (people)
- 13, 17, 43
Films (see also: Broadcasts)
  15
Fine Arts Council
  10, 147
Fine-tuners
  88, 89
Finesse (see: Embroidery (aesthetic))
Fingerhole (see also: Apertures)
  51, 52, 53, 58, 176
  177, 179, 180, 181, 184
Fingering (instrumental)
  25, 53, 54, 58, 68
  176, 178, 184
Fixed-pitch
  72, 91, 151, 183
Flat (accidental)
  4, 40, 58, 72, 79
  83, 97, 107, 108, 120
  122, 127, 145, 184
Flattened (see: Flat (accidental))
Flavour (intonation)
  2, 90, 137
Flawed (see: Fault (aesthetic))
Flexible (intonation)
  26, 45, 58, 70, 91
  125
Florid (see also: Ornamentation)
  26
Folk (lore)
  7, 10, 11, 13, 15
  16, 20, 22, 90, 130
  131, 132, 135, 137, 138
  143, 144, 145, 146, 224
Follower (see: Disciples)
Foot (poetic)
  222
  Anapaest
    222
  Dactyl
    222
  Iamb
    222
  Iamb
    222
  Phryric
    222
  Trochee
    222
Foreign(er)
  11, 18, 145, 148, 153
  154, 156
Forge (see also: Inception)
  1, 151
Formation
  (institutional/theoretical)
    13, 27
Forms (music)
  1, 7, 9, 22, 130
  134, 151, 223
Ayre
  7, 15, 16, 22, 137
  138, 141
Beste
  1, 222
Concerto
  134
Dance
  20, 129
Gazel
  1, 202
Hymn
  44, 144
ILâhî
  1
Kîr
  1, 150, 222
Lied
  134
March
  8, 16
Mevlid
  1
Murabba
  150
Nevbet
  223
Nocturne
  150
N’at
  1
Opera
  13, 17, 18, 130, 133
  135, 193, 218
Peşrev
  1, 9
(Forms continued)

Revue  
18

Semâî  
1, 9, 140, 222

Sonata  
133, 134

Song  
145, 202, 208

Symphony  
133, 134

Şarkî  
1, 9, 137, 140, 144  
146, 202

Taksim  
27, 29

Türkü  
137, 138

Yörük Semâî  
140

Formula (math)  
152, 222

Formulation  
117, 128

Fortepiano (see: Instrument(s) - Piano)

Foundation  
1, 5, 8, 10, 13  
14, 16, 17, 19, 21  
92, 123, 126, 133, 143  
144, 151, 222, 223

Fourth (intervalllic)  
21, 34, 35, 46, 50  
51, 52, 53, 55, 56  
57, 58, 59, 63, 91  
93, 104, 105, 106, 120  
124, 130, 145, 157, 162  
164, 165, 168, 169, 170  
171, 176, 179

Fourth tones (see also: Quarter-tone)  
145, 157, 162

Fraction (see also: Ratio)  
30, 99

Fracture (see also: Conflict)  
21

Framework (intonation)

24, 55

Franco-/Frankish/French  
9, 148, 151

Frequency  
3, 26, 27, 28, 29  
31, 32, 34, 35, 39  
46, 66, 72, 73, 75  
81, 102, 103, 104, 105  
106, 152, 158, 181, 182  
183, 222, 223, 224

Fret  
2, 54, 66, 68, 83  
99, 125, 156, 157, 224

Friend(s)  
17, 135, 137

Function  
(institutional/theoretical)  
8, 10, 14, 28

Fundamental (tone)  
55, 91, 184, 223

Fusion (see also: Eclectic)  
2

Futile (ideological)  
149, 152

Future  
4, 6, 9, 87, 122  
138, 144, 149

G

G-clef  
176

Galophile (see: Franco-/Frankish/French)

Gamut (see also: Compass)  
47, 186

Gap (intervalllic)  
94, 126

Gateway (theoretical)  
4, 122

Gazette  
11, 137, 157, 191, 192  
193, 195, 203, 208, 211

Gazi/Ghazi (titular) (see: Individuals - Atatürk)

Genera (see: Genus)
Generation (people)  
10, 137, 138, 139, 150  
151, 181  
Generation (theoretical)  
6, 34, 35  
*Generator (intervallic)*  
41, 42, 93, 126, 159  
Genesis (of a Music, see also: Partch)  
43, 195, 199, 209  
Genius  
154  
Genre (musical)  
1, 2, 4, 6, 10  
11, 14, 15, 16, 18  
21, 24, 25, 26, 43  
122, 124, 223  
Genuine (ideological/music)  
15, 54, 133  
Genus  
21, 92, 152  
Geometric(-er)  
28, 42  
Gerdâniye  
29, 30, 32, 33, 36  
50, 53, 56, 57, 58  
64, 65, 69, 80, 81  
96, 98, 177, 179, 180  
182, 184  
German  
11, 19, 144, 154  
Gestalt (perde)  
62, 66  
Gevâşt  
31, 33, 36, 37, 41  
49, 52, 56, 58, 63  
65, 66, 67, 70, 72  
73, 74, 75, 81, 85  
97, 98, 177, 179  
Giaour (see also: Foreign(er))  
9  
Glissandi  
26, 125  
Globe (see also: World)  
134, 224  
Goal (institutional/theoretical)  
4, 5, 24  
Government  
20, 23  
*Governor*  
18, 139  
Gökalp (see: Individuals - Ziyâ Gökalp)  
Graphical (see: Output (data))  
Great-limma (see also: Mujannab)  
30  
Greek  
42, 43, 92, 130, 144  
145, 157, 198, 204, 212  
Gregorian  
44, 156  
Grid (theoretical)  
83  
Group (music)  
123, 133, 139  
Guide (theoretical)  
42, 91  
Gülzar  
80, 81, 83, 84  

**H**

Habit (musical/theoretical)  
32, 125, 142, 154  
**Half (intervallic)**  
52, 53, 58, 61, 67  
76, 90, 106, 127, 130  
145, 146, 176, 180, 181  
182  
Half tones (see also: Semitone)  
61, 130, 145, 146  
Half-arrow (see: Sagittal)  
Hanende (see: Individuals - Hâfiz Post)  
Harmonic(s)  
25, 26, 54, 55, 125  
176, 179, 223  
Harmony  
2, 11, 21, 22, 55  
115, 123, 124, 130, 134  
140, 224
<table>
<thead>
<tr>
<th>Term</th>
<th>Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Havoc (intonation)</td>
<td>92, 126</td>
</tr>
<tr>
<td>Hear(ing)</td>
<td>5, 10, 102, 129, 131, 133, 134, 135, 140, 141, 143, 186</td>
</tr>
<tr>
<td>Hegira</td>
<td>1, 144</td>
</tr>
<tr>
<td>Hellenes (see: Greek)</td>
<td></td>
</tr>
<tr>
<td>Hemi-Neys (see: Ahenk)</td>
<td></td>
</tr>
<tr>
<td>Hemiolic</td>
<td>42</td>
</tr>
<tr>
<td>Heritage</td>
<td>14, 19, 20, 23, 124</td>
</tr>
<tr>
<td>Hertz</td>
<td>27, 29, 32, 103, 104, 182, 183, 184, 186</td>
</tr>
<tr>
<td>Heterodox (theoretical)</td>
<td>15</td>
</tr>
<tr>
<td>Heterogeneous (aesthetic)</td>
<td>24</td>
</tr>
<tr>
<td>Hiatus (see also: Interim)</td>
<td>10</td>
</tr>
<tr>
<td>Hicâz</td>
<td>31, 32, 33, 36, 37, 41, 49, 51, 52, 53, 56, 57, 58, 64, 65, 66, 67, 73, 74, 75, 80, 81, 84, 95, 97, 98, 120, 156, 177, 179, 180, 181, 183</td>
</tr>
<tr>
<td>Hicâzî segâh</td>
<td>95, 98</td>
</tr>
<tr>
<td>High (intonation)</td>
<td>18, 50, 51, 64, 65, 66, 72, 121, 132, 176</td>
</tr>
<tr>
<td>Higher (see: High (intonation))</td>
<td></td>
</tr>
<tr>
<td>Hijâz (see: Hicâz)</td>
<td></td>
</tr>
<tr>
<td>Hindustani</td>
<td>89, 143</td>
</tr>
<tr>
<td>Hints (see also: Clue)</td>
<td>63, 64, 117, 125, 156</td>
</tr>
<tr>
<td>Histogram</td>
<td>27</td>
</tr>
<tr>
<td>History</td>
<td>42, 64, 133, 143, 144</td>
</tr>
<tr>
<td>Historian</td>
<td>19, 144, 157</td>
</tr>
<tr>
<td>Historical</td>
<td>5, 6, 7, 8, 26, 28, 42, 43, 44, 90, 91, 97, 117, 123, 125, 127, 142, 143, 145, 157, 223</td>
</tr>
<tr>
<td>Hisâr</td>
<td>31, 32, 33, 36, 37, 41, 49, 51, 52, 53, 56, 57, 58, 64, 65, 66, 67, 73, 74, 75, 80, 81, 84, 95, 97, 98, 120, 156, 177, 179, 183</td>
</tr>
<tr>
<td>Hisârek</td>
<td>80, 81, 84, 96, 98</td>
</tr>
<tr>
<td>Holderian (see: Comma)</td>
<td></td>
</tr>
<tr>
<td>Hole (see: Fingerhole (see also: Apertures))</td>
<td></td>
</tr>
<tr>
<td>Hotel</td>
<td>139, 151, 203, 220</td>
</tr>
<tr>
<td>House (institutional)</td>
<td>1, 8, 10, 17</td>
</tr>
<tr>
<td>Hubristic</td>
<td>12</td>
</tr>
<tr>
<td>Hue (intonation)</td>
<td>26, 125</td>
</tr>
<tr>
<td>Human(ity)</td>
<td>144</td>
</tr>
<tr>
<td>Hûmâyûn (see: Imperial)</td>
<td></td>
</tr>
<tr>
<td>Hüseyni</td>
<td>29, 30, 31, 32, 33, 36, 37, 41, 49, 50, 53, 54, 56, 57, 58, 64, 65, 66, 67, 69, 74, 80, 81, 84, 96, 98, 120, 156, 176, 177, 179, 182, 184</td>
</tr>
<tr>
<td>Hüzzam</td>
<td>30, 96, 98, 120, 121</td>
</tr>
<tr>
<td>Hz. (see: Hertz)</td>
<td></td>
</tr>
</tbody>
</table>
Idea
22, 91, 123, 130, 133
143, 150, 151, 224

Ideology
11, 16, 21, 22, 24
26, 90, 123, 222

Ideal
13, 90, 91, 107, 127

Identical (theoretical)
66, 90

Identity (ideological)
21, 149

Idiom
40, 135

Idiosyncracy
22

Illicit (intonation)
26, 125

Illustration
26, 125

Imitation (aesthetic)
8, 13, 22, 149

Imperative (musical)
43, 133

Imperial
1, 8, 9, 11, 13
16, 223

Import (aesthetic)
2, 8, 9, 11, 43
92, 126, 144

Important
17, 28, 55, 109, 123
128, 139, 143, 157, 222

Impossible
54, 102, 121, 140, 143
182

Impracticable (intonation)
6

Improvisation (see also: Forms - Taksim)
15, 27, 117

Inadequate (intonation)
26, 130

Inaudible
96

Inception
(theoretical/intervallic)
11, 54

Incident (political)
129, 133, 148

Inclination (instrumental)
51, 65, 180

Incompatible (intonation)
2

Incorporate
(institutional/theoretical)
14, 20, 127, 223

Increment (intervallic)
28, 90

Independence
9, 16

Indigenous (see also: Native)
11, 21, 123, 155

Indispensable (intonation)
6, 21, 41, 124, 125

Individuals
44, 145, 151, 156
Abdulhamid II
16

Abdulkadir Meragi
43, 63, 145, 154, 199
206

Abdulkadir Töre
19

Abdurrahman Cami
43, 199, 207

Abdülbâki Nâsr Dede
44, 45, 47, 48, 50
51, 54, 55, 56, 57
58, 59, 60, 61, 62
63, 65, 66, 72, 176
177, 179, 180, 184, 200
201, 208, 218

Abdülmecid I
137

Adnan Saygun
12, 15, 132, 192, 209
224

Ahmet Irsoy (Hâfiz)
17
(Individuals continued)

Al-Farabi
43, 108, 128, 130, 144
145, 154, 204, 211, 214

Al-Kindi
42, 43, 198, 204, 214
219

Albert Lavignac
144

Alexander J. Ellis
152, 196, 199, 201, 203
207, 222

Alexander Vallaury
151

Ali Jihad Racy
91

Ali Rıfat Çağatay
17, 151, 190, 215

Amin ad-Dik
75, 76

Aristides Quintilianus
26, 157

Aristoxenus
144

Âşık Ömer
145

Atatürk
10, 11, 12, 13, 14
15, 23, 25, 129, 131
135, 137, 138, 139, 140
141, 190, 192, 193, 194
202, 203, 206, 208, 209
210, 211, 214, 216, 218
222

Ataullah Dede Efendi
17, 156

Baruch Spinoza
154

Bedr-i Dilşad
156

Buhurızâde Mustafa İtirî
133, 145

Béla Bartók
192, 193, 206, 211, 216
217

Callisto Guatelli
8

Can Akkoç
25, 26, 28, 30, 180

188, 196, 219

Carl Ebert
18

Celâlettin Dede Efendi
17, 156

Cemal Reşit Rey
12, 18, 133, 191, 211

Claude Debussy
133

David Keenan
106, 107, 127, 202, 216

Dellâlzâde Ismail Dede Efendi
140, 150

Dimitrie Cantemir
44, 45, 62, 63, 64
65, 66, 67, 68, 69
72, 125, 200, 201, 208
219

Ejder Güleç
87, 88

Ekrem Karadeniz
19, 44, 45, 195, 202
208

Emil Ludwig
11, 131

Emin Efendi
9, 190, 215

Emin Yazıcı
181

Ernst Praetorius
18

Ervin Wilson
93, 126, 202, 217, 219

Euclid
144

François-Joseph Fétis
157, 204, 221

Frederick Chopin
133, 150

Gabriel Fauré
133

Gene Ward Smith
93

George Secor
106, 107, 127, 202, 216

Giacomo Puccini
139

Giambattista Toderini
156
(Individuals continued)

Guiseppe Donizetti
8

Gökhan Özkök
180, 183

Gönül Paçacı
157

Gültêkin Oransay
19, 44, 45, 76, 77
78, 79, 83, 84, 85
86, 125, 187, 190, 192
193, 194, 195, 203, 208
213, 214, 215

Hammâmîzâde Îsmaîl
150

Hâmpar(t)sum Limonciyan
44, 45, 62, 70, 72
125, 189, 201, 202, 214
218, 219

Harry Partch
43, 195, 199, 209, 220
221

Hasan Ferit Alnar
12

Haşim Bey
9, 189, 190, 213

Henri Hippolyte Decugis
151

Hermann von Helmholtz
152, 196, 199, 201, 203
207, 222

Hâfîz Post
133, 145

Hâzîm Körmükçü
139

Hüseyin Fahrettin Dede Efendi
17

Hüseyin Sâ(a)dettin Arel
14, 15, 17, 18, 19
20, 22, 23, 24, 44
154, 156, 188, 194, 206
211

Hzîr bin Abdullah
199, 219

Immanuel Kant
154

Isaac Newton
154

İbn Sina
43, 154, 196, 199, 204
207, 214, 215

İsmâîl Hakkî Bey
17

J.S. Bach
133

Jalal al-din Muhammed Rumi
223

Jean Racine
150

Jean-Baptiste Poquelin
140

John Chalmers
198, 199, 202, 206, 219

Karl Signell
30, 197, 209

Karl Wilhelm Julius Hugo

Riemann
144

Kemal Küçük
140

L. v. Beethoven
133

M. Uğur Keçecioğlu
88

Mahmud II
8, 9

Manuel op de Coul
158, 197, 204, 220

Margo Schulter
89, 93, 126

Max Reinhardt
18

Mehmed IV
133

Mehmet Yücel
176

Mikha’il Mishaqa
22, 44, 45, 73, 75
76

Mildan Niyazi Ayomak
13, 136

Muhittin Üştündağ
17, 18, 139

Munirah al-Mahdiyyah
10, 129

Murad II
156, 222
(Individuals continued)

Mustafa Kemal Karaosmanoğlu
25, 26, 27, 28, 30
188, 196, 219

Necdet Yaşar
30

Necil Kâzım Akses
12

Nedim
145, 150

Nicomachus
144

Niyazi Saym
27, 29

Nuri Conker
137

Osman Dede (Kutb-i Nâyi)
44, 45, 62, 63, 64
65, 66, 67, 68, 72
125, 201, 208

Osman Zeki Üngör
16, 148, 150, 151, 152
194, 210, 211

Paul Hindemith
18

Ptolemaeus
144, 152

Pythagoras
42, 144

Rauf Yekta
15, 16, 17, 18, 20
22, 23, 24, 34, 35
36, 37, 38, 39, 40
41, 44, 45, 64, 73
83, 84, 85, 86, 124
125, 143, 144, 145, 147
148, 149, 150, 151, 152
156, 157, 158, 159, 160
161, 162, 163, 164, 165
166, 167, 168, 169, 170
171, 172, 173, 174, 181
182, 193, 195, 197, 200
201, 203, 204, 205, 207
209, 218

Richard Wagner
133

Ruhi Ayangil
183

Sadi Yaver Ataman
13, 17, 137, 138, 139
141, 192, 194, 205, 206
220

Safi ad-din Abdulmu’min Urmavi
42, 43, 45, 46, 47
48, 50, 55, 72, 154
198, 199, 209, 211, 212

Salih Murat Uzdilek
15, 18, 23

Scott Marcus
91

Selim III
143, 156

Shaahin Mohajeri
99

Suphi (Zühdü) Ezgi
15, 17, 18, 20, 22
23, 24, 32, 44, 156
157, 194, 195, 197, 207

Süleyman Cevad
20, 150, 151

Süleyman Erguner
180, 182, 193, 194, 195
201, 204, 205, 207

Tamburacı Osman Pehlivan
137

Tanburi (Küçük) Harutin
44, 45, 62, 70, 72
200, 208

Timur (the Lame)
1, 43

Ulvi Cemal Erkin
12

Vasfi Rıza Zobu
139, 140, 141

W. A. Mozart
133, 150

Yahyâ Kemâl Beyatlı
153

Yalçın Tura
26, 41, 156, 188, 191
192, 193, 194, 196, 198
200, 201, 208, 217

Yunus Emre
145

Yunus Nadi Abaloğlu
137
(Individuals continued)

Yılmaz Kale
180, 181

Ziya Gökalp
11, 16, 22, 24, 25
123, 130, 143, 144, 145
146, 190, 191, 193, 207
211, 218

Industrialization
11, 15

Inextricable (ideological)
24, 124

Infer (theoretical)
66, 72, 156

Inflection (perde)
3, 68, 90, 121

Influence (musical/theoretical)
15, 16, 19, 43, 130
154, 156, 195, 199, 203
211, 213

Information
42, 54, 108, 126, 139
176

Innovation
10, 14, 19, 88, 150
151

Input (data)
28, 88, 99

Insertion (see also: Intermedial)
54, 77

Installation (musical/theoretical)
2, 148, 154

Instances (see also: Occurrence)
78, 79, 82, 83, 110
111, 112, 113, 114, 115
159, 160, 162, 163, 164
166, 168, 170, 172, 174

Institution
1, 7, 13, 14, 23
83, 130, 148, 149

Instruction (musical)
10, 17, 88

Instructors (see also: Teachers)
14, 72

Instrument(s)
1, 2, 5, 7, 8
10, 14, 19, 27, 41
43, 54, 75, 86, 87
89, 91, 92, 106, 117
125, 126, 127, 128, 133
141, 142, 151, 153, 176
180, 181, 184, 185, 205
206, 222, 223

Bendir
1

Boru
143

Bowed Strings
1

Clarinet
1, 134, 183

Daire
1

Darbuka
1

Davul
143

Def
1

Drums
223

Flute
134

Guitar
2

Harmonium
151

Horn
134

Kemençe
1, 184, 223

Keyboard
91, 92, 197, 209

Nakkâre
143

Ney/Nay
1, 15, 27, 29, 44
51, 52, 54, 55, 56
58, 63, 65, 176, 177
178, 179, 180, 181, 182
183, 186, 201, 204, 205
207, 208, 219, 220, 222
223

Piano
2, 15, 134, 148, 153
196, 219
(Instruments continued)

Plectrum Strings

1

Qanun
1, 2, 3, 4, 5
6, 19, 86, 87, 88
89, 91, 92, 93, 126
127, 183, 184, 188, 202
219, 220, 223

Qudūm
1

Rebab
1, 223

Santur
1

Saz
137

Tanbur
1, 2, 15, 30, 44
54, 63, 66, 68, 69
83, 125, 133, 151, 156
157, 184, 198, 200, 208
217, 223

Trumpet
183

Ud
1, 25, 42, 184, 197
214, 223

Viola
53

Viola d’amore
53

Violin
1, 13, 15, 16, 134
150, 223

Violoncello
134, 151

Woodwinds
1

Zithers
1

Zurna
143

Insufflation (see: Blowing (instrumental))

Integration (institutional theoretical)
4, 10, 28, 122

Intellect(ual)
14, 154, 222

Intelligentsia (see also: Elite)
16, 18, 23, 123

Interim (see also: Hiatus)
18

Intermedial (pitch)
54

International
2, 4, 35, 122, 134
141, 222

Interval
3, 6, 11, 12, 21
25, 26, 28, 29, 30
31, 32, 33, 34, 35
36, 39, 40, 41, 46
47, 48, 50, 54, 55
56, 57, 62, 67, 73
74, 75, 78, 90, 91
92, 99, 100, 102, 103
104, 110, 112, 114, 115
122, 123, 124, 125, 127
128, 146, 152, 153, 156
157, 158, 159, 160, 162
163, 164, 166, 168, 170
172, 174, 175, 180, 222
223, 224

Interview
11, 20, 131, 150, 191
211

Intonation
2, 3, 43, 55, 87
89, 90, 91, 92, 121
152, 158, 201, 202, 213
217, 222, 223, 224

Invalid (ideological)
141, 145, 154

Invasion (see also:
Metamorphosis)
146, 154

Invention (see also: Innovation)
64, 154

Inversion (intervallic)
55, 62, 114, 115, 159
160, 162, 163, 164, 166
168, 170, 172, 174, 175
Investigation
(musical/theoretical)
10, 42, 45, 83, 143
145, 147, 181
Iranian (see: Persian)
Irregular (intervalllic)
66, 83, 224
Isfahan
140
Islam(ic)
1, 22, 25, 43, 89
144, 154, 193, 195, 196
198, 203, 204, 207, 210
212, 213, 214, 215, 224
Issue (see: Publication)
Issues (musical/theoretical)
3, 4, 5, 7, 83
126
Isthmus (instrumental)
180, 181
Itri (see: Individuals -
Buhurizâde Mustafa Itri)

I

İka' (rhythmic)
1, 222
İlm-i Edvâr (treatises on modes)
44, 144, 199, 200, 206
209, 219
İmam (titular)
138
İrhâ (see: Diesis (see also:
Quarter-tone))

J

Jacobin
22
Jazz
10
Jesuit (see: Christian)
Jewish
130

Journal
16, 19, 137, 193, 194
195, 196, 202, 205, 210
211, 212, 214, 216, 218
Journey (see: Expedition
(musical))
Julian (see also: Date)
156
Jummel (see: Abjad)
Just Intonation
3, 6, 29, 43, 78
87, 95, 96, 104, 107
127, 152, 158, 162, 182
222, 223, 224
Justify (ideological/music)
5, 10, 137, 147
Juveniles (see: Young/Youth)
Juxtaposition (intervalllic)
34, 132
JI (see: Just Intonation)

K

Kaba
31, 33, 34, 36, 37
40, 41, 49, 50, 51
52, 56, 58, 66, 73
74, 75, 81, 84, 97
98, 176, 177, 179, 183
Kant (see: Individuals -
Immanuel Kant)
Kanun (see: Instrument(s) -
Qanun)
Karadeniz (see: Individuals -
Ekrem Karadeniz)
Karşıgar
156
Kemalist
90, 92, 190, 212
Key (musical/theoretical)
4, 9, 41, 58, 72
76, 115, 120, 176, 178
183, 184, 185, 223, 224
Kinds (intervalllic)
86, 90, 102, 110, 111
Kiosk (see also: Mansion) 139, 141
Knowledge (musical/theoretical)  11, 117, 134, 141, 143  144, 148, 150, 152, 156  157
Kommali sesler (see: Comma)  
Koron (accidental) 90
Kurdish 89
Kütb-i Nâyî (titular) 44
Kürdî 31, 33, 36, 37, 41  49, 51, 52, 53, 54  56, 58, 63, 65, 66  67, 73, 74, 75, 80  81, 83, 85, 95, 97  98, 120, 121, 156, 177  179, 180, 181, 183
Küçük Asya/Anadolu (see: Places-Anatolia)

L

Label (musical)  8, 47, 154
Landlord (titular)  223
Language/Lexicon  15, 43, 44, 132, 144  149, 154
Late  42, 44, 45, 62, 72  133, 139, 143, 156
Latin  10, 132, 153, 154
Law  14, 54, 135, 144
Leader(ship)  10, 222
Leading tone  63, 64, 120, 121
League of Nations  133
Lebanese  22
Left-barb (see: Sagittal)
Left-wing (political)  23
Legacy (see also: Heritage)  14, 19
Legitimacy  2, 8, 24, 223
Length  (instrumental/theoretical)  2, 28, 92, 99, 126  179, 180, 181, 182, 183
Lessons (music)  18
Letters (see also: Alphabet)  12, 42, 132, 136, 153  176, 183
Levantine  151
Level (musical)  18, 51, 54, 131, 150
Levers (see: Mandals(instrumental))
Limit (math)  28, 42, 43, 78, 79  107, 114, 115, 127, 152  160, 224
Limma (see also: Bakiyye)  31, 34, 35, 46, 90  114, 115, 145, 152, 159
Lineage (see also: Descendant)  21, 123, 156
List (theoretical/intervallic)  44, 55, 56, 62, 115  174, 175, 179, 181, 182  197, 220
Listen(ing)  129, 133, 135, 136, 137  139, 141, 150, 153, 154
Literature  8, 145, 151, 195, 207
Location  10, 28, 66, 73, 88  125, 128, 137, 158
Lodge (ideological)  130, 148, 194, 211
<table>
<thead>
<tr>
<th>Term</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log (math)</td>
<td>93, 94, 99, 101, 152 222</td>
</tr>
<tr>
<td>Logic(al)</td>
<td>94, 143, 157, 184</td>
</tr>
<tr>
<td>Lower (intonation)</td>
<td>2, 50, 51, 53, 56 58, 63, 65, 66, 92 101, 126, 132, 176, 179 Lower (pitch) 68, 108</td>
</tr>
<tr>
<td>Lyrics</td>
<td>1</td>
</tr>
<tr>
<td>Mabeyn (see also: Ahenk)</td>
<td>182, 183</td>
</tr>
<tr>
<td>Macrotonal (see also:</td>
<td></td>
</tr>
<tr>
<td>Microtonal)</td>
<td>158</td>
</tr>
<tr>
<td>Madrassah (see also:</td>
<td></td>
</tr>
<tr>
<td>Quranic)</td>
<td>132</td>
</tr>
<tr>
<td>Maestri (see: Master(s))</td>
<td></td>
</tr>
<tr>
<td>Maḥür(ek)</td>
<td>32, 33, 36, 53, 56 57, 58, 64, 65, 69 70, 72, 80, 81, 83 96, 98, 120, 128, 177 179</td>
</tr>
<tr>
<td>Mamluks</td>
<td>1</td>
</tr>
<tr>
<td>Mandals (instrumental)</td>
<td>2, 88, 92, 126</td>
</tr>
<tr>
<td>Manifest(ation)</td>
<td>8, 62, 92, 111, 122 143, 148, 159, 168, 180</td>
</tr>
<tr>
<td>Manner (aesthetic)</td>
<td>8, 9, 52, 117, 140 141, 151</td>
</tr>
<tr>
<td>Manoeuvre (ideological)</td>
<td>13</td>
</tr>
<tr>
<td>Mansion</td>
<td>139, 203, 220</td>
</tr>
<tr>
<td>Manufacture (instrumental)</td>
<td>4, 87, 182</td>
</tr>
<tr>
<td>Mapping (theoretical/intervallic)</td>
<td>4, 66, 68, 91, 202 217</td>
</tr>
<tr>
<td>Maqam</td>
<td>1, 2, 3, 4, 5 6, 7, 8, 9, 10 11, 14, 15, 16, 17 18, 19, 21, 22, 24 25, 26, 27, 28, 30 31, 35, 41, 42, 44 45, 50, 51, 54, 63 64, 65, 72, 75, 76 77, 83, 86, 87, 89 90, 91, 92, 93, 97 109, 117, 118, 121, 122 123, 124, 125, 126, 127 128, 132, 137, 138, 139 140, 141, 142, 143, 147 152, 154, 156, 162, 176 183, 184, 186, 222, 223 224 Maqamat (maqams) 1, 2, 3, 5, 6 9, 13, 21, 24, 41 70, 86, 87, 89, 90 91, 92, 117, 119, 120 121, 124, 127, 128, 154 156, 157, 223 Maragah (see: Individuals - Abdulkadir Meragi) Margin (math) 96, 127</td>
</tr>
</tbody>
</table>
Master(s)
  3, 6, 26, 41, 143
  145, 149, 151, 181
Match (theoretical)
  91
Mathematics
  44, 196, 198, 207
  Mathematical(-ization)
    72, 73, 152, 198, 208
    212, 224
Mathematician
  15, 25, 26, 93
Maverick (see: Individuals -
Harry Partch)
Maximum (math)
  76, 99, 115
Máye
  63, 65, 67
McCarthyism (political)
  23
Mean (see: Average (math))
Meantone
  66, 94, 108, 126
Measure (ideological/music)
  18, 135, 222, 224
Measurement
  (theoretical/intervallic)
    3, 5, 26, 27, 28
    30, 41, 83, 87, 91
    109, 124, 152, 162, 180
    181, 183, 222
Median (see: Mabeyn (see also:
Ahenk))
Megalopolitan (see:
Metropolitan)
Mehmed Çelebi (see: Individuals -
Hâfiz Post)
Melody
  2, 10, 11, 54, 66
  90, 117, 130, 131, 143
  144, 145, 151, 224
Melodic
  11, 21, 25, 55, 117
  124, 146, 151, 152, 153
  156, 162, 223
Mélodiques (see: Melody -
Melodic)
Member (math)
  93, 126
Memory
  136, 138, 140
Merger (aesthetic)
  2, 23
Merit (musical)
  41, 76, 82, 126
Metal (instrumental)
  2, 88, 177
Metamorphosis (political)
  11
Method(ical)
  5, 22, 42, 101, 104
  106, 148, 149, 152, 181
Methodology
  3, 5, 6, 13, 35
  83, 93, 126, 186
Metrical (see also: Foot)
  1, 222
Metropolitan
  15, 19, 135
Mevlana (see: Individuals - Jalal
al-din Muhammed Rumi)
  Mevlevi
    133, 223
  Mevlevihane (see also: Convent)
    17, 44, 156
Meşk (musical rote)
  10, 149
Microtone
  1, 107, 132, 223, 224
Microtonal
  2, 3, 4, 6, 26
  43, 87, 106, 109, 122
  125, 127, 158, 184, 197
  223
Middle Ages
  130
Middle second (intervallic)
  3, 4, 6, 30, 41
  55, 56, 57, 59, 60
  66, 78, 82, 86, 91
  92, 122, 124, 125, 128
  162, 223, 224
Middle third (intervallic)
  55, 166, 168
MIDI (Musical Instrument Digital Interface)
158
Midpoints (see also: Intermedials)
72
Migrations (see: Emigration (see also: Urbanization))
Millennium
1, 8, 21, 22, 45
123, 156, 157
Mimesis/Mimicry (see: Imitation (aesthetic))
Minimal (pitch)
5
Minimax (math)
99
Miniscule (perde/intervallic)
53, 75, 102, 224
Ministry
10, 12, 14, 135, 142
148
Minor (musical/theoretical)
8, 9, 30, 31, 32
34, 35, 46, 55, 56
57, 59, 60, 90, 112
114, 115, 116, 145, 152
159, 160, 163, 164, 166
168, 180, 224
Minor second (see also: Semitone)
34, 35, 46, 55, 56
57
Minor third
31, 34, 35, 46, 55
56, 57, 59, 60, 112
114, 115, 116, 164, 166
Minor tone
145, 152
Minute (intonation)
30, 179
Mirrored (intervallic)
62, 107, 175
Misrepresentation (see also: Non-conformance)
6, 124
Missing (see: Omitted (pitch))
Mission (ideological/music)
16, 19, 24, 124, 130
Mixture (theoretical)
65, 66, 107
mm (millimeter)
180, 181, 182, 183
Mode (musical)
1, 44, 50, 54, 82
94, 97, 115, 116, 126
176, 184, 185, 186, 222
Model (theoretical)
2, 3, 5, 6, 7
15, 19, 25, 26, 29
30, 31, 35, 41, 42
73, 76, 79, 83, 87
89, 90, 92, 121, 124
125, 158, 223
Moderate
119
Modern
6, 10, 23, 42, 44
45, 73, 74, 91, 129
133, 134, 143
Modernization
7, 9, 136, 223
Modification (theoretical)
34, 45, 101, 107
Modulation
3, 41
Molière (see: Individuals - Jean-Baptiste Poquelin)
Moment of Symmetry
93, 94, 95, 96, 97
98, 99, 100, 102, 103
104, 105, 106, 107, 108
109, 110, 111, 112, 113
114, 115, 116, 117, 118
119, 121, 126, 127, 128
202, 219, 220
Monodic
72, 142
Monograph
145, 157
Monophony
130, 133, 223
Monotony
130
Mood (musical) 91, 117, 150

Morality 18, 154

MOS (see: Moment of Symmetry)

Motif (see also: Texture) 11

Mouthpiece (see: Embouchure)

Movement (political) 222, 224

Mughal (see: Hindustani)

Muhayyer 32, 33, 36, 53, 56
57, 58, 64, 65, 69
74, 81, 98, 177, 179
182

Mujannab 25, 26, 30, 42, 55
62, 152, 196, 217

Müçenneb-i Kebîr (see also: Minor tone) 152

Müçenneb-i Sagîr (see also: Apotome) 152

Mujannab Zone (see: Mujannab)

Multi-cultural 9

Multi-ethnic 1

Multipartyism (political) 23

Multiple (math) 92, 93, 126, 223

Municipality 10, 14, 19, 23

Mushaqah (see: Individuals - Mikha'il Mishaqa)

Music 1, 2, 3, 4, 5
6, 7, 8, 9, 10
11, 12, 13, 14, 15
16, 17, 18, 19, 20
21, 22, 23, 24, 25
26, 28, 30, 31, 35
40, 41, 42, 43, 44
45, 51, 54, 64, 72
75, 76, 77, 83, 86
89, 90, 92, 93, 97
109, 117, 121, 122, 123
124, 125, 126, 127, 128
129, 130, 131, 132, 133
134, 135, 136, 137, 138
139, 140, 141, 142, 143
144, 145, 146, 147, 148
149, 150, 151, 152, 153
154, 155, 156, 157, 162
183, 184, 186, 222, 223
224

Musical/Müzikal 28, 44, 73, 132, 133
144, 145, 151, 157, 187
196, 198, 200, 207, 208
216, 222

Musician(ship) 2, 4, 8, 12, 13
17, 18, 43, 44, 72
90, 91, 107, 122, 130
131, 133, 137, 141, 150
151, 154, 223

Müzik 187, 188, 189, 190, 191
192, 193, 194, 195, 196
197, 198, 199, 201, 202
204, 206, 209, 210, 212
213, 214, 215, 216, 217
218, 219

Musicology 16, 19, 117, 193, 194
198, 201, 202, 208, 210
211, 218

Musicologîst 14, 15, 19, 90, 144
157

Musiki (see: Music)

Musiki Muallîm Mektebi (institutional) 13, 16, 148

Musiklexkon 144

Musikwissenschaft (see: Musicology)

Musique (see: Music)
Muslim
8, 10, 42, 43, 144
154, 198, 204, 211, 213
214, 215, 217, 224
Mustafa Kemal (see: Individuals - Atatürk)
Mu’tazilah
42, 154, 204, 206, 215
217
Mürekkeb (see: Composite (see also: Terkib))
Müz-dak (Council)
188, 219
Müzikbilim (see: Musicology)
Mystics
224

N

n-limit (see: Limit (math))
Nameless (see: Na-ism (perde))
63, 64
Names (perde/intervalllic)
31, 32, 34, 35, 46
52, 54, 55, 63, 64
68, 76, 97, 108, 128
145, 183
Na-ism (perde)
63, 64, 65, 67
Namesake
183
Nanotone
102, 108, 126, 224
Nâsır Dede (see: Individuals - Abdülbâki Nâsır Dede)
Nation
9, 11, 13, 18, 43
129, 130, 132, 133, 135
137, 141, 143, 144, 147
148, 149, 153, 154
National(ist)
10, 11, 12, 14, 16
17, 18, 20, 21, 22
23, 24, 123, 124, 130
132, 133, 135, 137, 141
142, 143, 145, 148, 150
151, 152, 153, 154
Nationalization
24, 124
Native
2, 9, 11, 13, 21
124, 144, 154
Naturals (unaccidented notes)
40, 47, 50, 51, 58
63, 64, 67, 70, 72
88, 97, 118, 130, 145
146, 176, 184
Nature
129, 143
Necessary/Necessity
5, 18, 53, 93, 102
117, 123, 126, 129, 131
132, 133, 135, 137, 143
145, 148, 150, 151, 152
154, 156
Neck (instrumental)
2, 156, 157
Need (see: Necessary/Necessity)
Negligible (see: Miniscule (perde/intervalllic))
Neighbour (perde/intervalllic)
29, 72, 181
Nerm (See: Pest)
63, 64, 65, 95, 96
97, 98, 121
Neutral (intervalllic)
25, 30, 90, 91, 112
114
Nevruz
80, 81
Nevâ
27, 29, 30, 32, 33
36, 37, 49, 50, 51
52, 53, 54, 56, 57
58, 63, 64, 65, 67
69, 73, 74, 75, 80
81, 86, 96, 97, 98
126, 177, 179, 180, 181
182, 183, 184
Newspaper (see also: Gazette)
147, 149
Newton (see: Individuals - Isaac Newton)
Nigâr
80, 81, 83, 85

Nihâvénd
49, 54, 56, 58, 63
65, 66, 67, 69, 95
97, 98, 120, 121

Nihüft
74

Nikrîz
156

Nîm (see also: Half tones)
30, 31, 32, 33, 36
37, 49, 63, 64, 66
67, 68, 72, 80, 81
83, 84, 85, 86, 95
96, 98

Ninth-tones (see: Comma)

Niyaz
80, 81, 84, 86

Nişâbûr
54, 63, 65, 66, 67
95, 98

Node (instrumental)
177, 180

Nominal (intervallic)
107, 108, 127, 128

Nomination
18, 83

Non-conformance (see also: Conflict)
5, 17, 30, 126, 145

Norm (see also: Standard)
11, 89

Normalization (math)
18, 34, 35, 46

Note (musical)
18, 40, 58, 90, 92
94, 108, 118, 126, 129
145, 176, 183

Notaci (Notator) Emin (see: Individuals - Emin Efendi)

Notation
4, 6, 8, 9, 10
32, 33, 35, 36, 39
40, 42, 44, 45, 47
48, 50, 51, 54, 58
59, 60, 61, 62, 63
64, 66, 70, 71, 72
74, 76, 80, 91, 94
106, 107, 108, 109, 118
119, 121, 122, 124, 125
127, 128, 133, 145, 176
178, 183, 184, 202, 216

Noticeable (intonation)
106, 127, 176

Notion (ideological/music)
22, 68, 89, 91, 123
133, 144

Novel(ty)
3, 87, 93, 117, 123
130

Nuances (see: Subtle(ties) (of pitch))

Number
5, 24, 25, 28, 42
47, 82, 99, 118, 128
159, 160, 162, 163, 164
166, 168, 170, 172, 174
175, 224

Numerator (math)
28, 99, 101, 152, 224

Nut (instrumental)
2, 92, 126

Obfuscate (perde/intervallic)
6, 25, 63, 64

Objections
19, 54, 131

Obliquity (see: Inclination (instrumental))

Oblivion/Obscurity/Obsolescence
1, 8, 17, 150

Observation
3, 5, 21, 25, 42
61, 76, 89, 106, 108
125, 126, 127, 144, 156
181

Occidentale (see: West - Western)

Occidentalist (see: West - Westernization)
Occurrence (intervallic)
27, 29, 41, 62, 102
159, 160, 162, 163, 164
166, 168, 170, 172, 174
175

Octave
2, 3, 4, 5, 6
13, 18, 26, 29, 31
32, 33, 34, 35, 36
39, 41, 45, 46, 47
48, 50, 54, 55, 56
57, 58, 62, 63, 64
65, 66, 72, 73, 74
75, 76, 79, 80, 81
83, 86, 87, 90, 91
92, 93, 94, 97, 98
99, 102, 104, 106, 107
109, 114, 115, 118, 120
125, 126, 127, 131, 132
152, 156, 157, 158, 159
160, 162, 163, 164, 166
168, 170, 172, 174, 175
176, 180, 184, 222, 224

Official
7, 8, 14, 16, 19
20, 21, 22, 24, 139
147

Offset (intervallic)
88

Offshoot (see: Descendant)

Omitted (pitch)
48, 49, 64, 66

Open (instrumental/theoretical)
28, 51, 52, 53, 99
180, 183, 184, 205, 212
220

Operation (math)
152, 222

Opinion
11, 72, 124, 134, 135
143, 148, 150, 151

Opposition (ideological)
21, 23, 142, 152

Optimal/Optimized
5, 183

Oral (see also: Meşk)
10, 92, 126

Orchestra
16, 19, 139, 141, 223

Orchestration
11, 131, 205, 208

Order (institutional)
9, 24, 25, 223

Order (theoretical)
40, 50, 51, 56, 97
99, 176, 179, 184, 185
186

Orient (see: East)

Oriental (see also: Eastern)
22, 129, 130, 134, 143
144, 145, 146, 148, 149
151, 193, 195, 196, 198
199, 210, 212, 213

Origin (theoretical)
31, 34, 35, 46, 102
152, 222

Origination
1, 8, 22, 156

Ornamentation
53, 54

Orthodox(y)
9, 11, 130

Osman Dede (see: Individuals - Osman Dede (Kutb-i Nâyi))

Ottoman
1, 7, 8, 9, 14
15, 21, 22, 24, 44
45, 62, 71, 72, 130
133, 156, 187, 189, 195
199, 207, 208, 209, 216
217, 222

Outcome (ideological/music)
5, 22, 124, 148

Outdated/Outmoded
9, 72

Outlets (see: Apertures (instrumental))

Output (data)
27, 28

Overblowing (instrumental)
51, 53, 65

Overflow (math)
18

Overstep (theoretical)
26, 125
<table>
<thead>
<tr>
<th>Term</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palace</td>
<td>1, 9, 16, 24, 137</td>
</tr>
<tr>
<td>148, 203, 220, 222</td>
<td></td>
</tr>
<tr>
<td>Pantologist (see: Individuals - Dimitrie Kantemir)</td>
<td></td>
</tr>
<tr>
<td>Paradoxical (intonation)</td>
<td>152</td>
</tr>
<tr>
<td>Parallel (comparison)</td>
<td>12, 76, 87, 222</td>
</tr>
<tr>
<td>Parazvâne (instrumental)</td>
<td>177</td>
</tr>
<tr>
<td>Park Casino (see: Places - Sarayburnu)</td>
<td></td>
</tr>
<tr>
<td>Parliamentarian</td>
<td>137</td>
</tr>
<tr>
<td>Partition/Parts (intervallic)</td>
<td>5, 21, 41, 75, 76</td>
</tr>
<tr>
<td>92, 93, 124, 125, 126</td>
<td></td>
</tr>
<tr>
<td>132, 145, 179</td>
<td></td>
</tr>
<tr>
<td>Pasha (titular)</td>
<td>8, 137</td>
</tr>
<tr>
<td>Pass down/on (see also: Meşk)</td>
<td>10, 139, 149, 181</td>
</tr>
<tr>
<td>Passion</td>
<td>19, 130</td>
</tr>
<tr>
<td>Past</td>
<td>1, 3, 8, 20, 133</td>
</tr>
<tr>
<td>140, 143, 152, 180</td>
<td></td>
</tr>
<tr>
<td>Pastoral (see also: Rural)</td>
<td>21, 90, 123</td>
</tr>
<tr>
<td>Patriotic (see also: National(ist))</td>
<td>18, 150, 154</td>
</tr>
<tr>
<td>Patron (see: Individuals - Atatürk)</td>
<td></td>
</tr>
<tr>
<td>Pattern (musical/theoretical)</td>
<td>1, 47, 93, 94, 112</td>
</tr>
<tr>
<td>126, 222</td>
<td></td>
</tr>
<tr>
<td>Peak (math)</td>
<td>27</td>
</tr>
<tr>
<td>Pedal tone</td>
<td>51, 54, 176, 177, 179</td>
</tr>
<tr>
<td>184</td>
<td></td>
</tr>
<tr>
<td>Peer</td>
<td></td>
</tr>
<tr>
<td>19, 20</td>
<td></td>
</tr>
<tr>
<td>Pentatonic/Pentatonism</td>
<td>15, 22, 224</td>
</tr>
<tr>
<td>Pençgah</td>
<td>120</td>
</tr>
<tr>
<td>Percussion (see: Instrument(s))</td>
<td></td>
</tr>
<tr>
<td>Perde(ler) (see also: Pitch/Tone/Fret)</td>
<td>3, 4, 9, 12, 18</td>
</tr>
<tr>
<td>26, 27, 28, 29, 30</td>
<td></td>
</tr>
<tr>
<td>31, 32, 34, 37, 41</td>
<td></td>
</tr>
<tr>
<td>42, 44, 45, 47, 48</td>
<td></td>
</tr>
<tr>
<td>49, 50, 51, 52, 53</td>
<td></td>
</tr>
<tr>
<td>54, 55, 56, 57, 58</td>
<td></td>
</tr>
<tr>
<td>62, 63, 64, 65, 66</td>
<td></td>
</tr>
<tr>
<td>67, 68, 70, 72, 73</td>
<td></td>
</tr>
<tr>
<td>74, 75, 76, 79, 81</td>
<td></td>
</tr>
<tr>
<td>83, 87, 90, 91, 95</td>
<td></td>
</tr>
<tr>
<td>96, 97, 98, 118, 120</td>
<td></td>
</tr>
<tr>
<td>121, 125, 127, 132, 151</td>
<td></td>
</tr>
<tr>
<td>152, 156, 157, 176, 177</td>
<td></td>
</tr>
<tr>
<td>178, 179, 180, 182, 183</td>
<td></td>
</tr>
<tr>
<td>184, 186, 190, 196, 198</td>
<td></td>
</tr>
<tr>
<td>201, 212, 215, 217, 219</td>
<td></td>
</tr>
<tr>
<td>224</td>
<td></td>
</tr>
<tr>
<td>Perfect (intervallic)</td>
<td>31, 32, 34, 35, 46</td>
</tr>
<tr>
<td>97, 170, 171, 172</td>
<td></td>
</tr>
<tr>
<td><strong>Performance (music)</strong></td>
<td>1, 3, 8, 10, 12</td>
</tr>
<tr>
<td>18, 25, 27, 28, 29</td>
<td></td>
</tr>
<tr>
<td>41, 43, 54, 90, 91</td>
<td></td>
</tr>
<tr>
<td>92, 117, 126, 139, 151</td>
<td></td>
</tr>
<tr>
<td>162, 182, 188, 211, 212</td>
<td></td>
</tr>
<tr>
<td>213, 214, 216, 217, 222</td>
<td></td>
</tr>
<tr>
<td>223</td>
<td></td>
</tr>
<tr>
<td>Performers (music)</td>
<td>3, 91, 130</td>
</tr>
<tr>
<td><strong>Period</strong></td>
<td>12, 27, 62, 133, 154</td>
</tr>
<tr>
<td>155, 175, 195, 207, 223</td>
<td></td>
</tr>
<tr>
<td><strong>Persecution (see: Ban)</strong></td>
<td></td>
</tr>
<tr>
<td>Persian</td>
<td>1, 8, 30, 76, 89</td>
</tr>
<tr>
<td>90, 117, 130, 143, 154</td>
<td></td>
</tr>
<tr>
<td>199, 207, 223</td>
<td></td>
</tr>
<tr>
<td><strong>Personal correspondence</strong></td>
<td>19, 89, 93, 183</td>
</tr>
</tbody>
</table>
Perspective (ideological) 8, 9
Pes(t) (see: Kaba)
Pharaonic (titular) 144
Phenomenon (ideological) 15, 22
Philharmonic (see: Orchestra)
Philologist (see: Individuals - Gültekin Oransay)

Philosophy
19, 92, 204, 210
211, 212, 213, 214, 215
217
Philosopher 42, 43, 154

Phonetic
45, 62, 63, 64, 66
70, 71, 72, 125
Digraph 50
Diphthong 110
Gutturals 132
Phonemes 132
Spirants 132
Phrase(ology) 9, 132, 145
Physicist (see: Individuals - Salih Murat Uzdilek)
Picture (see: Instrument(s) - Qanun)
Piece (music) 41, 125, 151
Pioneer 17, 26
Pipe (see: Instrument(s) - Ney/Nay)

Pitch (see also: Perde) 2, 3, 4, 5, 6
9, 12, 13, 15, 18
21, 26, 27, 31, 32
34, 44, 50, 54, 56
58, 63, 64, 68, 72
87, 89, 91, 94, 99
102, 120, 122, 124, 125
128, 145, 151, 152, 156
159, 176, 179, 180, 182
184, 186, 222, 224

Pitch-cluster 26, 27, 68, 224

Places
8, 13, 135, 139, 145
149, 154, 224
Afghanistan 43
Algeria 154
America 43, 93, 108, 135, 205
212
Anatolia 7, 9, 11, 12, 16
21, 22, 23, 123, 131
132, 144, 146, 156, 157
191, 192, 199, 206, 215
217, 222, 224
Ankara 13, 14, 18, 83, 132
135, 138, 139, 141, 142
148, 187, 188, 189, 190
191, 192, 193, 197, 198
199, 202, 206, 207, 209
210, 212, 214, 215, 216
217
Arab Provinces 21
Austria 18
Bahariye 17
Balkan Provinces 21
Beşiktaş 137
Bulgaria 154
Cairo 17, 22
Caucasus 92
Çankaya Kiosk
15, 139
Dolmabahçe
137, 203, 220
Egypt
10, 92, 144, 154, 223
Erzurum
149
Europe
7, 130, 135, 148, 150
Farm Kiosk
139, 141
Galata
17, 44, 151, 156, 203, 220
Germany
18
Herat
43
Hungary
154
India
1, 143, 154
Iran
43, 76, 92, 143, 156, 223
Iraq
154, 156, 223
İstanbul
10, 13, 14, 18, 19
23, 44, 54, 129, 133
134, 136, 137, 139, 141
142, 146, 147, 148, 149
151, 153, 155, 156, 157
İzmir
87, 149, 187, 189, 190
194, 199, 200, 201, 206
208, 211, 213, 215
Kastamonu
149
Lebanon
44
Middle East
76, 223
Munich
19
Near East
1, 24, 73
Overseas
2, 11, 20
Paris
144
Pera
151
Romania
154
Samos
42
Sarayburnu
10, 129, 139
Syria
92, 154, 223
Thrace
21, 138, 149, 156
Tunisia
154
Turkestan
1, 156
Turkmenistan
43
Türkiye/Turkey
1, 2, 3, 7, 8
9, 11, 13, 15, 16
20, 21, 23, 25, 76
77, 79, 83, 92, 123
124, 126, 133, 139, 144
223
Yenikapı
17, 44, 156
Yugoslavia
154
Plagiarize
18
Plan (see: Configuration (perde/intervallic))
Play (see: Theatre)
Playing (see also: Performance)
26, 66, 91, 117, 138
150
Players (music)
91
Poem
18, 145, 150
Poet
145, 153
Polarization (see: Dichotomy (ideological/music))
Polemist (see: Individuals - Mikha‘il Mishasha)
Polemics
148
Policy
16, 23
Political
14, 16, 24, 25, 89
222
Polyhistor (see: Individuals - Immanuel Kant)
Polyphony
2, 3, 4, 5, 6
18, 19, 21, 87, 122
124, 127, 132, 133, 134
142, 191, 215, 223
Popular
15, 23, 26, 44, 72
123, 127, 130
Portamenti
26, 125
Position (institutional)
17, 142, 149, 222
Position (perde/intervallic)
3, 25, 66, 88, 99
162, 179, 180
Practical/Practicable
3, 6, 15, 86, 87
91, 93, 149, 182
Practice (music)
2, 3, 4, 5, 6
7, 21, 24, 25, 26
41, 76, 86, 90, 92
117, 122, 124, 125, 143
156, 162, 181, 197, 209
Practitioners (music)
21, 22, 91, 123, 145
Pragmatical (see: Practical/Practicable)
Precise (see also: Accurate)
89
Precursor/Predecessor
(institutional)
13, 17, 19
Prefix (perde)
Proper (theoretical)
  4, 5, 29, 40, 115
  133, 181
Prophet (titular)
  8
Proponents (ideological)
  9
Proportion
  (instrumental/theoretical)
  83, 102, 176, 180, 183
Proscribe (see: Ban)
Protagonists
  7, 124
Proverb
  138
Proximate/Proximity (intervallic)
  28, 35, 63
Public
  11, 135, 138, 145, 148
  150
Publication
  7, 9, 19, 133, 157
Publisher (see: Individuals - Emin Efendi)
Pundit
  157
Pupils (music)
  17, 148, 222
Pure (intervallic)
  34, 35, 39, 40, 42
  46, 50, 66, 93, 94
  101, 102, 104, 105, 106
  107, 108, 115, 116, 126
  145
Purebred (people)
  21, 123, 144, 154
Purpose (ideological/music)
  3, 4, 17, 42, 50
  106, 127, 142, 150
Pursuit (ideological/music)
  117, 139, 157, 181
Puselik (see: Buselik)
Pythagorean (perde/intervallic)
  2, 3, 5, 6, 7
  15, 25, 26, 30, 31
  32, 34, 35, 39, 40
  41, 42, 43, 45, 46
  50, 70, 72, 73, 79
  83, 90, 92, 109, 114
  115, 121, 123, 124, 125
  145, 152, 156, 158, 159
  160, 162, 163, 164, 165
  166, 167, 168, 169, 170
  171, 172, 173, 174, 175
Quarrel (see: Kaba)
Quarter-tone
  6, 7, 16, 21, 22
  24, 25, 26, 41, 42
  43, 54, 62, 68, 72
  75, 76, 90, 91, 92
  107, 108, 109, 123, 124
  125, 130, 145, 146, 152
  195, 213, 224
Quasi (theoretical)
  22, 73, 75, 76, 79
Quest(ion)
  4, 25, 76, 90, 102
  140, 142, 150
Quintilianus (see: Individuals - Aristides Quintilianus)
Quote
  7, 11, 12, 13, 14
  16, 20, 129, 130, 131
  132, 133, 135, 136, 137
  139, 142, 143, 147, 148
  150, 154, 156, 157
Quotidian (see also: Contemporary)
  1, 2
Quranic (see also: Madrassah)
  132
Race
  10, 139, 154, 224
Radio
15, 18, 83, 123, 133
137, 138, 139, 154
Radius (instrumental)
180, 181
Rag (Hindustani musical mode)
89
Râhatfezâ
154
Râhatülervah
154
Raise (pitch)
68, 94, 108
Ramal
74
Range (intervallic)
3, 18, 26, 30, 39
62, 81, 97, 98, 118
127, 224
Rank (institutional)
16, 223
Rast
31, 33, 36, 37, 49
50, 52, 54, 56, 58
63, 65, 66, 67, 69
73, 74, 75, 80, 81
85, 95, 97, 98, 118
128, 156, 176, 177, 179
180, 182, 183, 184, 185
186
Ratio (pitch)
3, 4, 18, 25, 28
29, 30, 31, 32, 34
35, 37, 38, 39, 42
46, 47, 48, 49, 50
51, 54, 55, 72, 73
75, 78, 95, 96, 99
102, 127, 152, 156, 158
162, 180, 182, 222, 223
224
Reaction (ideological)
8, 10, 16, 124
Realm
62, 130
Realpolitik
17
Rebuttal (see: Refutation (ideological))
Recital (see also: Concert)
15, 132
Reconcile (theoretical)
9, 92
Record(ing) (music/notational)
3, 6, 16, 17, 18
26, 27, 42, 72, 90
158
Redeem (ideological)
24, 124
Reduce (see: Normalization (math))
Reed (see also: Ney)
54, 180, 181, 183
Refined (aesthetic)
1, 90, 92
Reflect (see also: Conformance)
41, 90, 92, 128, 132
162
Reformation (Music)
7, 8, 12, 15, 16
17, 23, 123, 124, 137
148, 151, 193, 194, 202
210, 214, 216, 218, 223
Reformist
8, 19
Refutation (ideological)
6, 22, 143
Regal (see: Royal (see also: Imperial))
Regime (political)
7, 9, 16, 21, 22
24, 25, 123, 124
Region (intervallic)
26, 40, 42, 66, 97
127
Register (instrumental)
51, 52, 53, 176, 177
179, 180
Regular (music/notational)
83, 107, 122
Rehâvî
63, 65, 66, 67, 69
97, 98
Rote (see also: Meşk)  
42
Royal (see also: Imperial)  
8, 88, 223
Rudimentary (theoretical)  
17, 87
Rules (theoretical)  
54, 143, 144, 148, 151  
152, 157
Rumeli (see: Places - Thrace)
Running (see: Ascending (scale))
Rupture (see also: Conflict)  
123
Rural/Rustic (see also: Pastoral)  
11
Russian  
12, 141, 152

S

Sâbâ  
30, 49, 51, 52, 53  
54, 56, 57, 58, 63  
64, 65, 66, 67, 69  
80, 81, 83, 84, 86  
95, 97, 98, 121, 128  
177, 179, 180, 181
Sâbâî segâh  
95, 98
Sacrifice (musical)  
117, 137, 151
Safeguard (political)  
19, 24
Safiyüddin (see: Individuals - Safi ad-din Abdulmu’min Urmavi)
Sagittal (Notation)  
4, 6, 106, 107, 108  
122, 127, 128, 202, 216
Apollo’s arrow  
108, 128
Arbs  
107
Arrows  
108, 128

Artemis’ arrow  
108, 128
Barbs  
107
Didymus’ Dibbler  
108, 127
Salon  
16, 143
Samples (see: Examples (musical/theoretical))
Saray (see: Palace)
Sarp (steep)  
95, 96, 97, 98
Satisfactory (theoretical)  
4, 92
Satisfy/Satiate (aesthetic)  
129, 150, 151
Savants  
133
Savours (intonation)  
1, 26, 125
Scala (software)  
68, 79, 82, 99, 107  
158, 160, 204, 220
Scale  
4, 40, 41, 42, 43  
45, 46, 49, 50, 66  
82, 83, 99, 117, 118  
119, 120, 125, 127, 128  
145, 158, 182, 184, 186  
196, 198, 199, 208, 221  
223, 224
Schema/Scheme  
38, 55, 73, 90, 91  
176
Schism (intervallic)  
50
Scholar  
21, 43, 91, 123, 144  
145, 149, 154
School  
7, 9, 10, 11, 13  
15, 16, 17, 18, 19  
20, 21, 23, 24, 42  
76, 89, 123, 124, 146  
148, 149, 222
Science(s)  
43, 92, 144, 148, 151  
154, 193, 195, 196, 198  
199, 203, 207, 210, 211  
212, 213, 215  
Scientific  
145, 146, 149, 151, 156  
157, 205, 220  
Scientist  
42, 154  
Scordatura  
55  
Score (music)  
9, 18, 41, 107, 183  
184, 185, 186  
Scribe (see: Individuals - Bedr-i Dilşad)  
Scrutiny  
26, 40, 113, 145, 156  
Sebbabe (see: Mujannab)  
Second (intervallic)  
3, 4, 6, 25, 30  
34, 35, 41, 46, 55  
56, 57, 59, 60, 66  
78, 82, 86, 90, 91  
92, 94, 112, 114, 122  
124, 125, 128, 162, 166  
167, 170, 223, 224  
Sector (notational)  
40, 107  
Segment (see: Partition/Parts (intervallic))  
Segâh  
27, 29, 31, 32, 33  
36, 37, 49, 50, 51  
52, 53, 54, 56, 57  
58, 63, 64, 65, 66  
67, 69, 70, 72, 73  
75, 80, 81, 85, 95  
97, 98, 120, 121, 177  
179, 180, 181, 182, 183  
184  
Seljuks  
1, 157  
Semitone (see also: Half tones)  
2, 30, 63, 64, 66  
72, 90, 91, 92, 126  
145, 152, 157, 159, 160  
222, 223  
Sensation (intonation)  
196, 199, 201, 203, 207  
222  
Sentiments (political)  
21, 93, 129  
Septimal (intervallic)  
107, 115  
Sequence (notational)  
40, 41, 54  
Series (see also: Sequence)  
40, 55, 99, 176  
Sesqui-tone (see also: Middle third)  
166, 167  
Set (theoretical)  
18, 41, 91, 107, 127  
146, 158  
Setting (see also: Configuration)  
2, 91  
Seventh (intervallic)  
34, 35, 46, 90, 94  
160, 163, 166, 170, 180  
Seyir (see: Procedure (musical/theoretical))  
Shadd (see also: Şedd-i Sâbâ)  
74  
Shades (see: Savours (intonation))  
Shared (aesthetic)  
1, 11, 76, 93  
Sharp (accidental)  
4, 40, 58, 72, 79  
83, 107, 108, 120, 122  
127, 145  
Sharpened (see: Sharp (accidental))  
Shâhnâz (see: Şehnâz)  
Sheik (titular)  
17, 44, 51, 54, 156  
Shift (intonation)  
18, 34, 41, 55, 176  
201, 213, 222  
Significant  
41, 128, 138
Signs (see: Accidentals)
Sign (see: Cent(s) (intervalllic))

Simple (theoretical)
90, 102, 103, 104, 105
106, 120, 128, 148, 224
Simple(Small)-integer
3, 30, 152, 223
Simplification (intervalllic)
50
Simulate (theoretical)
6, 87
Sinekeman (see: Instrument(s) - Viola d’amore)
Sing(ing)
10, 90, 137, 139, 140
141, 201, 213
Singer
91, 139
Sinuosity (see: Inflection (perde))
Sire (titular)
140
Sixfold (see: Equal (intervalllic) - Equal Temperament)
Sixth (intervalllic)
34, 35, 46, 55, 90
159, 166, 168, 172, 173
Size (instrumental)
54, 176, 180, 181, 182
223
Size (intervalllic)
50, 79, 83, 90, 91
92, 93, 102, 126, 162
166, 168
Sketch
156
Skill (musical)
11, 41, 181
Skipped (see: Omitted (pitch))
Slum-dwellers
23
Sobriquet (see also: Epithets)
183
Society
10, 15, 135
Sociology/Sociopolitics
23, 143
Soft (see: Nerm (See: Pest))
Soldiery (see: Army)
Solfa (Solfège)
58
Solidarity
21
Solo
29
Solution
3, 41, 126, 141
Sophisticated (see also: Refined)
16, 89, 91, 117
Sori (accidental)
90
Soul (aesthetic)
10, 51, 54, 129, 132
150
Sound
27, 30, 52, 110, 130
132, 140, 151, 156, 158
180, 184, 186, 196, 219
224
Source(s) (musical/theoretical)
25, 42, 43, 68, 140
141, 143
Space (intervalllic)
2, 66, 89, 91
Species (theoretical)
92, 222
Spectrum (see also: Continuum)
224
Speculation
55, 124, 223
Speech (political)
12, 129, 135
Spirit (see: Soul (aesthetic))
Splitting (see: Division (intervalllic))
Spondiasme (intervalllic)
26
Stack (see: Chain (of fifths))
Staff (music)
4, 8, 9, 35, 45
58, 59, 60, 61, 66
71, 73, 74, 80, 106
145, 176, 178, 183, 184
Stage (see also: Concert)
10, 18, 129, 135, 139
Stagnation (musical)
2
Stalinism (political)
23
Stalk (see: Reed (see also: Ney))
Standard
(institutional/theoretical)
11, 108, 109
Standard diapason (see: Diapason)
Standardization (instrumental)
54, 176
State
9, 10, 11, 13, 14
17, 19, 20, 23, 83
123, 137, 138, 139, 142
223
Statement
43, 141, 145
Stature/Status
7, 222, 223
Stave (see: Staff (music))
Steep (see also: Sarp)
97
Step (intervallc)
3, 5, 39, 55, 76
79, 82, 90, 91, 93
94, 102, 109, 118, 120
121, 126, 159, 175
Story
139, 141
Strap/Tie (see: Fret)
Strategy (see also: Revisionism)
24
Strife (see: Dichotomy
(ideological/music))
String(s) (instrumental)
28, 88, 99
Study/Studies
3, 19, 26, 90, 91
145, 156
Students (see: Pupils (music))
Style(s) (musical)
1, 21, 91, 92, 123
133, 144, 149, 150, 152
Subset (theoretical)
4, 26, 86, 92, 93
94, 99, 104, 105, 106
115, 125, 126, 127
Substitution (intonation)
22, 54, 66, 83
Subtle(ties) (of pitch)
4, 6, 13, 15, 21
30, 70, 90, 124, 128
143, 152
Successful (intonation)
128, 129, 134, 140, 148
Sufficient
24, 30, 107, 141, 148
150, 180
Sufi (see: Convent (Sufi Order))
Suitable (theoretical)
3, 4, 115, 128, 132
151, 223
Sultanate (see also: Reign)
8, 136, 223
Sultan (titular)
8, 9, 13, 15, 16
133, 137, 143, 156, 222
Sultaniyegâh
139
Superlative (theoretical)
66, 183
Superparticular (math)
25, 99
Supersaturated (intervallc)
26, 125
Support (political)
11, 13, 23, 136
Sûzidil
81, 84, 85, 154
Sûzidilârâ
154
Sûzinâk
154
Sünbüle
32, 33, 36, 53, 56
57, 58, 64, 65, 69
74, 81, 98, 177, 179
Symbols (notational)
18, 40, 54, 107, 108
122, 127
Symmetry  
(theoretical/intervallic)  
77, 93, 126, 202, 220

Synagogue  
130

Synonym(ous)  
8, 90, 183

Synthetic  
16

Syntonic (see also: Comma)  
101, 102, 104, 108, 127

Syrian  
90

System (theoretical/intervallic)  
3, 15, 18, 19, 31  
32, 33, 41, 43, 44  
46, 47, 49, 55, 62  
72, 73, 76, 77, 83  
90, 91, 92, 106, 126  
132, 158, 174, 175, 184  
202, 216, 217, 223, 224

Systematization  
15, 17, 76, 145

Ș

Ședd-i Sâbâ  
63, 65, 67

Şehnâz  
30, 32, 33, 36, 53  
56, 57, 58, 64, 65  
69, 74, 81, 98, 177  
179, 199, 220, 221

Şevkefzâ  
154

Şevkutârâb  
154

Şûri  
56, 58, 64, 65, 66  
67, 95, 97, 98, 177  
179

T

Tactic (see also: Revisionism)  
16

Tailored (see also: Revisionism)  
24, 124

Talent (musical)  
222

Tam(am) (see also: Naturals)  
63, 64, 67, 70, 72

Tamerlane (see: Individuals - Timur (the Lame))

Tanînî (see also: Major tone)  
55, 152

Tasnif ve Tespit Heyeti  
10, 17

Taste (aesthetic)  
76, 91, 124, 137, 150

Tavir (see: Manner (aesthetic))

Teachings  
19, 23

Teachers (see also: Instructors)  
13, 14, 16, 181

Technique (instrumental)  
12, 23, 65, 117, 134  
141, 148, 151, 152, 184

Technical  
11, 149, 152

Tekke (see: Convent (Sufi Order))

Temper(ing) (intervallic)  
12, 50, 101, 102, 104  
116, 131, 146, 152, 222

Temperament  
3, 9, 15, 28, 37  
66, 76, 82, 83, 86  
93, 105, 106, 107, 125  
126, 132, 151, 152, 222  
223, 224

Template (theoretical)  
3, 18, 23, 107, 127

Tendency  
63, 68, 91

Terkib (composite maqam)  
1, 117, 224

Term(inology)  
8, 9, 21, 26, 92  
93, 126, 143, 145, 146  
151, 152, 176, 222

Tertian (see: Triadic)
Testimony (musical)  
145

tET (-tone Eq. Temp.)  
38, 39, 49, 93, 94  
95, 96, 97, 98, 99  
100, 102, 103, 104, 105  
106, 107, 108, 109, 110  
111, 112, 113, 114, 115  
116, 117, 118, 119, 121  
126, 127, 128

Tetimme (see also: Leading tone)  
63, 64, 65, 67

Tetrachord  
21, 43, 50, 198, 206

Text(ual)  
24, 54, 108, 156

Texture (music)  
26

Theatre  
18, 139, 140, 141

**Theory**  
2, 3, 5, 6, 7  
14, 15, 17, 18, 19  
23, 24, 25, 26, 29  
30, 40, 43, 44, 45  
54, 73, 87, 89, 92  
93, 106, 117, 124, 125  
127, 128, 132, 143, 144  
145, 152, 154, 156, 157  
162, 193, 195, 198, 199  
201, 202, 203, 211, 212  
213, 220

*Theoretical*  
3, 6, 15, 41, 144  
151, 182

*Theorist*  
1, 9, 14, 15, 19  
22, 24, 42, 43, 44  
144, 145, 198, 212, 213

Thesis  
3, 4, 26, 92, 123

**Third (intervallic)**  
34, 35, 46, 50, 55  
56, 57, 59, 60, 90  
94, 112, 114, 115, 116  
145, 152, 159, 163, 164  
166, 168, 169, 172, 174  
224

*Third tones*  
90, 161

Thousand years (see: Millennium)  

Thracian  
138

Tik (see: Dik (acute))  

Tilt (see: Inclination (instrumental))  

Timbre  
2

Times (see also: Occurrence)  
62, 93, 102, 137, 163  
175

Title  
10, 44, 106, 117, 152

Tiz (treble)  
32, 33, 36, 50, 53  
54, 56, 57, 58, 64  
65, 66, 69, 70, 72  
81, 98, 176, 177, 179  
181, 184

Tolerable (intonation)  
96, 127

**Tone**  
2, 3, 4, 5, 6  
7, 8, 9, 11, 12  
13, 15, 17, 18, 19  
21, 22, 23, 24, 25  
26, 28, 29, 30, 31  
34, 35, 37, 38, 39  
41, 42, 43, 45, 46  
47, 50, 51, 54, 55  
58, 61, 63, 64, 66  
70, 72, 73, 75, 76  
77, 78, 79, 82, 83  
84, 85, 86, 87, 88  
89, 90, 91, 92, 93  
96, 97, 101, 102, 104  
106, 107, 108, 109, 110  
111, 112, 113, 114, 116  
117, 120, 121, 122, 123  
124, 125, 126, 127, 128  
130, 131, 132, 135, 145  
146, 149, 152, 156, 157  
158, 160, 161, 162, 163  
164, 166, 168, 174, 175
(Tone continued)
176, 179, 180, 184, 188
196, 199, 201, 202, 203
207, 219, 220, 221, 222
223, 224
Tonal(ity)
8, 9, 223
Tone-circle
68, 79, 82, 109, 110
111, 112, 113, 114, 116
128, 158, 159, 160, 161
162, 163, 164, 165, 166
167, 168, 169, 170, 171
172, 173, 174
Tone-system (see also: Tuning)
15, 45, 73, 77, 90
156, 195, 214
Tonic
120
Tongue (see: Language)
Tool (theoretical)
27, 72, 92, 158
Töre (see: Individuals - Abdulkadir Töre)
Töre-Karadeniz
19, 76, 79, 80, 81
82, 83, 84, 85, 86
125
Tractate (see: Treatise (see also: İlm-i Edvâr))
Trade-off (see also: Revisionism)
24
Tradition(s)
1, 4, 7, 8, 10
18, 22, 23, 24, 72
75, 89, 90, 91, 92
93, 117, 125, 126
Traditional
4, 8, 12, 26, 31
41, 42, 45, 55, 65
70, 73, 87, 91, 97
98, 121, 132, 143, 176
196, 219
Traditionalist
13, 18, 150, 151
Training (musical)
10, 150
Trait (musical)
6, 123
Transcription (music)
58, 145, 154, 184
Transfiguration (aesthetic)
24
Transformation (political)
9, 148
Translation (works)
9, 129, 130, 138, 144
152, 198, 212, 222
Transliteration
153, 157
Transmission
130, 133, 144
Transoxania (see: Places - Turkestan)
Transposition (see also: Shadd)
3, 4, 5, 41, 54
63, 70, 83, 89, 94
114, 115, 117, 119, 127
176, 183, 186
Treatise (see also: İlm-i Edvâr)
15, 19, 43, 44, 55
56, 64, 154, 179, 199
200, 205, 206, 207, 208
Treble (see also: Tîz)
50, 176
Trend (ideological/music)
7, 9, 76, 142, 223
Triadic
2, 224
Trichotomy
76
Tridecimal (intervalic)
25, 111, 112
Tritone
31, 32, 34, 35, 174
Triumvirate
19
TRT (Turkish Radio Television)
83, 197, 207
Truncation (math)
82
Tšahâr-gâh (see: Çârgâh)
Tuner
2, 88, 92, 126
Tuning
2, 3, 4, 5, 6
7, 15, 17, 18, 19
22, 32, 34, 35, 42
44, 45, 55, 72, 75
76, 78, 79, 82, 83
84, 85, 86, 87, 88
89, 90, 91, 93, 94
96, 101, 102, 104, 106
107, 109, 122, 123, 124
125, 126, 127, 128, 132
145, 156, 158, 202, 220
223, 224
Turk
1, 8, 9, 11, 22
43, 129, 141, 143, 144
145, 148, 149, 150, 154
156, 157, 223
Turkic(ized)
11, 21, 123, 157
Turkish
1, 2, 3, 4, 5
6, 7, 8, 9, 10
11, 12, 14, 15, 16
17, 18, 19, 20, 21
22, 23, 24, 25, 26
27, 30, 31, 35, 40
41, 42, 44, 45, 72
76, 77, 83, 84, 85
86, 87, 89, 90, 91
92, 109, 117, 122, 123
125, 126, 127, 128, 129
130, 131, 132, 133, 134
135, 137, 138, 139, 140
141, 142, 143, 144, 145
147, 148, 149, 150, 151
152, 153, 154, 156, 157
162, 176, 180, 181, 183
186, 222, 223, 224
Turkish Five (composers)
12, 18
Turkism/Turkness
11, 21, 24, 123, 130
154
Turkopophile
148
Tutor(age) (see: Teachings - Teachers (see also: Instructors))
Twelve (tone)
3, 7, 9, 11, 12
15, 20, 21, 23, 70
89, 92, 93, 115, 116
123, 126, 131, 132, 133
Twenty-four (tone)
83, 89, 132, 145, 156
157
Twisting (see also: Revisionism)
6, 24
Type(s)
76, 88, 90, 91, 92
117, 130, 145, 176, 181
182, 183

U

Ubiquitous (see: Practice (music))
Unconforming (see: Non-conformance (see also: Conflict))
Unconventional/Unorthodox
30, 62, 176
Undecimal (intervallic)
108, 128
Understanding (theoretical)
4, 117
Undertone
51
Unequal (intervallic)
90, 91, 92, 132, 156
157
Unfolding (see also: Seyir)
90, 117
Unidecimal (intervallic)
25, 30, 114
Union (institutional)
13, 148, 203, 220
Unique
1, 5, 26, 88, 127
149, 151
Unison
186
Unit (intervallic)
28, 152, 222
Unity (musical)  
20, 89, 130, 132

Universal (musical/theoretical)  
135, 154

University  
10, 14, 19, 20

Unnatural (ideological)  
130, 138

Untraversed/untrodden (theoretical)  
125, 162

Unwieldy (theoretical)  
83, 125

Upper (see: High (intonation))

Upper class (see also: Elite)  
134, 143, 144, 145

Uproot (see: Ban)

Urbane(-ization)  
2, 15, 23

Urmavi (see: Individuals - Safi ad-din Abdulmu’min Urmavi)

Usage/Utilization (theoretical/intervallic)  
2, 3, 9, 45, 66
97, 108, 117, 127, 132
156, 223

Usûl (rhythmic)  
1, 187, 197, 208, 216
224

Uşşâk  
27, 29, 30, 80, 81
85, 156, 197, 207, 216

Uşşâki segâh

Uşâyra (see: Aşîrân)

Utility (software)  
28, 29

Uzzâl  
54, 56, 58, 63, 64
65, 66, 67, 69, 95
97, 98, 179

Value (intervallic)  
27, 28, 29, 72, 78

83, 128, 152, 158, 181
222

Vanishing (intervallic)  
12, 224

Variant/ Variety  
11, 26, 72, 90, 91
118, 120, 125, 135, 152
181, 223

Verdict (see: Dispatch (directive))

Versions (79 MOS 159-tET)  
102, 104, 105, 106, 107

Vibrating (sound)  
2, 28, 180

View(point)  
11, 16, 17, 72, 91
117, 125, 143

Village  
138, 146

Virtuoso  
30, 117, 150, 183

Vizier (titular)  
223

Vocal  
1, 10, 75, 117, 125

Voice  
140, 148

Voice box (instrumental)  
177, 180

Voivode (titular)  
44

Vössiche Zeitung (see: Gazette)

W

Wailing (aesthetic)  
13, 137, 138

Wave (sound)  
27, 180

Well-Temperament  
4, 122, 224

West  
9, 11, 43, 133, 141
143, 144, 146, 148, 149
189, 201, 211, 213, 219
(West continued)

Western
3, 8, 9, 12, 18
19, 22, 40, 89, 92
93, 123, 126, 130, 131
133, 134, 141, 143, 145
146, 148, 150, 151, 152
154, 156, 157, 158, 183
191, 204, 207, 215, 222
223

Westerners
21, 124, 131, 133, 134
145, 146

Westernization
7, 8, 9, 11, 16
22, 24, 124, 131, 133
134, 223

Whole tone/note
13, 21, 30, 31, 34
35, 38, 39, 46, 47
58, 72, 90, 91, 107
124, 145, 146, 152, 163
164, 166, 168

Width (instrumental/theoretical)
28, 181

Wolf fifth
40, 76, 115

Works (musical/theoretical)
3, 4, 5, 8, 9
17, 18, 19, 72, 133
134, 140, 141, 144, 145
149, 150, 151, 153, 154
157, 184, 195, 199, 209

World
10, 17, 21, 73, 76
90, 129, 133, 134, 135
150, 154, 204, 215

World War
9, 23

Writer
14, 137

X

Xenharmony
4, 122, 202, 216, 224

Xenophobia
9

Y

Yegâh
31, 33, 34, 36, 37
49, 51, 54, 56, 58
63, 65, 69, 73, 75
81, 84, 97, 98, 126
176, 177, 179, 182, 183
184

Yekta-Arel-Ezgi (School of)
7, 15, 21, 24, 42
76, 89, 123, 124, 195

Young/Youth
11, 13, 17, 133, 135
136, 139, 140, 151

Z

Zeal
13, 15

Zengûle (see also: Zîrgûle)
36, 37, 49, 63, 65
66, 67, 69, 80, 81
85, 95, 97, 98

Zevkutârâb
154

Zîrgûle (see also: Zengûle)
31, 37, 41, 49, 50
52, 56, 58, 63, 65
66, 73, 74, 75, 85
177, 179, 183
This Addendum features *Three Progress Reports* that I had written in Turkish, dating from August 2004, September 2005, and November 2005 respectively – all of which had been delivered to and accepted by the Doctoral Examining Committee during the preliminary stages in the preparation of my thesis. As early as by then, I had reached the decision to complete and present this Dissertation entirely in English.

The documents in question were slightly revised and re-formatted for this expanded publication – especially with regard to duplicate tables and figures that were possible to cross-reference to earlier pages of the finalized book in print.

The reader will notice, even by looking at the recurrently changing title suggestions in these Reports, as well as earlier numerical data and graphics therein, that the author had initially engaged in several trials and dead-end searches before finally settling on the 79-tone model as the preferred theoretic subject matter of this doctoral work.
Değerli Hocalarım,

İngilizce “The New Microtonal Theory of Turkish Music on the Resolution of the Alla Turca – Alla Franca Dichotomy” konulu Doktora Tezimi yazma aşamasına gelmiş bulunmaktadır. Yeterlik Sınavına girmeye hakkı kazanmış bir Ph.D. adayı olarak, İngilizce dilinde yazacağım Tezimin amacını, yöntemini ve çalışma planını kapsayan bu Raporu incelemenize sunmaktayım.


Bilindiği gibi, Alla Turka – Alla Franga zıtlaşması deyişi, çok uzun bir dönemdir, ülkemizin aydınları arasında sürekli olarak bir kültür-sanat kutuplaşmasını betimlemekte kullanılır. Bu kutbun bir ucunda, muhafazakâr- yerleşik Türk değerlerin, daha doğruşu şehirli Osmanlı’nın, tarihsel mirasına ve geleneklerine bağlılığı öne çıkar; diğer ucunda ise, Anadolu halk katmanlarından kök alan Türk Ulusu’nun geleceği, Batı Uygarlığının birikimlerini özümsemekte ve “eksiyi” terketmekte görenler, bulunmaktadıır.


Kabaca anlatmak gerekirse, yitikleşen değerlere bağlılığı gözterir “gelenekçiler” ile, çagdaş moda ıthal değerleri eskilerinin yerine koymayı önceliklendirir “yenilikçiler” arasında boy gösteren bir zıtlımdur bu. Müzik alanında ise, geleneklere (bazı önde gelen isimleri shardsiyetler ayrı tutulmak kaydıyla) sonuna kadar bağlı Saray Ehlinin, eksirıya teksesli ve ağır Osmanlıca lehçesile bezenmiş oturak besteleri ile, Batı tarzı ıslah yanlarının desteklediği ve beğendiği piyano aghırlıklı Avrupa oda müziği parçalarının ve bunların Osmanlı taklilerinin çekmişesidir.


Nedir ki, kendisinin bu yönde sarfettiği yüksek gayretlere karşın, Rauf Yekta’nın görüşleri, zamanında yaygın olarak benimsenmemiş, Cumhuriyet’in kurulmasıyla birlikte, Ziya Gökalp’in öğretisi aghırlık kazanmıştır.

Çağdaş uygurlığın Osmanlı’da değil Batı’dan alınması, Mustafa Kemal Atatürk’ün ilerici ve devrimcilık anlayışıyla biribir örtüştüğünden,

Ancak, geleneksel eğilimler birçok çevrede hâlâ süregeldiğinden, bu yeniliklerin hemen ertesinde müzik alanında bir ikilem baş göstermiş, kısa bir zaman içinde, Alla Turka – Alla Franga zıtlaşması Ulusal Müzik sahnesine egemen olmuştur.

Çoksesli Türk Müziğini köken benimsemiş olanların çoğu, tekseсли makam-altı bir müzik türü olarak betimlenebilecek Türk Mûsîkîsine karşı tavır almışlar, derûni tanımayan bile etmedikleri bu türü “irtica” olarak sınıflandırmışlar, tekseсли kültürünü “ilk” yahut “muzelik” telâkkı ederek Alaturka diye aşğılamlar ve dahası, yasaklanması gerekenin birikimlerine haddi aşacak ölçüde sataklamışlar, derûnsüz Türk Mûsîkîsini kökten benimsemiş olanlar, Avrupa müzik kültürünün tempere ses-sisteminin ve ezgi dağarcığına küçükülmüş, çoksesli Batı Müziği birimlerine haddi așacak ölçude ulaşmayan geri durmamışlar, hatta bunları yeğ tutmayı Türkülükle başa edemeyen bir Alafrangacî tilâk diye nitelendir dikleri beşeninin savunucularına nisbet olarak, (rejimin kuruluş ilkelerinden asında kopuk, fakat bu özelliği asla aksı turlar edilmeyen) bağımsız Türk Mûsîkîsini kurulmuşları işler hale getirmişlerdir.

Benzer olarak, Türk Mûsîkîsini geleneklerini kökten benimsemiş olanlar, Avrupa mûsîkî kültürünün tempere ses-sisteminin ve ezgi dağarcığını küçükülmüş, çoksesli Batı Müziği birimlerine haddi așacak ölçude ulaşamamışlar, daha bunları yeğ tutmayı Türkülükle başa edemeyen bir Alafrangacî tilâk diye nitelendir dikleri beşeninin savunucularına nisbet olarak, (rejimin kuruluş ilkelerinden asında kopuk, fakat bu özelliği asla aksı turlar edilmeyen) bağımsız Türk Mûsîkîsini kurulmuşları işler hale getirmişlerdir.


Günümüze kadar süregelen Alla Turka – Alla Franga zıtlaşması, müzik cephesinde, Batı Müziği dûstürü ile Türk Müzikisi nazariyesi dolayında, yani Rauf Yekta’nın sisteminin devami niteliğindeki *Arel-Ezgi Kuramus* ile, Batı Müziği’nin basitte açıklamak üzere ortaya konmuş olan Tempere Sistem arasında, cereyan etmektedir.
Türk Müziğinin, en başlardan beri Türklüğün sanatkârâne bir özü olduğu iddiasıyla yola çıkan gelenekçilere, Osmanlı'dan devralılmış olan heterofonik/monodik makamsal icrân'ın bütün Şark milletlerinde rastlanan nağmeciliğin anası olduğunu iddiasıyla yola çıkan, Osmanl›dan devralnmış olan heterofonik/monodik makamsalicri'nin bütün Şark milletlerinde rastlanan nağmeciliğin anası olduğunu; bu nağmelerle dayalı “mükemmel ses-sisteminin” de, bilhassa Türk kökenli diyaratı; hele ki, bunlardan önce ortada kayda değer bir müzik bulunmadığını; dolaysıyla sistemde, nağmelerde, baștan aşağı Türk olduğunu ve böylece Türk Müziğinin diğer tüm bölge müziklerinden üstün olduğunu savlamaktadırlar.

Ziyâ Gökâlp’in öğretisinde görülunden hiç de așan kalmayan bu “Süpremasist Müslüman-Türkçülük” anlayışı, Türk Müziğinin kökenini tavan (Türklerin atası olduklarını ileri sürülmüş) Sümer’lere izafe eden Hüseyin Saadettin Arel’in ve Osmanlı Müziğindeki nağmelerin hepten Türk olduğunu düşünden Suphi Ezgi’nin yazılarında, sıcak karşımıza çıkmaktadır.


Türk Beşler’in başı çektiği Çoksesli Türk Müziği Ekoloji, bu yönde girdiğilen atonal bestecilik ağırlıklı maceranın somut izlerini taşır. Atatürk’ün “Evrensel Müzik”ten kastının tam da bu olduğunu varsayanlar günümüzde az değildir.

Oysa, her iki iddianın da ası olduğu muhakkaktr. Bir tarafta, üstünliğin tarihteki geleneklere saşmaz bir bağlılıklı simsville sarılan eddâperver Türklüğe ait olduğunu haykran tuctular; diğer tarafta, üstünliğin “eski” olanın dışlanıp, ulusal anlamda bir Türklüğün modern yeniliklerle carılmasında olduğunu şiddetle savunan devrimciler bulunmaktadır.

Dahası, bu tartışmaların arasında kalan Türk Halk Müziği’nin, 20. Yüzyılın ortalarından itibaren her iki zihniyete de yüz çevirmek süretilyle, Halk Özanlarına / Aşklarına dayalı ayrı bir “Anadolu Türklüğü” sanat ekolü yarattığı gözlemlemektedir.

Herhangi bir öğretiden çok ticârî kazancı öncelikli kılan Arabesk de dahi olmak üzere, Popüler Türk Müziği akımı ise, 70’li yıllarda patlak veren derin sosyal bunalımların ve “sınıf” çatışmalarının Türkiye’ye bir armağanırdı.

Sonuç olarak, günümüzde ulusal müzik eğitimi paramparçadı. Farklı yerel türleri kapsayıcı ve kuramsal yönden bütünleştiren çağdaş bir eğitim programı bir türlü gelişirilememektedir. Müfredatlar ise darmadağın hâlinde, Arabesk dahil olmak üzere, Popüler Türk Müziği akımı ise, 70’li yıllarda patlak veren derin sosyal bunalımların ve “sınıf” çatışmalarının Türkiye’ye bir armağanırdı.

Ancak, bir uzlaşmaya yakınsaması, ulusal müzik eğitiminin bütünliği ve geleceği adına, şarttır. İşte, ileri sürdüğüm Tez, bu doğrultuda atılmış olan önemli bir adım olarak öne çıkmaktadır.

Tezimde izleyecim yöntem, Batı Müziği ile Türk Musikisi arasındaki en temel ayrt edici özellik olan mikrotonal farklılıkların esaslıca belirlenmesi ve her iki kültere ait tüm seslerin tek bir çatı altında buluşturulması yönündedir.
Çalışmanın en canalı noktasi, ilk bir yaklaşılmak olarak, her perde üzerinden tastamam göçürüm yapmasina olanak sağlayacak ve Batı Müziği ile çelişmeyecek bütünle bir “36 Bölgeni Ses-Sistemi” üzerinden, usûllerin yanı sıra, tüm makamların en baştan düzgünde sınıflandırılması ve notlandırılması olacaktır.

Bunlardan başka, Türk Müzikisine mahsus tarihsel dönemlerin, ses ve notasyon sistemlerinin, öncül bestekârların, yeri geldikçe bunlara ait örnek eserlerin, beste türleri ile biçimlerinin ve başlıca çalgıların genel olarak üzerinde durmayı hedefliyorum.

Bütün bu unsurlar biraraya getirildiğinde, dilerim ki, Türk Müzikisine ilişkin dağınık ve belirsiz bilgiler sistematik ve tutaşı biçimde açıklığa kavuşacak, sonuçta, tastamam bilimsel bir nazariye ortaya çıkacaktır.

Tezim, ümidediyorum, ulusal müzik eğitimini çarkan Alla Turka – Alla Franga çatışmasının kör-düğümlü çözmesi kalmayacak, Çağdaş Mikronatal Çokseslilik Ekolüne de geçit verecektir. Bunun uzantısında, yaptığım bu çalışma, geleneksel iskalalar üzerinden çoksesli makamal bestelerin kurgulanması ve Türk Müziği Çalgılarının da dahil olduğu Orkestralar tarafından yepyeni armoni ve kontrapunto kurallarına göre yazılmış eserlerin seslendirilmesine zemin teşkil edebilicektir.

Tezimi İngilizce sunmak istememdedeki neden, herşeyden önce, Türk Müziği’nin dünyaya saygı ölçütler çerçevesinde tanıtıması gerekliyidir. Özellikle bu nedenle ve yazılı müzik kültürümüzde de katkıda bulunmak üzere, makamlar için vereğim örnek eserleri, her biri Batılı müzik editörlerinin elinden çıkmışcasına, özenle yeniden notlandırmayı amaçlamaktayım.

Usûl ve Makam tariflerini incelemek üzere seçtiğim başlıca tarihsel kaynaklar şunlardır:

- Kitâbü’l Müsiki’l Kebîr (Muhammed el-Fârâbî)
- İhvânü’s-Sâfâ Risâleleri (Dostlar Meclisi)
- Kitâbü’l Edvar (Safiüddin Urmevi)
- Câmiü’l Elhân (Abdülkadir Merâğî)
- Fevâid-i Aşere (Abdülkadir Merâğî)
- Makasidü’l Elhân (Abdülkadir Merâğî)
- Şerhü’l Kitâbü’l Edvar (Abdülkadir Merâğî)
- El Fethiyye (Mehmed Lâdikî)
Elimin altındaki gelişkin bilgisayar sistemi yardımla, yeryüzündeki binlerce ses dizisinin ve bunlara ait araların hassas ölçümlerini yapabilmenin yanı sıra, Etnik Dünya Müziklerine ait egzotik/otantik sesleri ve araları duyurabilme olanağım vardır. Bu çerçevede, kullanacağım yazılımlardan başlıcaları şunlardır:

SCALA 2.05x, Manuel Op de Coul, 2002
FRACTAL TUNE SMITHY 2.21, Robert Walker, 2000
SOLO EXPLORER 1.0, Gaulius Raskinis/Recognisoft, 2003
İÇRA-ANALİZİ, M. Kemal Karaosmanoğlu, 2003
ARALIKÖLÇER, M. Kemal Karaosmanoğlu, 2003
KESİR 1.0, Yavuz Ekşi – Prof. Dr. Metin Arık, 2003

Son olarak, Tezimin kurgusunu, ana hatlarıyla, ekte veriyorum.

Saygılarmla,
Ozan Yarman
~Ağustos 2004~
Değerli Hocalarım,

İstanbul Teknik Üniversitesi Türk Müziği Devlet Konservatuvarı Müzikoloji Anabilim Dalı Başkanlığının bünyesinde sürdürdüğü Doktora Programı dahilinde, Doktora Savımtı hazırlama aşamasına geldiğim bir durumumu duyuyorum.

Savımtı, İngilizce olarak, “The New Microtonal Theory Of Turkish Music On The Resolution Of The Alla Turka – Alla Franca Dichotomy” başlığı altında yazmayı düşünmekteyim.

Savımtıda, Türk Müziği'nin tarihsel gelişimini, türlerini, çalgılarını, beste biçimlerini, geleneksel perdelerini ve notasyonlarını irdeleyerek, günümüzdeşen sürüşümüz olan Alla Turka - Alla Franga sürtümsesimizin temelden inşasına ve buna göre tüm makamların, ayrıca bütün usûllerin, başta olmak üzere tüm eserler esliğinde bunların “çağdaş müzik ölçülerine göre” yeniden notaya alınmasına yönelik kük hükmü bir nazariye ortaya koyabilmeymi umuyorum.


Tez çalışmanın süresince, Yrd. Doç. Dr. Süleyman Ergüner Hocamın bana danışmanlık etmesini diliyor, gereğinin yerine getirilmesini ricâ ediyorum.

Saygılarımla,
Ozan Yarman
Yüzlerce yıllık kültürel birikime dayanan, yüksek bir sanat zevkinin ürünü sayılan, ancak sonraları, gitgide Batı Dünyası’na raptolmuş ülkemizdeki radikal dönüşümler uzantısında, zamanla revaçtan düşüp gerileyerek, 20. Yüzyılın ortalarından itibaren tarihsel çizgisinden önemli ölçüde saptığı görülen Makamsal Türk Müziği’nin, asılın uygun ıcrасısında ve notalandırmalarında çok ciddi sıçkıntılar yaşandığı, günümüzde büyük ölçüde kabul edilen bir gerçektir.

Sözkonusu “sıçkıntılar” dört ana başlık altında toplanabilir...

1. **Aralıklar:** Türk Müzikisi Ses-Sistemi’nin, keza, Makamsal Müziğimizin Perdeleri’nin – tarihsel kaynaklara erişim ve bu kaynakların tutarlı yorumlanması güçlüğünden olduğu kadar, deneycilikten (empirisizmden) uzak kağıt-üstü hesaplarla yetinme kolaylıgından dolayı da – etrafıca belirlenmesinde yaşanan sorunlar.

2. **Makamlar ve Seyirleri:** Kuramsal ve eğitsel düzlemde, yukarıda anılan nedenlerden ötürü, makamlar ile seyirlerinin doğruluğuna açıklanmasında karşılaşılan güçlükler.

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1 İlk Raporumdan bu yana, “aralıklar sorunsalına” daha çok odaklandığımızdan dolayı, tarihsel nazariyat yazmalarına dayalı mikrotonal bir müzik kuramı hazırlamamızın önceliği olduğunu saptayarak, Tezimizin başlığı bu aşamada ona göre yeniden belirledim.
3. **Usuller ve İ’ka**: Benzer olarak, Türk Müziğinde kullanılan usullerin ve İ’kanın, yani tartım kalıpları ile vuruş bilgilerinin, tam bir biçimde müzik insanlarına aktarılmasında çekilen zahmetler.


Koşut olarak, gerek Mustafa Kemâl Atatürk’ün Makam Müziğini kısıtlayıcı 1926’daki devlet girişimine güdülen öfke, gerek bu müzik tarzının “Batılılaşma” adı altında yozlanmasına duyan tepki, güç-belâ kurumlaşabilmiş olan Makamsal Türk Müziği ile uğraşan gelenekçilerin, çoğunlukla notasal gelişimin üst-evreleri sayılan polifoni (ezgideşlik), armoni (harman), enstrümantasyon (çalgılama) ve orkestrasyon (çalgısal düzenleme) tekniklerine mesâfeli durmalarını, dahası, yetiştirildikleri sonraki küçük müzişinasların sözkonusu müzik bilgilerinden önemli ölçüde mahrum kalmalarını, tetiklemektedir.

Konuya ilintili tarihsel kaynakların eski dillerde yazılımsız olması kadar; eslâfin başvurduğu kuram terminolojisinin, geçen yüzünlün ilk yarısında yaşamış olan Rauf Yekta, Saadettin Arel ve Suphi Ezgi gibi önde gelen müzik adamlarının savlarıyla koşullanmış ve o arada Batılılaşma’da da nasiplerini alarak tarihle bağlı olarak önemli ölçüde aşmış küçükklara nisbeten yabancı gelmesi nedeniyile – genel olarak nazariyât çalışmalarını, geneldeki koruma telâşına düşen “örtbasç” birahlafın teklinde, sürvêncemedede kalmış görülmektedir.

Ne var ki, son dönemlerde girşim özgürüğü felsefesinin, diğer alanlarda olduğu kadar, Türkiye’nin müzik piyasasında da sınıra ait ölçüde nüfûz etmesiyle birlikte, uzun yıllar boyunca belirin kapalı birkaç kişinin ve kurumun himayesinde edilgenlemiş, ancak – öncü insanların, kitlesel bekeni kazanan popüler müzik türlerinin yayılmasını fırsat bilerek, yapultıkları CD, kaset, kitap yayınıları ve internet etkinlikleri sûyesinde – durağanhktan

2 Örtbasç/ Obskûrant: Doğru bilgilenenveyi ve islahati bastırmak için aşşırı çaba harcayan.

3 Örneğin, “Uyan Eş Gözlerim (12 Hynys)” – Ayangil Türk Müziği Orkestrası ve Korosu (Kaset/RAKS); “Tende camim” (CD/Erguner Müzik); “Avrupalı Gezginlerin Gözüyle Osmanlılarda Musîki”, Bülent Aksoy (Kitap/PAN Yayıncılık).
yavaş yavaş silkenin Makamal Türk Müziği, artık zengin içerikli, nostaljik kurgusu, tahl-buruk örgünlüğü ve kıvrak otantik motfıleriyle, yaygın olarak müzikseverlerin beğenisiine sunulmaktadır.

Müzik piyasasında gözlenen sözkonusu hareketlenme, benzer şekilde, Türk Müziği'nin incelikleri üzerine yoğunluş olan geniş araştırmaları cesaretlendirmiştir, uluslararası bilimsel düzenenin bu alanda yürütülen incelemelerle, araştırmalar ve tartışmalarla gidide daha çok hakim olmasına vesile yaratmıştır. Bunun uzantısında, “Türk Müzikisi’nde kullanılan ve tabiat içinden çıkan Mikemmel Ses-Sistemi İşte budur!” türünden inaklardan arınmış akademik ortamlarda, Makamal Türk Müziği'nin temel yapıtaşları olan perdelerin ve aralıkların kesin bir berraklıkla saptanması istemi ağırlık kazanmıştır.

İste, bu doğrultuda, görülebildiği kadartla ilk kez Dr. Can Akkoç’un icrâ kayıtlarına dayalı yazılım-donanım tabanlı aralık ve seyir çözümlemleri girişimiyle (“Observations On The Sound Structures Of Traditional Turkish Music”, 1987, Sixth Iowa Acoustic Colloquium, University of Iowa, Iowa City), Makamal Türk Müziği’ne ait özgür kurgunun, bilgisayar teknolojilerinin sunduğu gelişkin olanaklarla mercek alta alınmış bir dönem başlamıştır (EK1).


6 Bu raporun hazırlanmıştı sırada, YTÜ’de hocalık yapmakta olup, VEKOM’da etkin olan başlıca araştırmalardandı. 2015’te Doktoraşını bitirdi, 2016’da Doçentliğe yükselmiştir.

“Makamsal Türk Müziği’nin Ses-Sistemi gerçekten nedir?” sorusu bilimsel bulgular ışığında derinlemesine irdelendikçe, “Türk Müzikinde çeyrek-ses yoktur, ebâdîlahniyye vardır.” türünden, uzun bir süredir neredeyse kutsal metin imişçesine tırmış bellenen envâ-i cins iddia, yavaş yavaş sorgulanmaya başlanmıştır. Demek oluyor ki, müzik nazariyesi üzerine vakt-i zamanında ortaya konan skolâstik yaklaşımların doğruluğunu sorgulayanca, daha önceden bildirdiğimiz üzere, şunlardır:

SCALA 2.2, Manuel Op de Coul, 2002-2004 (EK3)
FRACTAL TUNE SMITHY 2.4, Robert Walker, 2002-2004 (EK4)
SOLO EXPLORER 1.0, Gaullius Raskinis, 2003 (EK5)
İÇRÂ-ANALİZİ 3.0, M. Kemal Karaosmanoğlu, 2003-2004 (EK6)
ARALIKÖLÇER 2.0, M. Kemal Karaosmanoğlu, 2003 (EK7)
KESİR 1.0, Yavuz Ekşi – Prof. Dr. Metin Arık, 2003 (EK8)
ORAN 1.2, Yavuz Ekşi (EK9)

Şu ana kadar, makamlara dair yaptığım gözlemler ve Dr. Akkoç’un icrâ-seyir çözümlemelerinden (“Non-Deterministic Scales Used In Traditional Turkish Music”, 2002, Journal of New Music Research, Cilt 31, Nr. 4, s. 285-293) edindiğim izlenimler neticesinde, Makam Müziğinde kullanılan seslerin pratikçe bir sınır olmadığını, dolaysıyla tüm seslerin asında müteber sayılmak gerektiğine – ancak, bunlardan yalnızca ölçüplü bicimli bir kaçırmı geçerli addeldip, geri kalaları “doğal olmayanları” gerekçesiyle” dışarlanmanın uygunsuz olduğu ve bu nedenle, mevcut kuramların, Makam Müziğine ait karakteristik kurguyu hakkıyla yansıtımadıklarına – yönelik hissiyatı kuvvetlenmiştir.


Herhangi bir makamın seyri ise, o makama ait ses-dünyasının “görece esnek ugrak yerleri”, yanı perdeleri arasında görülen, sıkraşışlar bütünü olarak tanımlanabilmektedir.8

Perdeler bahsine geri dönecek olursak, bugüne kadar ortaya konan kuramsal çalışmalarla sürekli yapıldığının aksine, Türk Müziği Perdeleri, Batı Müziği notalarına karşılık olmaktan çok, dereceleri, yanı, “temel alınan sese göre diğer seslerin konumlarını” belirleyici özellikte sayılacak, daha doğru bir yaklaşımda durmaktadır.9

Dimitri Kantermir’in (Kitâbû Ilmi’l-Mûsîkî A’lâ Vechi’l-Hurûfât, Haz.: Prof. Yalçın Tura, 2001, İYKY, İstanbul) bundan üçyüz yıl önce verdiği ve bugün de çoğunlukla aynı isimle kullanılan perdeler üzerinde zikrettiğimiz görüşü sinanmak istersek, aşağıdaki tabloya ulaşırız:


8 Bu doğrultuda, bir makam seyreden, o makama ait iki ses-dilimi, diğer bir deyişle, “birbirine çok yakın frekansların kümelendiği iki perdesel bulut” arasında, hangi frekanslar üzerinde, hangi dilimlerde sıkılaşmalar gerçekleştigi de, ayrı bir artırma konusu teşkil etmektedir. Ayrıca, bir makamın icrâ edilen herhangi birde, “birinci ve ikinci ses-diliminde bulunan bir frekans” ile “hemen sonraki ikinci ses-dilimindeki tüm frekanslar” arasında, çıkrıken ayrı, inerken ayrı idrefdenmek üzere, hangi aralıkların, toplam kaç kere, ne kadar süre boyunca ve hangi sıradır kullanıldığı sorusunun incelenmesi, seyir olayına önemli ölçüde işaret etmek için, diye düşünmektedir.

9 Bu olgu, belki de en çok, farklı ebatlardaki Ney kamusalarda açılan deliklerin tepatıp aynı oranlarda olmasına; dolayısıyla, Rast, Dûgâh, Segâh gibi “tamam perdelerin” farklı cins neylerde (Kız, Mansur, Şah, vs...) değişik seviyede sesler olarak duylulmasına, görülür. “Türk Müziği Akortlar/Âhenkleri”, içinde, bu uygulamaya dayanır.
<table>
<thead>
<tr>
<th>1. Sekizli Perdeleri (Koyular tamam perdeledir)</th>
<th>Simgesi</th>
<th>Derecesi</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Kaba Çargâh] (sistem-dişi tam yeden ses)</td>
<td>حجه</td>
<td>-5. derece</td>
</tr>
<tr>
<td>Yegâh</td>
<td>ی</td>
<td>-4. derece</td>
</tr>
<tr>
<td>Aşıran</td>
<td>عر</td>
<td>-3. derece</td>
</tr>
<tr>
<td>Acem Aşıran – Tetimme-i perde ve agâze-i Arak (yeden)</td>
<td>عله</td>
<td>(nim perdedir...)</td>
</tr>
<tr>
<td>Arak</td>
<td>ی</td>
<td>-2. derece</td>
</tr>
<tr>
<td>Rehâvi (Rehâvi-i Cedid – Rast’tan aşağı)</td>
<td>ر</td>
<td>...</td>
</tr>
<tr>
<td>Rast – Na ism perde (Arak’tan yukarı)</td>
<td>سر</td>
<td>1. derece</td>
</tr>
<tr>
<td>Zîrgûle (Zengûle) – Şedd-i perde-yi Sâbâ (Rast’tan yukarı)</td>
<td>نن</td>
<td>...</td>
</tr>
<tr>
<td>Dûgâh (Zengûle ve Nihâvend perdeleri Dûgâh’in nimleridir)</td>
<td>دن</td>
<td>2. derece</td>
</tr>
<tr>
<td>Nihâvend – Tetimme-i agâze-i makam-i Segâh (Mâye)</td>
<td>رس</td>
<td>...</td>
</tr>
<tr>
<td>Segâh</td>
<td>سج</td>
<td>3. derece</td>
</tr>
<tr>
<td>Bûselik (Çargâh’tan aș.) – Rehâvi-i Atîk (Segâh’tan yk.)</td>
<td>حچ</td>
<td>(3. derece?)</td>
</tr>
<tr>
<td>Çargâh – Nişâbur (Uzzâl’den yukarı)</td>
<td>مسل</td>
<td>4. derece</td>
</tr>
<tr>
<td>Sâbâ</td>
<td>صل</td>
<td>...</td>
</tr>
<tr>
<td>Uzzâl</td>
<td>له</td>
<td>...</td>
</tr>
<tr>
<td>Nevâ</td>
<td>له</td>
<td>5. derece</td>
</tr>
</tbody>
</table>

Tabloda, Yegâh yerine Rast perdesinin 1. derece alınmasının gerekçesi, Batı Müziği ölçünlere göre, Piyano klavyesinde diyatonik yarım tonlar olan Mi-Fa ve Si-Do tuşlarının dizekte (portede) anısal gösterilmeleridir. Klavıde alışlageldik ilk ses Do₄ olduğundan ve Kantemir’in verdiği diyatonik (koyu) perdelemi tamamen beyaz tuşlar üzerinden çalmının, yahut dizekte yarım-ton arızaları kullanılmaksızın yazmanın, başka yolu olmadığından, Rast perdesi Do₄ e denk gelecek şekilde bir düzenlenmeye gitmemiz kaçınılmaz durumdadır.

Kuramsal bir temelde Eksen (Tonik) kılarak, dizekte Sol Açkısıyla (Anahtaryyla) birinci çizginin altında Do yazılmasını onadığımız Rast perdesini, bu notannın karşılığı olan Do₄ olarak işletebilmek ve Türk Müziği Perdelerini “Bati Notasyonu Kastasları” çerçevesinde düzgün anlayabilmek açısından, Nevâ Perdesini 440 Hz=Re varsayan Yekta-Arel-Ezgi ekolüne göre “yerdenden akort” tâbir edilen ve aslında “Rast perdesi Re₄ sesine tekabul eden” Bolâhenk yerine, bir tam ses aşağıda olan ve “Rast perdesi Do₄ sesine
tekabul eden” Süpürde, yahut diğer adıyla, Mehtâbiye akordu (EK10) esas almak, gerekli olmaktadır.¹⁰

Tablonun devamı aşağıda verilmiştir:

<table>
<thead>
<tr>
<th>2. Sekizli Perdeleri (Koyular tamam perdelerdır)</th>
<th>Simgesi</th>
<th>Derecesi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nevâ</td>
<td>۶</td>
<td>5. derece</td>
</tr>
<tr>
<td>Bayâti</td>
<td>۷</td>
<td>...</td>
</tr>
<tr>
<td>Hisâr</td>
<td>۸</td>
<td>...</td>
</tr>
<tr>
<td>Hüseynî</td>
<td>۹</td>
<td>6. derece</td>
</tr>
<tr>
<td>Acem – Tetimme-i makam-i Evc</td>
<td>۱۰</td>
<td>...</td>
</tr>
<tr>
<td>Evc</td>
<td>۱۱</td>
<td>7. derece</td>
</tr>
<tr>
<td>Mâhur</td>
<td>۱۲</td>
<td>(7. derece?)</td>
</tr>
<tr>
<td>Gerdânîye – Na ism perde (Evc’den yukarı)</td>
<td>۱۳</td>
<td>8. derece</td>
</tr>
<tr>
<td>Şehnâz</td>
<td>۱۴</td>
<td>...</td>
</tr>
<tr>
<td>Muhayyer</td>
<td>۱۵</td>
<td>9. derece</td>
</tr>
<tr>
<td>Sünbüle</td>
<td>۱۶</td>
<td>...</td>
</tr>
<tr>
<td>Tiz Segâh</td>
<td>۱۷</td>
<td>10. derece</td>
</tr>
<tr>
<td>Tiz Bûsâlik</td>
<td>۱۸</td>
<td>(10. derece?)</td>
</tr>
<tr>
<td>Tiz Çargâh</td>
<td>۱۹</td>
<td>11. derece</td>
</tr>
<tr>
<td>Tiz Sâbâ</td>
<td>۲۰</td>
<td>...</td>
</tr>
<tr>
<td>Tiz Uzzâl</td>
<td>۲۱</td>
<td>...</td>
</tr>
<tr>
<td>Tiz Nevâ</td>
<td>۲۲</td>
<td>12. derece</td>
</tr>
</tbody>
</table>

¹⁰ Ne şairıtır bir ki, ulusalara müzik ölçülerine göre, yüzylar boyunca La₄ = 440 Hz civarı referans alınarak tüm nota adları neredeyse sabit tonlara raptedilmişken, Yekta-Arel-Ezgi yazımında bu ölçün ihlal edilmiş, 440 Hz’lik La₄ sesine hem Nevâ, hem Re denmiş ve gerek notalamada, gerek solfejde, içinden çıkılmaz bir karmasık payda olmuştur. Bu acayipliği gidermenin en pratik yolu, yukarıda anlattığımız gibi, Rast perdesini kestirmeden 261.63 Hz civarındaki Do₄ olarak ölçümleştirmek; yazılamanın çalınma ortuşmesini sağlamak için ise, yürürlükteki notasyonda 2/3 ve icrâda 8/9 oranında göçürüm yaparak, Süpürde/Mehtâbiye akordu benimsemektedir. Buna göre, Süpürde/Mehtâbiye Ney, aynı zamanda “C Ney” olarak anılmaktadır.
3. Sekizli Perdeleri (Koyular tamam perdelерdir) | Simgesi | Derecesi
---|---|---
Tiz Nevâ | ٢ | 12. derece
Tiz Bayâti | ٣ | ...
[Yaççrın Tura’ya göre Tiz Hisâr] | (٤) | ...
Tiz Hüseynî | ٥ | 13. derece


Bununla birlikte, Kantemir’in, *Rast’tan Gerdâniye’ye*, bir sekizli içinde zikrettği (Gerdâniye hariç) 16 perde, her ne kadar nim perdelerin konumları tam kestirilemese de, Bati tonlarıyla çok kabaca açıklanabilir:

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¹¹ Naturel Tonlar: C, D, E, F, G, A, B.

Diyezli Tonlar: C#, D#, E#, F#, G#, A#, B#. (Seçilecek diziye göre, bu tonlardan bazıları uygunuzdur.)

Bemollü Tonlar: Cb, Db, Eb, Fb, Gb, Ab, Bb. (Seçilecek diziye göre, bu tonlardan bazıları uygunuzdur.)

¹² Örneğin, Segâh-Mâye hareketinde, her iki perdenin komşu Bati tonlarından alışlagelmedik derecede nerm oluştu; ya da, Çargâh-Sâbâ hareketinde, Sâbâ perdesinin dikçe bir yarım-ton çıka denk gelişi gibi durumların…
Bu aşamada belirtmeliyiz ki, genellikle Batı Müziğinin diyatonik yarım seslerine nazaran 20 ila 50 ç kadar nerm olabildiği görülen Arak ve Evc perdelerine Yekta-Arel-Ezgi ekolünce dizekte atfedilen diyez (#) işareti, zannedildiğinin aksine +4 kommalık bir konuma çıkılıp olmayıp, kabaca +70 ila +130 ç’lik “yarım-ton aralıklar topluluğu” içinde, özellikle +85 ila +115 ç’lik olanları betimlemekte kullanilagelmştir (EK11).14 Hâlbuki, olağanda 16/15 oranında majör yarım-ton aralık (+112 ç) ile açıklanan Batı Müziği diyezi, Arel-Ezgi kuramında +5 kommalık “küçük mücenneb” adıyla

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13 Sent, Oktavi 1200 eşit parçaya bölün bir aralık ölçüm birimidir. 12-tET’e göre uslandırılmış yarım-ses aralığı (1/2 ton) 100 senttir. 1 Komma ise yaklaşık 23 senttir. 1/8 ton kabaca 1 kommaña, ¼ ton ise kabaca 50 sentlik çeyrek-sese denktir. Tablodaki değerler, salt kendi gözlemlerime dayanmaktadır.

14 Tarihsel Batı Müziği Tamperamanlarında bu olgu açık seçik görülmektedir. Yarım-ton aralıkların çeşitliliği, enharmoniklerin ne kadar esnek olabildiğine de delâlet eder. Bundan dolayı, yaygın olarak benimsenen 12-tET’i ancak bir yazım ve öğrenim kolaylığı olarak algılamak daha doğrudur. (Bkz. EK11.)
ve (♯) arızasıyla gösterilmekte, Batı Müziği tonlarından çeyrek-ses dolayına kadar sapabilen Arak/Evc perdeleri ise, ters bir biçimde, (Fa♯) olarak belirtilmektedir. Bu mantığa göre, Yekta’nın dizekte “Si natural” olarak yazdığı Segâh perdesi, sonraları Arel-Ezgi sisteminde irhâ/komma bemolü ile (Si d biçiminde) yazılanmış, akrot karmaşasından ileri gelen sıkıtlara bir de nota yazımı ölçümlerinde tahrifat eklenmişdir.

Oysa, yukarıda önerdğimiz ve Arapların da uyguladığı biçimde, Rast perdesi Do₄ notasına ve tonuna denk gelecek şekilde bir düzenlemeye başlan gidiseydi, gerek Segâh/Tiz Segâh “yatık bir Mi tonuna”, gerek Arak/Evc “yatık bir Si tonuna” iyi-kötü denk gelecek; tarihsel bulgularla ortuşen ve Türk Müziği’ne özgü diyetonik kurgu (EK12) ile nisbeten uyumlulu duran bir çözüme yakışan Batı müziği dizekte “Si d biçiminde” yazgalanmış kadar sapabilen bir sonralar Batı Notasyonuna aslî’ne özgü diyatonik kurgu (EK12) ile nisbeten uyumlu düzenli yaplan bir dizektedir, tamamen “Saygısız” olarak Batı genelinde sonradan çeyrek-ses dolayına kadar sapabilen bir dizektedir. Değer perdelere inan eden bu dizekte “Sol Major tonundan başka bir şey değildir” (a.g.e., s. 69) diyip (Sa joke Mi; Evc ikinin üzerine de) Do natürel gam olarak, tarih içinde basılan Arap/Evc ve Segâh/Tiz Segâh perdelereini ilk ve en az diziği ise Arak/Evc ve Segâh/Tiz Segâh perdelereini Batı Müziği’nin yarım sesleri cinsinden açıklama gerek duymuş olmalı ki – diyatonik yarım-ton arzalarını Batılılara 5 komma olarak 4’rümü edildiğini ikrar ettikten sonra, tarih içinde başkalarınla olan ölçümleri gözardı ederek, serbest perde Batı Müziği çağlarında kromatik/minör yarım-ton 5 komma değil de 75-90 sent, diyatonik/major yarım-ton ise 4 komma değil de 105-120 sent çalınageldiği halde, Makam Müziğinde olduğu gibi Batı Müziğinde de Pithagorsal oranlara bağlı muşterek bir ana dizi kullanıldığı iddia edecek kadar ileri gitmekle (a.g.e. s. 64-5), içinde düşüştüğü çeşitli goller öntüne seriyor. Diyatonik ve kromatik yarım-ton değerler için ayrıca bkz.:

http://music.cwru.edu/duffin/Vallotti/T1/55division.html
http://music.cwru.edu/duffin/Vallotti/T1/page4.html
http://www.rdrop.com/users/tblackb/music/temperament/stoess.htm

15 Rauf Yekta’nın, 1922 yılında basılan Lavignac Anseklopedisi’i için yazdığı “Türk Musikisi” (Çev.: Orhan Nasuhoğlu, 1986, Pan Yayıncılık, İstanbul) maddesinde, söz konusu 3. ve 7. derece perdelere inan eden ana diziği Rast için, “Sol Major tonundan başka bir şey değildir” (a.g.e., s. 69) diyip (Sa joke Mi; Evc ikinin üzerine de) Do natürel gam olarak, tarih içinde basılan Arap/Evc ve Segâh/Tiz Segâh perdelereini ilk ve en az diziği ise Arak/Evc ve Segâh/Tiz Segâh perdelereini Batı Müziği’nin yarım sesleri cinsinden açıklama gerek duymuş olmalı ki – diyatonik yarım-ton arzalarını Batılılara 5 komma olarak 4’rümü edildiğini ikrar ettikten sonra, tarih içinde başkalarınla olan ölçümleri gözardı ederek, serbest perde Batı Müziği çağlarında kromatik/minör yarım-ton 5 komma değil de 75-90 sent, diyatonik/major yarım-ton ise 4 komma değil de 105-120 sent çalınageldiği halde, Makam Müziğinde olduğu gibi Batı Müziğinde de Pithagorsal oranlara bağlı muşterek bir ana dizi kullanıldığı iddia edecek kadar ileri gitmekle (a.g.e. s. 64-5), içinde düşüştüğü çeşitli goller öntüne seriyor. Diyatonik ve kromatik yarım-ton değerler için ayrıca bkz.:
Makam Müziğinde “mikrotonal arzalarla bezenmiş bir Batı Notasyonu” kullanmanın pek de yararı olmayacağı açıklar.

Dahasi, tarihsel Makam Müziği kaynaklarından olduğu kadar Batı Müziği düşüründen da soytutlanmış “porte-tемelli çarpık bir makamal eğitim anlayışı”, armoni ve polifoni alanında aranan ileri düzey müzik bilgileri çoğunlukla eksik; profesyonelimarmoni orkestralarında yer alamayacak kadar nota birikimleri yetersiz; Batılı çağdaşlarıyla karşılaştırdıkları ise, virtüözite ve bestecilik bakımdan oldukça geri kalmış müzik insanların yetişmesine yol açıyor görünmektedir.

Benzer sertlikte bir eleştiri, çap yakalamaktan uzak üstün-körü bir tavır içinde yol alan ve gençlere yeten birikimlerden yoksun kalmaktan da soytutulmus; Batılı çağdaşlarıyla karşılaştırıldıkları ise, virtüözite ve bestecilik bakımdan oldukça geri kalmış müzik insanların yetişmesine yol açıyor görünmektedir.


Kuşku götürmez ki, oldukça ileri bir teknik kavrayış düzeyini gerektiren Mikrotonal Polifoni – hele hele makamlarımıza dayalı ses-dağırcığının ne kadar yükülü olduğu düşünülürse – “sağlam” ve “bütünsel” bir Mikrotonal Bati Notasyonuna dayandırılmak durumundadır.

Nedir ki, orkestral düzlemden geleneksel çalgılarımıza ve makamlarımızın özgün kurgusuna dayalı bir Mikrotonal Polifoni Kuramı, görülebildiği kadarıyla, hâlâ daha geliştirilememiştir.¹⁶,¹⁷

¹⁶ Her ne kadar, Kemal İleriçi'nin bu konuda bir istisna teşkil eden “Türk Müziği ve Armonisi” (MEB Yayınları, 1981, İstanbul) adlı kurumda, Halk kültürüne ve makamlarına dayalı “kontrpunta-homofonik bir bestelemek teşvik eden” bahsetmek mümkün ise de, mikrotonal aralıktan ve uyguluk (akor) ölçümüne dayalı bir ses-sisteminin yer verilmesi ve bunun yerine, Türk Müziği'nin 53-tET seslerini kapsayabileceğine ilişkin bir varsayıma dayandırılık komma sayları istirilmsiz diyezler ile beemollerden ibaret ne edeceğin beliriz bir uygulamaya yetinilmesi (a.g.e., s. 33); üstelik – 12-tET'e göre tasarlanmış Piyanolar çoksesli müzik eğitiminde temel alınıp kaçırmaz olacağını –

Demek ki, dizek temelli bir Mikrotonal Notasyona yakınlarının biricik dayanağı, en üst bir erkek olarak, Mikrotonal Polifonisi’yi gözetmek olmamak. Eğer Makam Müziğine ulusalarasi bir ölçün sayılan Batı Notasyonu uyarlanmakta iştir edilecekse, onu geliştiren müzik adamlarının vazgeçtiği ilkelere bağlı kalması şarttır. Sonrasında, gerek olması halinde, Batı Notasyonunun tarihsel yükselişi tarsel düzeyine ters düşmeyecek eklmeler, bunun hakkını verebilecek ehil kişiler tarafından, elbette yapılabilecektir.


Bu noktaya kadar açıklayageldiğim üzerine, Makamsal Türk Müziğini uzun bir süredir sekteye uğratan köklü açmazların aşılabilmesi için, hazırlaki skolastik kuramların ötesinde yeni bir Mikrotonal Makam Kuramı vazgeçmeni gerekli buluyorum. Tasarlamakta olduğum yeni Türk Müziği Kuramında, belki de ilk kez olarak, perdeler “noktasal değerler”i “frekanslar-arası ses-dilimlerine” yorumlaktır.18 Şu halde, makamlarımızın perdeleri üzerinde yaptığım incelemelerime dayanarak, tam ses aralığı, kabaca, aşağıdaki gibi taksim etmeyi uygun görüyorum:


Bir oktavda eşitlendirilmiş 12-ton tamperamanlarıyla uyumlu bu taksimata göre, Türk Müziği okullarında yürürlükte olan Arel-Ezgi kuramının arzalarından, *irhâ/komma bemolü* ve *diyezi* (±1/8 ton) olduğu gibi muhafaza edilmiş, ancak, tahrifata uğramış olan arzalar ve *irhâ/komma bemolü* gibi muhafaza edilmiştir, ancak, tahrifata uğradığından, 4 kommalık *Pithagorsal diyatonik/limma diyez ve bemol, 5 kommalık Avrupâî diyatonik/apotom diyez ve bemol olacak şekilde* baştan düzenlenmiştir. Böylelikle, tarihsel nazarıyatta 256/243 oranında bakiyye olan arzalar üzerinden belirtmiş oluyoruz.19


19 Dört kommalık “aksi-diyatonik yarım-ton arzaları” (limmalar) ve 1/8 ton (komma) arzalar, yanılsa, Batı Müziği tonlarına kıyasla hafif yuvarlak durdукları halde “tamam perde” ya da “yeden” olarak anılan *Arak/Eve* (Rast=C₃′e göre B₃/B₄) ile *Segâh/Tiz Segâh* (E₄/E₅) gibi perdeleri betimlemekte kullanılmaldır. Bu perdeler daha da nermleştiklerinde, çeyrek-ses (1/4 ton) arzalarına başvurulmalıdır. Bununla birlikte, ½ ton enharmonik bölgedi; olağan kromatik/diyatonik/enharmonik yarım-ton arzaları, bildik diyez (#) ve bildik bemol (b) ile ifade edilmelidir.

20 M. Ekrem Karadeniz, “Türk Musikisinin Nazariye ve Esasları”, 1983, İŞ Bankası Kültür Yayınları, İstanbul, s. 10-11 (**sagir** için 31/30=+2.5 komma denmiş).
Geçen yüzyılın kuramları tarafından küçük mücenneb ve büyük mücenneb olarak farklı adlarla betimlenen, ancak özgün olarak yalnızca mücenneb adıyla bilinen büyüküküler, aslında, “yarım-ton ile tam-ton arasında kalan makrotonal aralıklar bütünü” olarak anlaşılmak gerekir (EK12).

Yine de, irhâ ve sağır aralıklarıyla gelen noktaların enharmonik karşılığı olması bakımından, mücenneb aralığı iki kısma ayırmakta yarar görülüyor. Bu durumda, Yekta, Arel-Ezgi ve Karadeniz kuramlarında saptadıklarını aksine, mücenneb aralığı “sağir bölgesine”, büyük mücenneb aralığı ise, “irhâ bölgesine” karşılık gelecek, mücenneb sağırın, büyük mücenneb ile irhâ’nın enharmonik olarak olacaktır.

Bu noktada vurgulamakta yarar görüyoruz: “Aksi-diyatonik” kurguda yapılandırılğa tanık olduğumuz Makam Müziğinde, çok diyezli veya çok bemollü tonlar üzerinden transpozisyon/modülasyon yapılmadığı sürecde, mücenneb olarak niteledilmiş ve kabaça 130 ¢ ile 180 ¢ genişliğindeki aralığı kümelenen makrotonal arzalar22 gerek yoktur; zira Makam Müziği, sırf mikrotonal arzalar üzerinden, yani daha az işaretle, kolayca açıklanabilecektir.24

Görüldüğü gibi, Batı Müziğinin arzalarına ek olarak, tam ses aralığı boyunca 5 tür diyez ve 5 tür bemol yerleştirmek süretilde, insan kulağının algılayabileceği ve ayırdebileceği tüm mikrotonları açıklamak mümkündür olmaktadır.

21 İ.H. Özkan, a.g.e., s. 39 (sisteme dahilmediği halde, arızasız anılan eksik bakiye için +3 komma denmis).

22 Al-Fârâbî’nin binyılda önce verdiği aralıklara bakıldığında, mücenneb’in küçüktken büyüğe doğru 15/14, 14/13, 13/12, 12/11, 11/10 oranlarıyla açığa çıkarılmış (EK12’deki değerlerle karşılaştırınız), bu yöntemde görüşiğiz doğrulamaktadır (Bkz. Prof. Yalçın Tura, “Türk Müzikisinin Mes’eleleri”, 1988, Pan Yayıncılık, İstanbul, s. 107 ve Cris Forster’in sitesi: http://www.chrysalis-foundation.org/Al-Farabi-s_Uds.htm).

23 Büyük mücenneb ve küçük mücenneb için alternatif makrotonal arzalar, şekilde parantezler içinde verilmiştir.

24 Her ne kadar, benimsediğimiz terminolojiye göre, mikrotonları yarım-saten küçük aralıklara, makrotonları ise yarım-ses ile tam-ses arasındaki kalan aralıklara ayrıldıysak da, genel anlamda, 12-tET sesleri de dahil olmak üzere, insan kulağının algılayabileceği ses-banındaki tüm freksanslar “mikroton” olarak adlandırılabilir. Yine kabaça bir genellemeye yapmak istersek, 12-tET izgarasına yuvarlanak 30 sent yaklaşan tüm sesleri tempere edilmiş sesler olarak değerlendirilebilir, bunların dışında kalan freksansları ise mikrotonlar olarak nitelendirebiliriz (Bkz. EK11).
12 Batı tonunu bünyesinde barındıran ve oktav tamamlandığında 53’üncü perdede kapanan bu dizge – en üst bir erek olarak dizek temelli Mikrotonal Polifoni amacıyla – hem Makam Müziğine, hem çokesli Batı Müziğine özgü tarihsel birikimleri, yüzyıllar öncesinden açılan arayı kapatarak bir dorukta bulmaktadır ve bu iki kardeş kültürden yetişen müzisyenleri hayranlık uyandıracak klasikal yahut avant-garde çalgı topluluklarında biraraya getirmek üzere, ideal bir çözüm olarak belirmektedir.25

53-perdeli dizgemizde geçen arızaların konuslarını topluca aşağıdaki veriyoruz:

<table>
<thead>
<tr>
<th>Temel Ses</th>
<th>Diyezler (+)</th>
<th>Adı ve kısaltması (koyu)</th>
<th>Kimıldatma değeri</th>
<th>Bemoller (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mikrotonlar</td>
<td>‡</td>
<td>İRHÂ (KOMMA)</td>
<td>10 ilá 40 े (1/8 - 1/6 ton)</td>
<td>〽</td>
</tr>
<tr>
<td></td>
<td>†</td>
<td>SAGİR (EKSİK BAKİYE)</td>
<td>40 ilá 70 े (1/5 - 1/3 ton)</td>
<td>‑</td>
</tr>
<tr>
<td>Limma</td>
<td>†</td>
<td>BAKİYE 26</td>
<td>70 ilá 95 े (küçük ½ ton)</td>
<td>″</td>
</tr>
<tr>
<td>½ Ton</td>
<td>‡</td>
<td>MAJÖR YARIM SES 27</td>
<td>95 ilá 130 े (apotom)</td>
<td>‪</td>
</tr>
<tr>
<td>Makrotonlar</td>
<td>‡/ †</td>
<td>MÜCENNEB 28</td>
<td>130 ilá 160 े (2/3 - 4/5 ton)</td>
<td>〽/ ‪</td>
</tr>
<tr>
<td></td>
<td>†/ ‡</td>
<td>BÜYÜK MÜCENNEB</td>
<td>160 ilá 180 े (5/6 - 7/8 ton)</td>
<td>‪/ ‪</td>
</tr>
<tr>
<td>1 Ton</td>
<td>‡</td>
<td>TANİNİ (9/8)</td>
<td>180 ilá 210 े (tam ses)</td>
<td>‪</td>
</tr>
</tbody>
</table>

25 Burada kastedilenin, totaliter yapıda bazı kurumların zoruya bir zamanlar yenilenen özeni bir “Batıllaşma Kampanyası” olmadığını; aksine, tamamen serbest girişime ve geniş bilgiye dayalı özgür müzişsel arayışlar ve kültürel sararrassalar olduğu, hatırlatılır. 

26 Pithagorsal Limma olan bu yarım-ses, Makam Müziğinde sıkça görülen aksi-diyatonik hareketlere karşılık gelir.


28 Makrotonal bir aralık kümesi olan mụcенеб, gelenekle örtüşecek biçimde, 13/12, 12/11 ve 11/10 oranlarına karşılıktır.
Önerdiğimiz ve aşağıdaki sunduğumuz dizge, kestirmeden ifade edersek, 12-ton Batı Müziği çizgisi ile Makam Müziği perdelerinin içe geçmiş hâlidir. Böylece, geleneksel icrâ ile örtüsrken Batı Müziği düsturunu hiç dişlamayan bir reçeteye varmış olduğumuz söylenebilecektir.


<table>
<thead>
<tr>
<th>Derece</th>
<th>Perde</th>
<th>Sent</th>
<th>ARALIK</th>
<th>Notası</th>
<th>Adı</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1/1</td>
<td>0.0000</td>
<td>(örncesi sese olan orani)</td>
<td>C</td>
<td>unison, perfect prime</td>
</tr>
<tr>
<td>1</td>
<td>81/80</td>
<td>21.5063</td>
<td>81/80</td>
<td>irhâ</td>
<td>syntonic comma, Didymus comma</td>
</tr>
<tr>
<td>2</td>
<td>45/44</td>
<td>38.9058</td>
<td>100/99</td>
<td>sagîr</td>
<td>1/5-tone</td>
</tr>
<tr>
<td>3</td>
<td>33/32</td>
<td>53.2729</td>
<td>121/120</td>
<td>ek. bak.</td>
<td>undecimal comma, al-Farabi's 1/4-tone</td>
</tr>
<tr>
<td>4</td>
<td>21/20</td>
<td>84.4672</td>
<td>56/55</td>
<td>bakiye</td>
<td>minor semitone</td>
</tr>
<tr>
<td>5</td>
<td>15/14</td>
<td>119.4428</td>
<td>50/49</td>
<td>C# Eb+</td>
<td>major diatomic semitone</td>
</tr>
<tr>
<td>*6</td>
<td>12/11</td>
<td>150.6371</td>
<td>56/55</td>
<td>mücenneb</td>
<td>3/4-tone, undecimal neutral second</td>
</tr>
<tr>
<td>7</td>
<td>11/10</td>
<td>165.0042</td>
<td>121/120</td>
<td>by. müc.</td>
<td>4/5-tone, Ptolemy's second</td>
</tr>
<tr>
<td>8</td>
<td>10/9</td>
<td>182.4037</td>
<td>100/99</td>
<td>by. müc.</td>
<td>minor whole tone</td>
</tr>
<tr>
<td>9</td>
<td>9/8</td>
<td>203.9100</td>
<td>81/80</td>
<td>D</td>
<td>major whole tone</td>
</tr>
<tr>
<td>10</td>
<td>25/22</td>
<td>221.3095</td>
<td>100/99</td>
<td>irhâ</td>
<td>(acute major whole tone, O.Y.)</td>
</tr>
<tr>
<td>11</td>
<td>55/48</td>
<td>235.6767</td>
<td>121/120</td>
<td>sagîr</td>
<td>(undecimal semi-augmented whole tone, O.Y.)</td>
</tr>
<tr>
<td>12</td>
<td>7/6</td>
<td>266.8709</td>
<td>56/55</td>
<td>ek. bak.</td>
<td>septimal minor third</td>
</tr>
<tr>
<td>13</td>
<td>32/27</td>
<td>294.1350</td>
<td>64/63</td>
<td>bakiye</td>
<td>Pythagorean minor third</td>
</tr>
<tr>
<td>14</td>
<td>6/5</td>
<td>315.6413</td>
<td>81/80</td>
<td>D# Eb+</td>
<td>minor third</td>
</tr>
<tr>
<td>*15</td>
<td>27/22</td>
<td>354.5471</td>
<td>45/44</td>
<td>mücenneb</td>
<td>neutral third, Zalzal wusta of al-Farabi</td>
</tr>
<tr>
<td>16</td>
<td>21/17</td>
<td>365.8200</td>
<td>154/153</td>
<td>by. müc.</td>
<td>submajor third</td>
</tr>
<tr>
<td>17</td>
<td>5/4</td>
<td>386.3137</td>
<td>85/84</td>
<td>by. müc.</td>
<td>major third</td>
</tr>
<tr>
<td>18</td>
<td>81/64</td>
<td>407.8200</td>
<td>81/80</td>
<td>E</td>
<td>Pythagorean major third</td>
</tr>
<tr>
<td>19</td>
<td>9/7</td>
<td>435.0841</td>
<td>64/63</td>
<td>irhâ</td>
<td>septimal major third, BP third</td>
</tr>
<tr>
<td>20</td>
<td>35/27</td>
<td>449.2746</td>
<td>245/243</td>
<td>sagîr</td>
<td>9/4-tone, septimal semi-diminished fourth</td>
</tr>
<tr>
<td>21</td>
<td>21/16</td>
<td>470.7809</td>
<td>81/80</td>
<td>ek. bak.</td>
<td>narrow fourth</td>
</tr>
<tr>
<td>22</td>
<td>4/3</td>
<td>498.0450</td>
<td>64/63</td>
<td>F</td>
<td>perfect fourth</td>
</tr>
<tr>
<td>23</td>
<td>27/20</td>
<td>519.5513</td>
<td>81/80</td>
<td>irhâ</td>
<td>acute fourth</td>
</tr>
<tr>
<td>24</td>
<td>11/8</td>
<td>551.3179</td>
<td>55/54</td>
<td>sagîr</td>
<td>undecimal semi-augmented fourth</td>
</tr>
<tr>
<td>25</td>
<td>25/18</td>
<td>568.7174</td>
<td>100/99</td>
<td>ek. bak.</td>
<td>augmented fourth</td>
</tr>
<tr>
<td>26</td>
<td>7/5</td>
<td>582.5122</td>
<td>126/125</td>
<td>bakiye</td>
<td>septimal or Huygens' tritone, BP fourth</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Derece</th>
<th>Sınav</th>
<th>Doğru</th>
<th>Yanlış</th>
<th>Açıklama</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>10/7</td>
<td>617.4878</td>
<td>50/49</td>
<td>F# Gb+</td>
</tr>
<tr>
<td>28</td>
<td>16/11</td>
<td>648.6821</td>
<td>56/55</td>
<td>mückenb</td>
</tr>
<tr>
<td>29</td>
<td>22/15</td>
<td>663.0492</td>
<td>121/120</td>
<td>by. múc.</td>
</tr>
<tr>
<td>30</td>
<td>40/27</td>
<td>680.4487</td>
<td>100/99</td>
<td>by. múc.</td>
</tr>
<tr>
<td>31</td>
<td>3/2</td>
<td>701.9550</td>
<td>81/80</td>
<td>G</td>
</tr>
<tr>
<td>32</td>
<td>50/33</td>
<td>719.3545</td>
<td>154/153</td>
<td>by. múc.</td>
</tr>
<tr>
<td>33</td>
<td>55/36</td>
<td>733.7217</td>
<td>121/120</td>
<td>by. múc.</td>
</tr>
<tr>
<td>34</td>
<td>14/9</td>
<td>764.9159</td>
<td>154/153</td>
<td>by. múc.</td>
</tr>
<tr>
<td>35</td>
<td>5/3</td>
<td>884.3587</td>
<td>85/84</td>
<td>G Gb+</td>
</tr>
<tr>
<td>36</td>
<td>8/5</td>
<td>905.8650</td>
<td>100/99</td>
<td>G# Ab+</td>
</tr>
<tr>
<td>37</td>
<td>18/11</td>
<td>926.5921</td>
<td>45/44</td>
<td>mückenb</td>
</tr>
<tr>
<td>38</td>
<td>28/17</td>
<td>933.1291</td>
<td>64/63</td>
<td>G Gb+</td>
</tr>
<tr>
<td>39</td>
<td>5/3</td>
<td>947.4963</td>
<td>85/84</td>
<td>G Gb+</td>
</tr>
<tr>
<td>40</td>
<td>27/16</td>
<td>968.8259</td>
<td>245/242</td>
<td>ek. bak.</td>
</tr>
<tr>
<td>41</td>
<td>7/4</td>
<td>986.8259</td>
<td>245/242</td>
<td>ek. bak.</td>
</tr>
<tr>
<td>42</td>
<td>17/8</td>
<td>1023.191</td>
<td>64/63</td>
<td>G Gb+</td>
</tr>
<tr>
<td>43</td>
<td>13/7</td>
<td>1071.7018</td>
<td>572/567</td>
<td>by. múc.</td>
</tr>
<tr>
<td>44</td>
<td>15/8</td>
<td>1088.2687</td>
<td>105/104</td>
<td>by. múc.</td>
</tr>
<tr>
<td>45</td>
<td>20/11</td>
<td>1096.9958</td>
<td>45/44</td>
<td>major ¾</td>
</tr>
<tr>
<td>46</td>
<td>81/44</td>
<td>1056.5021</td>
<td>81/80</td>
<td>mückenb</td>
</tr>
<tr>
<td>47</td>
<td>13/7</td>
<td>1071.7018</td>
<td>572/567</td>
<td>by. múc.</td>
</tr>
<tr>
<td>48</td>
<td>15/8</td>
<td>1088.2687</td>
<td>105/104</td>
<td>by. múc.</td>
</tr>
<tr>
<td>49</td>
<td>243/128</td>
<td>1109.7750</td>
<td>81/80</td>
<td>B</td>
</tr>
<tr>
<td>50</td>
<td>27/14</td>
<td>1137.0391</td>
<td>64/63</td>
<td>G Gb+</td>
</tr>
<tr>
<td>51</td>
<td>35/18</td>
<td>1151.2296</td>
<td>245/243</td>
<td>by. múc.</td>
</tr>
<tr>
<td>52</td>
<td>49/25</td>
<td>1165.0244</td>
<td>126/125</td>
<td>ek. bak.</td>
</tr>
<tr>
<td>53</td>
<td>2/1</td>
<td>1200.0000</td>
<td>50/49</td>
<td>C</td>
</tr>
</tbody>
</table>

Scala Dökümü: Makam Müziği için 11-çarpanlı 53-Ton Genişletilmiş Tam Entonasyon

Dizisi, Ozan Yarman (çukcu-kromatik 12 Batı tonu koyu olarak gösterilmiştir ve yeri geldikçe “bakiye bölgesini” kullanabilirler.)

* Dizgenin 6., 15., 28., 37. ve 46. derecelerinde görülen mückenb aralığı, kendinden hemen önce gelen tam-tonlardan 12/11 oranında yukarıda olduğu halde, gerektikçe 13/12 oranıyla da açılabilir. Küçük mückenb ile laterelde bileceğimiz 13/12 ile 12/11 oranındaki olanı mückenb arasındakı fark, 91/90, yani yuvarlak 12 senttir. Bu durumda söz konusu dereceler, temel alınan sese göre, sırasıyla şu değerlerde sahip olacaklardır:

Altınçı derece: 13/12 _ 138.5727 sent (tridecimal 2/3 tone),
Onbesinci derece: 17/14 _ 336.1295 sent (supraminor third),
Yirmisekizinci derece: 13/9 _ 636.6177 sent (tridecimal diminished fifth),
Otuzyedinci derece: 34/21 _ 834.1745 sent (supraminor sixth),
Kırkaltinci derece: 11/6 _ 1049.3629 sent (21/4 tone, undecimal neutral seventh).
Yukarıdaki tabloda verilen makrotonal arızalar şimdilik esgeçersek, Makam Müziğinin temellerini – çok alterasyon gerektiren tonlar üzerinden göçürüm yaplamayacak olarak – olağan yarımlar ve tam ton arızalarının yanı sıra, mikrotonal yalnızca 3 adet Diyez (♯), (♭), (♮) ve 3 adet Bemol (♭♭), (♮♭), (♮♯) kullanarak açıklayabiliriz. Her hâlûkârda, 53-perdeli dizgemizden hiçbir ses eksilmeyecektir. Her ne kadar tabloda geçen 53 perde kesin oranlar cinsinden açıklanmış ise de, bu değerlerin yeri geldikçe nerah tiz veya hafif yatkınlabileceği unutulmamalıdır. Dikkat edilirse, önerdüğümüz 53 perdeli ses-sistemi, Urmiyeli Safiyüddin’in yedi yüzyl önce yazıdı ve tarihsel nazariyatta çok önemli bir yer tutan Kitâbü’l Edvar30 başlıklı eserinde zikrettiği 17’li dizgenin kabaca üç kat ayrıntılandırılmış şeklindedir. Görsel karşılaştırma yapabilmek üzere, sözkonusu dizgenin değerlerini veriyoruz:

<table>
<thead>
<tr>
<th>Derece</th>
<th>Perde</th>
<th>Sent</th>
<th>ARALIK</th>
<th>Notası</th>
<th>Adı</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alif-0</td>
<td>1/1</td>
<td>0.0000</td>
<td>(öncesi sese olan oranı)</td>
<td>C</td>
<td>unison, perfect prime</td>
</tr>
<tr>
<td>Ba-1</td>
<td>256/243</td>
<td>90.2250</td>
<td>256/243</td>
<td>C#4</td>
<td>limma, Pythagorean minor second</td>
</tr>
<tr>
<td>Cim-2</td>
<td>65536/59049</td>
<td>180.4500</td>
<td>256/243</td>
<td>D♭</td>
<td>Pythagorean diminished third</td>
</tr>
<tr>
<td>Dal-3</td>
<td>9/8</td>
<td>203.9100</td>
<td>531441/524288</td>
<td>D</td>
<td>major whole tone</td>
</tr>
<tr>
<td>He-4</td>
<td>32/27</td>
<td>294.1350</td>
<td>256/243</td>
<td>D#4</td>
<td>Pythagorean minor third</td>
</tr>
<tr>
<td>Vav-5</td>
<td>8192/6561</td>
<td>384.3600</td>
<td>256/243</td>
<td>E♭</td>
<td>Pythagorean diminished fourth</td>
</tr>
<tr>
<td>Zal-6</td>
<td>81/64</td>
<td>407.8200</td>
<td>531441/524288</td>
<td>E</td>
<td>Pythagorean major third</td>
</tr>
<tr>
<td>Hu-7</td>
<td>4/3</td>
<td>498.0450</td>
<td>256/243</td>
<td>F</td>
<td>perfect fourth</td>
</tr>
<tr>
<td>Ti-8</td>
<td>1024/729</td>
<td>588.2700</td>
<td>256/243</td>
<td>F#4</td>
<td>Pythagorean diminished fifth</td>
</tr>
<tr>
<td>Ye-9</td>
<td>262144/177147</td>
<td>678.4950</td>
<td>256/243</td>
<td>G♭</td>
<td>Pythagorean diminished sixth</td>
</tr>
<tr>
<td>Ya-10</td>
<td>3/2</td>
<td>701.9550</td>
<td>531441/524288</td>
<td>G</td>
<td>perfect fifth</td>
</tr>
<tr>
<td>Yeb-11</td>
<td>128/81</td>
<td>792.1800</td>
<td>256/243</td>
<td>G#4</td>
<td>Pythagorean minor sixth</td>
</tr>
<tr>
<td>Yec-12</td>
<td>32768/19683</td>
<td>882.4050</td>
<td>256/243</td>
<td>A♭</td>
<td>Pythagorean diminished seventh</td>
</tr>
<tr>
<td>Yed-13</td>
<td>27/16</td>
<td>905.8650</td>
<td>531441/524288</td>
<td>A</td>
<td>Pythagorean major sixth</td>
</tr>
<tr>
<td>Yeh-14</td>
<td>16/9</td>
<td>996.0900</td>
<td>256/243</td>
<td>A#4</td>
<td>Pythagorean minor seventh</td>
</tr>
<tr>
<td>Yev-15</td>
<td>4096/2187</td>
<td>1086.3150</td>
<td>256/243</td>
<td>B♭</td>
<td>Pythagorean diminished octave</td>
</tr>
<tr>
<td>Yez-16</td>
<td>1048576/531441</td>
<td>1176.5400</td>
<td>256/243</td>
<td>C♭</td>
<td>Pythagorean diminished ninth</td>
</tr>
<tr>
<td>Yet-17</td>
<td>2/1</td>
<td>1200.0000</td>
<td>531441/524288</td>
<td>C</td>
<td>octave</td>
</tr>
</tbody>
</table>

Scala Dökümü: Safiyüddin Urmevî’nin 17 perdeli dizgesi (koyu yazlar, Safiyüddin’e göre iki adet I. Tabaka I. Kısmdan oluşturan, diğer bir deyişle, dizinin birincisi perdesinden yukarı doğru 2 tam+1 yarım sesten oluşmuş bir dizgeyle, dizinin birinci perdesinden yukarı doğru 2 tam+1 yarım sesten oluşmuş iki tetrakordun yan yana ilistirilmesiyle meydana gelmiş olan ana dizi I. Uşak Devridir\(^{31}\)).

Buraya kadar, Makamsal Türk Müziği’nde kullanılan aralıkların bana göre yapısaldan özellikleri değerlendirme, Doktora Tezimde, çok daha derinlemesine bir inceleme yaparak ve uluslararası bir Mikrotonalité Ölçünü olabileceğini düşünüğüm yukarıdaki 53-perdeli dizge oranlarını esas almaktayım, tüm makamları elden geçirme ni dileyorum.

Böyle bir işe kalkışmanın gereği üç maddede özetlenebilir:

1- Makam Müziği eğitimi, yürürlükteki Arel-Ezgi metodolojisinde karşılaşılan tutarsızlıklar ve yeni kuşakların tarihsel kaynaklardan kopuk oluşu nedeniyle, sekteye uğramaktadır.

2- Skolâstik şablonlar Türk Müziği’ne pahalıya mâlolmuştur. Yeni bir kuramın dayanacağı, öncelikle, nesnel gözlem ve bilimsel bulgular olmalıdır.

3- İcrâ çözümlemelerinden ve aralık ölçümlerinden elde edilecek sonuçlar, uzman görüşler alınarak doğrulanmalı, tarihsel kaynaklardaki anlatımlarla karşılaştırılmalıdır. Makam Müziğinin evrimi, kronolojik sıraya verilecek nazari tarihlerle açıklanmalıdır ve alışkanlıkların zorlamayacak bir ara yol benimsenmelidir.

İşte, savunduğum görüşler çerçevesinde öncelikli amacım, günümüzdeki Makam Müziği icrasını en son ölçüm cihazlarıyla inceleme altına almak, başlica tarihsel ve çağdaş nazariyatta zikredilen makam tarihlerine eğilerek bunların etrafıca değerlendirilmesini yapmak ve bulgulanın sonuçlar ışığında, Batı Müziğinin saygı kaidelerine aykırı düşmeyecelik biçimde, yeni bir Mikrotonal Makam Kuramı ortaya koymaktır.

\(^{31}\) A.g.e., s. 171. (17’li dizinin aralıklarını 53-perdeli dizgedeki eşdeğerleriyle karşılaştırınız.)
Yüzyıllar öncesinden büyük bir hoca tarafından söylenmiş şu sözler kulağımıza küpe olmalıdır:

“Nazariyatçılıların ileri sürdükleri şeyler, eğer icrâçılırların, müsikişinasların ameliyatıyla, uygulamalarıyla çatışiyorsa, haksız olan, yamılan nazariyatçılardır, icrâçilar değil.”

Al-Fârâbî (M.S. 870-950)\(^{32}\)

Tezimin son kurgusunu EK13’te veriyorum. Başarabilirsem, iki cilt hâlinde yazmayı düşündüğüm “Türk Müziği’nin Mikrotonal Makam Kuramı”ni en çok iki sene zarında tamamlamayı umuyorum.

Saygılarımıla, 
Ozan Yarman
~Eylül 2005~

---

\(^{32}\) Prof. Yağcı Tura, “Türk Müsikişinin Mes’edeleri”, 1988, Pan Yayıncılık, İstanbul, s. 74’den alınmıştır.
KAYNAKLAR


EK1

Dr. CAN AKKOÇ'UN BİLGİSAYAR ÖLÇÜMLERİYLE
HAZIRLADIĞI SEYİR ÇİZELGESİ:

Şekil – Niyazi Sayın’ın Uşşak Makamında Ney ile icrâ ettiği bir Taksim’in %15’ini gösteren Seyir Çizelgesi. (Can Akkoç, “Non-Deterministic Scales Used in Traditional Turkish Music”, 2002, s. 5)
Dr. CAN AKKOÇ’UN BİLGİSAYAR ÖLÇÜMLERİYLE HAZIRLANDIĞI HİSTOGRAM:

**Şekil** – Niyazi Sayın’ın Uşşak Makamında Mansur Ney ile icrâ ettiği bir Taksim’in 0-228 sentlik ses-sahasını gösteren Histogram. Kuramdaki perde yerleri tirelidir ve frekanslarının kullanım sıklığı, parçanın toplam süresinin yüzdeleri cinsinden verilmiştir. (Can Akkoç, “Non-Deterministic Scales Used in Traditional Turkish Music”, 2002, s. 8)
MANUEL OP DE COUL’UN SCALA 2.2 PROGRAMI:

ROBERT WALKER'IN FRACTAL TUNE SMITHY 2.4 PROGRAMI:

EK5

GAULIJUS RASKINIS’İN SOLO EXPLORER 1.0 PROGRAMI:

Şekil – Solo Explorer Programının arayüzü. İcrâ kayıtlarından harekete bir ölçüm yazılımı olan Solo Explorer, monofonik .WAV dosyalarından elde ettiği frekans/sent degerlerini .TXT dosyası olarak depolamaya, bu değerleri AUDIO ve MIDI yoluyla seslendirmeye ve Bağ tonları cinsinden notalandırmaya yarar.
EK6

Y. Mat. Müh. M. KEMAL KARAOSMANOĞLU'NUN İÇRÄ-ANALİZİ 3.0 PROGRAMI:

<table>
<thead>
<tr>
<th>No</th>
<th>Rozet</th>
<th>Durumu</th>
<th>Kod</th>
<th>Sıra</th>
<th>Kayıt Tarihi</th>
<th>Enstrüman</th>
<th>Mahall</th>
<th>İçecek</th>
<th>Özel Kod 1,2</th>
<th>Zaman Bölgesi (Santıyanı)</th>
<th>Flash Bölgesi</th>
<th>Açıklama</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>hor_guzal</td>
<td>Durumu</td>
<td>Rozet</td>
<td>Sıra</td>
<td>Kayıt Tarihi</td>
<td>Enstrüman</td>
<td>Mahall</td>
<td>İçecek</td>
<td>Özel Kod 1,2</td>
<td>Zaman Bölgesi (Santıyanı)</td>
<td>Flash Bölgesi</td>
<td>Açıklama</td>
</tr>
</tbody>
</table>

Durumu: Durumu | Rozet | Sıra | Kayıt Tarihi | Enstrüman | Mahall | İçecek | Özel Kod 1,2 | Zaman Bölgesi (Santıyanı) | Flash Bölgesi | Açıklama |
Açıklama – İcra-Analizi, .WAV formatındaki bir kayıttan elde edilen ölçümleri .TXT formatında bir metin dosyasından alır. Bu yapı, ölçümlerde en çok yararlanılan SoloExplorer yazılımının standart çıktı formatı olduğu için tercih edilmiştir. Buna göre, icra kaydının her bir santasiyeleri boyunca ölçülmuş ve sıralanmış frekans değerleri girdi olarak (saniye başına 100 ölçüm birimi).

Program, gerek icrâlarla ilgili kimlik bilgilerini, gerek her icrânin ölçümlerini ve analiz sonuçlarını depolamak üzere, Paradox veritabanı kullanmaktadır.

Sağ sütunlardaki sayılar sent cinsindendir ve frekansların MIDI standartına göre en pest nota olan 8.175989156 Hz frekanslı C₀ (müzik fiziğindeki standartlara göre C₁) ile oluşturuldukları aralıklar ifade etmektedir.

Sonrasında program, icrânin seyir grafiği denilebilecek süre - frekans tablosu ile, seslerin parça boyunca yineleme sıklığından oluşan ve dikit grafiği adını verdiği histogramları çizebilmektedir.

Özellikle, taksim gibi yalnız olanmayan icrâlarda, glissando, çarpma gibi çeşitli süslemeler nedeniyle, hemen neredeyse hiçbir perde sâbit değerlerle açıklanamamakta, ancak, bölgelere olarak kümenelen çeşitli bulanık “doruklar” ortaya çıkmaktadır. İstatistiksel yöntemlerle bu “ses-kümeleri” çözümleme yöntemli, ortalamalara salışlıyor. Daha sonra, bu değerleri birimlendirmek istediğimizde, örneğin 6647 sent değerinden hareketle:

\[ x = 8.1757 \times \frac{26625}{1200} = 8.1757 \times 46.5 = 380.18 \text{ Hz} \]

ve farz-ı misal 452.89 Hz değerinden hareketle,

\[ x = 1200 \times \log_2(452.89 / 8.1757) = 6950.01 \text{ sent} \] değerleri hesaplanabilir.

Bu tür değerler ARALIKÖLÇER ile birbirine oranlanarak, icra boyunca kullanılan aralıklar hesaplanır.
EK7

Y. Mat. Müh. M. KEMAL KARAOSMANOĞLU’NUN
ARALIKÖLÇER PROGRAMI:

Aralık Ölçer 2.0, 2003, arşivlenmiş düzinelere müzikal aralık kaydı içeren ve herhangi iki sesi, en küçük iki tamsayınn kesirsel orantı şeklinde ifade etmeye yarayan bir yazılımdır.

Program ayrıca, herhangi bir birimle girilen ve rasyonel sayılara ve diğer birimlere dönüştürülen bir aralığın, dünyanın çeşitli kültürlerinde geçmişte ve / veya bugün kullanılmakta olan en yakın iki karşılığının adlarını ve oranlarını verir. Bu bilgiler, yazılım tarafından, büyük çoğunluğunun adlarını ve 326 farklı aralık içeren bir veritabanından alınır. Sözkonusu veritabanı, yeni eklemelere/düzenlemelere açmıştır.

Yazılım, girilen aralığı telli bir çalgıdan elde etmek için nereye basmak ya da perde bağlamak gerektiğini hesaplar. Telin uzunluğu tanımsız olarak 100 birimdir, fakat kullanıcı tarafından değiştirilebilir.

Oranlar hesaplanırken, Dave Keenan’ın (d.keenan@uq.net.au) ‘Yürüyen kesir’ ('Continued fraction') işlemine dayalı bir algoritmadan yararlanılır. Altta, AralikÖlçe’ren arayüzü görülüyor:

SEE Fig. 3.2 (page #28)
Aralık Birimleri

Program, aşağıdaki tanımları verilen 10 çeşit aralık biriminden herhangi birini girdi olarak alabilir ve bu değeri öteki 9 birime dönüştürür:

- **Sent**: Oktavın 1200 eşit parçaya bölünmesiyle elde edilen aralık birimi;
- **Pisagor Komması**: 531441 / 524288 oranıyla ifade edilen aralık birimi;
- **Holder Komması**: Oktavın 53 eşit parçaya bölünmesiyle elde edilen aralık birimi;
- **Mercator Komması**: Oktavın 300 eşit parçaya bölünmesiyle elde edilen aralık birimi;
- **Savart**: Oktavın 301.299 eşit parçaya bölünmesiyle elde edilen aralık birimi;
- **Düzeltilmiş Savart**: Oktavın 301.299 eşit parçaya bölünmesiyle elde edilen aralık birimi;
- **Komaç**: Oktavın 301.299 eşit parçaya bölünmesiyle elde edilen aralık birimi;
- **Santioktav**: Oktavın 100 eşit parçaya bölünmesiyle elde edilen aralık birimi;
- **Bağlı Frekans**: İki sesten birinin frekansı oranına bölünmesiyle elde edilen boyutsuz sayı.

Oran


Veritaban Bağlantısı

AralıkÖlčer, yukarıda anlatıldığı üzere, çeşitli birimlerde verilen aralıklar üzerinde ayrı ayrı işlem yapabildiği gibi, pessten tize çeşitli frekanslar içeren bir tablodaki değerleri de işleyebilir. Bu özellik, İcra-Analizi adlı bir diğer programın hesapladığı ortalama frekansları AralıkÖlčer’e tek tek elle girme külfetinden kurtulmak için eklenmiştir. İcra-Analizi’nin veritabanında bulunan ve ölçümleri yapılmış icrâların listesi istendiğinde ekranı gelir ve bu tablodan seçilen icrânın sonuçlarına ilişkin iki satır için gerekli hesaplamalar AralıkÖlčer tarafından otomatik olarak yapılır.

M. Kemal Karaosmanoğlu

e-posta: mkemal@plekom.com.tr
EK8

YAVUZ EKŞİ’NİN KESİR 1.0 PROGRAMI:

Reel Sayıların Rasyonel Sayılar ile Temsil Edilmesi ve KESİR 1.0 Programı


Anlatılanlardan çıkartılacak sonuç şudur: Ölçüm uzantısında elde edilen bir ondalıklı sayının, çeşitli yaklaşımlarda doğru olan sınırsız ölçüde farklı rasyonel sayı ile ifade etmek mümkün olsa bile, bunlar arasında özellikle en basit olanlar “müzikal oran” sayılmalıdır. Dolayısıyla, olası kesirleri yazarken en basit oranlardan başlamam, önceden belirlediğimiz bir hassasiyete ulaşmaya de en karmaşık oranlara doğru gittimiz.
KESİR 1.0 programı, ölçüm sonucu elde edilen ondalıklı sayıları kesirlere dönüştürürken, başlangıçta mümkün olan en basit oranı denemektedir. Böylelikle aranan denklek yakalandı ise, daha karmaşık oranları hiç denemez. Program, örneğin 1.5003 oranı için, doğrudan 3/2 yazar, 15003/10000 kesrine yer vermez, çünkü, 1.5003=3/2 yazmakla ortaya çıkan hata payı (0.346 sent), insan kulağının ayırdedemeyeceğini rahatlakla inanabileceğimiz bir farktır. Aslında, programın hassasiyet parametresi değiştirilerek, 3/2’nin yanı sıra 15003/10000 kesrini vermesi de sağlanabilir. Ancak bu teffruat, zihinleri bulandırmaktan başka bir işe yaramaz. KESİR 1.0, zaten yeterince yüksek bir hassasiyette çalışmaktadır.

Şimdi, KESİR 1.0 Programının, basit oranlardan başlayarak karmaşık oranlara nasıltruncate olduğunu açıklayabiliriz. Algoritma Prof. Dr. Metin Arık tarafından geliştirilmiştir:

Öncelikle, 0 ile 1 arasında ondalıklı bir sayı düşünelim (0.667 gibi). Bu sayıyı x ile gösterelim. 0 ile 1 arasındaki bir sayı kesirli olarak göstermek istendiğinde, payda mutlaka pay'dan büyük olmalıdır. Bu oranlar:

\[
\frac{k}{k+1} \\
\frac{k}{k+2} \\
\frac{k}{k+3} \\
\vdots \\
\frac{k}{k+j} \\
\vdots
\]

biçiminde gösterilebilir. Eğer x sayısı ilk oranı ile temsil edilebileseydi,

\[
\frac{k}{k+1} = x
\]

denklemden k çözülecek,

\[
k = \frac{x}{1-x}
\]

bulunurdu.

Eğer x sayısı bir sonraki oranı ile temsil edilebileseydi,

\[
x = \frac{k}{k+2}
\]

denklemden k çözülek

\[
k = \frac{2x}{1-x}
\]

bulunurdu.

Aynı şekilde devam edersek, eğer j. oran ondalıklı sayımızı iyi temsil ediyorsa,
\[ k = j \frac{x}{1-x} \]

bulacaktır. Görüldüğü gibi k sayısı,

\[ \frac{x}{1-x} \]

sayısının bir katı olmak durumunda. Bu sayıyı S ile tanımlayalım:

\[ S = \frac{x}{1-x} \]

k sayısı S sayısının belirli bir katı olacaktır. Dolayısıyla, bir x ondalıklı sayı verildiğinde, önce S sayısını hesaplayalım. Eğer x sayısı \( \frac{k}{k+1} \) biçiminde bir oran ile temsil edilebiliyorsa ise, S sayısı bir tam sayıya oldukça yakın olacaktır. Bununla birlikte, S sayısı bir tam sayıya yakınsadığı, bir tam sayı elde edilene değin katları alarak k için bir tam sayı elde edilmeye çalışılır. k sayısı bir tam sayı, önceden belirlenen bir hassasiyet mertebesinde, yaklaştırında \( \frac{k}{k+j} \) kesri de ondalık sayı istenen bir hassasiyet derecesinde temsil ediyor demektir.

Örnek olarak, 0.15 sayısının rasyonel karşılığı arayalım. Dikkat edilirse, bu sayıyı tam olarak 3/20 kesresiyle ifade edilebilir. Ancak, daha basit oranlar var mıdır acaba?

Öncelık sayısını hesaplayalım:

\[ S = \frac{0.15}{1-0.15} = 0.1764706 \]

Bu sayı bir tam sayıya yakın olmadığı için, S'in katlarını alarak devam ediyoruz:

\[ 2S = 0.3529412 \]
\[ 3S = 0.5294118 \]
\[ 4S = 0.7058824 \]
\[ 5S = 0.882353 \]
\[ 6S = 1.058824 \]

Altıncı kat, bir tam sayıya oldukça yakın çıkıyor (yakının ölçütünü biz belirliyoruz). Bu durumda:

\[ k = \text{int}(1.058824) = 1 \text{ ve } j = 6 \text{ olacaktır.} \]

Dolayısıyla, uygun bir oran

\[ \frac{k}{k+j}, \text{ yani } \frac{1}{7} \]

olacaktır.

\( \frac{1}{7} \) nin ondalık karşılığı 0.1428571 olup, hata payı
0.15-0.1428571 = 0.007,
yani, binde yedi mertebesindedir.

Bu fark, tahammül edilir hata payından küçük değil ise, program 7S, 8S şeklinde devam edecek, en sonunda, 3/20 oranını elde ettiği, tam doğruyu yakalamış olacağınından, duracaktır. Ama ondan önce, 2/13 ve 3/19 kesirlerini de elde edecektir. Başka bir örnekte, x=0.6667 sayısının rasyonel karşılığını bulmaya çalışalım:

\[ S = \frac{0.6667}{1 - 0.6667} = 2.0003 \]

Dolayısıyla, k = 2 ve j = 1 olduğunda,

\[ \frac{k}{(k + j)} = \frac{2}{3} \]

olmaktadır. Bu durumda program daha fazla tarama yapmayacaktır.

Yukarıda anlatılan yöntem, yalnızca 0 ile 1 arasındaki sayılardan geçerli ise de, bu kısıtlamayı kolayca aşabiliriz. Bir den büyük oranlar söz konusu olduğunda, bir sayının ilk basamağında tam sayıyı sayının kendisinden çıkartarsak, 0 ile 1 arasında bir sayı elde ederiz. Örneğin, 2.667 sayısından, sayının tam sayı kısmını olan 2yi çıkarırdığımızda, 0.667 elde ederiz. Elde ettigimiz bu tür bir sayı rasyonelleştirdikten sonra, eksiltiğimiz tam sayı kısmını eklemek kolaydır. 0.667'nin 2/3 olduğunu bulduktan sonra, bu kesire 2 sayısını eklerek, \( 2+\frac{2}{3} = \frac{8}{3} \) bulunur, ki böylece 2.667'nin en temel kesrine ulaşmış oluruz.

Demek ki, yalnızca 0 ile 1 arasındaki sayılardaki sayıyı rasyonel sayıya çeviren algoritmamız, her durumda işimizi görmektedir.

Ancak, S sayısı x=1.00 olduğunda sonsuzlaştığından dolayı, algoritma 1.00 sayısının rasyonel karşılığını bulamayacaktır. Bunun yanıtı programa ayrıca tanıtmak gerekiktedir.

Programlayan: Yavuz Ekşi

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EK9

YAVUZ EKŞİ’NİN ORAN 1.2 PROGRAMI:

ORAN 1.2 Programı

Serbest bir yazılım (freeware) olan ORAN 1.2 programı, olağan Piyano ların en peşte sesi olan A0 = 27.5 Hz (unison=0 sent) tonu temel referans alarak, 12000 sent (10 oktav) yukarıda olan A10 tonuna kadar geniş bir ses-sahası üzerinde çalışır. Bu ses-sahasındaki her bir frekansın, A0 = 27.5 Hz tonuna uzaklıklarını göre, sent cinsinden karşılar bulunur. Örneğin, A4 = 440 Hz, A0’a göre tam dört oktav yukarıda olduğundan, 4800 sentlik bir uzaklıktadır; dolaysıyla 4800 sentlik bir değere sahiptir. Bu ölçüm yapılırken mutlak alınan ses-sistemi 12-ton Esıt Taksimattır. Buna göre:

| 3900 sent | C4         | 4500 sent | F#4/Gb4   |
| 4000 sent | C#4/Db4    | 4600 sent | G4        |
| 4100 sent | D4         | 4700 sent | G#4/Ab4   |
| 4200 sent | D#4/Eb4    | 4800 sent | A4        |
| 4300 sent | E4         | 4900 sent | A#4/Bb4   |
| 4400 sent | F4         | 5000 sent | B4        |

Oktavı 1200 eşit parçaya bölün sent sistemine göre, 12-tET’nin her tonu, bir öncekine göre 100 sent yukarıdadır. 100 sent, Batı Müziğinde “tempere yarım-ton aralık” olarak anılır. (Örneğin, tablodaki E4 ile F4 arasına 100 senttir.)

ORAN 1.2, yukarıda anladığımız şekilde, 10 oktavlık (0 ila 12000 sent genişlikte) ses-sahası içinde sent olarak verilebilecek herhangi iki sesin (bunların Hertz karşılıklarını ve 12-tET tonlarından hangi yönde ve ne kadar saştıklarını gösterdikten sonra) oranını alır ve aralarındaki mesafeyi rasyonel kesirler cinsinden ölçer. Aralik hesaplama yöntemi KESİR 1.0 ile aynıdır.

Örneğin, A0’dan 4800 sent (4 oktav) yukarıda olan A4 ile 4950 yukarıda olan bir sesi oranlamak istedigimizde, önce ilk değeri, sonra de ikincisi değeri gireriz. Her değerin 12-tET karşılığı ile bu karşılıktan sapma miktarını (4800.0=A4 + 00 sent / 4950.0=B4 - 50 sent), A0 = 27.5 Hz’e göre frekansını (440 Hz / 479.8 Hz) ve MIDI standartına göre numarasını ile tonunu görürüz. Bundan sonra, ENTER tuşuna basıldığında, KESİR 1.0 algoritmasının devrede girer ve oranlanan aralığa karşılık rasyonel kesirler listelenir.

Kodu derleyen: Yavuz Ekşi

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EK10

Doç. Dr. RUHİ AYANGİL'E GÖRE TÜRK MÜZİĞİ ÂHENKLERİ:

<table>
<thead>
<tr>
<th>Bolâhenk</th>
<th>Davud</th>
<th>Şah</th>
<th>Mansur</th>
<th>Kızneyi</th>
<th>Müstahsen</th>
<th>Mehtâbiye (Süpürde)</th>
<th>Yıldız (Bol. Nis.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>La 4</td>
<td>La 4</td>
<td>La 4</td>
<td>La 4</td>
<td>La 4</td>
<td>La 4</td>
<td>La 4</td>
<td>La 4</td>
</tr>
<tr>
<td>Tiz Nevâ</td>
<td>Tiz Çargâh</td>
<td>Tiz Segâh</td>
<td>Muhayer</td>
<td>Gerdâniye</td>
<td>Acem</td>
<td>Hüseynî</td>
<td>Nevâ</td>
</tr>
</tbody>
</table>

~ La4 (440 Hz) sesinin yedi ana âhenkteki perde karşılıkları ~

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Bolâhenk</td>
<td>Davud</td>
<td>Şah</td>
<td>Mansur</td>
<td>Kızneyi</td>
<td>Müstahsen</td>
<td>Mehtâbiye</td>
<td>Yıldız</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Re 3</td>
<td>Mi 3</td>
<td>Fa 3</td>
<td>Solb</td>
<td>Lab</td>
<td>Si 3</td>
<td>Do 4</td>
<td>Reb</td>
<td>Re 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

~ Türk Makam Müziği'nde Âhenkler/ Ney Akortları ~

(Davud'dan aşağı ney, insan sınırları zorlanacağı için, çalınmaz.)
EK11

OZAN YARMAN’IN “MİKROTONLAR VE MAKAMSLAL MÜZİĞİMİZ”33
BAŞLIKLI SUNUMUNDA TANİTTİĞİ ARALIKLAR VE DİZİLER:

@ Dizi oluşturmada başlıca bir yöntem olarak doğuşkanlar

<table>
<thead>
<tr>
<th>Doğuşkan</th>
<th>Oran</th>
<th>Temel Sese Göre Sentler ve Aralık Adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:</td>
<td>1/1</td>
<td>0.000 ünison, mükemmel asal (temel ses)</td>
</tr>
<tr>
<td>2:</td>
<td>2/1</td>
<td>1200.000 oktav</td>
</tr>
<tr>
<td>3:</td>
<td>3/1</td>
<td>1901.955 mükemmel 12’li</td>
</tr>
<tr>
<td>4:</td>
<td>4/1</td>
<td>2400.000 2 oktav</td>
</tr>
<tr>
<td>5:</td>
<td>5/1</td>
<td>2786.314 majör 17’li</td>
</tr>
<tr>
<td>6:</td>
<td>6/1</td>
<td>3101.955 mükemmel 19’lu</td>
</tr>
<tr>
<td>7:</td>
<td>7/1</td>
<td>3368.826 armonik 21’li</td>
</tr>
<tr>
<td>8:</td>
<td>8/1</td>
<td>3600.000 3 oktav</td>
</tr>
<tr>
<td>9:</td>
<td>9/1</td>
<td>3803.910 mükemmel 23’lü</td>
</tr>
<tr>
<td>10:</td>
<td>10/1</td>
<td>3986.314 majör 24’lü</td>
</tr>
<tr>
<td>11:</td>
<td>11/1</td>
<td>4151.318 3 oktav + onbirsel yarı-artmış dörtlü</td>
</tr>
<tr>
<td>12:</td>
<td>12/1</td>
<td>4301.955 mükemmel 26’lı</td>
</tr>
<tr>
<td>13:</td>
<td>13/1</td>
<td>4440.528 3 oktav + onüçsel yalnız altılı</td>
</tr>
<tr>
<td>14:</td>
<td>14/1</td>
<td>4568.826 armonik 28’li</td>
</tr>
<tr>
<td>15:</td>
<td>15/1</td>
<td>4688.269 klasikal majör 28’li</td>
</tr>
<tr>
<td>16:</td>
<td>16/1</td>
<td>4800.000 4 oktav</td>
</tr>
</tbody>
</table>

---

33 Yıldız Teknik Üniversitesi Sahne Sanatları ve Tasarım Fakültesi’nce düzenlenen ve 6 Mayıs 2004 Perşembe günü gerçekleşen müzikbilim konferansında, dinletili olarak sunulmuştur.
@ Oktav içine göçürülen pestten tize sıralanan doğușkan sesler dizisi

<table>
<thead>
<tr>
<th>Ses</th>
<th>Oran</th>
<th>Temel Sese göre Sentler ve Aralık adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1/1</td>
<td>0.000 ünison, mükemmel asal (temel ses)</td>
</tr>
<tr>
<td>1</td>
<td>9/8</td>
<td>203.910 majör ikili</td>
</tr>
<tr>
<td>2</td>
<td>5/4</td>
<td>386.314 majör üçlü</td>
</tr>
<tr>
<td>3</td>
<td>11/8</td>
<td>551.318 onbirsel yarısıartmış dörtlü</td>
</tr>
<tr>
<td>4</td>
<td>3/2</td>
<td>701.955 mükemmel beşli</td>
</tr>
<tr>
<td>5</td>
<td>13/8</td>
<td>840.528 onüçsel yalin altılı</td>
</tr>
<tr>
<td>6</td>
<td>7/4</td>
<td>968.826 armonik yedili</td>
</tr>
<tr>
<td>7</td>
<td>15/8</td>
<td>1088.269 klásikal majör yedili</td>
</tr>
<tr>
<td>8</td>
<td>2/1</td>
<td>1200.000 oktav</td>
</tr>
</tbody>
</table>

@ Doğuşkanlar dizisindeki oktav hariç tüm aralıklar

--- İkitiler

<table>
<thead>
<tr>
<th>Aralık</th>
<th>Oran</th>
<th>Aralıkların genişlikleri ve adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16/15</td>
<td>111.731 sent minor diyatonik yarım ses</td>
</tr>
<tr>
<td>2</td>
<td>15/14</td>
<td>119.443 sent majör diyatonik yarım ses</td>
</tr>
<tr>
<td>3</td>
<td>14/13</td>
<td>128.298 sent 2/3-ton</td>
</tr>
<tr>
<td>4</td>
<td>13/12</td>
<td>138.573 sent onüçsel 2/3-ton</td>
</tr>
<tr>
<td>5</td>
<td>12/11</td>
<td>150.637 sent 3/4-ton, onbirsel yalin ikili</td>
</tr>
<tr>
<td>6</td>
<td>11/10</td>
<td>165.004 sent 4/5-ton, Batlamyus ikilisi</td>
</tr>
<tr>
<td>7</td>
<td>10/9</td>
<td>182.404 sent minör tam ses</td>
</tr>
<tr>
<td>8</td>
<td>9/8</td>
<td>203.910 sent majör tam ses</td>
</tr>
</tbody>
</table>

--- Küçük Üçlüler

<table>
<thead>
<tr>
<th>Görülme Sıklığı</th>
<th>Oran</th>
<th>Aralıkların genişlikleri ve adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 kez</td>
<td>8/7</td>
<td>231.174 sent yedisel ikili</td>
</tr>
<tr>
<td>1 kez</td>
<td>15/13</td>
<td>247.741 sent</td>
</tr>
<tr>
<td>1 kez</td>
<td>7/6</td>
<td>266.871 sent yedisel minör üçlü</td>
</tr>
<tr>
<td>1 kez</td>
<td>13/11</td>
<td>289.210 sent onüçsel minör üçlü</td>
</tr>
<tr>
<td>2 kez</td>
<td>6/5</td>
<td>315.641 sent minör üçlü</td>
</tr>
</tbody>
</table>
--- Büyük Üçlüler ---

<table>
<thead>
<tr>
<th>Görülmeye</th>
<th>Sıklığı</th>
<th>Oran</th>
<th>Aralıkların genişlikleri ve adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 kez</td>
<td>11/9</td>
<td>347.408 sent</td>
<td>onbirsel yalnız üçlü</td>
</tr>
<tr>
<td>1 kez</td>
<td>16/13</td>
<td>359.472 sent</td>
<td>onuşçel yalnız üçlü</td>
</tr>
<tr>
<td>2 kez</td>
<td>5/4</td>
<td>386.314 sent</td>
<td>majör üçlü</td>
</tr>
<tr>
<td>1 kez</td>
<td>14/11</td>
<td>417.508 sent</td>
<td>onbirsel eksilmiş dörtlü/majör üçlü</td>
</tr>
<tr>
<td>1 kez</td>
<td>9/7</td>
<td>435.084 sent</td>
<td>yedisel majör üçlü / BP üçlüsü</td>
</tr>
<tr>
<td>1 kez</td>
<td>13/10</td>
<td>454.214 sent</td>
<td>-</td>
</tr>
</tbody>
</table>

--- Dörtlüler ---

<table>
<thead>
<tr>
<th>Görülmeye</th>
<th>Sıklığı</th>
<th>Oran</th>
<th>Aralıkların genişlikleri ve adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 kez</td>
<td>4/3</td>
<td>498.045 sent</td>
<td>mükemmel dörtlü</td>
</tr>
<tr>
<td>1 kez</td>
<td>15/11</td>
<td>536.951 sent</td>
<td>-</td>
</tr>
<tr>
<td>1 kez</td>
<td>11/8</td>
<td>551.318 sent</td>
<td>onbirsel yarı-artrmuş dörtlü</td>
</tr>
<tr>
<td>1 kez</td>
<td>18/13</td>
<td>563.382 sent</td>
<td>-</td>
</tr>
<tr>
<td>1 kez</td>
<td>7/5</td>
<td>582.512 sent</td>
<td>yedisel triton yahut Huygens tritonu/BP dörtlüsü</td>
</tr>
<tr>
<td>1 kez</td>
<td>10/7</td>
<td>617.488 sent</td>
<td>Euler'in tritonu</td>
</tr>
<tr>
<td>1 kez</td>
<td>13/9</td>
<td>636.618 sent</td>
<td>-</td>
</tr>
<tr>
<td>1 kez</td>
<td>16/11</td>
<td>648.682 sent</td>
<td>onbirsel yarı-eksilmiş bezli</td>
</tr>
</tbody>
</table>

--- Beşliler ---

<table>
<thead>
<tr>
<th>Görülmeye</th>
<th>Sıklığı</th>
<th>Oran</th>
<th>Aralıkların genişlikleri ve adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 kez</td>
<td>22/15</td>
<td>663.049 sent</td>
<td>-</td>
</tr>
<tr>
<td>3 kez</td>
<td>3/2</td>
<td>701.955 sent</td>
<td>mükemmel bezli</td>
</tr>
<tr>
<td>1 kez</td>
<td>20/13</td>
<td>745.786 sent</td>
<td>-</td>
</tr>
<tr>
<td>1 kez</td>
<td>14/9</td>
<td>764.916 sent</td>
<td>yedisel minör altılı</td>
</tr>
<tr>
<td>1 kez</td>
<td>11/7</td>
<td>782.492 sent</td>
<td>onbirsel artmış bezli</td>
</tr>
</tbody>
</table>
~Altuhlär

<table>
<thead>
<tr>
<th>Görülme Sıklığı</th>
<th>Oran</th>
<th>Aralıkların genişlikleri ve adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 kez</td>
<td>8/5</td>
<td>813.686 sent minör altılı</td>
</tr>
<tr>
<td>1 kez</td>
<td>13/8</td>
<td>840.528 sent onüçsel yarın altılı</td>
</tr>
<tr>
<td>1 kez</td>
<td>18/11</td>
<td>852.592 sent onbirsel yarın altılı</td>
</tr>
<tr>
<td>2 kez</td>
<td>5/3</td>
<td>884.359 sent major altılı / Bohlen-Pierce altılı</td>
</tr>
<tr>
<td>1 kez</td>
<td>22/13</td>
<td>910.790 sent -</td>
</tr>
<tr>
<td>1 kez</td>
<td>12/7</td>
<td>933.129 sent yedisel major altılı</td>
</tr>
<tr>
<td>1 kez</td>
<td>26/15</td>
<td>952.259 sent -</td>
</tr>
</tbody>
</table>

~Yedililer

<table>
<thead>
<tr>
<th>Görülme Sıklığı</th>
<th>Oran</th>
<th>Aralıkların genişlikleri ve adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 kez</td>
<td>7/4</td>
<td>968.826 sent armonik yedili</td>
</tr>
<tr>
<td>1 kez</td>
<td>16/9</td>
<td>996.090 sent Pithagorsal minor yedili</td>
</tr>
<tr>
<td>1 kez</td>
<td>9/5</td>
<td>1017.596 sent tam minor yedili / BP yedilisi</td>
</tr>
<tr>
<td>1 kez</td>
<td>20/11</td>
<td>1034.996 sent büyük minor yedili</td>
</tr>
<tr>
<td>1 kez</td>
<td>11/6</td>
<td>1049.363 sent 21/4-ton, onbirsel yarın yedili</td>
</tr>
<tr>
<td>1 kez</td>
<td>24/13</td>
<td>1061.427 sent -</td>
</tr>
<tr>
<td>1 kez</td>
<td>13/7</td>
<td>1071.702 sent 16/3-ton</td>
</tr>
<tr>
<td>1 kez</td>
<td>28/15</td>
<td>1080.557 sent kahn major yedili</td>
</tr>
<tr>
<td>1 kez</td>
<td>15/8</td>
<td>1088.269 sent klásikal major yedili</td>
</tr>
</tbody>
</table>

@ 12-tET’te yakın düşültklerinden, mikrotonal sayılmayabilecek olan 20 aralık

<table>
<thead>
<tr>
<th>Oran</th>
<th>Aralıkların genişlikleri</th>
<th>Aralıkların adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/15</td>
<td>111.731 sent (12-tET sapma: +11.731 sent)</td>
<td>minor diyatonik yarım ses</td>
</tr>
<tr>
<td>15/14</td>
<td>119.443 sent (12-tET sapma: +19.443 sent)</td>
<td>major diyatonik yarım ses</td>
</tr>
<tr>
<td>10/9</td>
<td>182.404 sent (12-tET sapma: -17.596 sent)</td>
<td>minor tam ses</td>
</tr>
<tr>
<td>9/8</td>
<td>203.910 sent (12-tET sapma: +3.910 sent)</td>
<td>major tam ses</td>
</tr>
<tr>
<td>13/11</td>
<td>289.210 sent (12-tET sapma: -10.790 sent)</td>
<td>onüçsel minor üçlü</td>
</tr>
<tr>
<td>6/5</td>
<td>315.641 sent (12-tET sapma: +15.641 sent)</td>
<td>minor üçlü</td>
</tr>
<tr>
<td>5/4</td>
<td>386.314 sent (12-tET sapma: -13.686 sent)</td>
<td>major üçlü</td>
</tr>
<tr>
<td>14/11</td>
<td>417.508 sent (12-tET sapma: +17.508 sent)</td>
<td>onbirsel eksilmiş dörtlü</td>
</tr>
<tr>
<td>4/3</td>
<td>498.045 sent (12-tET sapma: -1.955 sent)</td>
<td>mükemmel dörtlü</td>
</tr>
</tbody>
</table>
7/5  582.512 sent (12-TET sapma: -17.488 sent)  yedisel triton
10/7  617.488 sent (12-TET sapma: +17.488 sent)  Euler’in tritonu
3/2  701.955 sent (12-TET sapma:  +1.955 sent)  mükemmel beşli
11/7  782.492 sent (12-TET sapma: -17.508 sent)  onbirsel artmış beşli
8/5  813.686 sent (12-TET sapma: +13.686 sent)  minör altı
5/3  884.359 sent (12-TET sapma: -15.641 sent)  majör altılı / BP altısı
22/13  910.790 sent (12-TET sapma: +10.790 sent) -
16/9  996.090 sent (12-TET sapma: -9.391 sent)  Pithagorsal minör yedili
9/5  1017.596 sent (12-TET sapma: +17.596 sent)  tam minör yedili / BP yedilisi
28/15  1080.557 sent (12-TET sapma: -19.443 sent)  ağır majör yedili
15/8  1088.269 sent (12-TET sapma: +11.731 sent)  klasikal majör yedili

@ Doğuşkanlar dizisinden türetilen 28 mikrotonal aralık

<table>
<thead>
<tr>
<th>Oran</th>
<th>Aralıkların genişlikleri ve adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>14/13</td>
<td>128.298 sent 2/3-ton</td>
</tr>
<tr>
<td>13/12</td>
<td>138.573 sent onüç sel 2/3-ton</td>
</tr>
<tr>
<td>12/11</td>
<td>150.637 sent 3/4-ton, onbirselden yakın ikili</td>
</tr>
<tr>
<td>11/10</td>
<td>165.004 sent 4/5-ton, Batlamyus ikilisi</td>
</tr>
<tr>
<td>8/7</td>
<td>231.174 sent yedisel ikili</td>
</tr>
<tr>
<td>15/13</td>
<td>247.741 sent -</td>
</tr>
<tr>
<td>7/6</td>
<td>266.871 sent yedisel minör üçlü</td>
</tr>
<tr>
<td>11/9</td>
<td>347.408 sent onbirselden yakın üçlü</td>
</tr>
<tr>
<td>16/13</td>
<td>359.472 sent onüç selde yakın üçlü</td>
</tr>
<tr>
<td>9/7</td>
<td>435.084 sent yedisel majör üçlü / BP üçlüsü</td>
</tr>
<tr>
<td>13/10</td>
<td>454.214 sent -</td>
</tr>
<tr>
<td>15/11</td>
<td>536.951 sent -</td>
</tr>
<tr>
<td>11/8</td>
<td>551.318 sent onbirselden yarısı-artmış dörtlü</td>
</tr>
<tr>
<td>18/13</td>
<td>563.382 sent -</td>
</tr>
<tr>
<td>13/9</td>
<td>636.618 sent -</td>
</tr>
<tr>
<td>16/11</td>
<td>648.682 sent onbirselden yarısı eksilmiştir beşli</td>
</tr>
<tr>
<td>22/15</td>
<td>663.049 sent -</td>
</tr>
<tr>
<td>20/13</td>
<td>745.786 sent -</td>
</tr>
<tr>
<td>14/9</td>
<td>764.916 sent yedisel minör altılı</td>
</tr>
<tr>
<td>13/8</td>
<td>840.528 sent onüçselde yakın altılı</td>
</tr>
<tr>
<td>18/11</td>
<td>852.592 sent onbirselden yakın altılı</td>
</tr>
<tr>
<td>12/7</td>
<td>933.129 sent yedisel majör altılı</td>
</tr>
<tr>
<td>26/15</td>
<td>952.259 sent -</td>
</tr>
<tr>
<td>7/4</td>
<td>968.826 sent armonik yedili</td>
</tr>
<tr>
<td>20/11</td>
<td>1034.996 sent büyük minör yedili</td>
</tr>
<tr>
<td>11/6</td>
<td>1049.363 sent 21/4-ton, onbirselden yakın yedili</td>
</tr>
<tr>
<td>24/13</td>
<td>1061.427 sent -</td>
</tr>
<tr>
<td>13/7</td>
<td>1071.702 sent 16/3-ton</td>
</tr>
</tbody>
</table>
@ Beşiler döngüsü ve Pithagorsal dizge (M.Ö. 550)

<table>
<thead>
<tr>
<th>Beşiler</th>
<th>Oran</th>
<th>Temel Sese göre Sentler ve Aralıklar adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>1/1</td>
<td>0.000 ünison, mükemmel asal (temel ses)</td>
</tr>
<tr>
<td>1:</td>
<td>3/2</td>
<td>701.955 mükemmel 5'li</td>
</tr>
<tr>
<td>2:</td>
<td>9/4</td>
<td>1403.910 majör 9’lu</td>
</tr>
<tr>
<td>3:</td>
<td>27/8</td>
<td>2105.865 Pithagorsal majör altılı + 1 oktav</td>
</tr>
<tr>
<td>4:</td>
<td>81/16</td>
<td>2807.820 Pithagorsal majör üçlü + 2 oktav</td>
</tr>
<tr>
<td>5:</td>
<td>243/32</td>
<td>3509.775 Pithagorsal majör yedilli + 2 oktav</td>
</tr>
<tr>
<td>6:</td>
<td>729/64</td>
<td>4211.730 Pithagorsal majör triton + 3 oktav</td>
</tr>
<tr>
<td>7:</td>
<td>2187/128</td>
<td>4913.685 apotom + 4 oktav</td>
</tr>
<tr>
<td>8:</td>
<td>6561/256</td>
<td>5615.640 Pithagorsal artış beşli + 4 oktav</td>
</tr>
<tr>
<td>9:</td>
<td>19683/512</td>
<td>6317.595 Pithagorsal artış ikili + 5 oktav</td>
</tr>
<tr>
<td>10:</td>
<td>59049/1024</td>
<td>7019.550 Pithagorsal artış altılı + 5 oktav</td>
</tr>
<tr>
<td>11:</td>
<td>177147/2048</td>
<td>7721.505 Pithagorsal artış üçlü + 6 oktav</td>
</tr>
<tr>
<td>12:</td>
<td>531441/4096</td>
<td>8423.460 Pithagor koması (ditonik koma) + 7 oktav</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sesler</th>
<th>Oran</th>
<th>Temel Sese göre Sentler ve Aralıklar adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>1/1</td>
<td>0.000 ünison, mükemmel asal (temel ses)</td>
</tr>
<tr>
<td>1:</td>
<td>2187/2048</td>
<td>113.685 apotom</td>
</tr>
<tr>
<td>2:</td>
<td>98</td>
<td>203.910 majör tam ses</td>
</tr>
<tr>
<td>3:</td>
<td>19683/16384</td>
<td>317.595 Pithagorsal artış ikili</td>
</tr>
<tr>
<td>4:</td>
<td>81/64</td>
<td>407.820 Pithagorsal majör üçlü</td>
</tr>
<tr>
<td>5:</td>
<td>177147/131072</td>
<td>521.505 Pithagorsal artış üçlü</td>
</tr>
<tr>
<td>6:</td>
<td>729/512</td>
<td>611.730 Pithagorsal triton</td>
</tr>
<tr>
<td>7:</td>
<td>3/2</td>
<td>701.955 mükemmel beşli</td>
</tr>
<tr>
<td>8:</td>
<td>6561/4096</td>
<td>815.640 Pithagorsal artış beşli</td>
</tr>
<tr>
<td>9:</td>
<td>27/16</td>
<td>905.865 Pithagorsal majör altılı</td>
</tr>
<tr>
<td>10:</td>
<td>59049/32768</td>
<td>1019.550 Pithagorsal artış altılı</td>
</tr>
<tr>
<td>11:</td>
<td>243/128</td>
<td>1109.775 Pithagorsal majör yedilli</td>
</tr>
<tr>
<td>12:</td>
<td>2/1</td>
<td>1200.000 oktav (ditonik kommalı oktav yerine)</td>
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</tbody>
</table>

@ Pithagor dizisindeki tüm aralıklar

<table>
<thead>
<tr>
<th>Görülme Sıklığı ve Oran</th>
<th>Aralıkların genişlikleri ve adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 kez 256/243</td>
<td>90.225 sent limma / Pithagorsal minör ikili</td>
</tr>
<tr>
<td>5 kez 2187/2048</td>
<td>113.685 sent apotom</td>
</tr>
<tr>
<td>2 kez 65536/59049</td>
<td>180.450 sent Pithagorsal eksilmiş üçlü</td>
</tr>
</tbody>
</table>
### Görülme Sıklığı ve Oran

<table>
<thead>
<tr>
<th>Kez Sayısı</th>
<th>Oran</th>
<th>Aralıklar genişlikleri ve adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 kez</td>
<td>9/8</td>
<td>203.910 sent majör tam ses</td>
</tr>
<tr>
<td>9 kez</td>
<td>32/27</td>
<td>294.135 sent Pithagorsal mınör üçlü</td>
</tr>
<tr>
<td>3 kez</td>
<td>19683/16384</td>
<td>317.595 sent Pithagorsal artmış ikili</td>
</tr>
<tr>
<td>4 kez</td>
<td>8192/6561</td>
<td>384.360 sent Pithagorsal eksişmiş dörtlü</td>
</tr>
<tr>
<td>8 kez</td>
<td>81/64</td>
<td>407.820 sent Pithagorsal mjaror üçlü</td>
</tr>
<tr>
<td>11 kez</td>
<td>4/3</td>
<td>498.045 sent mükemmel dörtlü</td>
</tr>
<tr>
<td>1 kez</td>
<td>177147/131072</td>
<td>521.505 sent Pithagorsal artmış üçlü</td>
</tr>
<tr>
<td>6 kez</td>
<td>1024/729</td>
<td>588.270 sent Pithagorsal eksişmiş beşli</td>
</tr>
<tr>
<td>6 kez</td>
<td>729/512</td>
<td>611.730 sent Pithagorsal triton</td>
</tr>
<tr>
<td>1 kez</td>
<td>262144/177147</td>
<td>678.495 sent Pithagorsal eksişmiş altılı</td>
</tr>
<tr>
<td>11 kez</td>
<td>3/2</td>
<td>701.955 sent mükemmel beşli</td>
</tr>
<tr>
<td>8 kez</td>
<td>128/81</td>
<td>792.180 sent Pithagorsal mınör altılı</td>
</tr>
<tr>
<td>4 kez</td>
<td>6561/4096</td>
<td>815.640 sent Pithagorsal artmış beşli</td>
</tr>
<tr>
<td>3 kez</td>
<td>32768/19683</td>
<td>882.405 sent Pithagorsal eksişmiş yedili</td>
</tr>
<tr>
<td>9 kez</td>
<td>27/16</td>
<td>905.865 sent Pithagorsal mjaror altılı</td>
</tr>
<tr>
<td>10 kez</td>
<td>16/9</td>
<td>996.090 sent Pithagorsal mınör yedili</td>
</tr>
<tr>
<td>2 kez</td>
<td>59049/32768</td>
<td>1019.550 sent Pithagorsal artmış altılı</td>
</tr>
<tr>
<td>5 kez</td>
<td>4096/2187</td>
<td>1086.315 sent Pithagorsal eksişmiş oktav</td>
</tr>
<tr>
<td>7 kez</td>
<td>243/128</td>
<td>1109.775 sent Pithagorsal mjaror yedili</td>
</tr>
</tbody>
</table>

@ Yahunlaştırılmış Pithagor dizisi

### Beşliler

<table>
<thead>
<tr>
<th>Beşliler</th>
<th>Oran</th>
<th>Temel Sese göre Sentler ve Aralik adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>1/1</td>
<td>0.000 ünison, mükemmel asal (temel ses)</td>
</tr>
<tr>
<td>1:</td>
<td>256/243</td>
<td>90.225 limma / Pithagorsal mınör ikili</td>
</tr>
<tr>
<td>2:</td>
<td>9/8</td>
<td>203.910 majör tam ses</td>
</tr>
<tr>
<td>3:</td>
<td>32/27</td>
<td>294.135 Pithagorsal mınör üçlü</td>
</tr>
<tr>
<td>4:</td>
<td>81/64</td>
<td>407.820 Pithagorsal mjaror üçlü</td>
</tr>
<tr>
<td>5:</td>
<td>4/3</td>
<td>498.045 mükemmel dörtlü</td>
</tr>
<tr>
<td>6:</td>
<td>729/512</td>
<td>611.730 Pithagorsal triton</td>
</tr>
<tr>
<td>7:</td>
<td>3/2</td>
<td>701.955 mükemmel beşli</td>
</tr>
<tr>
<td>8:</td>
<td>128/81</td>
<td>792.180 Pithagorsal mınör altılı</td>
</tr>
<tr>
<td>9:</td>
<td>27/16</td>
<td>905.865 Pithagorsal mjaror altılı</td>
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<td>10:</td>
<td>16/9</td>
<td>996.090 Pithagorsal mınör yedili</td>
</tr>
<tr>
<td>11:</td>
<td>243/128</td>
<td>1109.775 Pithagorsal mjaror yedili</td>
</tr>
<tr>
<td>12:</td>
<td>2/1</td>
<td>1200.000 oktav (ditonik koomali oktav yerine)</td>
</tr>
</tbody>
</table>
@ Diyatonik Aristozenos dizisi (M.Ö. 330)

<table>
<thead>
<tr>
<th>Ses</th>
<th>Oran</th>
<th>Temel Sese göre Sentler ve Aralık adları</th>
</tr>
</thead>
<tbody>
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<td>1/1</td>
<td>0.000 ünison, mükemmel asal (temel ses)</td>
</tr>
<tr>
<td>1:</td>
<td>20/19</td>
<td>88.801 -</td>
</tr>
<tr>
<td>2:</td>
<td>20/17</td>
<td>281.358 onyedisel artmış ikili</td>
</tr>
<tr>
<td>3:</td>
<td>4/3</td>
<td>498.045 mükemmel dörtlü</td>
</tr>
<tr>
<td>4:</td>
<td>3/2</td>
<td>701.955 mükemmel beşli</td>
</tr>
<tr>
<td>5:</td>
<td>30/19</td>
<td>790.756 küçük ondokuzsal minör altılı</td>
</tr>
<tr>
<td>6:</td>
<td>30/17</td>
<td>983.313 -</td>
</tr>
<tr>
<td>7:</td>
<td>2/1</td>
<td>1200.000 oktav</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sıra</th>
<th>Oran</th>
<th>Birbiri ardınca gelen aralıkların genişlikleri ve adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:</td>
<td>20/19</td>
<td>88.801 sent -</td>
</tr>
<tr>
<td>2:</td>
<td>19/17</td>
<td>192.558 sent -</td>
</tr>
<tr>
<td>3:</td>
<td>17/15</td>
<td>216.687 sent -</td>
</tr>
<tr>
<td>4:</td>
<td>9/8</td>
<td>203.910 sent majör tam ses</td>
</tr>
<tr>
<td>5:</td>
<td>20/19</td>
<td>88.801 sent -</td>
</tr>
<tr>
<td>6:</td>
<td>19/17</td>
<td>192.558 sent -</td>
</tr>
<tr>
<td>7:</td>
<td>17/15</td>
<td>216.687 sent -</td>
</tr>
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</table>

@ Diyatonik Aristozenos dizisinde oktav dışında bulunan tüm aralıklar

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<th>Görülme Sıklık ve Oran</th>
<th>Aralıkların genişlikleri ve adları</th>
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<tbody>
<tr>
<td>2 kez 20/19</td>
<td>88.801 sent</td>
</tr>
<tr>
<td>2 kez 19/17</td>
<td>192.558 sent majör tam ses</td>
</tr>
<tr>
<td>1 kez 9/8</td>
<td>203.910 sent onyedisel artmış ikili</td>
</tr>
<tr>
<td>2 kez 17/15</td>
<td>216.687 sent</td>
</tr>
<tr>
<td>2 kez 20/17</td>
<td>281.358 sent ondokuzsal diton</td>
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<td>1 kez 45/38</td>
<td>292.711 sent onyedisel büyük üçlü</td>
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<tr>
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<td>305.487 sent</td>
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<td>2 kez 19/15</td>
<td>409.244 sent</td>
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<td>1 kez 51/40</td>
<td>420.597 sent</td>
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<td>1 kez 45/34</td>
<td>485.268 sent</td>
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<tr>
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<td>498.045 sent</td>
</tr>
<tr>
<td>1 kez 51/38</td>
<td>509.397 sent</td>
</tr>
<tr>
<td>1 kez 57/40</td>
<td>613.154 sent</td>
</tr>
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<td>586.846 sent</td>
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<td>690.603 sent</td>
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<td>Aralıkların genişlikleri ve adları</td>
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<td>----------------------------------</td>
</tr>
<tr>
<td>4 kez</td>
<td>3/2</td>
</tr>
<tr>
<td>1 kez</td>
<td>68/45</td>
</tr>
<tr>
<td>1 kez</td>
<td>80/51</td>
</tr>
<tr>
<td>2 kez</td>
<td>30/19</td>
</tr>
<tr>
<td>1 kez</td>
<td>57/34</td>
</tr>
<tr>
<td>1 kez</td>
<td>76/45</td>
</tr>
<tr>
<td>2 kez</td>
<td>17/10</td>
</tr>
<tr>
<td>2 kez</td>
<td>30/17</td>
</tr>
<tr>
<td>1 kez</td>
<td>16/9</td>
</tr>
<tr>
<td>2 kez</td>
<td>34/19</td>
</tr>
<tr>
<td>2 kez</td>
<td>19/10</td>
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@ 12-ton Zarlino Tamperamani (1558)

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<thead>
<tr>
<th>Aralık</th>
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<th>Aralık adları</th>
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<td>0:</td>
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<tr>
<td>1:</td>
<td>70.672 sent 25/24 klâsikal kromatik yarım ton, minör kroma</td>
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</tr>
<tr>
<td>2:</td>
<td>191.621 sent</td>
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</tr>
<tr>
<td>3:</td>
<td>312.569 sent</td>
<td></td>
</tr>
<tr>
<td>4:</td>
<td>383.241 sent</td>
<td></td>
</tr>
<tr>
<td>5:</td>
<td>504.190 sent</td>
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</tr>
<tr>
<td>6:</td>
<td>574.862 sent</td>
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</tr>
<tr>
<td>7:</td>
<td>695.810 sent</td>
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</tr>
<tr>
<td>8:</td>
<td>766.483 sent</td>
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</tr>
<tr>
<td>9:</td>
<td>887.431 sent</td>
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</tr>
<tr>
<td>10:</td>
<td>1008.379 sent</td>
<td></td>
</tr>
<tr>
<td>11:</td>
<td>1079.052 sent</td>
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</tr>
<tr>
<td>12:</td>
<td>1200.000 sent 2/1 oktav</td>
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~Dizinin kurgusu~

<table>
<thead>
<tr>
<th>Do-Do#</th>
<th>+70.672 sent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do#-Re</td>
<td>+120.948 sent</td>
</tr>
<tr>
<td>Re-Re#</td>
<td>+120.948 sent</td>
</tr>
<tr>
<td>Re#-Mi</td>
<td>+70.672 sent</td>
</tr>
<tr>
<td>Mi-Fa</td>
<td>+120.948 sent</td>
</tr>
<tr>
<td>Fa-Fa#</td>
<td>+70.672 sent</td>
</tr>
</tbody>
</table>

| Fa#-Sol | +120.948 sent |
| Sol-Sol# | +70.672 sent |
| Sol#-La | +120.948 sent |
| La-La# | +120.948 sent |
| La#-Si | +70.672 sent |
| Si-Do | +120.948 sent |
@ 12-ton Tam Entonasyon dizisi (5 asal çarpanlı)

<table>
<thead>
<tr>
<th>Ses</th>
<th>Oran</th>
<th>Temel Sese göre Sentler ve Aralık adları</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>1/1</td>
<td>0.000 ünison, mükemmel asal (temel ses)</td>
</tr>
<tr>
<td>1</td>
<td>16/15</td>
<td>111.731 minör diyatonik yarım ton</td>
</tr>
<tr>
<td>2</td>
<td>9/8</td>
<td>203.910 majör tam ses</td>
</tr>
<tr>
<td>3</td>
<td>6/5</td>
<td>315.641 minör üçlü</td>
</tr>
<tr>
<td>4</td>
<td>5/4</td>
<td>386.314 majör üçlü</td>
</tr>
<tr>
<td>5</td>
<td>4/3</td>
<td>498.045 mükemmel dörtlü</td>
</tr>
<tr>
<td>6</td>
<td>45/32</td>
<td>590.224 triton</td>
</tr>
<tr>
<td>7</td>
<td>3/2</td>
<td>701.955 mükemmel beşli</td>
</tr>
<tr>
<td>8</td>
<td>8/5</td>
<td>813.686 minor sezikli</td>
</tr>
<tr>
<td>9</td>
<td>5/3</td>
<td>884.359 majör sezikli / BP seziklisi</td>
</tr>
<tr>
<td>10</td>
<td>9/5</td>
<td>1017.596 tam minör yedili / BP yedilisi</td>
</tr>
<tr>
<td>11</td>
<td>15/8</td>
<td>1088.269 klâsikal majör yedili</td>
</tr>
<tr>
<td>12</td>
<td>2/1</td>
<td>1200.000 oktav</td>
</tr>
</tbody>
</table>

@ 12-ton Tam Entonasyon dizisindeki oktav hariç tüm aralıklar

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<tr>
<th>Görülme Sıkliği ve Oran</th>
<th>Aralıkların genislikleri ve adları</th>
</tr>
</thead>
<tbody>
<tr>
<td>3   25/24</td>
<td>70.672 sent klâsikal kromatik yarım ton, minör kroma</td>
</tr>
<tr>
<td>2   135/128</td>
<td>92.179 sent majör kroma, majör limma</td>
</tr>
<tr>
<td>6   16/15</td>
<td>111.731 sent minör diyatonik yarım ton</td>
</tr>
<tr>
<td>1   27/25</td>
<td>133.238 sent büyük limma / BP küçük yarım tonu</td>
</tr>
<tr>
<td>4   10/9</td>
<td>182.404 sent minör tam ses</td>
</tr>
<tr>
<td>6   9/8</td>
<td>203.910 sent majör tam ses</td>
</tr>
<tr>
<td>2   256/225</td>
<td>223.463 sent eksilmiş üçlü</td>
</tr>
<tr>
<td>3   75/64</td>
<td>274.582 sent klâsikal artmış ikili</td>
</tr>
<tr>
<td>3   32/27</td>
<td>294.135 sent Pithagorsal minör üçlü</td>
</tr>
<tr>
<td>6   6/5</td>
<td>315.641 sent minör üçlü</td>
</tr>
<tr>
<td>8   5/4</td>
<td>386.314 sent majör üçlü</td>
</tr>
<tr>
<td>4   32/25</td>
<td>427.373 sent klâsikal eksilmiş dörtlü</td>
</tr>
<tr>
<td>1   675/512</td>
<td>478.492 sent geniş artmış üçlü</td>
</tr>
<tr>
<td>9   4/3</td>
<td>498.045 sent mükemmel dörtlü</td>
</tr>
<tr>
<td>2   27/20</td>
<td>519.551 sent keskin dörtlü</td>
</tr>
<tr>
<td>2   25/18</td>
<td>568.717 sent klâsikal artmış dörtlü</td>
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<tr>
<td>4   45/32</td>
<td>590.224 sent triton</td>
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<tr>
<td>4   64/45</td>
<td>609.776 sent 2. triton</td>
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<tr>
<td>2   36/25</td>
<td>631.283 sent klâsikal eksilmiş beşli</td>
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<tr>
<td>2   40/27</td>
<td>680.449 sent kalın beşli</td>
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<tr>
<td>Görülme Sıklığı ve Oran</td>
<td>Aralıkların genişlikleri ve adları</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>9 3/2 701.955 sent 701.955 sent</td>
<td>mükemmel beşli</td>
</tr>
<tr>
<td>1 1024/675 721.508 sent</td>
<td>dar eksilmiş altılı</td>
</tr>
<tr>
<td>4 25/16 772.627 sent</td>
<td>klâsikal artmış beşli</td>
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<tr>
<td>8 8/5 813.686 sent</td>
<td>minör altılı</td>
</tr>
<tr>
<td>6 5/3 884.359 sent</td>
<td>majör altılı / BP altılı</td>
</tr>
<tr>
<td>3 27/16 905.865 sent</td>
<td>Pithagorsal majör altılı</td>
</tr>
<tr>
<td>3 128/75 925.418 sent</td>
<td>eksilmiş yedili</td>
</tr>
<tr>
<td>2 225/128 976.537 sent</td>
<td>artmış altılı</td>
</tr>
<tr>
<td>6 16/9 996.090 sent</td>
<td>Pithagorsal minör yedili</td>
</tr>
<tr>
<td>4 9/5 1017.596 sent</td>
<td>tam minör yedili / BP yedilisi</td>
</tr>
<tr>
<td>1 50/27 1066.762 sent</td>
<td>kalın majör yedili</td>
</tr>
<tr>
<td>6 15/8 1088.269 sent</td>
<td>klâsikal majör yedili</td>
</tr>
<tr>
<td>2 256/135 1107.821 sent</td>
<td>oktav - majör kroma</td>
</tr>
<tr>
<td>3 48/25 1129.328 sent</td>
<td>klâsikal eksilmiş oktav</td>
</tr>
</tbody>
</table>

@ William Holder’in Ortalanmış Tamperamani (1694)

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<tr>
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<th>Aralık adları</th>
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<tbody>
<tr>
<td>0: 0.000 sent 1/1 ünison, mükemmel asal (temel ses)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: 81.473 sent</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2: 193.586 sent</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3: 307.401 sent</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>4: 388.267 sent</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>5: 502.671 sent</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>6: 583.932 sent</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>7: 695.768 sent</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>8: 777.526 sent</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>9: 890.009 sent</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>10: 1004.177 sent</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>11: 1085.279 sent</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>12: 1200.000 sent</td>
<td>2/1 oktav</td>
<td></td>
</tr>
</tbody>
</table>

~SUNUMUN KAYNAKÇASI~

- Definition of Tuning Terms, Joseph. L. Monzo, 1998
- History of Western Music, Donald J. Grout & Claude. V. Palisca, 2001
- Scala 2.05, Manuel op de Coul, 2002
- Fractal Tune Smithy 2.4, Robert Walker, 2004
- Solo Explorer 1.0, Gauilius Raskinis, 2002
- İcrâ-İnalizi, M. Kemal Karaosmanoğlu, 2003
- AralıkÖlçer, M. Kemal Karaosmanoğlu, 2003
Y. Mat. Müh. M. KEMAL KARAOSMANOĞLU’NUN İCRÂ-ANALİZİ PROGRAMINA GÖRE SEYİR VE DİKİT GRAFIKLERİNDE PERDELER:

Şekil - Neyzen Niyazi Sayın’ın Uşşak taksiminin ilk 10 saniyeliğe kısmı. Taksim 390 – 400 Hz frekanslı bölgeden başlayıp, hemen 450 Hz (Düğâh) dölayına çıkmakta ve bu bantta yaklaşık 4.5 saniye kalmaktadır. (M. Kemal Karaosmanoğlu & Can Akkoç, “Türk Musikisinde İcra-Teori Birliği Sağlama Yolunda Bir Girişim”, s. 3)

SEE Fig. 3.1 (page #27)

Şekil – Uşşak taksimin tümüne ait sıklık grafiği. Yalnızca 452.11 Hz frekanslı Düğâh perdesi 98 santı-saniye (cs) süreye işittirilmiş.. 483.72 Hz’lik (Segâh) ikinci maksimumda 45 cs, 526.89 Hz’likte (Çargâh) ise 35 cs kalınımsız, vb. (a.g.e., s. 3)
SEE Table 3.2 (page #29)

Tablo – Uşşak taksimde kullanılan bazı perdelerin oluşturduğu aralıklar (a.g.e., s. 5).

SEE Fig. 3.3 (page #29)

Şekil – Uşşak makamı için Arel-Ezgi kuramında verilen (içteki halka) ve Niyazi Sayın’ın icrâsından elde edilen değerler. (a.g.e., s. 5).

SEE Table 3.3 (page #30)

Tablo – Karl L. Signell’in, Tanbûrî Necdet Yaşar’ın 6 ek perdesiyle ilgili ölçüm sonuçları. Sağ yarındaki oran sütunları, M. Kemal Karaosmanoğlu tarafından eklenmiştir (a.g.e., s. 6).

<table>
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<tr>
<th></th>
<th>Düğün</th>
<th>Şekil</th>
<th>Çarşaf</th>
<th>%68</th>
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<td>5.3</td>
<td>6.4</td>
<td>9.8</td>
<td></td>
</tr>
<tr>
<td>İhsan Özgen</td>
<td>6.5</td>
<td>5.9</td>
<td>9.4</td>
<td></td>
</tr>
<tr>
<td>Akagündüz Kutbay</td>
<td>6.2</td>
<td>6.1</td>
<td>9.6</td>
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<tr>
<td>Mehmet Polat</td>
<td>6.56</td>
<td>7.59</td>
<td>8.38</td>
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<td>5.84</td>
<td>5.2</td>
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<td>6.48</td>
<td>9.1</td>
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<td>8.65</td>
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<td>9.15</td>
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<td>10.2</td>
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<td>6.33</td>
<td>8.88</td>
<td></td>
</tr>
<tr>
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<td>6.59</td>
<td>5.85</td>
<td>9.45</td>
<td></td>
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<td>Derya Türkan</td>
<td>6.93</td>
<td>5.47</td>
<td>9.39</td>
<td></td>
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<td>Ortalama</td>
<td>6.7</td>
<td>6.0</td>
<td>9.3</td>
<td></td>
</tr>
<tr>
<td>En yakın aralıklar</td>
<td>12/11</td>
<td>13/12</td>
<td>9/8</td>
<td></td>
</tr>
</tbody>
</table>

Tablo – M. Kemal Karaosmanoğlu’nun “Türk Musikisi Perdelerini Ölçüm, Analiz ve Test Teknikleri” başlıklı YTÜ sunumundan: Uşşak makamında yapılan çeşitli icrâların toplu bir incelemesi, saptanan aralıklar ve bunların ortalama değerleri.

Şekil – İcrâ-Analizi programında, dikti grafiğinde doruklanan frekanslar üzerinden bir perdenin “ağırlık merkezinin” nasıl hesapladığı görülüyor. (Karaosmanoğlu’nun “Türk Musikisi Perdelerini Ölçüm, Analiz ve Test Teknikleri” başlıklı sunumundan).

Türk Müziği’nin Mikrotonal Makam Kuramı
Bilgisayar Tabanlı Ses-Kümesel Çözümlemeler Işığında, Tarihsel Nazariyat Çalışmalarının Karşılaştırmalı Bir İncelemesi

Dizin

Diş Kapak
İç Kapak (i)
Öz (ii - +)
Teşekkür
İçindekiler
Kısaltmalar
Çizelgeler Listesi
Şekiller Listesi
Simgeler Listesi
Türkçe Özet
İngilizce Özet
Önsöz
1. Giriş Bölümü
2.3.4.... Diğer Bölümler
1. Cilt

- Makamsal Türk Müziğinde Yaşanan Sıkıntılar: Eleştirel Bir Gözlem
- Başıca Tarihsel Nazariyaya Göre Perdeler ve Makamlar
- Başka Çağdaş Nazariyaya Göre Perdeler ve Makamlar
- Perdelerin ve Makamlarının Karşılaştırmalı Bir Ara-Değerlendirmesi
- İcrâ Kayıtlarından Yola Çıkarak Seslerin Ölçülmesi Yöntemi
- Üstadların Makam Müziği Yorumları: Seyir/Sıklik Çizelgeleri, Perdeler ve Aralıklar
- Ses-Kümesel Çözümleme: Makam Müziğinin Kurgusuna Dair Ortalama Değerler
- Makamların Açıklanması ve Tasnif Edilmesi Sorunsalı
- Geleneksel Ney Âhenkleri ve Türk Müziğinde Akort Sorunu
- Batı Ölçünleri Çizgisinde Bir Mikrotonal Notasyon Dizgesi Önerisi
- Bilinen Tüm Makamların Notalandırılması ve 21 Batı Tonu Üzerinden Göçürümüleri

2. Cilt

- Başıca Makam Müziği Kaynaklarına göre Usûller ve İka
- Usûllerin Yazımında Gözetilmesi Gereken Düsürlar
- Usûllerin Açıklanması ve Tasnif Edilmesi Sorunsalı
- Makam Müziğinde Tarihsel Kaynaklara Dayalı Bir Usûller Derlemesi
- Makamsal Türk Müziğinde Kullanılan Türler ve Biçimler Üzerine
- Makamlara ve Usûllere Dair Hazırladığımız Nota Örnekleri
- Ufkun Ötesinde: Mikrotonal Polifoni ve Senfonik Makam Müziği Çağrısı

( x ) Sonuçlar ve Tartışma

Kaynaklar
Ekler
Özgeçmiş
Microtonal Maqam Theory Of Turkish Music
A Comparative Study Of Historical Treatises
In Light Of Computer Based Pitch-Cluster Analyses

Index

Outer Cover
Inner Cover (i)
Abstract (ii - +)
Acknowledgements
Table of Contents
Abbreviations
List of Tables
List of Figures
List of Symbols
Turkish Summary
English Summary
Foreword
1. Introduction
2.3.4…. Chapters

Volume I

- Enduring Issues In Turkish Maqam Music: A Critical Observation
• Pitches and Maqams According To Prominent Historical Treatises
• Pitches and Maqams According To Prominent Contemporary Treatises
• An Intermediate Comparative Evaluation On Pitches and Maqams
• Method Of Calculating Sounds In Performance Records
• Interpretation Of Maqam Music Masters: Time-Plots, Histograms, Pitches & Intervals
• Pitch-Cluster Analysis: Approximating The Intrinsic Nature Of Maqam Music
• The Problem Of Describing and Classifying Maqams
• Traditional Ney Transpositions & The Problem of Tuning In Turkish Music
• Suggestion For A Microtonal Notation System In Accordance With Western Standards
• Transcription Of All Known Maqams & Transpositions Over 21 Western Tones

**Volume II**

• Usûls and I’qa According To Prominent Maqam Music Sources
• Principles Requiring Adherence To Concerning The Transcription of Usûls
• The Problem Of Explaining and Classifying Usûls
• A Compilation Based on Historical Sources Of Usûls In Maqam Music
• On The Genres And Forms Used In Turkish Maqam Music
• Notation Examples On Maqams & Usûls
• Beyond The Horizon: Microtonal Polyphony And Symphonic Maqam Music Era

( x ) Conclusions & Discussions

References

Appendices

Curriculum Vitae
“Tarihsel Nazariyatın Karşılaştırmalı Değerlendirmesine
Dayalı ve İcrâ Kayıtlarından Elde Edilen Perde Ölçümleri
İle Uyumlu – Türk Makam Müziği’nin Mikrotonal Kuramı”

Başlıklı 34 Doktora Tezime İlişkin İzleme Raporu III

Bir önceki Tez İzleme Raporumda, Makam Müziğimiz’dedeki teori
örtüşmeziğinden ilerli gelen ciddi sıkıntılar yaşadığını, yürürlüktedeki
Arel-Ezgi-Uzdilek kuramının “yerel olarak kullanılan temel aralıklar
geçekte nedir?” sorusuna tatmikâr yanıt veremediğini, buna bağlı olarak
makamların düzgün biçimde açıklanamadığını, hatta, teorik kalıplara
uyan aralar diye zorlanarak yer yer tahrif edildiğini ve “çarpık” bir nota
yazımı anlamın tehlikeli boyutlarda kök salarak Türkiye’deki müzik
eğitiminin feci şekilde tıkanmasına yol açtığını ifade etmiştim.

Bugün gelinen noktada, önceki denememiz zemininde vurguladığımız
 gibi, Makam Müziğimiz’in notalandırılmasında ivedi düzeltimler (reformlar)
yapılması gerekiğine ilişkin kuvvetli bulgular vardır…

1. Asıl Sistem: Makamsal Türk Müziği’nde, bilhassa “mücenneb
bölgesi” denilen “bağl frekans tayfında” karşılaşma perdesel
esneklik, gerekirse temel aralıklar baştan tanımlanarak, düzgün
bíçimsel açıklanabilmelidir. Zaten, repertuvardaki arzı işaretleri,
24 perdeli gayri-müsâvî taksimatta arzı taksimatta arzı sürlenin hayal diyında
yorumlanagelmektedir. Bu durum Uşşak, Sâbâ, Hüzzam gibi
makamlarda kendini hemen belli eder. Makam Müziğimiz’de,
haziranda tüm Âhenkler üzerinden “tam” ve “yarm” perdelerin

34 Son sunduğum Raporun akabinde, “The Microtonal Theory Of Turkish Maqam Music –
Reinforced By A Comparative Assessment Of Historic Treatises & Consistent With Pitch
Measurements Derived From Actual Performances” başlığı altında, İngilizce olarak yazmayı
bu aşamada uygun gördüğüm Doktora Tezimin konusunun Türkçeleştirilmiş hâlidir.

35 Buradan itibaren AEU olarak anlacaktr.
doğru açıklamaebileceği bir sistem, yaygın kanının aksesine, oktav 53 eşite bölün bir yaklaşımı değil, aslında, ton sayısını tabii bir hayli yükülü bir Pithagorsal Barok karma temperamanını (yedirimini) gerektirmektedir denebilir. Nitekim, böyle bir yedirimi özel yapım bir kanuna başaryla uyguladım (Bzk. EK 14).36


3. Makam Dizileri: Yunan modları açıklayarak kullanılan dördüllerin (tetrakordları), hatta beşillerin (pentakordları) üstüne bindirilmesine dayanılarak makamlar, aslında diyatonik şablonlara daha rahat oturmaktaadırlar. Hem sonra, üçüller (trikordlar), dördüller ve beşiller üzerinde anlatıların makamların tasnifinde çekilen zorluklar ve seyir esnasında “imtiyaz kazanan perdeleri” vurgulama ihtiyacı, Batı notasına bu denli bünyesine sindirmiş olan Makam Müziği’nin modal olmakta çok


37 Oktava “tam ses” ve “yaran ses” aralarının uygundu biçimde sıralanmasıyla, genelde 7 farklı nota oluşturan dızlere denir. Buna göre, en yaygın diyatonik dizi, meşhur major ile minor modları bünyesinde barındırılan septatonik dizidir. Ancak diyatonik dıziler bununla sınırlı olmadığı gibi, pratikçe sınırsız mikrotonal entonasyon seçeneği vardır.


4. Âhenk/Akort Karmaşası: Bundan iki yüzyıl önce, Avrupa ile etkileşimlerin başladığı bir dönemde yaygın olan Bolâhenk Nisfiye[d] düzendeki rast perdesine, Batı Müziğinin standart diyapazonuna (A/La=440 Hz’ye) göre re notası (293.3333 Hz) atfedilmiştir. Sonra, bu referans sese göre Rauf Yekta Bey, Mansur (Nisfiye) Neyde[d] rast perdesini tam dörtlü yukarıdaki sol notasi ile açıklamıştır.[e] Sonrasında, sanki rast perdesinin portedeki konumu Batı’nın standart diyapazonuna göre tayin edilmişsi gibi, okta yükseldiği re notasını (Mansur Neylerde rast’a göre nevâ perdesi için, akustik olarak Bolâhenk Nisfiye döndülmüş) [f] Bu yetmiyormuş gibi, günümüzde yine böylesi tam dörtlü aşağı (zihinsel) göçürümler yaplarlar, Kız Âhenge varımlktadır; ki bu, repertuvarın yazılına kıyaslara minor yedili aşağıdan okunması demektir! Hâlbuki, Âhenkler ilk etapta standart diyapazona göre belirleniyor iken, sonradan bu çizgiden üşengeç davranışlar sapılmıştır. Ústelik, Batı’da yüzüllü metodürülükte olan Ton Aktarımşal Çalğı (Key Transposing Instrument) ilkesi hiç hesaba katılmamış, Ney gibi boyu değiştiği halde delikleri arasındaki oranlar hiç değişmeyen çalgılar ile, Ud, Tanbur, Kanun, Kemençe gibi doğrusal göçürtme müsait olmayan standart diyapazon çalgıları – Batı’daki

---

[d] Tanburlar ve Udlar Bolâhenk, Kemençeler, Kemanlar ve Kanunlar bir oktav yükseldikten Bolâhenk (Nisfiye), Neyler de yine bir oktav yükseldikten Yıldız (Bolâhenk Nisfiye Nisfiye) düzende, yanı hef birden iki oktav üstüste çalarlar. Tanburlarn sempatik rezonans tellerine mızrap vurulmasıyla, üç oktav üstüste bindiği de olur.


uygulamalarla katıyan bağdaşmayacak biçimde – bir tutulmuş ve tek bir partisyonu mahkûm edilmişlerdir. Batı notası ilkelerini bu denli tarımsal eden bir anlayışla, Makam Müziğinin düzgün öğrenlemeyeceği ve gelişim gösteremeyeceği aşıkardır. Batı notasının tam olarak hakkını verebilmek için, Ton Aktarım olarak doğru diyapazonu bağlı olarak doğrusal göçürüme müsait olmayan diğer Fas çalgıları için ayrı partitür hazırlanması gerektiği ortadadır (Bkz. Ek 16).

5. **Huruf Nota:** Makam Müziği tarihinde yer etmiş olan Huruf Notaların, anlatılan çerçevede, dizek üzerinde doğru ifade edilmesi ise apayrı bir soruna ilişkilidir. Bu sorunun çözümü somut çözümler getirdiği de belirtmek isterim (Bkz. Ek 17).


7. **Usûller ve İ’ka:** Tarihsel nazariyatta açıklanıp çekilde, Makam Müziği ritimlerinin yeniden gözden geçirilmesi ve darbalar (düm-tekerlerin) Kudüm ve Kös gibi çok-akortlu vurmlar için ayrı, Defler ve Darbukalar gibi tek-akortlu vurmlar için ayrı çekilde, üstelik velveleli olarak, ayrıntılandırılması zaruridir düşündüğümüzdeyim.

Saygılarmla,
Ozan Yarman
~Kasım 2005~

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EK14: Kanun için 79-ton Karma Yedirim

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En yüksek mutlak fark: 254.4451 sent  
En yüksek biçimsel beşli farka: 7.7105 sent

79 TURDAN SONRA, 46. OKTAVDA SİSTEM KAPANIR. KOYU OLARAK BELİRTİLEN SESLER, DİYATONIK ANA DİZİ RAST’IN ÇIKICI HÂLINİN NATÜREL PERDELERİDİR. SİSTEMDÈ ÜÇ CİNS MAKBUL BEŞLİ VARDIR:

694.245 sent (33 adet), Yedirilmiş Beşli. Segâh ve Evc perdelerinin doğruluğu için gerekliidir.  
701.955 sent (46 adet), Tam Beşli. Köprü görevi görür.  
709.337 sent (32 adet), Süper-Pithagorsal Beşli. Sûz-i Dilârâ (tatlî melodik major) bununla elde edilir.
DİYEZLER VE BEMOLLER GEREK YEDİRLİMİŞ BEŞLİLER YOLUYLA BİRİBİRLERİNE ERİŞEMEYECÊK, GEREK TAM VE GENİŞ BEŞLİLER YOLUYLA BİRİBİRLERİNİ SOLLAYACAK, GEREKSE DE TANİNİ ARALIĞININ RESMİYETTE BÖLÜNMESİNDEKİ GİBİ ENHARMONİK DÜZLEMDE ÇAKIŞACAK BİÇİMDE YORUMLANABİLİRLER.

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41: 374.4295 Hertz
42: 377.7079 Hertz
43: 381.0150 Hertz
44: 384.3511 Hertz
45: 387.7163 Hertz
46: **392.8569 Hertz**
    G4 NEVÂ 3/2
47: 396.2966 Hertz
48: 399.7665 Hertz
49: 403.2668 Hertz
50: 406.7977 Hertz
51: 410.3595 Hertz
52: 413.9525 Hertz
53: 417.5769 Hertz
54: 421.2331 Hertz
55: 424.9214 Hertz
56: 428.6419 Hertz
57: 432.3949 Hertz
58: 436.1809 Hertz
59: **440.0000 Hertz**
    A4 HÜSEYNİ 27/16
60: 443.8525 Hertz
61: 447.7388 Hertz
62: 451.6591 Hertz
63: 455.6137 Hertz
64: 459.6029 Hertz
65: 463.6271 Hertz
66: 467.6865 Hertz
67: 471.7814 Hertz
68: 475.9122 Hertz
69: 480.0792 Hertz
70: 484.2826 Hertz
71: 488.5229 Hertz
72: **492.8003 Hertz**
    B4 EVC 15/8
73: 497.1151 Hertz
74: 501.4677 Hertz
75: 505.8584 Hertz
76: 510.2876 Hertz
77: 514.7556 Hertz
78: 519.2626 Hertz
79: **523.8092 Hertz**
    C5 GERDÂNİYE 2/1
Makam Müziği perdeleri gerçekte frekanslara değil başınlı frekanslara karşılık olup, yukarıdaki standart diyapazon sesleri ile ancak SİPÜRDE ANA ÂHENK’te çakışır (Eşdeğer Sipürde Ney Âhengi, bundan 1 oktav yukarıda ses verdiği için, tüm Ney Âhenkleri gibi, Nisfiyedir).

Kesirlerle ifade edilen değerler, ilk oktadvaki tam perdelerin tatminkâr bir yaklaşımla tutturduğu ideal tam-tımsal oranlardır.

### 12-tET’den Sapmalara göre Mandallar (sent hassasiyetine göre basitleştirilmiştir)

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<tr>
<td>11:</td>
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<td>12:</td>
<td>181 sent</td>
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| 7:   | 106 sent   | C#0,+6   | Reb   |
| 8:   | 121 sent   | C#0,+21  |       |
| 9:   | 136 sent   | C#0,+36  |       |
| 10:  | 151 sent   | D0,-49   |       |
| 11:  | 166 sent   | D0,-34   |       |
| 12:  | 181 sent   | D0,-19   |       |
| 13:  | 196 sent   | D0,-4    | DÜGAH – Re |
| 14:  | 211 sent   | D0,+11   |       |
| 15:  | 226 sent   | D0,+26   |       |
| 16:  | 242 sent   | D0,+42   |       |
| 17:  | 257 sent   | D#0,-43  |       |
| 18:  | 272 sent   | D#0,-28  |       |
| 19:  | 287 sent   | D#0,-13  | Re#   |
| 20:  | 302 sent   | D#0,+2   | Mib   |
| 21:  | 317 sent   | D#0,+17  |       |</p>
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|       | 55:    | 838    | A0,+38      |      |
|       | 56:    | 853    | A0,-47      |      |
|       | 57:    | 868    | A0,-32      |      |
|       | 58:    | 883    | A0,-17      |      |
| 59:    | 898    | A0,-2    | HÜSEYİNİ - La (440 Hz) |
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| 61:    | 928    | A0,+28   |       |
| 62:    | 943    | A0,+43   |       |
| 63:    | 958    | A#0,-42  |       |
| 64:    | 974    | A#0,-26  |       |
| 65:    | 989    | A#0,-11  | La#    |
| 66:    | 1004   | A#0,+4   | Sib    |
| 67:    | 1019   | A#0,+19  |       |
| 68:    | 1034   | A#0,+34  |       |
| 69:    | 1049   | A#0,+49  |       |
| 70:    | 1064   | B0,-36   |       |
| 71:    | 1079   | B0,-21   |       |

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<tr>
<td>7:</td>
<td>1306</td>
<td>C#1,+6</td>
<td>Reb</td>
</tr>
<tr>
<td>8:</td>
<td>1321</td>
<td>C#1,+21</td>
<td></td>
</tr>
<tr>
<td>9:</td>
<td>1336</td>
<td>C#1,+36</td>
<td></td>
</tr>
<tr>
<td>10:</td>
<td>1351</td>
<td>D1,-49</td>
<td></td>
</tr>
<tr>
<td>11:</td>
<td>1366</td>
<td>D1,-34</td>
<td></td>
</tr>
<tr>
<td>12:</td>
<td>1381</td>
<td>D1,-19</td>
<td></td>
</tr>
</tbody>
</table>

(Tablonun orijinalinde bulunmadığı hâlde – ancak Tez Savunnamında sunduğum 79’lu Kanunda bu genișlemler çoktan yapılmış olduğundan – transpozisyonlar için gerekli olan çift-diyez mandallarının değerleri gri renkte verilmiştir.)
### 79-ton Karma Yedirim içinden 12-ton Enharmonikli Kapalı Sistem

| 0: | 1/1 | C   | Db  | * 0 |
| 6: | 90.554 sent | C#  | Db  | * 1 |
| 13: | 196.200 sent | D   | Ebb | * 2 |
| 19: | 286.753 sent | D#  | Eb  | * 3 |
| 26: | 392.399 sent | E   | Fb  | * 4 |
| 33: | 498.045 sent | F   | Gbb | * 5 |
| 39: | 588.599 sent | F#  | Gb  | * 6 |
| 46: | 701.955 sent | G   | Abb | * 7 |
| 52: | 792.509 sent | G#  | Ab  | * 8 |
| 59: | 898.155 sent | A   | Bbb | * 9 |
| 64: | 988.708 sent | A#  | Bb  | * 10 |
| 72: | 1094.354 sent | B   | Cb  | * 11 |
| 79: | 1200.000 sent | C   | Db  | * 12 |

### 12-ton Enharmonikli Kapalı Sisteme Beşiler Döngüsü

| 0: | 0.000 sent | 0.000 | 0 | 0 komma |
| 7: | 701.955 sent | -0.000 | 0 | 0 komma |
| 2: | 694.245 sent | -7.710 | -237 |
| 9: | 701.955 sent | -7.710 | -237 |
| 4: | 694.245 sent | -15.421 | -473 |
| 11: | 701.955 sent | -15.421 | -473 |
| 6: | 694.245 sent | -23.131 | -710 |
| 1: | 701.955 sent | -23.131 | -710 |
| 8: | 701.955 sent | -23.131 | -710 |
| 3: | 694.245 sent | -30.842 | -947 |
| 10: | 701.955 sent | -30.842 | -947 |
| 5: | 709.337 sent | -23.460 | -720 | -1 Pithagorsal komma |
| 12: | 701.955 sent | -23.460 | -720 | -1 Pithagorsal komma |

Farkların mutlak ortalaması: 18.6884 sent
Farkların karelerinin kök ortalaması: 21.7483 sent
En yüksek mutlak fark: 30.8418 sent
En yüksek biçimsel beşli fark: 7.7105 sent
**12-tET ile Karşılaştırma**

<table>
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<tr>
<th>Adım boyu 100.0000 senttir</th>
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</thead>
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<td>1: 90.554: 1: 100.0000 sent, fark 0.094463 adım, 9.4464 sent</td>
</tr>
<tr>
<td>2: 196.200: 2: 200.0000 sent, fark 0.038004 adım, 3.8005 sent</td>
</tr>
<tr>
<td>3: 286.753: 3: 300.0000 sent, fark 0.132468 adım, 13.2468 sent</td>
</tr>
<tr>
<td>4: 392.399: 4: 400.0000 sent, fark 0.076009 adım, 7.6009 sent</td>
</tr>
<tr>
<td>5: 498.045: 5: 500.0000 sent, fark 0.019550 adım, 1.9550 sent</td>
</tr>
<tr>
<td>6: 588.599: 6: 600.0000 sent, fark 0.114013 adım, 11.4014 sent</td>
</tr>
<tr>
<td>7: 701.955: 7: 700.0000 sent, fark -0.019550 adım, -1.9550 sent</td>
</tr>
<tr>
<td>8: 792.509: 8: 800.0000 sent, fark 0.074913 adım, 7.4914 sent</td>
</tr>
<tr>
<td>9: 898.155: 9: 900.0000 sent, fark 0.018454 adım, 1.8454 sent</td>
</tr>
<tr>
<td>10: 988.708: 10: 1000.0000 sent, fark 0.112918 adım, 11.2918 sent</td>
</tr>
<tr>
<td>11: 1094.354: 11: 1100.0000 sent, fark 0.056459 adım, 5.6459 sent</td>
</tr>
<tr>
<td>12: 1200.000: 12: 1200.0000 sent, fark -0.000000 adım, -0.0000 sent</td>
</tr>
</tbody>
</table>

Toplam mutlak fark: 0.756804 adım, 75.6804 sent
Farkların mutlak ortalaması: 0.063067 adım, 6.3067 sent
Farkların karelerinin kök ortalaması: 0.076019 adım, 7.6019 sent
En yüksek mutlak fark: 0.132468 adım, 13.2468 sent

* * * * * * * * * * *

Yukarıdaki Döngü, yalnızca Makam Müziği’nin tam perdelerini arzalı veya Standart Diyapazonda 79 MOS (”Moment of Symmetry” / Müttenâzir Orantılı Sıra) 159-tET’in herhangi noktasından harekete olan arzaları – ifade etmekle kalınmaz, aynı zamanda, Yekta-Arel-Ezgi ekolünde natürelden 4 komma yukarıda olduğu belirtilen (#) diyezi, natürel sesten makbul biçimde 4 “komma” (bakiye/limma) üstü yerleştirerek, hemen sonradaki natürel sesten 5 “komma” (apotom/küçük mücenneb) aşağıya düşen (b) bemol ile (tepki teoride anlatılırak istendiği gibi) bulunur.

Ne yazık ki, Makam Müziği çevresi tarafından yaygın olarak benimsenmiş olan AEU Notasyonu, değerlendirilemeyecek kadar derme çatma vaziyettiir. Birakalım perdeleri konumlandırmada başvurduğu tutarsız mantığı, herşeyden önce, makamların izahında yolaçığı tahrifat telafi edilebilir türden değildir görülüyorduyum 44.

44 Burada tahrifattan kasit, tamam sayılmak gereken perdelerin arzalı notalar üzerinden gösterilmesi, keyfiyete dayalı olarak birçok makamın yapısını bozulması ve “insicâm bozuk” dizilerin oluşturulması, birtakım perdelerin yazıldığından farklı yorumlanacağını
Dahası, “Beşliler Zinciri” ve Batı Müziği’nin özgü arızı işaretler ile yola çıkan bir sistemin, her zaman 7 tam beşli eksi 4 oktav düzeyiyle açıklanan ve istisnasız(#) işaretli affedilen apotom diyezi için, televizyon antenini andıran bir simgeyi, üstelik zıt yoldan elde edilen apotom bemolünün (b) eşdeğeri olarak, ihdas etmeye kalkması, bu da yetmiyormuş gibi, diyezli Batı tonlarını açıklanan ve istisnası z (♯) işareti atfedilen apotom diyezli Batı tonlar hiçbir zaman kanaatimce son derece ters bir yaklaşımın.45

Gerek AEU notasyonunun yaratıcıları, gerek savunucuları, Batı notasının çok iyi tanımlıklarından olsa gerek, “hamâsî söylemler” güdümünde bu tür tuhafklara rağmen apotom bemolda bu garip arızaya başvurmasının, kanaatimce son derece ters bir yaklaşımın. Bu açıdan ele alınmış, hazırlıksız düzümlere çeşitli Batı Müziği temperamanları, beşliler döngüsünde minik kalibrasyonlar yapılmış suretiyle, diyezleri ve bemollerı istenen noktalarda çarkıtırabilmeekte ve birçok örnek itibariyle tam 12 tur attıktan sonra (oktav eşdeğerliği ilkesi gereğince) başladıkları noktaya dönebilmektedirler. Diğer bir deyişle, Batı temperamanlarında sistem kapanmaya ve diyezler ile bemoller enharmonik olarak aynı seslerde buluşabilmektedirler.

Bu açıdan ele alınmış, hazırlıksız düzümlere çeşitli Batı Müziği temperamanı, iddia edilenin aksine “bozuk” yahut “yanlış” sesler içermediği gibi, matematiksel tamamı halde yeni seslere sağlamak için matematiksel çalısal yelpâzeler oluşturmaktadır. Son toplamda, Makam Müziği’nin salâhı açısından, bilimsel ciddiyetlendirilen alabama yoksun modasi geçmiş bir ekolün rafa kaldırılması, değiştireçlerin ise matematiksel tamamıyette yeniden yorumlanmak üzere baştan ele alınması, gayet yararlı olacaktır.

Önerilen 79’lu sistemin başlica eşit temperamanlarla mukayesesi aşağıda verilmiştir...

* * * * * * * * * * *

sıkça talâffuz edilmesi ve Batı’dan ıthal bir nota yazımı kullanıldığı halde, uluslararasını müzik diline aynın bir diyapazon anlayışının (440 Hz = Re!) perçinlenmesidir. Böylesine derme-çatma bir düsturla, Makam Müziği’nin doğru düzgün öğrenilemeyeceği aşıkardır. Nitekim, İcrâ-Teori örtüşmesi gibi boylu olarak olup, acil olarak çözüm beklemektedir.

45 Bkz. Yalçın Tura, Türk Mûsîkisînin Mes’eleleri, 1988, İstanbul, s. 135-7
<table>
<thead>
<tr>
<th>Adım boyu 15.1899 senttir</th>
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<td>36: 543.322</td>
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<td>42: 633.875</td>
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46: 701.955: 46: 708.8734 sent, fark -0.212037 adı, -3.2208 sent
47: 717.047: 47: 713.9241 sent, fark -0.199187 adı, -3.0256 sent
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49: 747.232: 49: 744.3038 sent, fark -0.186336 adı, -2.8304 sent
50: 762.324: 50: 759.4937 sent, fark -0.179911 adı, -2.7328 sent
51: 777.416: 51: 774.6835 sent, fark -0.173485 adı, -2.6352 sent
52: 792.509: 52: 789.8734 sent, fark -0.167059 adı, -2.5376 sent
53: 807.601: 53: 805.0633 sent, fark -0.160635 adı, -2.4400 sent
54: 822.693: 54: 820.2532 sent, fark -0.154209 adı, -2.3424 sent
55: 837.785: 55: 835.4430 sent, fark -0.147783 adı, -2.2448 sent
56: 852.878: 56: 850.6329 sent, fark -0.141358 adı, -2.1472 sent
57: 867.970: 57: 865.8228 sent, fark -0.134933 adı, -2.0496 sent
58: 883.062: 58: 881.0127 sent, fark -0.128507 adı, -1.9520 sent
59: 898.155: 59: 896.2025 sent, fark -0.122082 adı, -1.8544 sent
60: 913.247: 60: 911.3924 sent, fark -0.115657 adı, -1.7568 sent
61: 928.339: 61: 926.5823 sent, fark -0.109231 adı, -1.6592 sent
62: 943.431: 62: 941.7722 sent, fark -0.102806 adı, -1.5616 sent
63: 958.524: 63: 956.9620 sent, fark -0.096380 adı, -1.4640 sent
64: 973.616: 64: 972.1519 sent, fark -0.089955 adı, -1.3664 sent
65: 988.708: 65: 987.3418 sent, fark -0.083530 adı, -1.2688 sent
66: 1003.800: 66: 1002.5316 sent, fark -0.077104 adı, -1.1712 sent
67: 1018.893: 67: 1017.7215 sent, fark -0.070767 adı, -1.0736 sent
68: 1033.985: 68: 1032.9114 sent, fark -0.064324 adı, -0.9760 sent
69: 1049.077: 69: 1048.0103 sent, fark -0.057882 adı, -0.8784 sent
70: 1064.170: 70: 1063.2911 sent, fark -0.051403 adı, -0.7808 sent
71: 1079.262: 71: 1078.4810 sent, fark -0.044977 adı, -0.6832 sent
72: 1094.354: 72: 1093.6709 sent, fark -0.038552 adı, -0.5856 sent
73: 1109.446: 73: 1108.8608 sent, fark -0.032127 adı, -0.4880 sent
74: 1124.539: 74: 1124.0506 sent, fark -0.025701 adı, -0.3904 sent
75: 1139.631: 75: 1139.2405 sent, fark -0.019276 adı, -0.2928 sent
76: 1154.723: 76: 1154.4304 sent, fark -0.012851 adı, -0.1952 sent
77: 1169.815: 77: 1169.6203 sent, fark -0.006425 adı, -0.0976 sent
78: 1184.908: 78: 1184.8101 sent, fark -0.000000 adı, -0.0000 sent
79: 1200.000: 79: 1200.0000 sent, fark -0.000000 adı, -0.0000 sent

Toplam mutlak fark: 10.25490 adı, 155.7707 sent
Farkların mutlak ortalaması: 0.129808 adı, 1.9718 sent
Farkların karelerinin kök ortalaması: 0.151508 adı, 2.3014 sent
En yüksek mutlak fark: 0.289141 adı, 4.3920 sent
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<tr>
<th></th>
<th>Adım boyu 16.6667 senttir</th>
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<td>15.092: 16.6667 sent, fark 0.094463 adım, 1.5744 sent</td>
<td>2</td>
<td>30.185: 33.3333 sent, fark 0.188927 adım, 3.1488 sent</td>
</tr>
<tr>
<td>3</td>
<td>45.277: 50.0000 sent, fark 0.283390 adım, 4.7232 sent</td>
<td>4</td>
<td>60.369: 66.6667 sent, fark 0.377854 adım, 6.2976 sent</td>
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<td>5</td>
<td>75.461: 83.3333 sent, fark 0.472318 adım, 7.8720 sent</td>
<td>6</td>
<td>90.554: 83.3333 sent, fark -0.433218 adım, -7.2203 sent</td>
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<td>105.646: 100.0000 sent, fark -0.338754 adım, -5.6459 sent</td>
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<td>120.738: 116.6667 sent, fark -0.244291 adım, -4.0715 sent</td>
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<td>150.923: 150.0000 sent, fark -0.055363 adım, -0.9227 sent</td>
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<tr>
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<td>166.015: 166.6667 sent, fark 0.039100 adım, 0.6517 sent</td>
<td>12</td>
<td>181.107: 183.3333 sent, fark 0.133563 adım, 2.2261 sent</td>
</tr>
<tr>
<td>13</td>
<td>196.200: 200.0000 sent, fark 0.228027 adım, 3.8005 sent</td>
<td>14</td>
<td>211.292: 216.6667 sent, fark 0.322490 adım, 5.3748 sent</td>
</tr>
<tr>
<td>15</td>
<td>226.384: 233.3333 sent, fark 0.416954 adım, 6.9492 sent</td>
<td>16</td>
<td>241.476: 233.3333 sent, fark -0.488582 adım, -8.1430 sent</td>
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<td>256.569: 250.0000 sent, fark -0.394118 adım, -6.5686 sent</td>
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<td>271.661: 266.6667 sent, fark -0.299654 adım, -4.9942 sent</td>
</tr>
<tr>
<td>19</td>
<td>286.753: 283.3333 sent, fark -0.205191 adım, -3.4199 sent</td>
<td>20</td>
<td>301.845: 300.0000 sent, fark -0.110727 adım, -1.8455 sent</td>
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<td>21</td>
<td>316.938: 316.6667 sent, fark -0.016263 adım, -2.7111 sent</td>
<td>22</td>
<td>332.030: 333.3333 sent, fark 0.078200 adım, 1.3033 sent</td>
</tr>
<tr>
<td>23</td>
<td>347.122: 350.0000 sent, fark 0.172663 adım, 2.8777 sent</td>
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<td>362.215: 366.6667 sent, fark 0.267127 adım, 4.4521 sent</td>
</tr>
<tr>
<td>25</td>
<td>377.307: 383.3333 sent, fark 0.361590 adım, 6.0265 sent</td>
<td>26</td>
<td>392.399: 400.0000 sent, fark 0.456054 adım, 7.6009 sent</td>
</tr>
<tr>
<td>27</td>
<td>407.491: 400.0000 sent, fark -0.449482 adım, -7.4914 sent</td>
<td>28</td>
<td>422.584: 416.6667 sent, fark -0.355018 adım, -5.9170 sent</td>
</tr>
<tr>
<td>29</td>
<td>437.676: 433.3333 sent, fark -0.260554 adım, -4.3426 sent</td>
<td>30</td>
<td>452.768: 450.0000 sent, fark -0.166090 adım, -2.7682 sent</td>
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<td>482.953: 483.3333 sent, fark 0.022836 adım, 0.3806 sent</td>
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<td>33</td>
<td>498.045: 500.0000 sent, fark 0.117300 adım, 1.9550 sent</td>
<td>34</td>
<td>513.137: 516.6667 sent, fark 0.211763 adım, 3.5294 sent</td>
</tr>
<tr>
<td>35</td>
<td>528.230: 533.3333 sent, fark 0.306227 adım, 5.1038 sent</td>
<td>36</td>
<td>543.322: 550.0000 sent, fark 0.400690 adım, 6.6782 sent</td>
</tr>
<tr>
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<td>558.414: 566.6667 sent, fark 0.495154 adım, 8.2526 sent</td>
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<td>573.506: 566.6667 sent, fark -0.410382 adım, -6.8397 sent</td>
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<td>39</td>
<td>588.599: 583.3333 sent, fark -0.315918 adım, -5.2653 sent</td>
<td>40</td>
<td>603.691: 600.0000 sent, fark -0.221454 adım, -3.6909 sent</td>
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<tr>
<td>41</td>
<td>618.783: 616.6667 sent, fark -0.126990 adım, -2.1165 sent</td>
<td>42</td>
<td>633.875: 633.3333 sent, fark -0.032527 adım, -0.5421 sent</td>
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<td>648.968: 650.0000 sent, fark 0.061936 adım, 1.0323 sent</td>
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<tr>
<td>44: 664.060:</td>
<td>40: 666.6667 sent, fark 0.156400 adı, 2.6067 sent</td>
<td></td>
<td></td>
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<tr>
<td>45: 679.152:</td>
<td>41: 683.3333 sent, fark 0.250863 adı, 4.1811 sent</td>
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<td>46: 701.955:</td>
<td>42: 800.0000 sent, fark -0.117300 adı, -1.9550 sent</td>
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<td>47: 717.047:</td>
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<td>79: 1200.000:</td>
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Toplam mutlak fark: 19.13356 adı, 318.8927 sent  
Farkların mutlak ortalaması: 0.242197 adı, 4.0366 sent  
Farkların karelerinin kök ortalaması: 0.281949 adı, 4.6992 sent  
En yüksek mutlak fark: 0.495154 adı, 8.2526 sent
| 53-tET ile Karşılaştırma |
| Adım boyu 22.6415 senttir |
| 1: 15.092: | 1: 22.6415 sent, fark 0.333244 adm, 7.5492 sent |
| 2: 30.183: | 1: 22.6415 sent, fark -0.333151 adm, -7.5306 sent |
| 3: 45.277: | 2: 45.2830 sent, fark 0.000273 adm, 0.0124 sent |
| 4: 60.369: | 3: 67.9245 sent, fark -0.332876 adm, -7.5368 sent |
| 5: 75.461: | 3: 67.9245 sent, fark -0.332603 adm, -7.5306 sent |
| 6: 90.554: | 4: 90.5660 sent, fark 0.000547 adm, 0.0124 sent |
| 7: 105.646: | 5: 113.2075 sent, fark 0.334972 adm, 7.5616 sent |
| 8: 120.738: | 5: 113.2075 sent, fark 0.334519 adm, 7.5740 sent |
| 9: 135.830: | 6: 135.8491 sent, fark 0.000821 adm, 0.0186 sent |
| 10: 150.923: | 7: 158.4906 sent, fark 0.334246 adm, 7.5678 sent |
| 11: 166.015: | 7: 158.4906 sent, fark -0.331781 adm, -7.4996 sent |
| 12: 181.107: | 8: 181.1321 sent, fark 0.001095 adm, 0.0248 sent |
| 13: 196.200: | 9: 203.7736 sent, fark 0.334519 adm, 7.5740 sent |
| 14: 211.292: | 9: 203.7736 sent, fark 0.332055 adm, -7.5182 sent |
| 15: 226.384: | 10: 226.4151 sent, fark 0.001369 adm, 0.0310 sent |
| 16: 241.476: | 10: 226.4151 sent, fark 0.333244 adm, 7.5492 sent |
| 17: 256.569: | 11: 249.0566 sent, fark -0.331781 adm, -7.5120 sent |
| 18: 271.661: | 12: 271.6981 sent, fark 0.001643 adm, 0.0372 sent |
| 19: 286.753: | 13: 294.3396 sent, fark 0.335067 adm, 7.5864 sent |
| 20: 301.845: | 13: 294.3396 sent, fark -0.331507 adm, -7.4872 sent |
| 21: 316.938: | 14: 316.9811 sent, fark 0.335341 adm, 7.5926 sent |
| 22: 332.030: | 14: 316.9811 sent, fark -0.331234 adm, -7.4934 sent |
| 23: 347.122: | 15: 339.6226 sent, fark 0.335341 adm, 7.5926 sent |
| 24: 362.215: | 15: 339.6226 sent, fark -0.331234 adm, -7.4934 sent |
| 25: 377.307: | 16: 362.2642 sent, fark 0.335341 adm, 7.5926 sent |
| 26: 392.399: | 16: 362.2642 sent, fark 0.335341 adm, 7.5926 sent |
| 27: 407.491: | 17: 384.9057 sent, fark -0.330957 adm, -7.4934 sent |
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| 29: 437.676: | 18: 407.5472 sent, fark 0.335615 adm, 7.5988 sent |
| 30: 452.768: | 18: 407.5472 sent, fark -0.330957 adm, -7.4934 sent |
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| 32: 482.953: | 19: 430.1887 sent, fark -0.330686 adm, -7.4872 sent |
| 33: 498.045: | 20: 452.8302 sent, fark 0.335889 adm, 7.6050 sent |
| 34: 513.137: | 20: 452.8302 sent, fark -0.330686 adm, -7.4872 sent |
| 35: 528.230: | 21: 475.4717 sent, fark 0.336163 adm, 7.6112 sent |
| 36: 543.322: | 21: 475.4717 sent, fark -0.330412 adm, -7.4810 sent |
| 37: 558.414: | 22: 498.1132 sent, fark 0.336436 adm, 7.6174 sent |
| 38: 573.506: | 22: 498.1132 sent, fark -0.330412 adm, -7.4810 sent |
| 39: 588.599: | 23: 520.7547 sent, fark 0.336436 adm, 7.6174 sent |
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| 42: 633.875: | 24: 543.3962 sent, fark -0.330412 adm, -7.4810 sent |
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| 48: 723.428: | 27: 611.3208 sent, fark -0.330412 adm, -7.4810 sent |
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| 50: 753.612: | 28: 633.9623 sent, fark -0.330412 adm, -7.4810 sent |
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53: 807.601: 36: 815.0943 sent, fark 0.331233 adı, 7.4996 sent
54: 822.693: 36: 815.0943 sent, fark -0.335615 adı, -0.5899 sent
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56: 852.878: 38: 860.3774 sent, fark 0.331507 adı, 7.5058 sent
57: 867.970: 38: 860.3774 sent, fark -0.335067 adı, -0.6064 sent
58: 883.062: 39: 883.0189 sent, fark -0.001917 adı, -0.0434 sent
59: 898.155: 40: 905.6604 sent, fark 0.332054 adı, 7.5182 sent
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63: 958.524: 42: 950.9434 sent, fark -0.334794 adı, -0.6580 sent
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71: 1079.262: 48: 1086.7925 sent, fark 0.332602 adı, 7.5306 sent
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74: 1124.539: 50: 1132.0755 sent, fark 0.332876 adı, 7.5368 sent
75: 1139.631: 50: 1132.0755 sent, fark -0.333698 adı, -0.5554 sent
76: 1154.723: 51: 1154.7170 sent, fark -0.000274 adı, -0.0062 sent
77: 1169.815: 52: 1177.3585 sent, fark 0.333150 adı, 7.5430 sent
78: 1184.908: 52: 1177.3585 sent, fark -0.333424 adı, -0.5492 sent
79: 1200.000: 53: 1200.0000 sent, fark -0.000000 adı, -0.0000 sent

Toplam mutlak fark: 17.38189 adı, 393.5524 sent
Farkların mutlak ortalaması: 0.220024 adı, 4.9817 sent
Farkların karelerinin kök ortalaması: 0.270409 adı, 6.1225 sent
En yüksek mutlak fark: 0.337258 adı, 7.6360 sent
EK15: Abdülbâki Nâsır Dede’nin Geleneksel Ney Perdeleri

<table>
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<tr>
<th>1. Oktav</th>
<th>Derece</th>
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<td>Hicaz (Uzzal)</td>
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Yukarıdaki açık anlatıldan görülebileceğini üzere, Nâsır Dede toplamda 38 ve bir oktav (sezikli) içinde 17 geleneksel perde saymıştır. Gerçekte, Ney’den elde edilebilecek perdeler bunlarla sınırlı olmayıp, Kaba Rast’tan Tiz Gerdânîye’ye de geniş üç oktavlık bir ses-sahası kullanlabilmektedir.

Nihâvend ile Uzzal ise, Nâsır Dede’den yüz yıl kadar önce Dimitri Kantemir tarafından zikredilmiş olan perdelerdir.

Nâsır Dede, Ney’den perdelerin nasıl elde edildiğini bize şöyle bildiriyor (COMPARE WITH pages #51-54):

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47 Dimitri Kantemir, Kitâbu İlim-i Müsiki Al’a Vechî’l-Hurûfât, Prof. Yağış Tura’nın çevirisini, 2001, İstanbul, s. 2-3.

48 İnceleme ve Gerçeği Araştırma (Tedkik Ü Tahkik), Prof. Yağış Tura’nın çevirisini, 1997, İstanbul, s. 6-7.
“... Cana can katan Ney’in delikleri ise, ağzından (uç kısmından) üfelenen yere (başpäreveye) değil yedi deliktir. Sırasıyla, birincisine Düğâh, ikincisine Kûrdî, üçüncüye Segâh, dördüncüye Çargâh, beşinciye Sâbâ, altınıcta Nevâ, yedinciye Aşirân 49 adı verilmiştir.

Bunları öğrendikten sonra, bilin ki, Yegâh’in Ney’de kendine özgü bir perdesi yoktur. Nevâ perdesinin pesi olduğuundan, inceden kalına doğru, üfleyenin nefesinin birinci derecesi ile - ki ona dem denir - yine Nevâ perdesinden elde edilir.


Pes Hisar: yedinci Aşirân deliğinin açığından, aşılmıştan fazla doğrultarak (dem),

Aşirân: adet olduğu şekilde (Aşirân deliğinin açığından, dem),

Acem Aşirân: eğîlînen tarafa biraz eğmekle (Aşirân deliğinden, dem),

Arak: Pes Beyâtî’de olduğu kadar eğîlerek (yine Aşirân deliğinden, dem) üflenir.

Gevaş: önceki Düğâh deliğinin kapalısdan (tüm delikler kapalıken, Rast deliğinden) Pes Hisar için olduğu kadar doğrultarak (olağan üfleme siddetiyle),

RAST: aşılmış şekilde (Rast deliğinden),

Şûri: Arak gibi (Rast deliğinden, ama eğik) üflener elde edilir.

Zîrgûle: adı geçen deliğ (Dügâh’i) yarımcırmakla,

Dügâh: adet olduğu gibi (Dügâh deliğini tam) açmakla,

Kûrdî: adını taşıyan delikten elde edilir.

Segâh da öyledir (adını taşıyan delikten, Segâh deliğinden, elde edilir),

Bûselik: dördüncü Çargâh deliğini yarımcırmak,

Çargâh ise, adet olduğu şekilde (Çargâh deliğini tam açarak) üflenir.

Sâbâ: Rast perdesinden Nevâ’ya çıktırayorken (Sâbâ deliğinden),

Hicaz: Nevâ perdesinden Rast’a inilip yaranın karşılaştırılacak basamak gibi düşünülerek, beşinci Sâbâ deliğinden elde edilir.

Nevâ: adet olduğu gibi (Nevâ deliğinden),

Beyâtî ise Pesi gibi (eğmekle), altınıcta Nevâ deliğinden üflenir.

Hisar: ikinci derece üflemeyle ilk Dügâh deliğinden Zîrgûle şeklinde (yarım),

Hüseyî ise, o deliğ (Dügâh’i) tam açmakla üflenir.

49 Hüseyî yerine Aşirân denmesinin nedeni, “Dem Perdelerin” bu delikten elde edilmesi olmalıdır.
Acem: ikinci (delikten, yani) Kürdi deliğinden,

Evc: üçüncü (delikten, yani) Segâh deliğinden elde edilir.

Mâhur: Bâselik şeklinde (Çargâh deliğini yarım açarak),

Gerdâniye ise tam açılar dördüncü Çargâh deliğinden,

Şehnaz: beşinci Sâbâ deliğinden çıkarılır.

Muhayyer: birinci Dügâh deliğinden (üçüncü derece üfleme ile),

Sünbüle: ikinci Kürdî deliğinden üçüncü derece üfleme ile elde edilir.

Tiz Segâh, Tiz Bûselik, Tiz Çargâh, Tiz Sâbâ, Tiz Hicaz, Tiz Beyâti de, peslerin çıkıntı deliklerden (aynı şekilde), fakat üçüncü derece üfleme ile elde edilirler.

Tiz Hisar ve Tiz Hüseyînî de, Hisar ve Hüseyînî’nin çıkıntı deliklerden, fakat dördüncü derecede üfleme ile elde edilirler. ...

Şimdi, yukarıdaki açıklamaları tablo halinde görelim:

<table>
<thead>
<tr>
<th>Dem Perdeler (I. Selen)</th>
<th>1. Devir (II. Selen)</th>
<th>2. Devir (III. Selen)</th>
<th>3. Devir (IV. Selen)</th>
<th>5. Devir (VI. Selen)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>YEGÂH</strong> (-4.) Pes Beyatî</td>
<td>Gevaşt</td>
<td>(NEVÂ)</td>
<td>(GERDâNIYE)</td>
<td>(TİZ NEVÂ)</td>
</tr>
<tr>
<td>Pes Hisar</td>
<td>RAST (1.) Şûri</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AŞİRÂN (-3.)</td>
<td>Zirgué ø</td>
<td>Hisar ø</td>
<td>(Şehnaz ø)</td>
<td>Tiz Hisar ø</td>
</tr>
<tr>
<td>Acem Aşirân</td>
<td>DÜGÂH (2.) HÜSEYNİ (6.)</td>
<td>MUHAYYER</td>
<td>TIZ HÜSEYNİ</td>
<td></td>
</tr>
<tr>
<td><strong>ARAK</strong> (-2.)</td>
<td>Kürdi-Nihâvend</td>
<td>Acem</td>
<td>Sünbüle</td>
<td></td>
</tr>
<tr>
<td>İlk iki perde Nevâ deliğinden, sonraki dört perde Aşirân deliğinden elde edilir.</td>
<td><strong>SEGÂH</strong> (3.)</td>
<td>EVC (7.)</td>
<td>TIZ SEGÂH</td>
<td></td>
</tr>
<tr>
<td>Bûselik ø</td>
<td>Mâhur ø</td>
<td>Tiz Bûselik ø</td>
<td>TIZ ÇARGÂH</td>
<td></td>
</tr>
<tr>
<td>ÇARGÂH (4.)</td>
<td>Gerdâniye</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sâbâ Hicaz-Uzzal</td>
<td>Şehnaz</td>
<td>Tiz Sâbâ</td>
<td>Tiz Hicaz-Uzzal</td>
<td></td>
</tr>
<tr>
<td>NEVÂ (5.) Beyâti \</td>
<td>(MUHAYYER)</td>
<td><strong>TIZ NEVÂ</strong></td>
<td>Tiz Beyâti \</td>
<td></td>
</tr>
</tbody>
</table>

50 Ney tutuşundaki açısal farklılıklar, değişik üfleme teknikleri ve makamların seyri, bazı perdelerin kesin aralıklar cinsinden anlatılmasını güçleştiriktirdir. Bununla birlikte, perde-çiftlerinin, oktav, beşli, dörtlü, majör üçlü, minör üçlü gibi belli kalıplara oturması gereğini de aşıkardır. İleriide bu konuya döneceğiz.

Ney deliklerinden elde edilen perdelerin tasviri aşağıda yapılmıştır

SEE Fig. C.1 (page #177)

\[\text{Rauf Yekta'nın Mansur Ney delikleri için verdiği ölçüleri:}\]

- Acem (yarısı) 403 mm
- Nevâ 436 mm
- Sâbâ-Hicaz 527 mm
- Çargâh 558 mm
- Segâh 620 mm
- Kürdî 651 mm
- DÜgâh 682 mm
- Rast (ucu) 806 mm

(Kaynak: Rauf Yekta, Türk Musikisi, Orhan Nasuhioglu'nun çevirisı, 1986, İstanbul, s. 91)

Nâsîr Dede, her perdenin sırasıyla 18’incisi, 11’incisi, 8’incisi, 28’incisi, 25’incisi, 4’ünçüsü, 3’ünçüsü, 2’incisi, 5’incisi ve 6’incisi ile tam uyumlu olduğunu yazmaktadır (COMPARE WITH Table 4.4, page #55):

<table>
<thead>
<tr>
<th>Küçüklik</th>
<th>İlan (1200.000 sent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oktav, 2:1</td>
<td>(1200.000 sent)</td>
</tr>
<tr>
<td>Beşli, 3:2</td>
<td>(701.955 sent)</td>
</tr>
<tr>
<td>Dörtlü, 4:3</td>
<td>(498.045 sent)</td>
</tr>
<tr>
<td>Oktav+Beşli, 3:1</td>
<td>(1901.955 sent)</td>
</tr>
<tr>
<td>Oktav+Dörtlü, 8:3</td>
<td>(1698.045 sent)</td>
</tr>
<tr>
<td>Majör İkili (Tanini), 9:8</td>
<td>(203.910 sent)</td>
</tr>
<tr>
<td>Mütçenem, 10:9 ilâ 16:15</td>
<td>(182.403 ilâ 111.731 sent)</td>
</tr>
<tr>
<td>Minör İkili (Bakiye), 17:16 ilâ 25:24</td>
<td>(104.955 ilâ 70.672 sent)</td>
</tr>
<tr>
<td>Minör Üçlü, 6:5 ilâ 13:11</td>
<td>(315.641 ilâ 289.209 sent)</td>
</tr>
<tr>
<td>Majör Üçlü, 5:4 ilâ 27:22</td>
<td>(386.313 ilâ 354.547 sent)</td>
</tr>
</tbody>
</table>

\[52\] Ney çizimi http://www.neyzen.com/ney_metodu/ney_metodu_001.pdf adresinden alınmış olup, Mehmet Yücel'e aittir.

\[53\] İnceleme ve Gerçeği Araştırma (Tedkîk ü Tahkîk), Yağlıım Tura’nın çevirisı, 1997, İstanbul, s. 8.

\[54\] İnscâm ki korumak üzere, yer yer ditonik (9/8+9/8) kurguda Pîthagorsal Majör Üçlüler (81:64=407.82 sent) kullanılmalıdır. Bu aralık, başlangıç perdesinden hareketle, 6 yerine 7 derece ötededir.
Üçlülerin en az uyumlu aralıklar olarak sonda anılması ve bunların çevrimleri olan altılılardan hiç bahsedilmemesi, hem melodik, hem armonik açıdan oldukça düşündürücü olup, Makam Müziğinde Seyri belirleyen bir ipucu nitelikindedir.

Küçük sayılara dayalı oranlar, Makam Müziği perdelerinin göreli uzaklıklarını belirlemede öncelikle başvurulması gerektiğini saptadığımız Tam Tintlama (Just Intonation) aralıklarını vermektedirler.

Aralıkları ayrıntılandırımida kullandığımız “sent” birimi, Alexander J. Ellis tarafından 1870’lerde önerilen bir aralık ölçüm birimi olup, 2’nin (oktavın) 1200’üncü kuvvetten köküdür. Buna göre, oktavı 1200 eşit parça bölmemekle elde edilen 1 sentin bağıf frekansı, 1:1.0005777895’tir.55

Tam Tunsal bir aralığın kaç sent olduğunu belirlemekte kullanılacak denklem aşağıdaki:

\[ [log_{10}(\text{gerçel veya oransal sayı})] \times [\frac{1200}{log_{10}(2)}] \]

Bir örnekle pekiştirmek istersek, 3:2 oramıyla bilinen ve bağf frekansı 1.5000 olan mükemmel saf beşlinin sent adedini, yukarıdaki denkleme göre

\[ [log_{10}(1.5)] \times [\frac{1200}{log_{10}(2)}] \]

\[ = 0.17609125905568124208128900853062 \times 3986.3137138648348174443833153938 \]

\[ = 701.95500086538741774448673273839 \text{ (≈702) sent} \]

SEE Table 4.5 (pages #56-57)

Ancak, insan kulağının, birakalım bu denli çok ondalık basamağı, onda bir senti dahi algılama mümkün olmadıından, virgülden sonraki üç basamağın dışında matematiksel ayrıntıya girmenin gereği yoktur. Dolayısıyla, mükemmel saf beşli 701.955 sent olarak ifade edilebilir ve 702 sente yuvarlanabilir. Aynı düştür, sent yoluyla ifade edilen tüm aralıklar için geçerlidir.

Benzer olarak, belli sayıda sent ile gösterilen herhangi bir aralığın bağlı frekansını bulmak için aşağıdaki denklem kullanılır:

\[ 10 ^ { \left[ \log_{10} (2) \times \text{sent adedi} \right] / 1200} \]

Sözgelimi, meşhur 12-ton Eşit Taksimat'taki 700 sentlik "yedirilmiş (tempere edilmiş) beşli"nin bağlı frekansını hesaplamak istersek,

\[ 10 ^ { \left[ \log_{10} (2) \times (700) \right] / 1200} \]

\[ = 10 ^ { (0.3010299566398119521373889472449 \times 0.58333333333333333333333333333333 \ldots) } \]

\[ = 10 ^ {0.175600830803989030541347688589} \]

\[ =1.4983070768766814987992807320288 (~1.4983) \text{ buluruz.} \]

Bu noktadan itibaren, hecelere dayalı bir solfej pratikinin benimsenmesi pek uygundur. Heceler ve Temel Oranlar ile ilişkilendirdiğimiz Ney perdeleri aşağıdaki tabloda verilmiştir (COMPARE WITH Fig 4.3, page #58):

Sözgelimi, Rast dizisini yeğâh perdesi üzerine göçürmek olanak dâşdır; olsa olsa, yeğâh perdesinin seçilmiş Âhenge bağlı olarak isgal ettiği frekansa göçürüm yapmaktan bahsedilebilir. Nitekim, Rast dizisini rast yerine yeğâh perdesinin göreceli frekansından başlatmak, rast eksenine bağlı tüm diğer perdeleri aynı oranda göçürmeye beraberinde getireceğinden, son toplamda ötelenen dizi değil, Âhenk olur.
Sözkonusu diziyi aynı Âhenk içinde farklı bir konuma taşımak üzere kullanılması gerekken tâbir “yegâh’ta Rast âgâzesi”dir. Böyle demek sürenin, Rast dizisinin, rast perdesi yerine tam dörtlü (4:3) aşağıdaki yegâh perdesini kendisine eksen alıp, aynı aralıkları kullanarak geçiçi yapmasıdır. İşte, Şedd Makamlar Âhenk değişimmesinin bu yolla elde edilmiş olurlar.

Oysa, Batı tonları için böyle bir durum sözkonusu değildir; çünkü notalar, olağanda Standart Diyapazona raptedilmiştir. Nitekim, tonalitesi önceden saptanmış bir parça içinde bir notayı ton-_disi bir sesle değiştirmeye alterasyon, bir dizideki notalara bağlı kalarak eksen değiştirmeye modülasyon, motifi kalıcı olarak (aynı aralıkları gözeterek) farklı bir tona aktarmaya da transpozisyon denir.

“Key transposition” uygulaması ise, diyapazonun göçürülmesi ile eşanlamlı olup, yalnızca hava hacmi değiştiği halde tuş sistemi değişmeyen (Ney gibi) akordu şaşmaz üflemeliler ve eşit aralıklı dokungaya sahip Gitar gibi telli çalgılar için sözkonusudur; çünki notalar, olağanda Standard Diyapazona raptedilmiştir. Nitekim, tonalitesi önceden saptanmış bir parça içinde bir notayı ton-Disi bir sesle değiştirmeye alterasyon, bir dizideki notalara bağlı kalarak eksen değiştirmeye modülasyon, motifi kalıcı olarak (aynı aralıkları gözeterek) farklı bir tona aktarmaya da transpozisyon denir.

Bu meseleyi de etrafıca irdeledikten sonra, Ney’den elde edilen tüm perdelerin notalandırılmasını gerçekleştirebiliriz.

Aşağıda, büyükten küçüğe, Nâsır Dede’nin bildirdiği tam uyumlu aralıkların kapsamlı bir döküm hazırlandığını ve perde-nota ilişkisi “Ney Perdeleri” şemasında (COMPARE WITH Fig. C.2, page #178) resmedilmiştir:

SEE Figs. 4.3, 4.4, 4.5, 4.6 (pages #58-61)

SEE Table C.6 (page #183)


İlginç olarak, oktavda 12-tuş içeren tarihi Halberstadt klavye tasarımında, “diyatonik natürel yarım ses” muamelesi gören ve Batı dizeğinde arzasız yazılan Mi-Fa ile Si-Do, tam (koyu) Ney Âhenkleri ile örtüştüktedir. Bu açıdan ele alındığında, tablodaki müteakib Rast perdekillerin pestten tize diyatonik dizilimi, Doriyen modunu (Re-Mi-Fa-Sol-La-Si-Do-Re) vermektedir.

Gerek şimdi altını çizdiğimiz Doriyen modunun, gerek Makam Müziği’nde “Esas-ı Süllem” 57 sanyyla bilinen Rast dizisinin – uluslararası müzik camiasının aşın olduğu şekilde – dizekte arzasız yazıp, bugün Standart Diyapazona göre akortlanan klavyelerde natürel tuşlar üzerinden (iyi-kötü) çalınmasının tek yolu, aşıkardır ki, ilk perdesi (yani kaba rast) Standart Diyapazonda C sesini (~260 Hz) veren Sipürde (Mehtabıye)’yi Ana Âhenk (Do/C, kaba rast = 261 Hz) kabul etmektir.

Aşağıda, kendine özgü aralıklarla tüm Ney Âhenkleri için diyapazondan bağımsız *Do naturel gam* olarak yazılan ve Standart Diyapazon sesleriyle *Sipürde Ana Âhenk*te (La/A₄, *aşırân* = 440 Hz) çakan II. Selende (yani yerinde) Rast dizisinin notasını sunuyoruz: \(^{58}\)

**SEE Fig. C.4 (page #184)**

Şimdi, yukarıdaki nota örneğini I. Selende her Âhenkten ayrı ayrı seslendirdiğimizde neler olacağını anlamak için, aşağıdaki "Ton Aktarımı Cetveline" yoğunlaşalım:

<table>
<thead>
<tr>
<th>X Âhenk</th>
<th>C Sipürde</th>
<th>Db</th>
<th>D Yıldız</th>
<th>Eb</th>
<th>E Davud</th>
<th>F Şah</th>
<th>F#</th>
<th>G Mansur</th>
<th>Ab</th>
<th>A Kız</th>
<th>Bb</th>
<th>B Müst.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RAST</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do</td>
<td>C₅</td>
<td>Db₅</td>
<td>D₅</td>
<td>Eb₅</td>
<td>E₄</td>
<td>F₄</td>
<td>F#₄</td>
<td>G₄</td>
<td>Ab₄</td>
<td>A₄</td>
<td>Bb₄</td>
<td>B₄</td>
</tr>
<tr>
<td>Re</td>
<td>D₅</td>
<td>Eb₅</td>
<td>E₅</td>
<td>F₅</td>
<td>F#₄</td>
<td>G₄</td>
<td>G#₄</td>
<td>A₄</td>
<td>B₄</td>
<td>C₅</td>
<td>C₅</td>
<td>C#₅</td>
</tr>
<tr>
<td>Mi</td>
<td>E₅</td>
<td>F₅</td>
<td>F#₅</td>
<td>G₅</td>
<td>G#₄</td>
<td>A₄</td>
<td>A#₄</td>
<td>B₄</td>
<td>C₅</td>
<td>C#₅</td>
<td>D₅</td>
<td>D#₅</td>
</tr>
<tr>
<td>Fa</td>
<td>F₅</td>
<td>Gb₅</td>
<td>G₅</td>
<td>Ab₅</td>
<td>A₁</td>
<td>B₁</td>
<td>B₁</td>
<td>C₅</td>
<td>D₅</td>
<td>Eb₅</td>
<td>Eb₅</td>
<td>E₅</td>
</tr>
<tr>
<td>Sol</td>
<td>G₅</td>
<td>Ab₅</td>
<td>A₅</td>
<td>Bb₅</td>
<td>B₄</td>
<td>C₅</td>
<td>C#₅</td>
<td>D₅</td>
<td>Eb₅</td>
<td>E₅</td>
<td>F₅</td>
<td>F#₅</td>
</tr>
<tr>
<td>La⁺</td>
<td>A₅</td>
<td>Bb₅</td>
<td>B₅</td>
<td>C₆</td>
<td>C#₅</td>
<td>D₅</td>
<td>D#₅</td>
<td>E₅</td>
<td>F₅</td>
<td>F#₅</td>
<td>G₅</td>
<td>G#₅</td>
</tr>
<tr>
<td>Si</td>
<td>B₅</td>
<td>C₆</td>
<td>C#₆</td>
<td>D₆</td>
<td>D#₆</td>
<td>E₅</td>
<td>E#₆</td>
<td>F#₆</td>
<td>G₅</td>
<td>G#₅</td>
<td>A₅</td>
<td>A#₅</td>
</tr>
<tr>
<td>Do</td>
<td>C₆</td>
<td>Db₆</td>
<td>D₆</td>
<td>Eb₆</td>
<td>E₅</td>
<td>F₅</td>
<td>F#₅</td>
<td>G₅</td>
<td>Ab₅</td>
<td>A₅</td>
<td>Bb₅</td>
<td>B₅</td>
</tr>
</tbody>
</table>

**Adım**

- 0 yerinde
- +1 yr. ses
- +2 T. ses
- +3 m. üçlü
- +4 m. altılı
- -7 Beşli
- -6 E. beşli
- -5 Dörtlü
- -4 M. üçlü
- -3 m. üçlü
- -2 T. ses
- -1 yr. ses

**Diyapazon**

- La*= 440Hz
- La*= 464Hz
- La*= 495Hz
- La*= 520Hz
- La*= 278Hz
- La*= 293Hz
- La*= 310Hz
- La*= 330Hz
- La*= 348Hz
- La*= 372Hz
- La*= 390Hz
- La*= 418Hz

---

\(^{58}\) Mi ve Si notalarına parantez içinde eklenen "irhâ bemolleri", 3. derece Segâh (5/4) ile 7. derece Evc (15/8) perdelereinden seyir esnasında "peste doğru bir nebe" (genellikle Segâh için 56/45 ve Evc için 28/15 sınırna kadar, 1/3 komma) Mikrotonal Portamento (yatıklama/kaydırma/bükme) yapılabilmeğini vurgulamak içindir.

Notalar, Piyano ve Keman gibi Standart Diyapazona Akortlanan Çalgılar için cetvelde gösterildiği gibi göçürüldüğü halde, Ney’in de aralarına kesinlikle dahil edilmek durumunda olduğu (Bb Klârnet, D Trompet, F Korno gibi) Ton Aktarımssal Üflemeliler için – mutlak frekanslar değişse bile – Sipürde Ana Âhenk’te yazıldığı gibi kalırlar.

Rast dizisinin, yerinde, yani II. Selende, tüm Neyler için nasıl notalandırılması gerektiği ve ayrı ayrı çalındığında nasıl duyulacağı aşağıda görülmektedir:

SEE Fig. C.5 (page #185)

Uygulamadan da anlaşılacağı üzere, Ney gibi hava hacmi değiştiği halde tuş sistemi ("Parmak-Perde" ilişkisi) değişimseren üflemeli çalgılar söz konusu olduğu zaman, perdelerin dizekteki konumları da, adları da, değişmez; hangi Âhenk olursa olsun, Makam Müziği’nin ana dizisi Rast, donanımsız Do natürel gam olarak yazılır.

Aşağıda, Rast dizisi seslerini Standart Diyapazonda (Sipürde Ney’den) duyulduğu gibi (ünsion) duyarabilen üzeri, muhtelif Neylerin hangi notalara/perdelere göçürülmesini gerektiği görülmektedir:

SEE Fig. C.6 (page #186)
Buraya kadar, neden Ümmü’l Makamat (Makamların Anası) betimlemesine lâyık görülen Rast dizisini Do natuurı gam şeklinde yazmak durumunda olduğumuzu ve neden Sipürde’yi Ana Âhenk olarak belirlediğimizi uzun uzadiya açıkladık.

Demek oluyor ki, Makam Müziği’nde tamam perdeler, “diyapazondan bağımsız mutlak dereceler” olarak, Ney gibi Ton Aktarımşal Üflemeliler için dâima şu şekilde notalandırılır59:

SEE Fig. C.3 (page #184)

Ancak, Makam Müziği belirli bir Âhenkten bağımsız kurgulandığından, Ney dışındaki Standart Diyapazona Bağlı Fasil Çalışlarına yönelik en az 12 farklı ton üzerine göçürülmüş yeni partiler yazmak (dolayısıyla her eser için “partitür klâsörleri” oluşturmak) gerekmektedir.

Bu köklü uygulama, yüz yılları aşkın Batı notası geleneğinde sâbittir ve partitür hazırlanırken ihmal edilmesi bağışlanamaz, olmazsa olmaz bir düsturdur.

Bu çerçevede, dizek notasının düzgün kullanımına ilişkin bir örnek aşağıda verilmiştir60:


Rast Dizisi


Ne yazık ki, hazırladığı repertuvarın büyük bir bölümü, (Standart Diyapazonda okunduğunda) yine Mansur Nisfiye Âhenge göre, ancak yanlış ve saçma bir âdete dayanarak, Ney, Kemençe ve Keman dışındaki tüm çalgılar için – duyulan seslere kıyaslamba bir oktav yukarıdan notalandırılmaktadır.

Bu yetmiyormuş gibi, 440 Hz’e La (A₄) yerine Re (A₄) dendiğinden, anlamsız uygulamalara bir yenisi daha eklenerek, okunan tüm frekanslar (nota adları yerinde kaldiği halde) tam dörtlü aşağı – diğer bir deyişle, nota adları (frekanslar yerinde durduğu halde) tam dörtlü yukarı – göçürülmektedir; ki bu, yaygın olarak benimsenen Bolâhenk Nisfiye düzene varmcaya dek, gerekse yere iki kere diyapazonun değiştirildiği anlamına gelir.

Repertuvardaki bu kafa bulandırıcı uygulamadan doğan karışıklığı geçici olarak (alışkanlıkları gözterek) telafi etmenin en kesirme yolu, icrâ edilecek tüm eserlerin başına “Yalnızca Mansur Âhenk içindeyir (La/A₄=440 Hz, muhaye)” ibâresinin eklenmesi ve Sol anahtarlarının hepsinin altına “8(va)” işaretinin konulmasıdır. Ancak, her hâlâ kýarda, Ney partilerinin, evvelce belirtildiği şekilde, yeniden yazılması şarttır.
Alternatif olarak, perde isciçâmını bozmak ve ses-sahasını taşıurma riskini göze almak pahasına, sırı C Üflemeliler (Şipürde Ney, C Klârnet, vs...) 5 perde yukarıdan (Sol notası gördükleri yerde – rast değil – nevâ perdesinden) çalabilirler.

Bir de tabii, Klâsikal Kemençe’nin telleri Bolâhenk (Nısfıye) düzende yeğâh-rast-nevâ perdelere karşılık gelecek şekilde, olağanda A₃ (220 Hz) - D₄ (293 Hz) - A₄ (440 Hz) seslerine akortlanyorken, Mansur Nısfıye Âhenge ayak uydurabilme için, Kemençekeşlerin tam dörtlü yukarıdan ırâ yapması gerekecektir.

Gelgelelim, Rast perdesi ~391 Hz’lik G₄’ten başlarak, Kemençe’nin ses sahasının zorlanacağı ortadadır. Telin sonuna geliıldığı için oktav sıçramaları yapmak düppedüz amatörlük olacağandır, şu hâlinde Kemençe, Bolâhenk Nısfıyeden yukarı hiç bir düzenden Makam Müziği perdelerini tastamam duyuramaz.

Yine de, repertuvar yeniden tanzim edilirken, Kemençeler için Sol anahtarlarını altında “8va” işaretini konmayıp, yürürlüğe olduğu gibi, Tanbura kıyasla bir oktav yukarıdan (Nısfıye/Yarım Âhenkten) ırâ yapmalarına göz yumulabilir.

Anlaşılmalıdır ki, göçürümlerde “Parmak-Perde” ilişkisi birebir korunamayacak olan Piyano, Keman, Kemençe, Tanbur, Ud, Kanun gibi çalgılar, katiyyen Ton Aktarımısta telâkkı edilemez. Bu olgunun altı özellikli çizilmelidir. Düzgün nota yazımı, göçürülebilir ile göçürülemez müzik âletlerini esasla öğrenmeyi ve bunları teknik kapasitelere göre değerlendirirebilmeyi gerektirir.

Bunlar yapılmadığı sürece Batı notası kullanmaktan kesinlikle kaçınmalıdır. Sazlar ve insan sesi geliştirilmiş transpoze çalğı muamelesi gördüğü sürece, Makam Müziği’nin Batı notasıyla yazmanın hiçbir anlamı yoktur.

“Efendim, bizim mûsikimizin kendine özgü notası vardır, çalgılarımız bu notayı istedikleri düzenden seslendirirler!”

şeklinde yükselen itirazlara:
“Madem öyle bir kaabiliyetiniz var, neden Batılı bir müzisyenin rahatsızla uyum sağlayabileceği hâlîsane uluslararası nota yazımı kurallarına uymakta zorlanıyorsunuz?”

demek icâbeder.

Bir de,

“Zahmetten kaçarcasına hazırlanmış tek bir dizek üzerinden, muhtelif çalgıların topluca göçürüm yaparak unison çalmayı bekliyorsanız, ne diye bu iş için en ters yol olduğu belli olan Batılı notasıyla (üstelik ayrıkı şekilde) çalışıyorsunuz?”

diye eklemek gerekir.

Bu sâyede, Makam Müziği solfejine ve nota yazımına külfetten başka bir şey getirmeyen – dahası, müzik eğitiminin feci şekilde tıkanmasa yolaçan – köhne bir anlayışın ivedîlikle terkedilmesi umulur61.

Aşağıda, repertuvardan alınan bir nota örneğinin pürüzlereken nasıl arındırıldığı görülmektedir62.
Valuza Mansur Ahenk'indir.
A4=440 Hz, L=Uhayyer
(Kemençe ler ve ses sahane zorlanacak
olan çalgılar Nasıfye Ahenken çalır.)

RAST ŞARKI
YINE BİR GÜL-NİHAL ALDI BU GÖNLÜMÜ

(53ET sistemine göredir. Arzaların üstündeki
sayılar, Holder komması adedine karşılıktır.)

Hamamızade Ismaıl DEDE EFENDİ
(1777 - 1845)

Semai = 168

Fasıl Çalgıları

ARANAĞME

1. Yine bir gül-nilah aldı bu gönlümü
gönlümü gönlümü
Görmedim kim-se-de böyle bir dili-raba dili-raba

2. Sim-ten gönc-ca fem be-del ol güzel ol güzel
böyle-le güzel zoals-le güzel

1. Böyle kaş böyle le güzel

2. Böyle le güzel D.S.

Ney Parıtıvona, Sipürde Ana Ahenk (A4=440Hz, Hüseyni) Standartına göre,
yukarıdaki notannın tam bezeli peste geçirülmesiyle hazırlanacaktır.

Yine bir gül-nilah aldi bu gönlümü
Sim-len, gönca-fem, böyle bir güzel
eleştir lan ruhları yakın bu gönlümü
Pür-eda, pür-efşa, pek kaşık, pek güzel

Görmedim kimse de böyle bir dili-raba
Böyle kaş, böyle le güzel, böyle el, böyle yüz
Aşkın bağrını azme geç sécur
El-aman pek yaman her zaman ol güzel
EK17: Makam Müziği’nde Huruf Notalar

- **Dimitri Kantemir** (1673-1723): “Kitâbu ‘İlmi‘l-Mûsîkl-Êlî Vechîl-Hurûfât” başlıklı eserin yazarı. Önerdiği nota, çağdaşı Osman Dede’nin (ö. 1729) notasına benzer;  

SEE Table 4.7 (pages #63-64)

- **Abdülbâki Nâsır Dede** (1765-1821): “Tahririyve” adlı eserinde, kendi adını alan, ancak Safiyüddin Urmevî (1216-1294) ve Abdülkadir Merâgî (1350?-1435) tarafından öne sürülen ile neredeyse aynı bir Ebced notası ortaya koymuştur;  

SEE Table 4.2 (pages #47-48)

- **Hamparsum Limonciyan** (1768-1839): Ermeni harflerine dayalı meşhur notanın mücididir;  

SEE Table 4.10 (page #70)

TÜM HURÚFÂTIN PERDE İSİMLERİYLE DİZEKTE NOTASYONU:

SEE Fig. 4.9 (page #71)
EK18: Ses-Sistemlerinin Karşılaştırılması


Anlaşılacağı üzere, 106-tET, oktavı 53*2 eşit kısmın bileşeniyle elde edilmektedir. Oktav 1200 sent genişliğinde olduğuna göre, 106-tET’nin her bir adımı:

\[
\frac{1200}{106} = 11.320754716981132075471698113208 \approx 11.321 \text{ sent}
\]

olmaktadır.

Bu sayı, oktavı 53 eşit parça bölünerek elde edilen *Holder Kommasi*’nin tam yarısıdır:

\[
\frac{1200}{53} = 22.6415094396264150943396226415 \approx 22.642 \text{ sent}
\]

AEU sistemi ise, basitçe, *başlangıç sesinden 11 beşli yukarı, 12 beşli aşağı* olarak anlatılabilir:\[63\]

---

AEU oranları bir oktav sahası içine toplandığında, 53/106-tET sesleriyle neredeyse aynı sonuçlar elde edildiği somut olarak görülmektedir. Aynı durum, Rauf Yekta’nın önerdiği ve AEU sistemine ilham olan, başlangıç sesinden 9 beşli yukarı, 14 beşli aşağı kurgusundaki 24-tonlu sistem için de geçerlidir. AEU ile Yekta-24 arasındaki farklar ve 53/106-tET derecelerinden sapmalar aşağıdaki tabloda verilmiştir:

SEE Table 3.8 (page #38)


Ton sayısı dışında, düstür ve içerik olarak 24-perdeli gayri-müsâvî sistemden farklı olan 17-perdeli Safiyüddin Dizgesi de, 53/106-tET sesleri üzerinden zahmetsizce açıklanabilmektedir:

---


Bunlardan başka, Abdülkadir Töre ile Ekrem Karadeniz tarafından ileri sürülen 41 perdeli sistem de (ATEK), 106-tET sesleri ile hatası örtüşmektedir.67

---

Son olarak, Gültekin Oransay tarafından önerilen sıradışı "Pithagorsal/Tam-Tınsal kırm" 29-perdeli sistemi ele alalım. Bu ses-sistemi de 53/106-tET sesleri ile pekâla ırtuşuyor:

SEE Table 4.14 (page #81)

Kıssadan hisse, ne Yekta-24 ile, ne AEU ile, ne ATEK ile 53/106-tET arasında 1 sent mutlak fark dahil görülmemiş gibi, kalabalık ve anlaşılmaz oranların artık tedavülden kaldırılıp, görüşmelerde fazlasıyla kolaylık sağlayan 53/106-tET’nin yellenmesi çok daha akla yatkınlık.

SEE Table 4.13 (page #78)


Elbette, 53/106-tET seçeneği, kulağın duymayı arzu ettiği tam tınsal oranları beşliler döngüsü yoluyla elde etmeye dönük bir yaklaşılktan öte kabul edilmemelidir; zira, sabit değerlere indirgenmiş kalıpçı ses-sistemleri yoluyla ustalık pratiğini açıklamanın ne denli güç olduğunu ve gerçek icrânın ne kadar karmaşık haller alabildiğini, aralık ölçümleri ile elektroakustik çözümlemeler ortaya koymaktadır.


Coming next is the unabridged article (in Turkish) produced from this Doctorate Dissertation and co-authored with my Thesis Supervisor Prof. Şehvar Beşiroğlu.

The manuscript in question differs by only two extra pages from the compactified version that was published in İtüergisi/b (social sciences), vol. 5, nr. 2, pp. 23-34. Previously omitted material now taken into account comprises tabular analyses of the intervallic deficiency of the tone-systems proposed by Oransay and Karadeniz respectively.

Hence, a significant novelty with the unabridged edition at hand is an orderly list enumerating the dyadic locations – with reference to the original perde names – of all middle seconds occurring in the 41-tone system by Ekrem Karadeniz. This clarity was initially left out from the dissertation text, but is incorporated hereinafter as such.
Türk makam müziği’nde nazariyat-icra örtüşmezliğiğine bir çözüm: 79-sesli düzen

Özet


Anahtar Kelimeler: Türk makam müziği, mikroton, 79-sesli düz

1) Yatay ve diz üstünde çalınan, trapezoidal gövdeli, üzerine üçlü gruplar halinde teller gerilen ve “mandal” denilen küçük metal parçalarla tel uzunlukları değiştirilebilen zither türü çalgı.
A new 79-tone tuning, as a solution to the non-conformance between theory and practice in Turkish maqam music

Extended Abstract
The long-standing conflict between the “Arel-Ezgi-Uzdilek” System and Turkish maqam music practice had been established through computer analyses of audio recordings by master musicians such as Neyzen Niyazi Saygı and Tanburi Necdet Yaşar. Results incontrovertibly manifest the deliberate employment of multifarious “middle second” intervals peculiar to the genre, yet, evaded by the current model. These “middle seconds” are roughly expressible as 2/3, 3/4, and 4/5 tones, and often referred to by the protagonists of the Music Reformation in Türkiye during the early 20th century as “quarter-tones”. While the frequency ratios of the Pythagorean theory in effect are naturally limited by prime 3, the “middle seconds” observed in performance and dubbed “mucennel bölgesi” (the mujannab zone) by Yağmur Tura require the employment of superparticular simple-integer ratios whose numerators or denominators are mathematically constrained by as high a prime as 13. Here, prime-limit denotes the mathematical constraint by the highest prime in the factorization of both the numerator and denominator of a given frequency ratio for any set of intervals in a Just Intonation system.

A portion of this article has been devoted to the investigation of the effect of beat rates on the perception of middle seconds, since it is assumed by Ayhan Zeren, who is a major proponent of the “Arel-Ezgi-Uzdilek” System today, that these intervals are aberrations caused by the confusion arising from the miscalculation of beat frequencies in the human ear. It has been shown that such is not the case, and that, simple-integer ratios which may account for the executed “middle seconds” will produce no audible psychoacoustic beat frequencies at any given diapason. The first author debunks the current model for falling short of accommodating played intervals, and shows that the 24 tone Pythagorean tuning used in notation and music education embodies only five 2/3 tones and two 3/4 tones between uncommon, hence, unrecognized tone pairs – that is to say, at untraversed and inconvenient locations – rendering it a model far from representing actual practice.

It is maintained that non-conformance arose, because the 24-tone Pythagorean theory in effect was specifically engendered by what may be properly named the “Yekta-Arel-Ezgi School” to ward off “quarter-tones” which allegedly affiliated the maqam music heritage to Byzantines & Arabs. It may be said that the “Yekta-Arel-Ezgi School” condoned alienating theory to practice in an effort to save the genre from the anticipated disfavour of the new regime.

The first author predicates furthermore, that historical and contemporary alternatives such as the 17-tone Ajjad Scale, late-Ottoman Phonetic Notations like Kantemir, Osman Dede, Hamparsum, Harutin, Arabic 24-tone Scales, Oransay’s 29-tone Tuning, and Karadeniz’s 41-tone subset out of 106 equal divisions of the octave cannot favourably reflect the plethora of microtones observed in performance either. The fact that metallic levers on qanuns called “mandals”, which are manipulated by the executant on-the-fly to alter the lengths of the courses, are affixed by qanun-makers on these instruments in such a way as to yield 72 equal divisions of the octave due to the common usage of standard electronic tuners imported from overseas, is proof that the widespread 53 equal commas to the octave methodology is most likely confined to paper, and that, a higher resolution is demanded by performers of Turkish maqam music.

Since 53-tone equal temperament does not appear to be applied to qanuns, and dividing the octave into 72 parts is none other than the sixfold elaboration of twelve equal steps per octave methodology of Western music, it henceforth becomes a necessity to devise a tuning which is more compatible with Turkish maqam music tradition.

On such grounds, a novel 79-tone tuning has been developed and implemented on a unique custom-made qanun by the first author. This one-of-a-kind Turkish qanun was manufactured by Ejder Güleç in 2005, a renown instrument maker in İzmir, and acclaimed by music circles at various occasions. This tuning, with its complementary Sagittal microtonal notation designed by George Secor and David Keenan, is defended as a solution to overcome persisting issues regarding the accurate representation and consistent understanding of maqamat. With the employment of only three microtonal accidentals in addition to ordinary sharps and flats, it becomes possible to express subtle nuances of pitch in maqam music in accordance with electroacoustically measured intervals.

Keywords: Turkish Maqam Music, microtones, 79-tone tuning
Giriş
Bu makale, birinci yazarın İTÜ Sosyal Bilimler Enstitüsü, Müzikoloji ve Müzik Teorisi Programı’nda tamamladığı, “Türk Makam Müziği İçin 79-Sesli Düzen ve Kuram” başlıklı doktora tezinde ele alınan konuların ve sonuçlarının bir değerlendirilmesidir.


Esasen, günümüzde tanbura, malum, yegahneva aralığı boyunca 32 veya daha çok sayıda destan bağlanır. Aynı çerçevede, kanun yapıcılarında, yarımтон mandallarını Batı’dan getirilen akort aygıtılara göre, logaritmik olarak oktavın on ikide birine çıkıp, eğer kadar olan arayı altı eşit kısa böller; başka bir deyişle, oktavi, muhtemelen pek bilinçli olmadan, pratikte 72 eşit parça taksım ederler, ki icranın bugün kullanılan nazarıyya ile çatışmaması olanaksızlaştı.

Tarihsel ve çağdaş seçenekler arasında, aşağıdaki irdelenenek Ebced Sistemi’nin, Huruf Notalar’ın, yaygın 24 perdeli Arap Düzeni’nin, Oransay-29’un ve Karadeniz-41’in de, makam müziği icrasını tam olarak karşılayamayacağı, yapılan incelemeler sonucunda, açığa çıkartılmıştır.

Bu makalede, icra-kuram uyuşmazlığına çözüm olarak, Yarman tarafından geliştirilen 79-Sesli düzen ve notasyon, özetlenerek önerilmektedir.

İcra-kuram uyuşmazlığının gerisinde, “orta ikili” aralıklar
değerleri\(^2\) (Helmholtz & Ellis, 1885) ile gösterebiliriz:

- \(11:10 = 165\) sent (4/5 ton),
- \(12:11 = 151\) sent (3/4 ton),
- \(13:12 = 139\) sent (onüçsel 2/3 ton),
- \(14:13 = 128\) sent (2/3 ton).


Ne var ki, gayri müsavi 24 perdeli taksimatın “mücennel bölgesi” aralıklarından ancak iki çeşit, üstelik, içra (AEU Sisteminde, beşiler zincirinin uç kısımlarında) perdeler arasında ve çok ender, görülmektedir (Yarman, 2008) (Tablo 1):

<table>
<thead>
<tr>
<th>Sıklık</th>
<th>Aralık</th>
<th>Sent</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 kez</td>
<td>256/243 (bakiye)</td>
<td>90.225</td>
</tr>
<tr>
<td>17 kez</td>
<td>2187/2048 (k. mücenn)</td>
<td>113.685</td>
</tr>
<tr>
<td>5 kez</td>
<td>1162261467/1073741824</td>
<td>137.145</td>
</tr>
<tr>
<td>2 kez</td>
<td>(3.138 \times 10^3 / 3.436 \times 10^3)</td>
<td>156.989</td>
</tr>
<tr>
<td>14 kez</td>
<td>65536/59049 (bük m.)</td>
<td>180.450</td>
</tr>
</tbody>
</table>

137 sentlik aralık (onçüsel 2/3 ton), şu perdeler arasında bulunmaktadır:

- **dik buselik - hicaz**,
Bu sav, şayan-ı kabul sayılamaçaktır. Vuruların, aynı anda duyurulan yanık frekansta iki sesten doğan engellener veya uzak iki sesin ortak dalgaformundaki periyodik değişimler sonucu oluştuları ve AEU Sistemi’nin beş tür saflarını yoluyla4 inşa edildiği hatırlanacak olursa, tanbur gibi sabit perdeli Türk Müziği Sazları’nda, hele hele teksesli icra yapılırlarında Zeren’e göre “hatalı ve belirsiz sesler” katı surette icra edilmemek gerekir ki, gerçek hiç de böyle deildir.

Kaldı ki, gayri müsavi 24 perdeli taksimatta, 27/16 oranını ve Cole’nin teşkili perdesine 330 hertz (hz) titreşime sahip düğah perdesiyle, 4096/2187 oranıyla gösterilen 366.2531 hz’lik segah veya 59049/32768 oranıyla gösterilen 352.3975 hz’lik dik kürdi perdesi arasında oluşturacak vurular, aynı düğah perdesiyle, oranda 13:12, 12:11 ve 11:10 yukarıdaki “orta ikili” aralarının meydana getirilmesi vurulardan çok daha karmaşıktır:

\[
\begin{align*}
&f_2 [\text{AEU } \text{segah}] - f_1 [\text{düğah}] = \\
&366.2531 - 330 \text{ hz} = \text{saniyede 2.43 vuru}
\end{align*}
\]

\[
\begin{align*}
&f_2 [\text{düğah}+13:12] - f_1 [\text{düğah}] = \\
&357.5 - 330 \text{ hz} = \text{saniyede 27 + 1/2 vuru}
\end{align*}
\]

\[
\begin{align*}
&f_2 [\text{düğah}+12:11] - f_1 [\text{düğah}] = \\
&360 - 330 \text{ hz} = \text{saniyede 30 vuru}
\end{align*}
\]

\[
\begin{align*}
&f_2 [\text{düğah}+11:10] - f_1 [\text{düğah}] = \\
&363 - 330 \text{ hz} = \text{saniyede 33 vuru}
\end{align*}
\]

Kuşkusuz, son üç örnekteki “uşşak bölgesinde perdeleri”, ölçün kabul edilen Bolahenk’te, sırf bu tür vurular dikkate alındığında, AEU’unun segah ile dik kürdisine nazaran, daha rahat bulunur.

Esyanın tabiatına uygun olan; araları bu kadar açık seslerde, selenlere (doğu kanı) dayalı psikofiziksel vuruları esas almaktır. Buna göre, Bolahenk’te 293.3333 hz titreşime sahip rast perdesi temel kabul edilip, segah ve dik kürdi perdesinin, rast ile oluşturacakları vurulara yoğunlaşmak yerinde olur:

\[
\begin{align*}
&f_2 [\text{AEU } \text{segah}] \times 4 - f_1 [\text{rast}] \times 5 = \\
&1465.0124 - 1466.6665 \text{ hz} = 1.6541 \text{ v/s,}
\end{align*}
\]

\[
\begin{align*}
&f_2 [\text{AEU } \text{dik kürdi}] \times 5 - f_1 [\text{rast}] \times 6 = \\
&1761.9875 - 1759.9998 \text{ hz} = 1.9877 \text{ v/s.}
\end{align*}
\]

Ayrıca, bu psikofiziksel vurular dahil, kolay sayılır cinsten deildir. Zikredilen “uşşak bölgesinde perdelerin” ise, düğah perdesi ile hiçbir biçimde psikofiziksel vuru oluşturmadıkları, görülür:

\[
\begin{align*}
&f_2 [\text{AEU } \text{segah}] \times 10 - f_1 [\text{düğah}] \times 11 = \\
&3630 - 3630 \text{ hz} = 0 \text{ v/s,}
\end{align*}
\]

\[
\begin{align*}
&f_2 [\text{AEU } \text{dik kürdi}] \times 12 - f_1 [\text{düğah}] \times 13 = \\
&4290 - 4290 \text{ hz} = 0 \text{ v/s.}
\end{align*}
\]

Erol Sayan, Uşşak makamı dizindeki ikinci dereceyi, aşağıda gösterdiği üzere, “glissando bölgeleri” yoluya açıklamaya çalışmaktadır (Sayan, 1992) (Şekil 1):

Açıklanan veriler içinde, mevcut kuramın, ne kadar elden geçirilirse geçirilsin, makam müziği icrasındaki “orta ikililer” ifade etmekte yetersiz kaldıgı, kanıtlanıyor olmaktadır.


\[
\begin{align*}
19683/16384 & \quad kaba hisâr & 318 \, \text{¢} \\
17714/131072 & \quad dik acem aşırân & 522 \, \text{¢} \\
262144/177147 & \quad dik geveş & 678 \, \text{¢} \\
6561/4096 & \quad zirgûle & 816 \, \text{¢} \\
59049/32768 & \quad dik kürdî & 1020 \, \text{¢} \\
1048576/531441 & \quad dik bûselik & 1177 \, \text{¢}.
\end{align*}
\]

Yarman, 17’li dizide “orta ikili” aralıklar bulunmadığını, “Türk Makam Müziği İçin 79-Sesli Düzen ve Kuram” başlıklı doktora tezinde göstermiştir.

Bununla birlikte, 19. Yüzyıl’da yaşamlı olan Abdülhak Nasur Dede’nin, Ebed’e dayalı olarak geliştirdiği nota yazımı (Başer, 1996), 5 17’li dizide, başlangıç sesi yegah kabul edilirse, buradan 4 tam beşli yukarı, 12 tam beşli aşağı gidilerek bulunur.
Bazı dereceleri söylendiği gibi değişken kabul edildiği takdirde, Ebced Sistemi, icada tespit edilen “orta ikili” aralıkları karşılamaz. Ancak, Yalçın Tura’nın ifade ettiği şekilde (Tura, 1982), olağan genel beşli ölçüleri, 17 turdan sonra cember kapanabilir ve bu durumda, bir “orta-ikili” bulunur:

\[(1200 / 17) \times 2 = 141 \text{ sent.} \]

Yine de, bu oldukça zorlamalı bir yaklaşımdır ve 17 perdenin, makam müziği için, yeterli bir çözümüre olmadığı düşünülmektedir.


Arap Dünyası’nda yaygın kabul gören düzenleme, oktav 24 eşite bölün taksimattır (Touma, 1934). Bu düzenleme ilk kez ortaya koyan, Lübnanlı müzik kurucusu Mihail Muşaka’dır (D’Erlanger, 1949). Bu düzende, tipki oktavi 17 eşite bölme ve 15 tonu artan “orta ikili” bir cins “orta ikili” bulunur:

\[(1200 / 24 ) \times 3 = 150 \text{ sent.} \]


Suriye’de ise, aynı Türkiye’deki gibi, oktavi 53 eşit kommandan varsayılmış eğitimli hakimdir (Touma, 1934), ki böylece iki cins “orta ikili” bulunur:

\[(1200 / 53 ) \times 6 = 136 \text{ sent,} \]
\[(1200 / 53 ) \times 7 = 158 \text{ sent.} \]


Bununla birlikte, Türk kanunlarına mandallar, Batı’dan getirilen akort aygıtlarına bağlı olarak, 72-ton eşit taksimatı göre çakılmasına bakılarak, 53-şer kommandan, en azından kanun eşlikti icerilere, zannedilenin aksine, uygulanmadığı söylenebilecektir.


Bu düzende 10 adet 2/3 ton ve 7 adet 4/5 ton bulunmaktadır (Tablo 4):
Tablo 3

<table>
<thead>
<tr>
<th>#</th>
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<th>Muhtemel Oran</th>
<th>Müteakip Aralıklar</th>
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<td>0:</td>
<td>0 (Re)</td>
<td>1/1</td>
<td></td>
</tr>
<tr>
<td>1:</td>
<td>22</td>
<td>81/80</td>
<td>21.506 €</td>
</tr>
<tr>
<td>2:</td>
<td>90</td>
<td>256/243</td>
<td>68.719 €</td>
</tr>
<tr>
<td>3:</td>
<td>112</td>
<td>16/15</td>
<td>21.506 €</td>
</tr>
<tr>
<td>4:</td>
<td>182</td>
<td>10/9</td>
<td>70.673 €</td>
</tr>
<tr>
<td>5:</td>
<td>204 (Mi)</td>
<td>9/8</td>
<td>21.506 €</td>
</tr>
<tr>
<td>6:</td>
<td>274</td>
<td>75/64</td>
<td>70.673 €</td>
</tr>
<tr>
<td>7:</td>
<td>294 (Fa)</td>
<td>32/27</td>
<td>19.553 €</td>
</tr>
<tr>
<td>8:</td>
<td>316</td>
<td>6/5</td>
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</tr>
<tr>
<td>9:</td>
<td>386</td>
<td>5/4</td>
<td>70.673 €</td>
</tr>
<tr>
<td>10:</td>
<td>408</td>
<td>81/64</td>
<td>21.506 €</td>
</tr>
<tr>
<td>11:</td>
<td>476</td>
<td>320/243</td>
<td>68.719 €</td>
</tr>
<tr>
<td>12:</td>
<td>498 (Sol)</td>
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<tr>
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<td>520</td>
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<tr>
<td>14:</td>
<td>590</td>
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<tr>
<td>15:</td>
<td>610</td>
<td>64/45</td>
<td>19.552 €</td>
</tr>
<tr>
<td>16:</td>
<td>680</td>
<td>40/27</td>
<td>70.673 €</td>
</tr>
<tr>
<td>17:</td>
<td>702 (La)</td>
<td>3/2</td>
<td>21.506 €</td>
</tr>
<tr>
<td>18:</td>
<td>724</td>
<td>243/160</td>
<td>21.506 €</td>
</tr>
<tr>
<td>19:</td>
<td>792</td>
<td>128/81</td>
<td>68.719 €</td>
</tr>
<tr>
<td>20:</td>
<td>814</td>
<td>8/5</td>
<td>21.506 €</td>
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<tr>
<td>21:</td>
<td>884</td>
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<td>22:</td>
<td>906 (Si)</td>
<td>27/16</td>
<td>21.506 €</td>
</tr>
<tr>
<td>23:</td>
<td>926</td>
<td>128/75</td>
<td>19.553 €</td>
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<td>24:</td>
<td>996 (Do)</td>
<td>16/9</td>
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</tr>
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<td>25:</td>
<td>1018</td>
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<td>1088</td>
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<tr>
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<td>1110</td>
<td>243/128</td>
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<tr>
<td>29:</td>
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<td>2/1</td>
<td>21.506 €</td>
</tr>
</tbody>
</table>


6 Oranlar, en çok 1 sentin altında hata ile, Oransay’ın sent değerlerini karşır.

7 Oransay, bu sesi, arzı işaretlerdeki simetriyi korumak için yerleştirmiştir.


Karadeniz-41’deki başlica eksiklik, notasyondaki bozukluk ile ilgilidir. Tipki AEU’da olduğu gibi, diyeli sesler +4 komma, bemollü sesler -5 komma olup, nütrüllerden eşit mesafe olduğu; ayrıca, nim kürdi için kullanılan bemol, başlangıça açıklandığından tersine, -5 yerine -4 kommaya, kürdi için kullanılan bemol ise, -3.5 yerine -2.5 kommaya karşılık gelmektedir.

Tablo 4

<table>
<thead>
<tr>
<th>Ses-1</th>
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<th>Muhtemel Oran</th>
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<td>27:25</td>
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</tr>
<tr>
<td>9</td>
<td>13</td>
<td>27:25</td>
<td>133 €</td>
</tr>
<tr>
<td>11</td>
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Tablo 5

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159-ton eşit taksimatin ikinci derecesiyle meydana getirilen 79-sesli düzen
Bu çalışmada, Türk makam müziği için yeni bir düzen arayışında, gözettiğimiz ilkeler, sırasıyla, şunlardır:

1. Ana makamın, AEU’da Do majör olarak tanımlanan Çargah yerine, eskiden olduğu gibi, Rast olması (Levendoğlu, 2003) ve bu makamın temel dizisinin dizekte natürel notalarla gösterilebilmesi

2. Batı notasının beraberinde getirdiği standart diyapazon’ ile uyumlu olarak, Rast dizisinin piyanoformatenin beyaz tuşlarına yaklaştığ denk geldiği “Sipürde Ahengin” esas alınması

3. Rast’tın 3. derecesi olan segah ve yedinci derecesi olan evc perdelerinin, dizinin işasında kullanılan beşiler zinciri koprmağızın elde edilmesi

4. Yine Rast dizisinin 3. ve 7. derecelerinin, kesintisiz bir diğer beşiler zincirinden hareketle, daha dik olan buselik ve mahur perdelere ilke ikiy edilebilmesi ve böylece Mahur dizisine geçiş yaplabilmek

5. İcrada görülen çeşitli “orta ikili” aralıkların, dügah-segah, çargah- saba, neva-hisar gibi konumlarla yerleştirilmesi

6. Bu tür işlemlerin, natürel tonlarda olduğu kadar, diyezli ve bembollü tonlarda da gerçekleştirebilirleşmesi ve böylece kanun sazinin her ahente öteleme (transpozision) yapabilecek hale gelmesi

7. Kromatik geçikler için 12-sesli kapalı bir döngünün çıplık çıkarılabilmesi

8. Notasyonda tutarsızlık olmaması ve arzaların mikrotonal çaprazlığı elverişli olması.

Tüm bu hususları hâkkiyle karşılayabilecek olan düzen, Oktavin 159 eşit parçaya bölünmesi ardından 79 sesin ayrılanmasıyla elde edilmiştir (Tablo 6). 79-sesli düzene, yegah-neva arasındaki oktay boyunca, 159-ton eşit taksimatın 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 modundan oluşmaktadır. Bu durumda “jeneratör aralığı”'10 (başlangıç noktası yegah adedilme koşuluyla) 159-ton eşit taksimatin ikinci derecesi olan 15.1 senttir11.

79-sesli düzene, Sipürde Ahenkte standart diyapazon sesleriyle karşılaştırılacak biçimde, Rast dizisinin kesintisiz beşiler zinçireye (dugah, segah, hiseyni ve evc perdelerini yedirerek), Tablo 6'da sunulan arzaların notalara oturtmaktadır:

---

8 (1200 / 72) x 8 = 133 sent, (1200 / 72) x 9 = 150 sent, (1200 / 72) x 10 = 167 sent.
9 A4/La = 440 Hz
10 düzeni işe koyacak aralık birimi
11 Bu aralık, 2/3 Holder komması kadardır.
Tablo 6

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<td>159</td>
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</table>

F-(702¢)-C-(702¢)-G-(694¢)-D-(702¢)-A-(694¢)-E-(702¢)-B.

79-sesli düzende, bir diğer beşiler zinciri yoluyla, segah ve evc yerine buselik ve mahur konabilmekte, Rast makamından Mahur makamına geçki, mümkün hale gelmektedir:

F-(702¢)-C-(702¢)-G-(694¢)-D-(702¢)-A-(694¢)-E*(702¢)-B*.
79-sesli düzen, her seste en yüksek 8 sent sapma ile, dizilerin herhangi bir dereceye ötelenmesine son derece elverili/g250lidir. En çok 8 sent mutlak fark ile tutturulan bazı oranların dökümü, Tablo 7'de sunulmuştur (Tablo 7).

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</table>

Sistemde, 70 adet 135.849 sent (13:12 - 2.724 sent ve/veya 14:13 + 7.551 sent), 9 adet 143.396 sent (13:12 + 4.823 sent) ve 8 adet 128.302 sent (14:13 – 0.004 sent) olmak üzere, toplam 87 adet 2/3 ton; 69 adet 150.943 sent (12:11 +
79-sesli düzenin notalandırılmasında, George Secor ve David Keenan tarafından geliştirilmiş, “Sajital” adlı “mikrotonal sistem” kullanılmıştır (Secor & Keenan, 2006). Bildik diyezlerin ve bemollerin yanısına, sadece üç çeşit mikrotonal arzalar ve bütün komma ayrıntılar ifade edilebilmektedir. Bu arzalar şöyleledir:

1. Bir komma kaldıracı ve indirici sol yarım oklar]** & **
2. İki komma kaldıracı ve indirici sağ yarım oklar** & **
3. Üç komma, yahut çeyrek ton kaldıracı ve indirici tam oklar** & **

Bu hesapça, (** + ** = **) formülü, daima geçerlidir. Diyezler ve bemoller daima 6 komma, çift diyezler ve çift bemoller 12 komma olup, aradaki sesler Sajital Sistem’deki mikrotonal arzalar bunlara eklenerek, yahut bunlardan çıkartılarak, bulunmaktadır. Notasyon, son derece tutarlıdır. Sajital notasyonu 79-sesli düzen; Yarman’ın Doktora Tezinde, on makam örneğiyle pekiştirilmiştir. Üç komma, yahut çeyrek ton kaldıracı ve indirici tam oklar** & **

Sonuç

Yarman’ın önderliği 79-sesli düzen; notasyonda hiçbir tutsalsız olmaksızın, kesintisiz beşler zincirile, Rast dizisini arızasız seslere karşılık getirebilmektedir. Mahur dizisinin, benzer şekilde, elde edilebilmesine olanak sağlanmaktadır. Ayrıca, her ahenkte Saba, Hüzzam, Uşşak, Karcığar gibi değişken perdeli makamlar, bunlara has karakteristik aralıklarla, duyurabilimekte. 79-sesli düzen, bu özellikleriyile, Türk makam müziği için son derecede uygun bir temperaman olmaktadır.

Kaynaklar
Çevirmenin ekleri


Included herewith are slides of my Doctoral Defense Presentation (in Turkish) that I had used in my address to the Doctoral Evaluation Jury on June 10th, 2008. The event had taken place in one of the main auditoriums of the “Taşkısla Building” (Faculty of Architecture near Taksim) of Istanbul Technical University, where I have been robed with Ph.D. honors following a unanimously affirmative vote.

The appearance, flow, and contents of the slides were not modified, except cosmetically, for inclusion in this expanded publication.

Readers who are able to follow Turkish will notice a few gems that were omitted in the dissertation text. These pertain to the discussion on the “mujannab zone” or “mujannabat” starting from Urmavi all the way to the Yekta-Arel-Ezgi School, and add further support to my theoretical premise that maqams require several gradations in the case of middle second intervals to yield a satisfactory intonation – but that these were deliberately shunned in the modern era insofar as resulting in the entrenched centennial mismatch between theory and practice.
Türk Makam Müziği için 79-sesli Düzen ve Kuram

Ozan Yarman
Doktora Tez Savunması
10 Haziran 2008

İstanbul Teknik Üniversitesi Türk Musikisi Devlet Konservatuvarı Müzikoloji Anabilim Dalı

Neden yeni bir düzene ihtiyaç var?

- Yürürlükteki kuram, usta icraçılardan kayıtlarından elde edilen ölçüm sonuçları ile uyumsuz.

- Örtüşmezlik daha çok_USARTK, Hüseyni, Hüzzam, Karcığar ve Saba gibi makamlarda görülüyor.

- En sorunlu perdeler, segah, hicaz, hisar, eviç, şehnaz.

- Sapmaları açıklayabilmek üzere - gayri müsavı 24 perdeli düzeni de kapsayacak şekilde - oktavı 53 kommaya bölme eğilimi yaygın.
“Mücenneb bölgesi” ve orta ikililer

- Sorunlu makamlarda, tanını (majör tam ses) ile bakiye (limma) arasındaki “mücenneb bölgesi” kilit rol oynuyor.

- Bu bölgede, 11/10, 12/11, 13/12, 14/13 şeklinde basit sayılı oranlarla ifade edilebilecek çeşitli orta ikililerin duyurulmak istendiği düşünülmeliydi.

- Yürürülükteki “Arel-Ezgi-Uzdilek Sistemi” (AEU), bu kritik aralıklara yer vermiyor.
Farklı ahenkler de işin içine girince...

- Müziğimizde, Batı’dağine benzer bir diyapazon standartı yok. Bolahenk (neva=440 hz) dışında, Süpürde, Kız, Mansur ve diğer ahenkler üzerinden de icra yapılabiliyor.

- Birçok ahenk işin içine girince, kanunda ve tanburda görülebildiği üzerede, 24 perde hiç yetmiyor.

Yüksek çözünürlükte bir temperaman şart

- İcrada seslendirilen orta ikilileri karşılayacak, farklı ahenklerde makamların eksiksiz ifade edilebilmesine uygundur. Dahası, ileriye dönük mikrotonal çöksesliliğe elverişli, yüksek çözünürlükte bir temperaman gereklidir.

- 53-ton eşit taksimat (tET), tercihe şayan bir seçenek olarak beliriyor.
Ama 53-ton eşit taksimat kağıt üstünde kalıyor

- “Tam seste 9, oktavda 53 komma metodolojisi”, sağlam bir seçeneğe olmasına karşın, sabit perdeli sazlar arasında kanunlara da, tanburlara da uygulanmıyor.

- Tanburlara destanlar adeta gelişigüzel bir şekilde yerleşiriliyor.

- Kanunlarda, yarı-ses mandalı 100 sente çıkılıp eşikle arası 6 eşit parçaya bölünüyor; pratikçe, 72-tET’in bir alt-kümesine varılıyor.

Ya 72-ton Eşit Taksimat?

- Oktavın logaritmik olarak 72’ye bölünmesiyle ortaya çıkan çözümülük, makam müziği perdelerinin geleneğe yakın temsil edilmesine uygun görünmüyor. çünkü temelinde Batı müziğinin 12 eşit sesi var.

- Kanuniler, bazı makamları seslendirirken bu düzenden şikayetçiler.

- Yine de, makam müziği için ideal sistemin çözümülüğü hakkında bir fikir veriyor.
Alternatif düzenler

- **Karadeniz41**: Oktav 106 eşit parçaya bölünerek elde ediliyor; 53-tET’den daha başarılı değil.

- **Oransay29**: Neredeyse 53-tET’in alt kümesi; bu da icradaki bütün orta ikiileri karşılamıyor.

- **24-ton Eşit Taksimat**: Arap dünyanın müzik kuramının temeli; bize hayli ters.

- **Ebcded ve Huruf notalar**: Perde sayısı yetersiz, huruf notaların işaret ettiği belli bir düzen yok.

Eleştiri

- Arapların kullandığı 24 eşit aralıklı sistem hariç, AEU ve buna alternatif olarak ileri sürülen düzenler 106-tET izgarasına oturuyor, ancak hiçbirinin iki yakası biraraya gelmiyor.

Neden müziğimizin sistemi hala tartışılıyor?

- Hazırda, AEU’ya alternatif ve farklı düzenlere dayalı birkaç makam kuramı var. Alternatif kuramlar, sanki ölçüm sonuçları ile bulgulanan ve AEU’nun karşılamadiği karakteristik orta ikilileri yakalamaya uğraşıyor.

- Yürürülükteki kuram icradaki ortaikileri neden içermiyor? Bu aralıklar yeni olarak mı peyda oldu? Hayır. Peki, yürürülükteki kuramı yazanlar bu aralıkları duymuyorlar mıydı?

İcra-kuram örtüşmezliğinin gerisinde

- Orta ikilileri kastetmekte kullanılan “çeyrek-ton” tabiri, Cumhuriyet’in ilk yıllarında Bizans ve Araplar ile ilişkilendiriliyordu.

- Yapay olduğu varsayılan aralıklara dayalı bir müziğin Türk kökenli olamayacağı görüşü hakimdi. Alaturka bu yüzden yasaklara maruz kaldı.

- Yürürülükteki kuramın temelleri, ilginçtir ki, tam bu evrede atıldı.
Orta ikilileri dışlayan bir düzen!

- Alaturka’nın yasaklandığı bir evrede, Yekta, Arel ve Ezgi, Türk (makam) müziğinde “çeyrek-ton” bulunmadığını ileri sürdüler.

- Nitekim, tarihi nazariyatla desteklemeye çalışıkları gayri müsavi 24 perdeli taksimat, sorunlu makamlardaki orta ikilileri karşılayamayacak bir kurguya sahiptir.

- Bunun bilinçli olarak böyle yaptığı kuvvetle çağrısıyor.

Urmevi ile gayri müsavi 24 perdeli taksimat ilişkisi

- Rauf Yekta tarafından geliştirilen gayri müsavi 24 perdeli taksimat, yegah perdesinden 9 beşli yukarı, 14 beşli aşağı gidilerek inşa edilmiştir.

- AEU, kaba çargah’tan 11 beşli yukarı, 12 beşli aşağı gidilerek bulunuyor. İkisi de tipatıp aynı düzen.

- Urmevi’nin 17 sesli Ebced düzeni, 4 beşli yukarı, 12 beşli aşağı gidilerek bulunuyor. Yani, gayri müsavi 24 perdeli taksimat, Urmevi’den mülhem.
Oysa Urmevi kuramında orta ikililer de var

- Bununla birlikte, Safiyüddin Urmevi, kendini Pithagoryen oranlarla sınırlamıyor, 2/3, 3/4 ve 4/5 tam ses şeklinde açıklanabilecek orta ikili aralıklardan da söz ediyor!

- 750 yıl öncesinin orta ikilileri ile bugünki usta icracıların kayıtlarında ölçülen “kuram-dışı” aralıklar arasındaki benzerlik şaşırtıcı.

Urmevi’nin Şerefiyye Risalesi

- Safiyüddin Urmevi’nin Şerefiyye Risalesi, 2007 yılında Türkçe’ye çevrilmişinde, müellifin yüksek asal limitli orta ikili aralıklardan ve bunlara dayalı pek çok cinsten söz ettiği anlaşıldı.

- Ayrıca, Ebced ile notalandırıldığı ud parmak pozisyonlarına bakıldığında, gayri müsavi 24 perdeli taksimatta bulunmayan, 99, 145 ve 168 sentlik “Mücenneb-i Sebbabe” (işaret parmağı yanı) perdeleri (mücennebat) görülüyor!
Urmevi’nin Ebced düzeni nasıl anlaşılmalı?

- Urmevi, bir yandan yüksek asal limitli tetrakordal bölünmelere değinirken, neden diğer yandan 17 sesli Pithagoryen bir düzen veriyor?

- Tetrakordal bölünmelerde perde sayısının başedilemez boyutlara varmasının önüne geçmek ve telleri dörtülerle akortlanan kadim udda parmak pozisyonlarının kolay anlaşılmasını sağlamak üzere, Ebced notasını, tipki kendiden yüzüllar önce El-Kindi’nin yaptığı gibi, ilk etapta, Pithagoryen değerlere izdüşürmüş olmalı.

Gayri müsavi 24 perdeli taksimat yorumu açık mı?

- Rauf Yekta, Saba’da üç çeyrek-ton boyutunda “nakis büyük müceneb” oranına (12:11) değiniyordu, ancak bunun için ayrı bir perde vazetmiyor.

- Suphi Ezgi, Uşşak’ta karara gidilirken, düğahsegah arası için Yekta’dan aldığıni söylediği 11:10 oranını düzelterek, 65536:59049 oranından sadece 5 sent kadar daha aşağıdaki 125:113 aralığını veriyor; eskilerin Hicaz tetrakordunu doğru belirleyemediklerini söylüyor; Saba’da 12:11 ile 11:10 oranlarını dîşliyordu.
Değerlendirme

- Yekta, Arel ve Ezgi, müziğimizdeki makamları açıklamak üzere, gayri müsavi 24 perdeli taksimattan başka bir düzen önermemişlerdir.

- Arel, Ezgi ve Uzdilek tarafından son şekli verilen kuram, geleneksel perdelerin esnekliğini ortadan kaldıran bir cendereye dönüşmüştür.

- Gayri müsavi 24 perdeli taksimatta, ücra perdeler arasında bulunan beş adet 2/3 ve iki adet 3/4 ton, icrayı temsil etmiyor.

Yeni bir düzene doğru: kısıtaslar

- Ana makamin, gelenekte olduğu gibi Rast kabul edilmesi ve Rast dizisinin, kesintisiz beşliler zinciri yoluyla elde edilip, natürel seslere denk getirilmesi;

- Aynı şekilde, Mahur dizisine, ayrı bir kesintisiz beşliler zinciri yoluyla, geçki yapılabilmesi;

- Sorunlu makamlara özgü orta ikili aralıkların, tüm ahenklerde hakkıla temsil edilebilmesi.
79 sesli bir düzen

- Tam dörtlü aralığı (4:3) logaritmik ıskalada 33 eşit parça taksim edilir.
- Elde edilen “komma” 78 kere üstüste bindirilir.
- Varılan ses oktava yakındır. Oktav aralığı düzene dahil edilir.
- Böylece, yegah ile neva perde arasındaki yapı ortaya çıkar.

79 MOS 159-tET

- Varılan düzen, 159-tET’in ikinci derecesi ile üretilen 79 ses ile pratiğe aynıdır.
- İngilizce “79-tone Moment of Symmetry out of 159-tone Equal Temperament” deyişinin kısaltılmışsi olan 79 MOS 159-tET şeklinde anılır.
- “Moment of Symmetry” tabiri, hangi yöne döndürülürse döndürülübün, sistemin bünüyesinde bulunan iki cins komma aralığından dolayı, simetrinin koruduğununu anlatmaktadır.
Ötelemelerde, her seste en çok 1/3 komma sapma

- Sistemde 46 adet Pithagoryen, 33 adet tempere, 32 adet Süper-Pithagoryen beşli bulunur.
- Ötelemeler noksansızdır.
- Kromatik pasajlar için 12 sesli kapalı bir beşliler döngüsü elde edilebilmektedir.
- Mücenneb bölgesi oranları, her derecede en çok 7 sent hata ile yakalanır.

Uygulanabilirlik ve gelenekle örtüşme

- 79 MOS 159-tET, tarafımızdan tasarlanan bir kanuna uyarlanmıştır.
- Bu çalgı çeşitli çevrelerde tanıtılmış, usta kanun icracılarının ilgisini ve beğenisini toplamıştır.
- 79 sesli düzen sayesinde, Uşşak, Hüseyni, Hüzzam, Karcığar, Saba gibi çetrefil makamların anatomisini deşifre etmek hayli kolaylaşmaktadır.
Yeni düzenin notasyonu nasıl olmalı?

- Yürürlükteki nota, ton-aktarimsal olmayan (non key-transposable) sabit perdeli çalgılar için uygun değil.
- Arızi işaretler, büyük çaplı çoksesilik tekniklerinin denenmesine elvermiyor.
- Yeni düzene, çağdaş bir notasyon lazım.

Sajital Notasyon

- 79 MOS 159-tET’i notalandırmak üzere, George Secor ve David Keenan tarafından geliştirilen Sajital Notasyon’u kullandık. Bildik diyezlere ve bemollere ilaveten yalnızca üç yeni işaret öğrenmek yetecektir.
- Bunlar, komma, iki komma ve çeyrek-ton arızalarıdır.
- Sajital Notasyon, uluslararası mikrotonal camiayı sarmaştırmakta köprü görevi üstlenebilir.
Tam seste 13 “komma”

Tanını boyunca çıkarken

Tanını boyunca inerken

SONUÇ

- 79 sesli düzende, perdeler, geleneğe uygun olarak, 17 bölgede toplanıp ayrıntılandırılmıştır.
- Seslerde en çok 1/3 Holder komması sapma ile makamların her ahenge ötelenmesi mümkündür.
- Notasyon tutarlıdır ve mikrotonal polifoniye elverişlidir.
- 79 sesli bir makam kuramı denemesine girişilmiş, on ana ve bileşik makam notalandırılmıştır.
This is a Supplementary Resource (long overdue!) of select maqam scales and their significant transpositions in the 79-tone tuning. They are given as ascending-descending gamuts for want of ease (also on account of typesetting constraints with the Mus2© score editor), by emphasis on the tonics (written as whole notes) and secondary functional degrees pertaining to the nodes of genera (written as half notes), and are engraved using a dedicated Sagittal® notation – aside from the exposition of the entire system using also my personal innovation by the name of Mandalatura®.

The reader will notice that, unless a 12-tone cyclic subset is specifically extracted out of 79/80 MOS 159-tET, ordinary (i.e., Western common-practice) sharps and flats cannot, in order to preserve consistency, be enharmonically respelled in place of each other when transposing scales microtonally over a twelve-step-circle of perfect fifths.

MAIN maqams, as laid down in this work, are Rast (2 indispensable alterations for the barebones case), Mahur (2 i.a.), Pençgah (1 i.a.), Nihavend (3 i.a.), and Hüseyni (2 i.a.), etc... while COMPOSITE maqams are Segah (4 i.a.), Hüzzam (6 i.a.), and Saba (7 i.a.), etc.... Bear in mind that Acemli Rast (4 i.a.) and Hicaz (4 i.a.) fall into the composite category – although not previously elaborated as such – and naturalizing alterations in descent are not counted when estimating scale complexity.
79/80-tone Moment of Symmetry 2° 159-tET
"MIXED SAGITTAL®" notation

Tuning / Accidentals

Dr. Oz.
All flats thru G-F require to be increased by 7-8 cents unless G is modified to be 695¢ as part of 80 MOS 159-TET
Sol notası 80 MOS 159-TET bünyesindeki 695¢ klinmazsa, G-F boyunca her bemolün 7-8 sent artırılması gerekir.
G-F flats err by 7-8 cents if G is 702 cents, which is here modified to 695 cents conforming to 80 MOS 159-tET. Sol 702 olursa, G-F bemolleri 7-8 sent hatalı olacağından, burada 80 MOS 159-tET bünyesinde 695 sent kılındı.

RAST (Süpürde Ahenk esas alınarak, Kaba Çargah yerine asıl dizi)

Kız Neyi Ahengiyle yerinde NİHAVEND (Süpürde ile ise LA'da)
79/80-tone Moment of Symmetry 2° 159-tET
"MANDALATURA®" notation

Tuning / Accidentalas

Dr. Oz.
All flats thru G-F require to be increased by 7-8 cents unless G is modified to be 695¢ as part of 80 MOS 159-ET.

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Sol 702 sent olursa, G-F bemolleri 7-8 sent hatalı olacağından, burada 80 MOS 159-tET bünyesinde 695 sent kılındı.
Rast transpositions

MAIN MAQAM
Mahur transpositions

MAIN MAQAM
Pençgah transpositions

MAIN MAQAM
Nihavend transpositions

MAIN MAQAM
Neveser transpositions

MAIN MAQAM
Hüseyni transpositions

MAIN MAQAM
Uşşak transpositions

MAIN MAQAM
Acemli Rast transpositions

COMPOSITE MAQAM (Mix Rast)
Buselik transpositions

COMPOSITE MAQAM
Hicaz transpositions

COMPOSITE MAQAM
Zengule transpositions

COMPOSITE MAQAM
Segah transpositions

COMPOSITE MAQAM
Hüzzam transpositions

COMPOSITE MAQAM
Saba transpositions

COMPOSITE MAQAM
End