İSTANBUL TECHNICAL UNIVERSITY ★ INSTITUTE OF SOCIAL SCIENCES

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

Ph.D. Thesis by

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Department: Musicology

Programme: Musicology and Music Theory

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İSTANBUL TEKNİK ÜNİVERSİTESİ ★ SOSYAL BİLİMLER ENSTİTÜSÜ

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

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FOREWORD

Motivated by a personal resentment against the prevalance 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 accomodates 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 Akkoç*, *Kemal Karaosmanoğlu*, *Ömer Tulgan*, and *Uğur Keçecioğlu* 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 Schulter*, *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

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ABBREVIATIONS

ADO	: Arithmetical divisions of the octave
AEU	: *Arel-Ezgi-Uzdilek* System
ASCII	: American Standard Code for Information Exchange
CPS	: Cycles per second
EDO	: Equal divisions of the octave
HZ	: Hertz
JI	: Just Intonation
MIDI	: Musical Instrument Digital Interface
MM	: Millimeter
MOS	: Moment of Symmetry
TET	: (n)-tone equal temperament

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ÖZET

"Arel-Ezgi-Uzdilek" Sistemi ile Türk Makam Müziği icrası arasında uzun süreden beri var olduğu algılanan uyuşmazlık, ses kayıtlarının bilgisayar çözümlemeleri yoluyla kesinleştirilmiş bulunmaktadır. Bulgular, Türk Makam Müziği'ne özgü, ne ki, hazırdaki kuramın yer vermediği, çok çeşitte "orta ikili" aralığın, tartışmaya yer bırakmayacak şekilde, bilhassa çalındığını göstermektedir. Sözkonusu "orta ikili" aralıklar, 2/3, 3/4 ve 4/5 tanini şeklinde açıklanabilmekte olup, Türkiye'de, 20. Yüzyılın başlarında gerçekleştirilen Musıki İnkılabının kilit isimlerince, "çeyrek-tonlar" olarak vasıflandırılmışlardır.

Yürürlükteki Pithagorsal kuramın frekans oranları, doğal olarak asal çarpan 3 ile sınırlanıyor iken, icrada gözlemlenen ve Yalçın Tura tarafından "mücenneb bölgesi" olarak adlandırılan "orta ikililer", payları ve paydaları matematiksel olarak asal çarpan 13 ile kısıtlanmış basit sayılı süperpartiküler kesirlerin kullanımını gerektirmektedir. Burada asal-kısıt, Tam Tınısal bir sistemde, herhangi aralıklar kümesine ait bir frekans oranındaki payın veya paydanın, çarpanlarına ayrılması sonucu elde edilen en yüksek asal sayı ile matematiksel sınırlandırmayı ifade eder.

Örtüşmezlik, 'Yekta-Arel-Ezgi Ekolü'nce, icrada ve eğitimde kullanılan yürürlükteki gayri müsavi 24 perdeli kuramın, Makam Müziği mirasını Bizans ve Arap Uygarlıkları ile ilişkilendirdiği düşünülen "çeyrek-tonları" dışarlayacak biçimde kurgulanmasından kaynaklanıyor görünmektedir. Bu durumda, 'Yekta-Arel-Ezgi Ekolü'nün, yeni rejimden yükselebilecek hoşnutsuzluğu bertaraf edebilmek üzere, kuramın icra ile uyumsuzluğuna göz yumduğu söylenebilecektir.

Yazar, gayri müsavi 24 perdeli taksimatın, çalınan aralıkları tümüyle karşılayamayacağını ortaya koymakta olup, notalandırma ile müzik eğitiminde kullanılan bu düzenin alışılagelmedik, keza, aşina olunmayan perde ikilileri arasında – diğer bir deyişle, ulaşılmadık ve uygunsuz noktalarda – beş adet 2/3 ton ve iki adet 3/4 ton içerdiğini, bu nedenle de, gerçek icrayı temsil etmekten hayli uzak olduğunu göstermektedir.

Yazar ayrıca, Ebced, Kantemir, Osman Dede, Harutin, Hamparsum, Arap Dünyası'nda tanınan 24-perdeli diziler, Oransay'ın 29 sesli düzeni ve Karadeniz'in 106-ton eşit taksimat içinden çıkardığı 41-perdeli sistem gibi tarihsel ve çağdaş alternatiflerin – her ne kadar, bunların çoğu 106-ton eşit taksimat ızgarasına oturuyor ise de – icrada gözlemlenen birçok mikrotonu

tatminkar düzeyde yansıtamadığını bulgulamaktadır. Bu çalışmada, sözkonusu seçeneklerin ayrıntılı bir değerlendirmesi sunulmuştur.

Kanun yapımcıları tarafından, kanunlara, çalgıcının icra esnasında tellerin uzunluğunu değiştirmekte kullandığı ve "mandal" olarak adlandırılan küçük metal parçaların, dışarıdan getirtilen standart elektronik akort aygıtlarının sıklıkla referans alınmasından kaynaklanıyor olarak, 72-ton eşit taksimata göre çakılması, yaygın olan "oktavda 53 Holder komması" metodolojisinin kağıt üstünde kaldığına delil sayılabilir ve en azından, Türk Makam Müziği icracılarının daha yüksek bir çözünürlük aradıklarını işaret ediyor olarak gözetilebilir.

53-ton eşit taksimat kanunlara uygulanmadığına ve oktavı 72 eşit parçaya bölmek, Batı Müziği'ne özgü "oktavda 12 eşit yarım adım" metodolojisinin altı kat ayrıntılandırılmış halinden başka birşey olmadığına göre, Türk Makam Müziği geleneği ile daha uyumlu bir düzen tasarlanması gerekli görünmektedir.

Bu nedenlerden dolayı, yazar, 79-sesli yeni bir düzen geliştirmiş olup, bu düzeni, münhasıran tasarlayıp yaptırdığı bir kanuna uyarlamıştır. Bu nev-i şahsına münhasır Türk kanunu, 2005 yılında, İzmirli çalgı yapımcısı Ejder Güleç tarafından imal edilmiş ve çeşitli akademik etkinliklerde, müzik çevrelerinin beğenisini toplamıştır. 159-ton eşit taksimatın bir alt-kümesi olan 79-sesli düzen, bu çalışmada etraflıca açıklanmakta ve makamların eksiksiz temsil edilmesine ve bütünüyle kavranmasına yönelik süregelen sorunların aşılabilmesinde bir çözüm olarak savunulmaktadır.

79-sesli düzeni yazabilmek üzere, Sajital Notasyon® seçilmiş ve bu tezde ayrıntısıyla çalışılmıştır. Böylece, bildik diyezlere ve bemollere ilaveten, yalnızca üç çeşit mikrotonal arıza ile, Makam Müziği'ne mahsus incelikli ayrıntıların ifade edilebilmesi mümkün hale gelmiştir. Ayrıca, Sajital Notasyon®, gelecekteki makam çokseslilığı denemelerine geçit aralayabilir.

79 perdeli makam kuramına bir giriş denemesi olarak, 79-sesli düzenin üstünlüklerini sergileyecek şekilde, bazı ana ve bileşik makamlar notalandırılmıştır. Makamların, "Arel-Ezgi-Uzdilek" kuramında basit ve mürekkeb/şedd olarak ele alınmasına karşıt olarak, ana ve bileşik şeklinde iki farklı kategoride ele alınıp baştan tanımlanması, bu tezde yazarın ortaya koyduğu bir buluştur. Hüzzam ve Saba gibi sorunlu makamlar, 79-sesli düzen sayesinde, tutarlı bir biçimde notalandırılabilmektedir.

Makam kuramına yönelik yukarıda adı geçen diğer yaklaşımlarla kıyaslandığında, 79-sesli düzen, karmaşık 13 asal-kısıtlı dizilerin notalanmasına, ötelenmesine ve armonize edilmesine son derecede elverişlidir.

79-TONE TUNING & THEORY FOR TURKISH MAQAM MUSIC
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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 delibarate 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 "mücenneb bölgesi" (the mujannab zone) by Yalçın 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 affliated 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 accomodating 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.

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/maqam*s/*terkib*s [i] [5-6] and *ika'/usûl*s [ii] [7], comprising such vocal forms as *gazel*, *ilâhî*, *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 *şarkıs* 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 *tanbur*s, and the affixture on *qanun*s of *mandal*s [i] 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 *mandal*s (for the lower courses in particular – to the detriment of octave equivalances) 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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[i] Metallic levers arrayed across the diagonal side of the *qanun* that serve to alter vibrating lenghts 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 *perde*s (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 accomodating 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 *qanun*s 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 *perde*s 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 *perde*s.

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 *maqam*s 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 *maqam*s 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 *maqam*s 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 indispensible 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 *maqam*s 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-ı Atik vs Fasl-ı 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 fulfils 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-ı 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-ı 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* [i] [47], under a publication bearing his name dated 1864, analyzed close to eighty *maqam*s, 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*, *peşrevs*, and *şarkıs* in the future pertaining to the *maqam*s he gave the descriptions for [48-51].

Although, *Haşim Bey* could not fulfil the promise in his lifetime [51], *Notacı* (Notator) *Emin Efendi* [ii] [52] and others after him did; wherefore *maqam* tones, called *perde*s, 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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[v] *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.*)

[i] *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 *Mûsikâ-i Hümâyûn* after primary school; composer and score publisher after 1875. (See, accompanying endnote.)

Accused of being "Byzantine" [i], and even "Arabic" [ii] [59,60], *Maqam* Music was stigmatized [61] and swiftly uprooted from *Dar'ül-Elhan* [iii] [62,63] in 1926 [iv] [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* [v] *Mustafa Kemal*, was staged in the Istanbul Sarayburnu Park [vi] [67] Casino on 9 August 1928 [vii], 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]:

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[i] *i.e.*, "non-Muslim", or rather, "non-Turkish", hence, 'perfidious' in this context. (See, accompanying endnotes.)

[ii] *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.*)

[iii] *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.)

[iv] 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.)

[v] Ghazi; a veteran Muslim warrior; title given to the Turkish military elite.

[vi] Curiously, this was the location where the first life-size statue of *Mustafa Kemal* was erected on October 3rd, 1926. (See, accompanying endnote.)

[vii] 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.

[See, APPENDIX A: Quote A.1]

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' [i] [70-73] reduced to twelve tones [74], as stressed in the Turkism ideology of *Ziyâ Gökalp*, 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]:

[See, APPENDIX A: Quote A.2]

As baffling as it may seem, *Gökalp*'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]:

[See, APPENDIX A: Quote A.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].

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[i] 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* [i] [79,80], draws a rather fanciful parallel between discarding unuttered Arabic letters from the Turkish alphabet and tempering [ii] traditional *perde*s 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 [iii] [82,83], allowing only music composed and performed by musicians educated according to Western techniques [84].

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[i] 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.)

[ii] *i.e.*, 'averaging (the pitches) via vanishing commatic intervals.'

[iii] 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 [i] [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 *Mildan Niyazi Ayomak* [ii] [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, *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]:

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[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] *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.)

[See, APPENDIX A: Quote A.9]

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]:

[See, APPENDIX A: Quote A.10]

This awkward situation lasted until the opening, under more propitious political circumstances, of a 'Turkish Music State Conservatory' [i] [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, *Hüseyin Sadettin Arel* [ii] [99-101].

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[i] 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.)

[ii] *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" [i] [102-105] 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* [ii] [109,110] and *Salih Murat Uzdilek* [iii] [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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[i] A slogan coined by *Atatürk* in 1934 during one of his Çankaya dinner receptions featuring *Saygun*'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.)

[ii] *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.)

[iii] *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.)

Upon realizing that the new regime marked *Maqam* Music as "Byzantine", "Arabic", "quarter-tonal", hence, 'synthetic', 'unnational', and 'abominable', *Yekta* reacted immediately.

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* [i] in defense of the prevailing Music Reformation [118,119]:

[See, APPENDIX A: Quote A.13]

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[i] *Osman Zeki Üngör* (1880-1958); violinist and concertmeister of *Mûsikâ-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 *Musiki Muallim 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*" [i] [120] 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 [121,122].

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 [ii] [123] (among whom were *Ezgi* and *Ataman* previously mentioned) and pioneered in the founding of 'Turkish Music Federation' [124] 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 [125] 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 [126,127].

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[i] '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 *Hâfız 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 commitee's inefficiency), and was instrumental in rescuing from oblivion innumerable classical compositions of Turkish *Maqam* Music during the Music Reformation years. (See, accompanying endnote.)

[ii] 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 priviledges 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].

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[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* [i] [152,153] and *Gültekin Oransay* [ii] [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.

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[i] *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]

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[i] 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].

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[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" [i] [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.

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[i] 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 occurences toward the end of World War II [i] [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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[i] 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] [175] as 12:11 [ii], 13:12 [iii], and 14:13 [iv] [176] – 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.

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[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*s 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" [i] [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*s 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.

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[i] 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 Quintillianus*. (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 *Uşşak taksim* (instrumental improvisation in the given *maqam*) by a venerable Turkish Neyzen – *Niyazi Sayın* [32]:

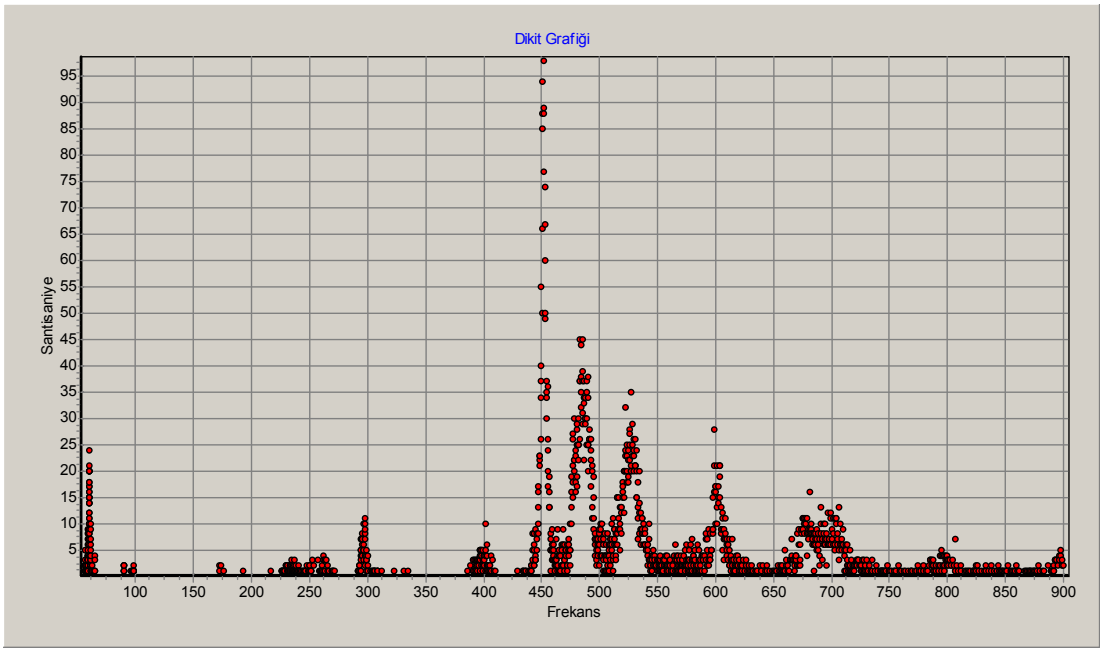

Figure 3.1: Histogram of *Niyazi Sayın*'s *Uşşak Ney* Taksim [i]

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

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

Perde	Peak Value	Average of ± 35.3 cents-wide Band
Dügâh	452.11 cps	452.626 cps
Segâh	483.72 cps	486.085 cps
Çargâh	526.89 cps	526.154 cps
Nevâ	599.32 cps	600.173 cps

[i] 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 occuring 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:

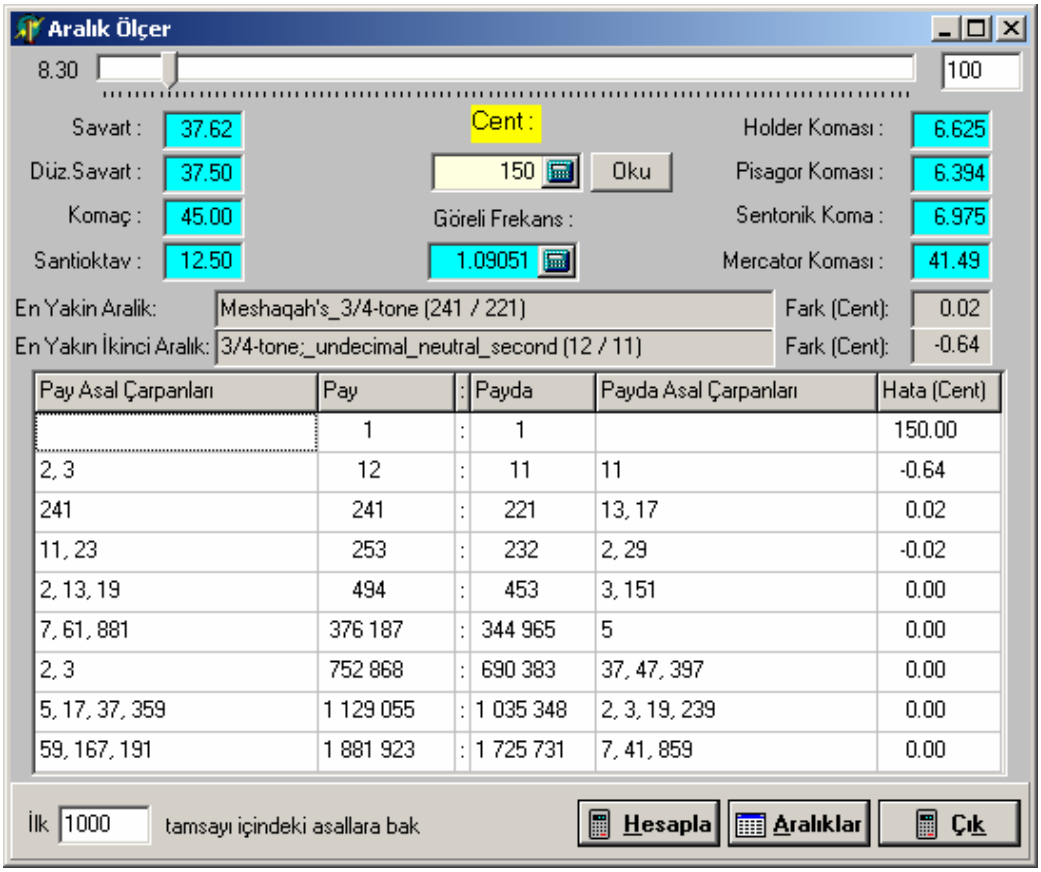

Figure 3.2: Interval Measurements by "AralıkÖlçer©" [ii]

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[i] A criterion chosen by *Karaosmanoğlu* & *Akkoç* to facilitate the exhumation from within performance of 17 historical *perde*s of *Maqam* Music – to be detailed in the next chapter.

[ii] Graphical display of "AralıkÖlçer©", 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 "İcraAnalizi©".

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

	Frequency (Hertz)	Interval with neighbouring *perde*				Error (¢)
		Cents	Commas [i] [197]	Near Ratio & Cent Value		
Dügâh	452.63					
		123.47	5.5	**14:13**	128.30	-4.8
Segâh	486.09					
		137.13	6.1	**13:12**	138.57	1.4
Çargâh	526.15					
		227.87	10.1	**8:7**	231.17	-3.3
Nevâ	600.17					

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:

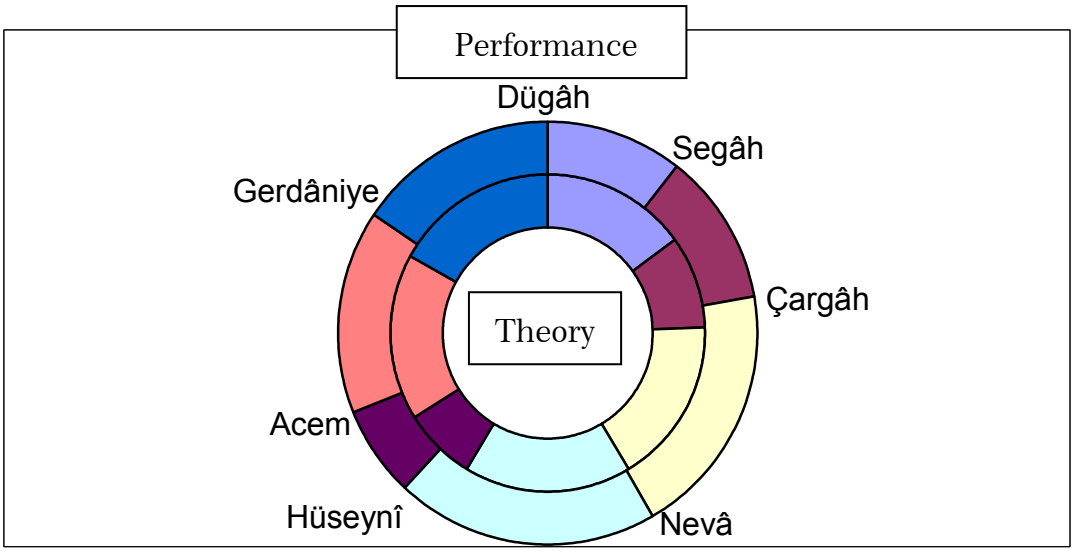

Figure 3.3: Comparison of Pivotal Intervals from *Niyazi Sayın*'s *Uşşak Ney* Taksim with the *Arel-Ezgi-Uzdilek* Model

[i] *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 *perde*s 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**

Perde-1	Perde-2	Measured Interval	Ratio	Cents	Error
hüseynî aşîrân	*nîm-ırak*	148 ¢	12: 11	150.64	-2.64
dügâh	*uşşak*	145 ¢	12: 11	150.64	-5.64
çargâh	*sabâ*	143 ¢	13: 12	138.57	4.43
nevâ	*hüzzam*	143 ¢	" "	"	"
hüseynî	*nîm-eviç*	133 ¢	14: 13	128.30	4.70
gerdaniye	*dikçe şehnâz*	133 ¢	" "	"	"
Average		**141 ¢**	**13: 12**	138.57	2.43

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.

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[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 *perde*s of Turkish *Maqam* Music are explained today, is enclosed in Table 3.4 [201,202]:

Table 3.4: ***Arel-Ezgi-Uzdilek*** **System**

Pitch	Frequency Ratios	Cents	Classic Interval Names	I. Octave *Perde*s
0:	1/1	0.000	(tone of origin – perfect prime)	*KABA ÇÂRGÂH*
1:	256/243	90.225	limma,Pythagorean minor 2nd	*Kaba Nîm Hicâz*
2:	2187/2048	113.685	apotome	*Kaba Hicâz*
3:	65536/59049	180.450	Pythagorean diminished 3rd	*Kaba Dik Hicâz*
4:	9/8	203.910	major whole tone	*YEGÂH*
5:	32/27	294.135	Pythagorean minor 3rd	*Kaba Nîm Hisâr*
6:	19683/16384	317.595	Pythagorean augmented 2nd	*Kaba Hisâr*
7:	8192/6561	384.360	Pythagorean diminished 4th	*Kaba Dik Hisâr*
8:	81/64	407.820	Pythagorean major 3rd	*HÜSEYNÎ AŞÎRÂN*
9:	4/3	498.045	perfect 4th	*ACEM AŞÎRÂN*
10:	177147/131072	521.505	Pythagorean augmented 3rd	*Dik Acem Aşîrân*
11:	1024/729	588.270	Pythagorean diminished 5th	*Irak*
12:	729/512	611.730	Pythagorean tritone	*Geveşt*
13:	262144/177147	678.495	Pythagorean diminished 6th	*Dik Geveşt*
14:	3/2	701.955	perfect 5th	*RÂST*
15:	128/81	792.180	Pythagorean minor 6th	*Nîm Zirgûle*
16:	6561/4096	815.640	Pythagorean augmented 5th	*Zirgûle*
17:	32768/19683	882.405	Pythagorean diminished 7th	*Dik Zirgûle*
18:	27/16	905.865	Pythagorean major 6th	*DÜGÂH*
19:	16/9	996.090	Pythagorean minor 7th	*Kürdî*
20:	59049/32768	1019.550	Pythagorean augmented 6th	*Dik Kürdî*
21:	4096/2187	1086.315	Pythagorean diminished 8th	*Segâh*
22:	243/128	1109.775	Pythagorean major 7th	*BÛSELİK*
23:	1048576/531441	1176.540	Pythagorean diminished 9th	*Dik Bûselik*
24:	2/1	1200.000	octave	*ÇÂRGÂH*

Table 3.4: ***Arel-Ezgi-Uzdilek*** **System – Continued**

Pitch	Frequency Ratios	Cents	Classic Interval Names	II. Octave *Perdes*
24:	2/1	1200.000	octave	*ÇÂRGÂH*
25:	512/243	1290.225	Pythagorean minor 9th	*Nîm Hicâz*
26:	2187/1024	1313.685	apotome+octave	*Hicâz*
27:	131072/59049	1380.450	Pythagorean diminished 10th	*Dik Hicâz*
28:	9/4	1403.910	major ninth	*NEVÂ* [i]
29:	64/27	1494.135	Pythagorean minor 10th	*Nîm Hisâr*
39:	19683/8192	1517.595	Pythagorean augmented 9th	*Hisâr*
31:	16384/6561	1584.360	Pythagorean diminished 11th	*Dik Hisâr*
32:	81/32	1607.820	Pythagorean major 10th	*HÜSEYNÎ*
33:	8/3	1698.045	perfect 11th	*ACEM*
34:	177147/65536	1721.505	Pythagorean augmented 10th	*Dik Acem*
35:	2048/729	1788.270	Pythagorean diminished 12th	*Eviç*
36:	729/256	1811.730	Pythagorean tritone+octave	*Mâhûr*
37:	524288/177147	1878.495	Pythagorean diminished 13th	*Dik Mâhûr*
38:	3/1	1901.955	perfect 12th	*GERDÂNİYE*
39:	256/81	1992.180	Pythagorean minor 13th	*Nîm Şehnâz*
40:	6561/2048	2015.640	Pythagorean augmented 12th	*Şehnâz*
41:	65536/19683	2082.405	Pythagorean diminished 14th	*Dik Şehnâz*
42:	27/8	2105.865	Pythagorean major 13th	*MUHAYYER*
43:	32/9	2196.090	Pythagorean minor 14th	*Sünbüle*
44:	59049/16384	2219.550	Pythagorean augmented 13th	*Dik Sünbüle*
45:	8192/2187	2286.315	Pythagorean diminished 15th	*Tîz Segâh*
46:	243/64	2309.775	Pythagorean major 14th	*TÎZ BÛSELİK*
47:	2097152/531441	2376.540	Pythagorean diminished 16th	*Tîz Dik Bûselik*
48:	4/1	2400.000	two octaves	*TÎZ ÇÂRGÂH* [ii]

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

[i] Taken as 440 cps, although notated as D.

[ii] Further extending until 6/1 from "*Tîz Nîm Hicâz*" to "*TÎZ GERDÂNİYE*" according to *Ezgi*.

II. Octave	I. Octave	Intervals
24. *ÇÂRGÂH*	0. *KABA ÇÂRGÂH*	(with previous)
25. *Nîm Hicâz*	1. *Kaba Nîm Hicâz*	90.225 ¢
26. *Hicâz*	2. *Kaba Hicâz*	23.460 ¢
27. *Dik Hicâz*	3. *Kaba Dik Hicâz*	66.765 ¢
28. *NEVÂ*	4. *YEGÂH*	23.460 ¢
29. *Nîm Hisâr*	5. *Kaba Nîm Hisâr*	90.225 ¢
30. *Hisâr*	6. *Kaba Hisâr*	23.460 ¢
31. *Dik Hisâr*	7. *Kaba Dik Hisâr*	66.765 ¢
32. *HÜSEYNÎ*	8. *HÜSEYNÎ AŞÎRÂN*	23.460 ¢
33. *ACEM*	9. *ACEM AŞÎRÂN*	90.225 ¢
34. *Dik Acem*	10. *Dik Acem Aşîrân*	23.460 ¢
35. *Eviç*	11. *Irak*	66.765 ¢
36. *Mâhûr*	12. *Geveşt*	23.460 ¢
37. *Dik Mâhûr*	13. *Dik Geveşt*	66.765 ¢
38. *GERDANİYE*	14. *RÂST*	23.460 ¢
39. *Nîm Şehnâz*	15. *Nîm Zirgûle*	90.225 ¢
40. *Şehnâz*	16. *Zirgûle*	23.460 ¢
41. *Dik Şehnâz*	17. *Dik Zirgûle*	66.765 ¢
42. *MUHAYYER*	18. *DÜGÂH*	23.460 ¢
43. *Sünbüle*	19. *Kürdî*	90.225 ¢
44. *Dik Sünbüle*	20. *Dik Kürdî*	23.460 ¢
45. *Tîz Segâh*	21. *Segâh*	66.765 ¢
46. *TÎZ BÛSELİK*	22. *BÛSELİK*	23.460 ¢
47. *Tîz Dik Bûselik*	23. *Dik Bûselik*	66.765 ¢
48. *TÎZ ÇÂRGÂH*	24. *ÇÂRGÂH*	23.460 ¢

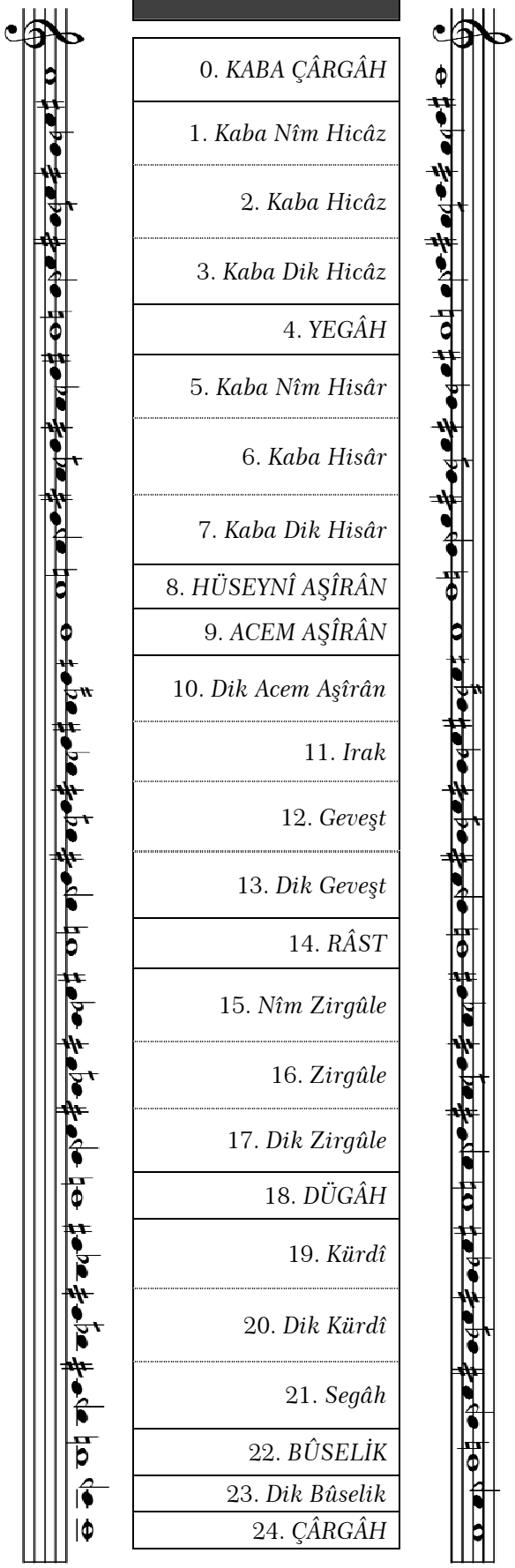

Figure 3.4: Notation of the *AEU* System

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 3.5: Generation of *AEU* by a Chain of Pure Fifths

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

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, *perde*s) 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

Fifths	Frequency Ratios	Octave Normalization		Classic Interval Names
$3^9 : 2^9$	19683/512	6.	19683/16384	Pythagorean augmented second
$3^8 : 2^8$	6561/256	16.	6561/4096	Pythagorean augmented fifth
$3^7 : 2^7$	2187/128	2.	2187/2048	apotome
$3^6 : 2^6$	729/64	12.	729/512	Pythagorean tritone
$3^5 : 2^5$	243/32	22.	243/128	Pythagorean major seventh
$3^4 : 2^4$	81/16	8.	81/64	Pythagorean major third
$3^3 : 2^3$	27/8	18.	27/16	Pythagorean major sixth
$3^2 : 2^2$	9/4	4.	9/8	major whole tone
3 : 2	3/2	14.	3/2	perfect fifth
0	1/1	0.	1/1	(tone of origin – perfect prime)
2 : 3	2/3	10.	4/3	perfect fourth
$2^2 : 3^2$	4/9	20.	16/9	Pythagorean minor seventh
$2^3 : 3^3$	8/27	5.	32/27	Pythagorean minor third
$2^4 : 3^4$	16/81	15.	128/81	Pythagorean minor sixth
$2^5 : 3^5$	32/243	1.	256/243	limma, Pythagorean minor second
$2^6 : 3^6$	64/729	11.	1024/729	Pythagorean diminished fifth
$2^7 : 3^7$	128/2187	21.	4096/2187	Pythagorean diminished octave
$2^8 : 3^8$	256/6561	7.	8192/6561	Pythagorean diminished fourth
$2^9 : 3^9$	512/19683	17.	32768/19683	Pythagorean diminished seventh
$2^{10} : 3^{10}$	1024/59049	3.	65536/59049	Pythagorean diminished third
$2^{11} : 3^{11}$	2048/177147	13.	262144/177147	Pythagorean diminished sixth
$2^{12} : 3^{12}$	4096/531441	23.	1048576/531441	Pythagorean diminished ninth
$2^{13} : 3^{13}$	8192/1594323	9.	2097152/1594323	Pythagorean double dim. fifth
$2^{14} : 3^{14}$	16384/4782969	19.	8388608/4782969	Pythagorean double dim. octave

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	I. Octave	Intervals
24. *NEVA*	0. *YEGÂH*	(with previous)
25. *Nim Hisar*	1. *Nim Pest Hisar*	90.225 ¢
26. *Hisar*	2. *Pest Hisar*	23.460 ¢
27. *Dik Hisar*	3. *Dik Pest Hisar*	66.765 ¢
28. *HÜSEYNİ*	4. *HÜSEYNİAŞİRAN*	23.460 ¢
29. *Acem*	5. *Acemaşiran*	90.225 ¢
30. *Dik Acem*	6. *Dik Acemaşiran*	23.460 ¢
31. *EVİÇ*	7. *ARAK*	66.765 ¢
32. *Mahur*	8. *Geveşt*	23.460 ¢
33. *Dik Mahur*	9. *Dik Geveşt*	66.765 ¢
34. *GERDANİYE*	10. *RAST*	23.460 ¢
35. *Nim Şehnaz*	11. *Nim Zengûle*	90.225 ¢
36. *Şehnaz*	12. *Zengûle*	23.460 ¢
37. *Dik Şehnaz*	13. *Dik Zengûle*	66.765 ¢
38. *MUHAYYER*	14. *DÜGÂH*	23.460 ¢
39. *Sünbüle*	15. *Kürdî*	90.225 ¢
40. *Dik Sünbüle*	16. *Dik Kürdî*	23.460 ¢
41. *TİZ SEGÂH*	17. *SEGÂH*	66.765 ¢
42. *Tiz Puselik*	18. *Puselik*	23.460 ¢
43. *Dik Tiz Puselik*	19. *Dik Puselik*	66.765 ¢
44. *TİZ ÇARGÂH*	20. *ÇARGÂH*	23.460 ¢
45. *Nim Tiz Hicaz*	21. *Nim Hicaz*	90.225 ¢
46. *Tiz Hicaz*	22. *Hicaz*	23.460 ¢
47. *Dik Tiz Hicaz*	23. *Dik Hicaz*	66.765 ¢
48. *TİZ NEVA*	24. *NEVA*	23.460 ¢

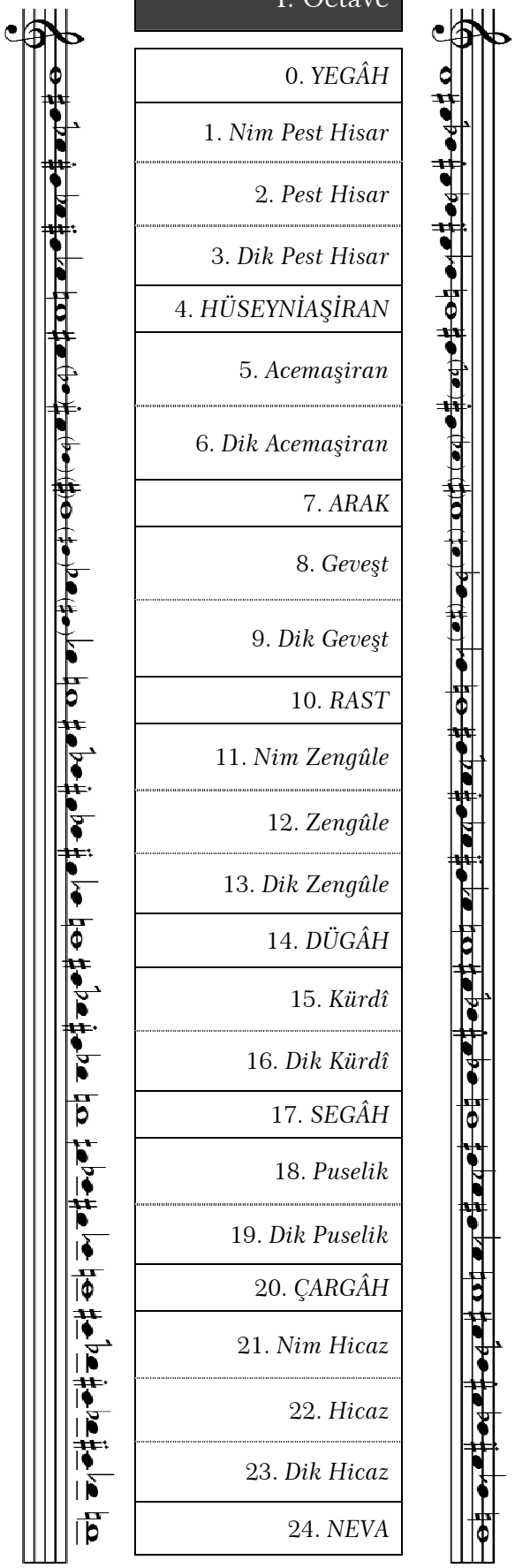

Figure 3.5: Notation of *Yekta-24*

Table 3.7: Comparison of *AEU & Yekta-24*

AEU Ratios		Cents	*Perdes*	*Yekta-24* Ratios		Cents	*Perdes*
0:	1/1	0.000	*KABA ÇÂRGÂH*				
1:	256/243	90.225	*Kaba Nîm Hicâz*				
2:	2187/2048	113.685	*Kaba Hicâz*				
3:	65536/59049	180.450	*Kaba Dik Hicâz*				
4:	9/8	203.910	*YEGÂH*	0:	1/1	0.000	*YEGÂH*
5:	32/27	294.135	*Kaba Nîm Hisâr*	1:	256/243	90.225	*Nim Pest Hisar*
6:	19683/16384	317.595	*Kaba Hisâr*	2:	2187/2048	113.685	*Pest Hisar*
7:	8192/6561	384.360	*Kaba Dik Hisâr*	3:	65536/59049	180.450	*Dik Pest Hisar*
8:	81/64	407.820	*HÜSEYNÎ AŞÎRÂN*	4:	9/8	203.910	*HÜSEYNİAŞİRAN*
9:	4/3	498.045	*ACEM AŞÎRÂN*	5:	32/27	294.135	*Acemaşiran*
10:	177147/131072	521.505	*Dik Acem Aşîrân*	6:	19683/16384	317.595	*Dik Acemaşiran*
11:	1024/729	588.270	*Irak*	7:	8192/6561	384.360	*ARAK*
12:	729/512	611.730	*Geveşt*	8:	81/64	407.820	*Geveşt*
13:	262144/177147	678.495	*Dik Geveşt*	9:	2097152/1594323	474.585	*Dik Geveşt*
14:	3/2	701.955	*RÂST*	10:	4/3	498.045	*RAST*
15:	128/81	792.180	*Nîm Zirgûle*	11:	1024/729	588.270	*Nim Zengûle*
16:	6561/4096	815.640	*Zirgûle*	12:	729/512	611.730	*Zengûle*
17:	32768/19683	882.405	*Dik Zirgûle*	13:	262144/177147	678.495	*Dik Zengûle*
18:	27/16	905.865	*DÜGÂH*	14:	3/2	701.955	*DÜGÂH*
19:	16/9	996.090	*Kürdî*	15:	128/81	792.180	*Kürdî*
20:	59049/32768	1019.550	*Dik Kürdî*	16:	6561/4096	815.640	*Dik Kürdî*
21:	4096/2187	1086.315	*Segâh*	17:	32768/19683	882.405	*SEGÂH*
22:	243/128	1109.775	*BÛSELİK*	18:	27/16	905.865	*Puselik*
23:	1048576/531441	1176.540	*Dik Bûselik*	19:	8388608/4782969	972.630	*Dik Puselik*
24:	2/1	1200.000	*ÇÂRGÂH*	20:	16/9	996.090	*ÇARGÂH*
				21:	4096/2187	1086.315	*Nim Hicaz*
				22:	243/128	1109.775	*Hicaz*
				23:	1048576/531441	1176.540	*Dik Hicaz*
				24:	2/1	1200.000	*NEVA*

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

AEU Ratios		Cents	*Yekta-24* Ratios		Cents	53-tET Aprx.	Diff.
0:	1/1	0.000	0:	1/1	0.000	**0:** 0.000	0
1:	256/243	90.225	1:	256/243	90.225	**4:** 90.566	0.341
2:	2187/2048	113.685	2:	2187/2048	113.685	**5:** 113.208	-0.4775
3:	65536/59049	180.450	3:	65536/59049	180.450	**8:** 181.132	0.6821
4:	9/8	203.910	4:	9/8	203.910	**9:** 203.774	-0.1364
5:	32/27	294.135	5:	32/27	294.135	**13:** 294.340	0.2046
6:	19683/16384	317.595	6:	19683/16384	317.595	**14:** 316.981	-0.6139
7:	8192/6561	384.360	7:	8192/6561	384.360	**17:** 384.906	0.5457
8:	81/64	407.820	8:	81/64	407.820	**18:** 407.547	-0.2728
			9:	2097152/1594323	474.585	**21:** 475.472	0.8867
9:	4/3	498.045	10:	4/3	498.045	**22:** 498.113	0.0682
10:	177147/131072	521.505				**23:** 520.755	-0.7503
11:	1024/729	588.270	11:	1024/729	588.270	**26:** 588.679	0.4093
12:	729/512	611.730	12:	729/512	611.730	**27:** 611.321	-0.4093
13:	262144/177147	678.495	13:	262144/177147	678.495	**30:** 679.245	0.7503
14:	3/2	701.955	14:	3/2	701.955	**31:** 701.887	-0.0682
15:	128/81	792.180	15:	128/81	792.180	**35:** 792.453	0.2728
16:	6561/4096	815.640	16:	6561/4096	815.640	**36:** 815.094	-0.5457
17:	32768/19683	882.405	17:	32768/19683	882.405	**39:** 883.019	0.6139
18:	27/16	905.865	18:	27/16	905.865	**40:** 905.660	-0.2046
			19:	8388608/4782969	972.630	**43:** 973.585	0.9549
19:	16/9	996.090	20:	16/9	996.090	**44:** 996.226	0.1364
20:	59049/32768	1019.550				**45:**1018.868	-0.6821
21:	4096/2187	1086.315	21:	4096/2187	1086.315	**48:**1086.792	0.4775
22:	243/128	1109.775	22:	243/128	1109.775	**49:**1109.434	-0.341
23:	1048576/531441	1176.540	23:	1048576/531441	1176.540	**52:**1177.358	0.8185
24:	2/1	1200.000	24:	2/1	1200.000	**53:**1200.000	0

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]:

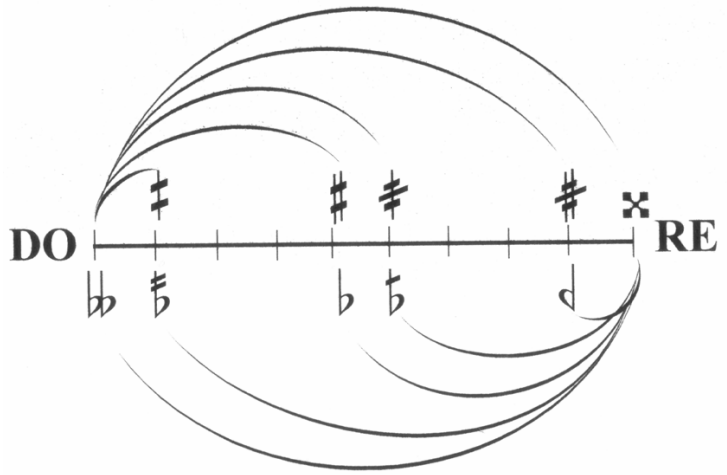

Figure 3.6: *AEU* Division of the Whole Tone into 9 equal commas [i]

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*

	AEU Ratios	Notation		*Yekta-24* Ratios	Notation		Intervals	53-tET, Cents
0:	4/3	F	G𝄫	32/27	F		(with previous)	(22.-31.)
1:	177147/131072	F𝄰	G𝄭	19683/16384	F𝄰	G𝄬	531441:524288	22.642 ¢
2:								
3:								
4:	1024/729	F𝄯	G𝄬	8192/6561	F𝄯	G𝄭	134217728:129140163	67.925 ¢
5:	729/512	F𝄰	G𝄬	81/64	F𝄯	G𝄬	531441:524288	22.642 ¢
6:								
7:								
8:	262144/177147	F𝄯	G𝄮	2097152/1594323	F𝄯	G𝄮	134217728:129140163	67.925 ¢
9:	3/2	F𝄪	G	4/3		G	531441:524288	22.642 ¢

[i] 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 [i]; 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:

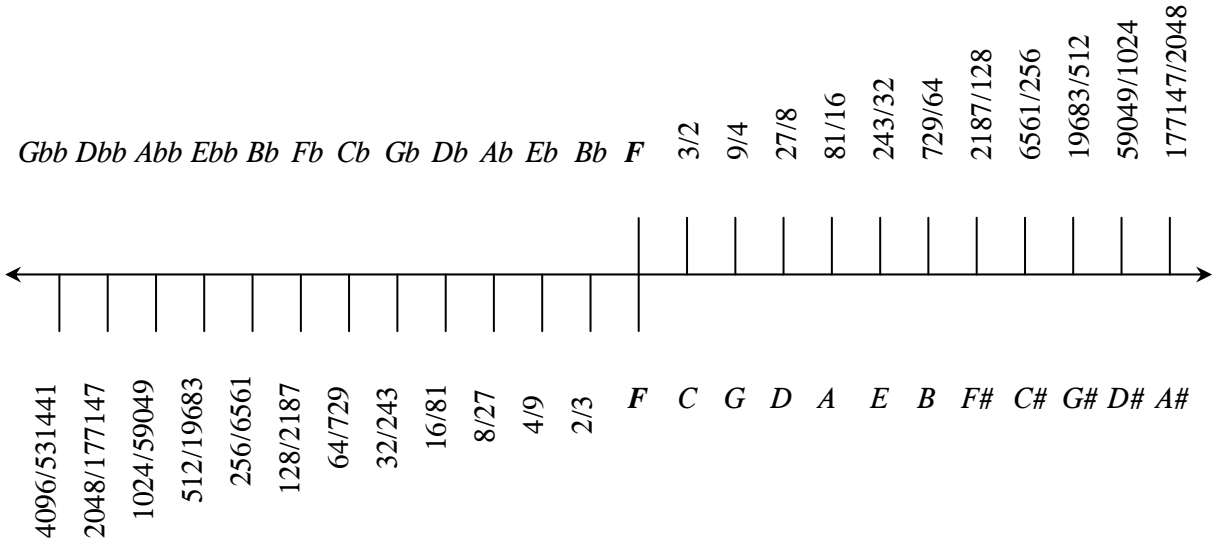

Figure 3.7: Correct Sequence of Notes in a Chain of Pure Fifths

[i] 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 [i].

Adding to this the discovery that some *perde*s of the 24-tone Pythagorean model (*kaba dik hicaz*, *dik acem aşiran*, *dik geveşt*, 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 *perde*s 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 occuring within an octave between any two *perde*s of the 24-tone Pythagorean System.

This comprehensive pandect circumstantiates 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 aşiran*, *dik geveşt-zirgule*, *dik zirgule-dik kürdi*, and two 3/4 tones (156.99 cents) hidden amongst *dik kürdi-dik buselik*, and *dik acem aşiran-dik geveşt* – none of which are feasible, let alone, significative in a perfromance – 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 indispensible.

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[i] 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 *perde*s 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* [i] [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].

---

[i] 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* [i] [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.

---

[i] *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 amidmost 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 *Suphi 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:

---

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

[ii] *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.)

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

[iv] *Tanburi Küçük Harutin* (d. *ca.*1750); Ottoman-Armenian musician and theorist. He detailed his notation in the Turkish language in *Mûsıkî Edvârı*. (See, accompanying endnote.)

[v] *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- *Perde*s according to *Nasır Dede* in extended and modified *Abjad* notation;

C- *Perde*s in Arabic phonetics by *Kantemir* & *Osman Dede*;

D- *Perde*s in Armenian phonetics by *Harutin* & *Hamparsum*;

E- *Mushaqah*'s pseudo-equal 24-tone tuning and modern Arabic staff notation of *perde*s;

F- *Yekta*'s 24-tone Pythagorean tuning and modern Turkish staff notation of *perde*s;

G- *Karadeniz*'s 41-tone tuning and staff notation of *perde*s;

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 *Nasır 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 *perde*s.

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 *perde*s.

4.2. Abjad Tone-System

The 17-tone Pythagorean scale, with which the traditional *perde*s 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]:

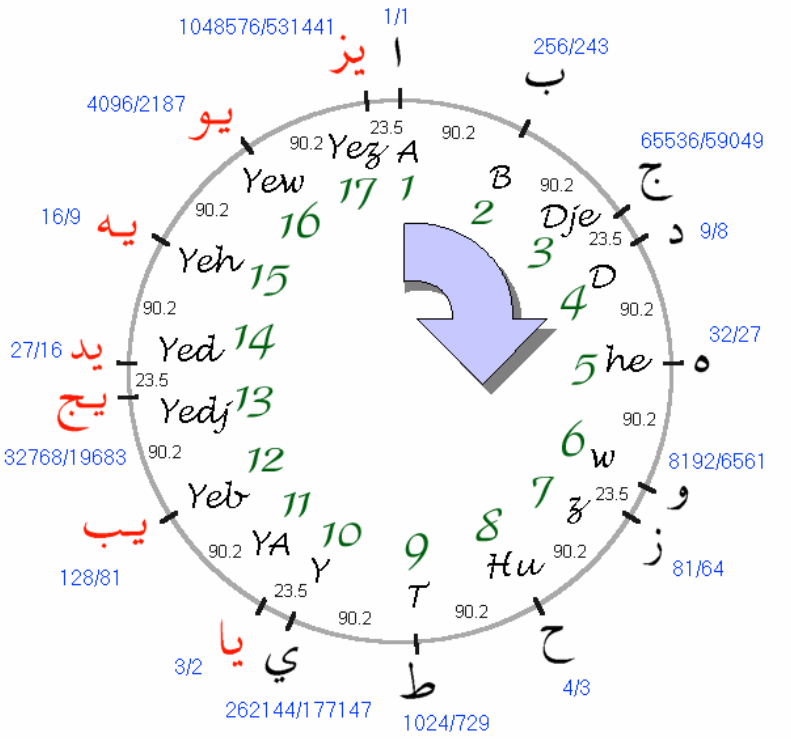

Figure 4.1: ***Safiuddin Urmavi*'s 17-tone Pythagorean System**

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 4.1: Chain of Fifths Making Urmavi's 17-tone Scale

Fifths	Frequency Ratios	Octave Normalization		Classic Interval Names
$3^4 : 2^4$	81/16	7.	81/64	Pythagorean major third
$3^3 : 2^3$	27/8	14.	27/16	Pythagorean major sixth
$3^2 : 2^2$	9/4	4.	9/8	major whole tone
3 : 2	3/2	11.	3/2	perfect fifth
0	1/1	1.	1/1	(tone of origin – perfect prime)
2 : 3	2/3	8.	4/3	perfect fourth
$2^2 : 3^2$	4/9	15.	16/9	Pythagorean minor seventh
$2^3 : 3^3$	8/27	5.	32/27	Pythagorean minor third
$2^4 : 3^4$	16/81	12.	128/81	Pythagorean minor sixth
$2^5 : 3^5$	32/243	2.	256/243	limma, Pythagorean minor second
$2^6 : 3^6$	64/729	9.	1024/729	Pythagorean diminished fifth
$2^7 : 3^7$	128/2187	16.	4096/2187	Pythagorean diminished octave
$2^8 : 3^8$	256/6561	6.	8192/6561	Pythagorean diminished fourth
$2^9 : 3^9$	512/19683	13.	32768/19683	Pythagorean diminished seventh
$2^{10} : 3^{10}$	1024/59049	3.	65536/59049	Pythagorean diminished third
$2^{11} : 3^{11}$	2048/177147	10.	262144/177147	Pythagorean diminished sixth
$2^{12} : 3^{12}$	4096/531441	17.	1048576/531441	Pythagorean diminished ninth

The *Abjad* numeric system repeating the pattern ابجد هوز حطي originally spanned two octaves. *Nasır 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 *Perde*s [i]

Abjad	*Urmavi* Ratios	Cents	Intervals	Degrees		*Nasır Dede Perde*s
A	**1/1**	**0.000**		ا	①	**Yegah**
B	256/243	90.225	90.225 ¢	ب	②	Pes Beyati
Ce	65536/59049	180.450	90.225 ¢	ج	③	Pes Hisar
D	**9/8**	**203.910**	23.460 ¢	د	④	**Aşiran**
he	32/27	294.135	90.225 ¢	ه	⑤	Acem Aşiran
Ve	**8192/6561**	**384.360**	90.225 ¢	و	⑥	**Arak**
Z	81/64	407.820	23.460 ¢	ز	⑦	Gevaşt
Hu	**4/3**	**498.045**	90.225 ¢	ح	⑧	**Rast**
T	1024/729	588.270	90.225 ¢	ط	⑨	Şuri
Y	262144/177147	678.495	90.225 ¢	ي	⑩	Zirgule
YA	**3/2**	**701.955**	23.460 ¢	يا	⑪	**Dügah**
YeB	128/81	792.180	90.225 ¢	يب	⑫	Kürdi/Nihavend
YeC	**32768/19683**	**882.405**	90.225 ¢	يج	⑬	**Segah**
YeD	27/16	905.865	23.460 ¢	يد	⑭	Buselik
Yeh	**16/9**	**996.090**	90.225 ¢	يه	⑮	**Çargah**
YeV	4096/2187	1086.315	90.225 ¢	يو	⑯	Saba
YeZ	1048576/531441	1176.540	90.225 ¢	يز	⑰	Hicaz/Uzzal
YaH	**2/1**	**1200.000**	23.460 ¢	يح	⑱	**Neva**

[i] *Perde*s expressed in bold are diatonic naturals.

Table 4.2: Complete *Abjad* Notation of *Perdes* –Continued

Abjad	*Urmavi* Ratios	Cents	Intervals	Degrees		*Nasır Dede Perdes*
YaH	**2/1**	**1200.000**	23.460 ¢	يح	⑱	**Neva** (ع)
YaT	512/243	1290.225	90.225 ¢	يط	⑲	Beyati
ke	131072/59049	1380.450	90.225 ¢	ك	⑳	Hisar
kÂ	**9/4**	**1403.910**	23.460 ¢	كا	㉑	**Hüseyni**
keB	64/27	1494.135	90.225 ¢	كب	㉒	Acem
keC	**16384/6561**	**1584.360**	90.225 ¢	كج	㉓	**Evc**
keD	81/32	1607.820	23.460 ¢	كد	㉔	Mahur
keh	**8/3**	**1698.045**	90.225 ¢	كه	㉕	**Gerdaniye**
keV	2048/729	1788.270	90.225 ¢	كو	㉖	Şehnaz
keZ	524288/177147	1878.495	90.225 ¢	كز	㉗	[i]
kaH	**3/1**	**1901.955**	23.460 ¢	كح	㉘	**Muhayyer** (كز) ㉗
keT	256/81	1992.180	90.225 ¢	كط	㉙	Sünbüle (كح) ㉘
L	**65536/19683**	**2082.405**	90.225 ¢	ل	㉚	**Tiz Segah** (كط) ㉙
LÂ	27/8	2105.865	23.460 ¢	لا	㉛	Tiz Buselik (ل) ㉚
LeB	**32/9**	**2196.090**	90.225 ¢	لب	㉜	**Tiz Çargah** (لا) ㉛
LeC	8192/2187	2286.315	90.225 ¢	لج	㉝	Tiz Saba (لب) ㉜
LeD	2097152/531441	2376.540	90.225 ¢	لد	㉞	Tiz Hicaz (لج) ㉝
Leh	**4/1**	**2400.000**	23.460 ¢	له	㉟	**Tiz Neva** (لد) ㉞
LeV	1024/243	2490.225	90.225 ¢			Tiz Beyati (له) ㉟
LeZ	262144/59049	2580.450	90.225 ¢			Tiz Hisar (لو) ㊱
	9/2	**2603.910**	23.460 ¢			**Tiz Hüseyni** (لز) ㊲

[i] The octave complement of *zirgule* does not exist in *Nasır Dede* and is therefore skipped.

A comparison is made between *Arel-Ezgi-Uzdilek* (*AEU*) and *Abjad* scale in Table 4.3:

Table 4.3: Comparison of *AEU* with the *Abjad* System

	AEU Ratios	Cents	*Perdes*		*Abjad* Ratios	Cents	*Perdes*
0:	1/1	0.000	*KABA ÇÂRGÂH*				
1:	256/243	90.225	*Kaba Nîm Hicâz*		(…Continued from previous column) Average absolute difference: 0.3531 cents Highest absolute difference: 0.8185 cents		
2:	2187/2048	113.685	*Kaba Hicâz*				
3:	65536/59049	180.450	*Kaba Dik Hicâz*				
4:	9/8	203.910	*YEGÂH*	0:	1/1	0.000	*YEGÂH*
5:	32/27	294.135	*Kaba Nîm Hisâr*	1:	256/243	90.225	*Pes Beyati*
6:	19683/16384	317.595	*Kaba Hisâr*				
7:	8192/6561	384.360	*Kaba Dik Hisâr*	2:	65536/59049	180.450	*Pes Hisar*
8:	81/64	407.820	*HÜSEYNÎ AŞÎRÂN*	3:	9/8	203.910	*AŞİRAN*
9:	4/3	498.045	*ACEM AŞÎRÂN*	4:	32/27	294.135	*Acem Aşiran*
10:	177147/131072	521.505	*Dik Acem Aşîrân*				
11:	1024/729	588.270	*Irak*	5:	8192/6561	384.360	*ARAK*
12:	729/512	611.730	*Geveşt*	6:	81/64	407.820	*Gevaşt*
13:	262144/177147	678.495	*Dik Geveşt*				
14:	3/2	701.955	*RÂST*	7:	4/3	498.045	*RAST*
15:	128/81	792.180	*Nîm Zirgûle*	8:	1024/729	588.270	*Şûri*
16:	6561/4096	815.640	*Zirgûle*				
17:	32768/19683	882.405	*Dik Zirgûle*	9:	262144/177147	678.495	*Zengûle*
18:	27/16	905.865	*DÜGÂH*	10:	3/2	701.955	*DÜGÂH*
19:	16/9	996.090	*Kürdî*	11:	128/81	792.180	*Kürdî/Nihâvend*
20:	59049/32768	1019.550	*Dik Kürdî*				
21:	4096/2187	1086.315	*Segâh*	12:	32768/19683	882.405	*SEGÂH*
22:	243/128	1109.775	*BÛSELİK*	13:	27/16	905.865	*Bûselik*
23:	1048576/531441	1176.540	*Dik Bûselik*				
24:	2/1	1200.000	*ÇÂRGÂH*	14:	16/9	996.090	*ÇARGÂH*
	Omitting in Table 3.8 degrees 5, 14, 23, 27, 36, 45, 49 of 53-tET yields (Continued in next column…)			15:	4096/2187	1086.315	*Sâbâ*
				16:	1048576/531441	1176.540	*Hicaz*
				17:	2/1	1200.000	*NEVA*

In *Nasır 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.

Nasır 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 *Nasır Dede*'s *Abjad* as shown in Figure 4.2:

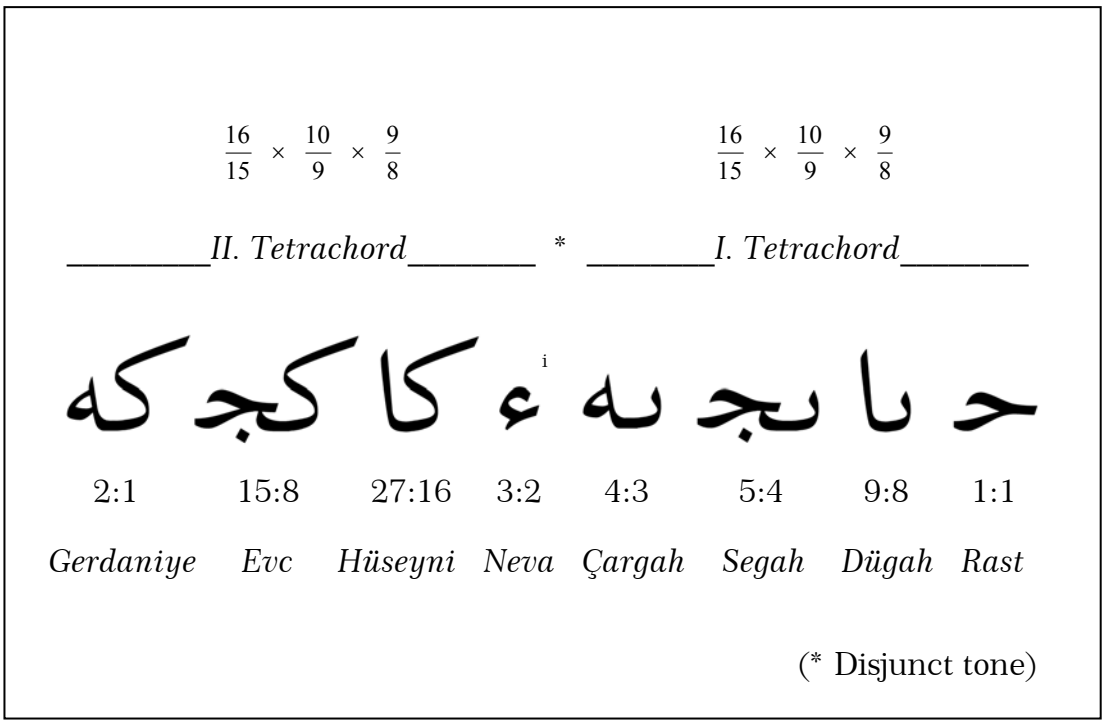

Figure 4.2: *Abjad* Notation of the Principal Mode in Ascending Order of *Maqam Rast* with Schismatic Simplifications [ii] [255]

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[i] *Nasır Dede* uses the letter "ع" instead of the digraph "يه" for *perde neva*.

[ii] 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, *Nasır Dede* too notated *Maqam* Music *perde*s in *Abjad*, the sheik did not specify any ratios. Instead, he derived them from the *ney* in the following fashion [256, pp. 153-6; 257, pp. 6-8]:

> « … The fingerholes of the *ney* that enlivens the soul are seven fingerholes from its opening to the blown end [mouthpiece]. By order, the first is known as **Dügâh**, second is **Kürdî**, third is **Segâh**, fourth is **Çârgâh**, fifth is **Sâbâ**, sixth is **Nevâ**, seventh [in the back] is **'Aşîrân**.
>
> Now that these are learnt;
>
> ■ *Yegâh* [i], the *perde* of; does not possess a *perde* [*i.e.,* fingerhole] of its own on the *ney*. 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 Beyâtî*; 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 *ney*] toward the side that the blower tilts the head.
>
> ⊖▸ *Pes Hisâr*; [is blown] from the opening of the seventh **'Aşîrân** fingerhole [by an inclination of the *ney*] more than customary.
>
> ⊖▸ *'Aşîrân*; [is blown from the **'Aşîrân** fingerhole] as customary.
>
> ⊖▸ *'Acem 'Aşîrân*; [is blown from the **'Aşîrân** fingerhole] by a little declination toward the side of obliquity.
>
> ⊖▸ *'Arak*; is blown [from the **'Aşîrân** fingerhole] with a declination as much as *pes beyâtî*.

[i] Underlined *perde*s denote diatonic naturals; "■" signifies pedal tones, "⊖" the fingerhole of *'aşîrân*, "●" that all fingerholes are to be shut, "▸" normal blowing, "▸▸" 1st level of overblowing, "▸▸▸" 2nd level of overblowing, "▸▸▸▸" 4th level of overblowing.

●▸	*Gevâşt*;	[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 *'arak*.
▸	*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**].
▸	*Bûselik*;	[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 **Dügâh** fingerhole's] opening.
▸▸	*'Acem*;	[is overblown] from the fingerhole of **Kürdî**.
▸▸	*Evc*;	is [overblown] from the fingerhole of **Segâh**.
▸▸	*Mâhur*;	like *bûselik* [it is overblown with the fourth fingerhole of **Çârgâh** half-open].
▸▸	*Gerdâniye*;	[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] **Dügâh**.
▸▸▸	*Sünbüle*;	is [overblown similarly] from the **Kürdî** 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 *perde*s 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 *perde*s beyond these, they are [mostly] disused. And just as is the case with *sînekeman* [viola d'amore], some lowest of the low *perde*s are for ornamentation, and need for them is miniscule.

But, if these are desired to be performed on the soul-soothing *ney*, they [too] – just like *yegâh* and *nevâ* are considered one as has been stated above – are [similarly] *perde*s [*viz.*, pedal tones] below *nevâ* [i] [252].

And *perde* inception in between them are forbidden, and learning it useless and against the rule – unless it be for [attaining] the interval of an *irhâ* [*i.e.*, diesis] [ii] [31].

Moreover, it is obvious beyond doubt that the [presence of the] *perde* tied by the name of *nişâbûr* on the *tanbur* [just] below *perde bûselik* is genuinely absurd; for, seeing as the intermedial of *bûselik* and *segâh* – like the intermedials, in sequence, of *perde*s [*viz.*, dyads] from *yegâh* to *tîz hüseynî* – 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] *perde* is ordained [after them] [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 perde from *nevâ* to *tîz hicâz* are the [octave] equivalents of *yegâh* to *hicâz*, and are at the second level [of pitch] from *tîz nevâ* till *tîz hüseynî*; so much so that they [readily] substitute each other in the construction of melody. …» (Istanbul, 1795.)

APPENDIX C contains relevant information on the *perde*s of *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 *Maqam Rast*.

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[i] The sheik notates these ornamental pedal tones with the same *Abjad* symbols he used for *segah* to *hicaz* (their octave equivalents), save his addition to the top right of each character of a superscript notch: ٬. (See, accompanying endnote.)

[ii] By *irhâ*, the sheik surely insinuates "quarter-tone alterations". (See, accompanying endnote.)

[iii] It is odd that *Nasır Dede* objects to the insertion of *nişabur* after *buselik* while contradicting himself further down the text by nonchalantly dodging *nihavend* just above *kürdi*, and *uzzal* amidst *hicaz* and *saba*. (See, accompanying endnote.)

Nasır 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 *Nasır Dede*'s Consonant *Ney* Intervals

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

This tabulation gives one the impression that some *perde*s 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, *Nasır 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 *perde*s of *Nasır Dede* are catalogued in Table 4.5:

Table 4.5: Catalogue of *Nasır Dede*'s Dyadic Consonances

Perdes of the first octave	*(28.) Octave+ Fifth*	*(25.) Octave+ Fourth*	*(18.) Octave*	*(11.) Fifth*	*(8.) Fourth*	*(6.)* [i] *Major Third*	*(5.) Minor Third*	*(4.) Major Second*	*(3.) Middle Second*	*(2.) Minor Second*
1. YEGAH	*Muhay.*	*Gerdan.*	*Neva*	*Dügah*	*Rast*	*Arak*	Acem Aşiran	*Aşiran*	Pes Hisar	Pes Beyati
2. Pes Beyati	Sünbüle	Şehnaz	Beyati	Kürdi	Şuri	*Rast*	*Arak*	Acem Aşiran	*Aşiran*	Pes Hisar
3. Pes Hisar	*Tiz Segah*	Şehnaz	Hisar	*Segah*	Zirgule	*Rast*	Gevaşt	*Arak*	Acem Aşiran	*Aşiran*
4. AŞİRAN	Tiz Buselik	*Muhay.*	*Hüseyni*	Buselik	*Dügah*	Şuri/ Zirgule	*Rast*	Gevaşt	*Arak*	Acem Aşiran
5. Acem Aşiran	*Tiz Çargah*	Sünbüle	Acem	*Çargah*	Kürdi	*Dügah*	Şuri	*Rast*	Gevaşt	*Arak*
6. ARAK	Tiz Hicaz	*Tiz Segah*	*Evc*	Hicaz	*Segah*	Kürdi	Zirgule	Şuri	*Rast*	Gevaşt
7. Gevaşt	Tiz Saba	Tiz Buselik	Mahur	Saba	Buselik	Kürdi	*Dügah*	Zirgule	Şuri	*Rast*
8. RAST	*Tiz Neva*	*Tiz Çargah*	*Gerdan.*	*Neva*	*Çargah*	*Segah*	Kürdi	*Dügah*	Zirgule	Şuri
9. Şuri	Tiz Beyati	Tiz Hicaz	Şehnaz	Beyati	Hicaz	*Çargah*	*Segah*	Kürdi	*Dügah*	Zirgule
10. Zirgule	Tiz Hisar	Tiz Hicaz / Saba	Şehnaz	Hisar	Hicaz/ Saba	*Çargah*	Buselik	*Segah*	Kürdi	*Dügah*
11. DÜGAH	*Tiz Hüseyni*	*Tiz Neva*	*Muhay.*	*Hüseyni*	*Neva*	Hicaz/ Saba	*Çargah*	Buselik	*Segah*	Kürdi
12. Kürdi (Nihav.)		Tiz Beyati	Sünbüle	Acem	Beyati	*Neva*	Hicaz	*Çargah*	Buselik	*Segah*
13. SEGAH		Tiz Hisar	*Tiz Segah*	*Evc*	Hisar	Beyati	Saba	Hicaz	*Çargah*	Buselik
14. Buselik		*Tiz Hüseyni*	Tiz Buselik	Mahur	*Hüsey.*	Hisar	*Neva*	Saba	Hicaz	*Çargah*
15. ÇARGAH			*Tiz Çargah*	*Gerdan.*	Acem	*Hüsey.*	Beyati	*Neva*	Saba	Hicaz
16. Hicaz [ii]			Tiz Hicaz	Şehnaz	*Evc*	Acem	Hisar	Beyati	*Neva*	Saba
17. Saba (Uzzal)			Tiz Saba	Şehnaz	Mahur	Acem	*Husey.*	Hisar	Beyati	*Neva*

[i] Sometimes, this interval should be the 7th.

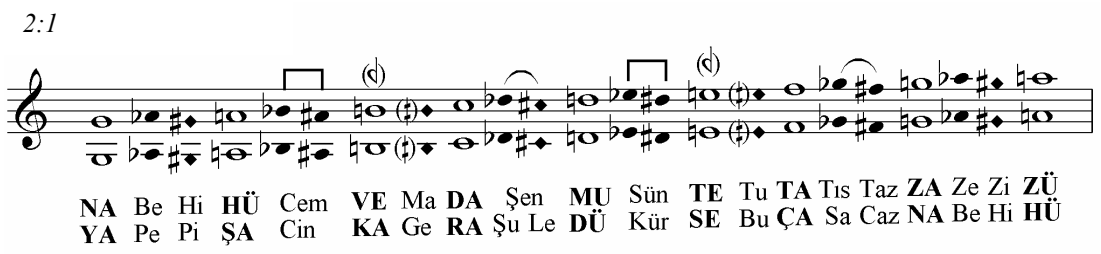
[ii] The reason for the precedence of *hicaz* over *saba* is due to its being a lower pitch in alignment with *Nasır Dede*'s derivation of these *perde*s from the *ney* despite the order by which they are customarily listed in his treatise. Note that *uzzal* is equivalent to or lower than *saba*.

Table 4.5: Catalogue of *Nasır Dede's* Dyadic Consonances–Continued

Perdes of the second octave	*(18.) Octave*	*(11.) Fifth*	*(8.) Fourth*	*(6.)* [i] *Major Third*	*(5.) Minor Third*	*(4.) Major Second*	*(3.) Middle Second*	*(2.) Minor Second*
18. NEVA	*Tiz Neva*	*Muhay.*	*Gerdan.*	*Evc*	Acem	*Hüsey.*	Hisar	Beyati
19. Beyati	Tiz Beyati	Sünbüle	Şehnaz	*Gerd.*	*Evc*	Acem	*Hüsey.*	Hisar
20. Hisar	Tiz Hisar	*Tiz Segah*	Şehnaz	*Gerd.*	Mahur	*Evc*	Acem	*Hüsey.*
21. HÜSEYNİ	*Tiz Hüseyni*	Tiz Buselik	*Muhay.*	Şehnaz	*Gerd.*	Mahur	*Evc*	Acem
22. Acem		*Tiz Çargah*	Sünbüle	*Muhay.*	Şehnaz	*Gerd.*	Mahur	*Evc*
23. EVC		Tiz Hicaz	*Tiz Segah*	Sünb.	Şehnaz	Şehnaz	*Gerd.*	Mahur
24. Mahur		Tiz Saba	Tiz Buselik	Sünb.	*Muhay.*	Şehnaz	Şehnaz	*Gerd.*
25. GERDANIYE		*Tiz Neva*	*Tiz Çargah*	*Tiz Segah*	Sünb.	*Muhay.*	Şehnaz	Şehnaz
26. Şehnaz		Tiz Beyati	Tiz Hicaz	Tiz Buselik	*Tiz Segah*	Sünb.	*Muhay.*	Şehnaz
27. Şehnaz		Tiz Hisar	Tiz Saba	*Tiz Çargah*	Tiz Buselik	*Tiz Segah*	Sünb.	*Muhay.*
28. MUHAYYER		*Tiz Hüseyni*	*Tiz Neva*	Tiz Hic. / Saba	*Tiz Çargah*	Tiz Buselik	*Tiz Segah*	Sünb.
29. Sünbüle			Tiz Beyati	*Tiz Neva*	Tiz Hicaz	*Tiz Çargah*	Tiz Buselik	*Tiz Segah*
30. TİZ SEGAH			Tiz Hisar	Tiz Beyati	Tiz Saba	Tiz Hicaz	*Tiz Çargah*	Tiz Buselik
31. Tiz Buselik			*Tiz Hüseyni*	Tiz Hisar	*Tiz Neva*	Tiz Saba	Tiz Hicaz	*Tiz Çargah*
32. TİZ ÇARGAH				*Tiz Hüsey.*	Tiz Beyati	*Tiz Neva*	Tiz Saba	Tiz Hicaz
33. Tiz Hicaz					Tiz Hisar	Tiz Beyati	*Tiz Neva*	Tiz Saba
34. Tiz Saba					*Tiz Hüsey.*	Tiz Hisar	Tiz Beyati	*Tiz Neva*
Perdes of the third octave						*(4.)*	*(3.)*	*(2.)*
35. TİZ NEVA						*Tiz Hüsey.*	Tiz Hisar	Tiz Beyati
36. Tiz Beyati							*Tiz Hüsey.*	Tiz Hisar
37. Tiz Hisar								*Tiz Hüsey.*
38. T. HÜSEYNİ								

[i] 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 *Nasır Dede*:



Solfa:	*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 *Nasır Dede*'s Octave Consonances [i]

In like manner, *Nasır Dede*'s consonances of the fifth, fourth, twelveth and eleventh are transcribed in Figure 4.4:

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[i] Notation is key-transposing. Whole notes are diatonic naturals, black notes are *perde*s in between. Flattened tones are lower in pitch than their sharpened pairs. Diamond-shaped notes signify *perde*s produced by half-opening the next *ney* fingerhole (*zirgule*, *buselik*, *hisar*, *mahur*, *tiz buselik*, *tiz hisar*) and their octave equivalents (*pes hisar*, *gevaşt*, *şehnaz*). Enharmonic tones in brackets are produced from the same fingerhole (**Aşiran** fingerhole: *acem aşiran*); (**Kürdi** fingerhole: *kürdi/nihavend – 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. Solfa and degrees are diatonical. Legend for *perde* syllables is as follows:

<u>*Perde*s of 1st Fifth</u>		<u>*Perde*s of 2nd Fifth</u>		<u>*Perde*s of 3rd Fifth</u>		<u>*Perde*s of 4th Fifth</u>	
YEGAH	**1. YA**	*DÜGAH*	**11. DÜ**	*HÜSEYNİ*	**21. HÜ**	*T. Buselik*	29. Tu
Pes Beyati	2. Pe	*Kürdi*	12. Kür	*Acem*	22. Cem	*T. ÇARG.*	**31. TA**
Pes Hisar	3. Pi	*SEGAH*	**13. SE**	*EVC*	**23. VE**	*T. Saba*	32. Tıs
AŞİRAN	**4. ŞA**	*Buselik*	14. Bu	*Mahur*	24. Ma	*T. Hicaz*	33. Taz
Acem Aş.	5. Cin	*ÇARGAH*	**15. ÇA**	*GERDAN.*	**25. DA**	*T. NEVA*	**34. ZA**
ARAK	**6. KA**	*Saba*	16. Sa	*Şehnaz*	26. Şen	*T. Beyati*	35. Ze
Gevaşt	7. Ge	*Hicaz*	17. Caz			*T. Hisar*	36. Zi
RAST	**8. RA**	*NEVA*	**18. NA**	*MUHAY.*	**27. MU**	*T. HÜSEY.*	**37. ZÜ**
Şuri	9. Şu	*Beyati*	19. Be	*Sünbüle*	28. Sün		
Zirgule	10. Le	*Hisar*	20. Hi	*T. SEGAH*	**29. TE**		

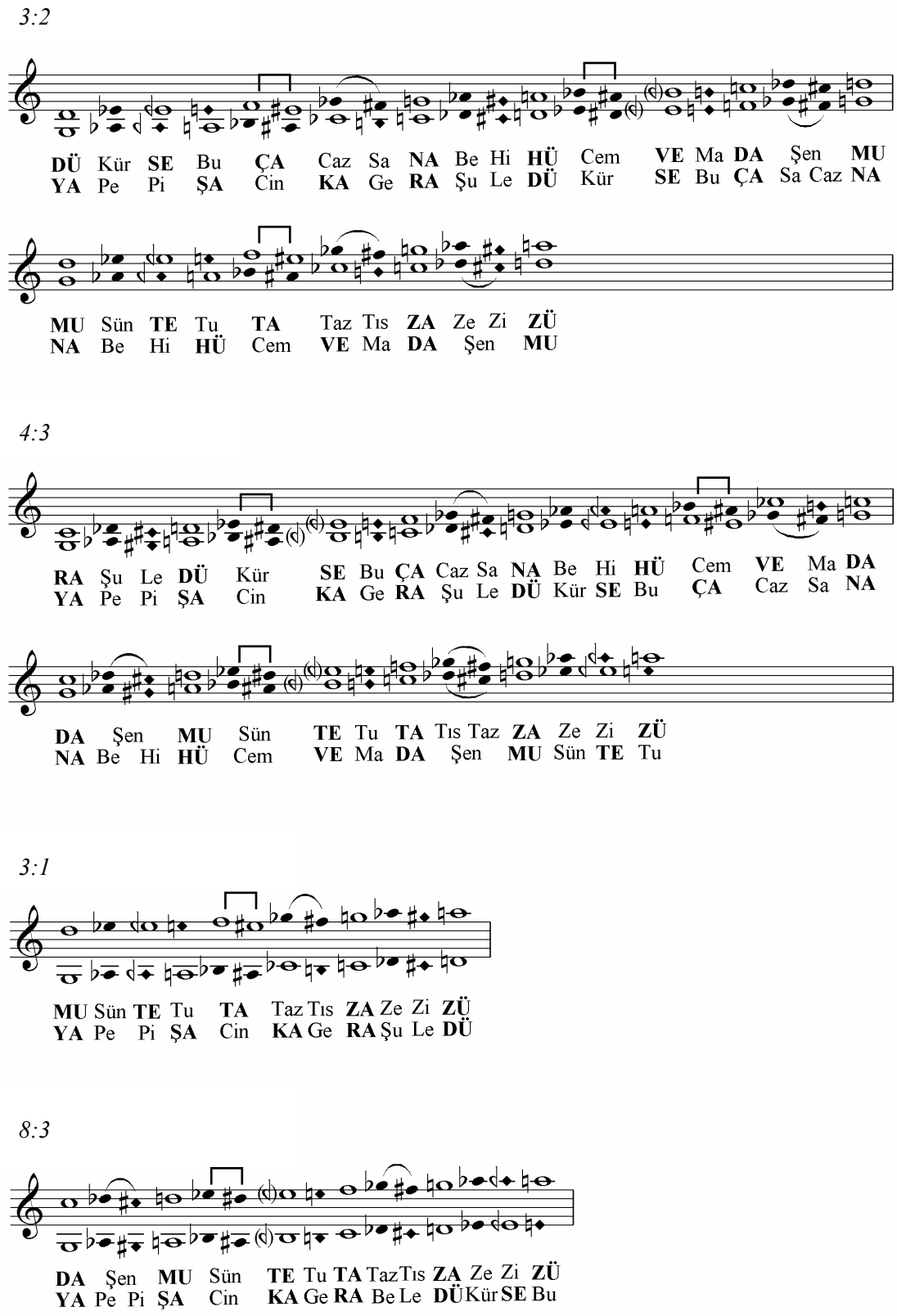
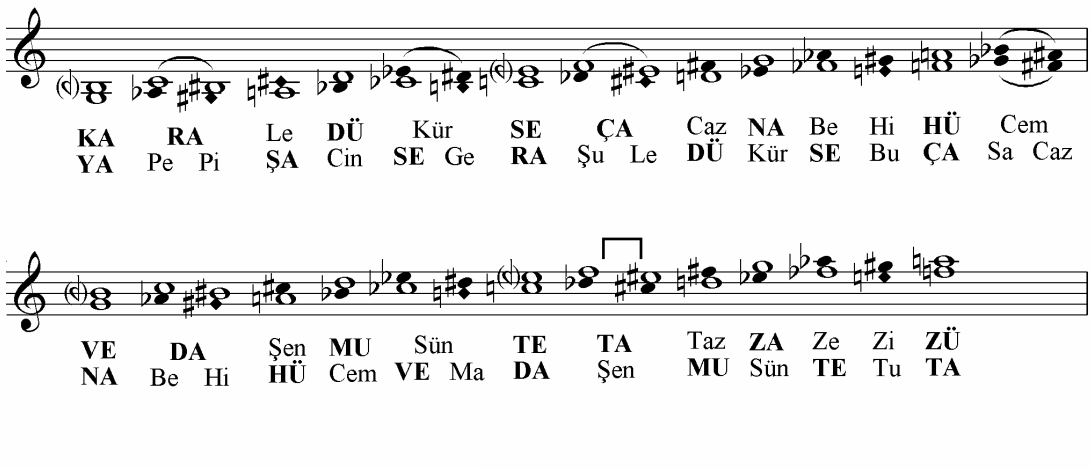


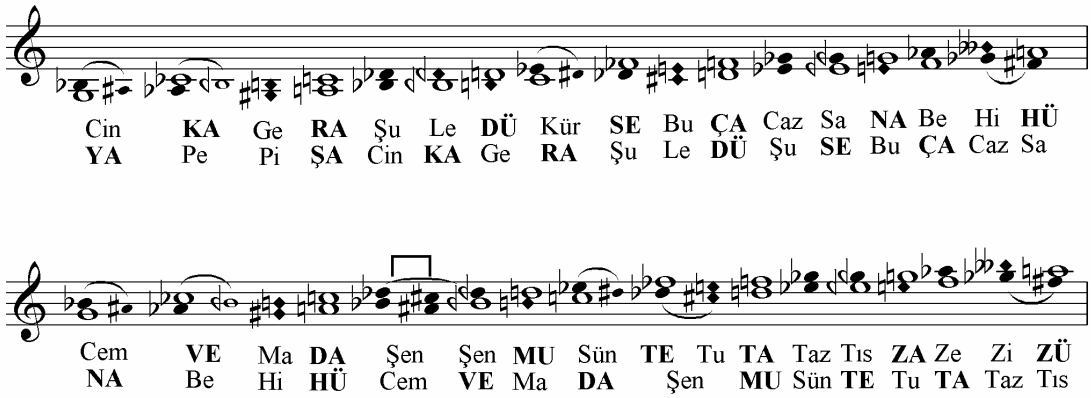
Figure 4.4: Staff Notation of *Nasır Dede*'s Consonances of the Fifth, Fourth, Twelveth, and Eleventh

Furthermore, *Nasır Dede*'s consonances of the major third, minor third, and the middle second are exposed in Figure 4.5:

27:22 to 81:64



7:6 to 6:5



16:15 to 10:9

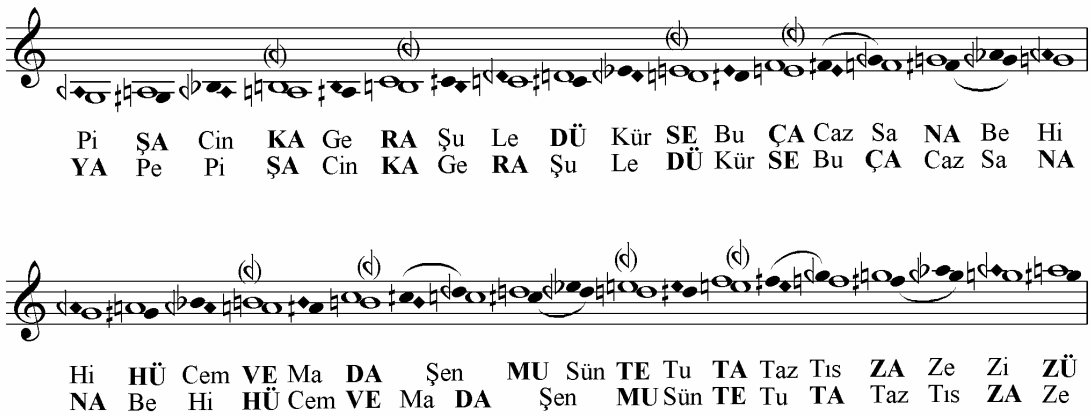


Figure 4.5: Staff Notation of *Nasır Dede*'s Consonances of the Major Third, Minor Third, and Middle Second

And finally, *Nasır Dede*'s consonances of the whole and half tones can be observed in Figure 4.6:

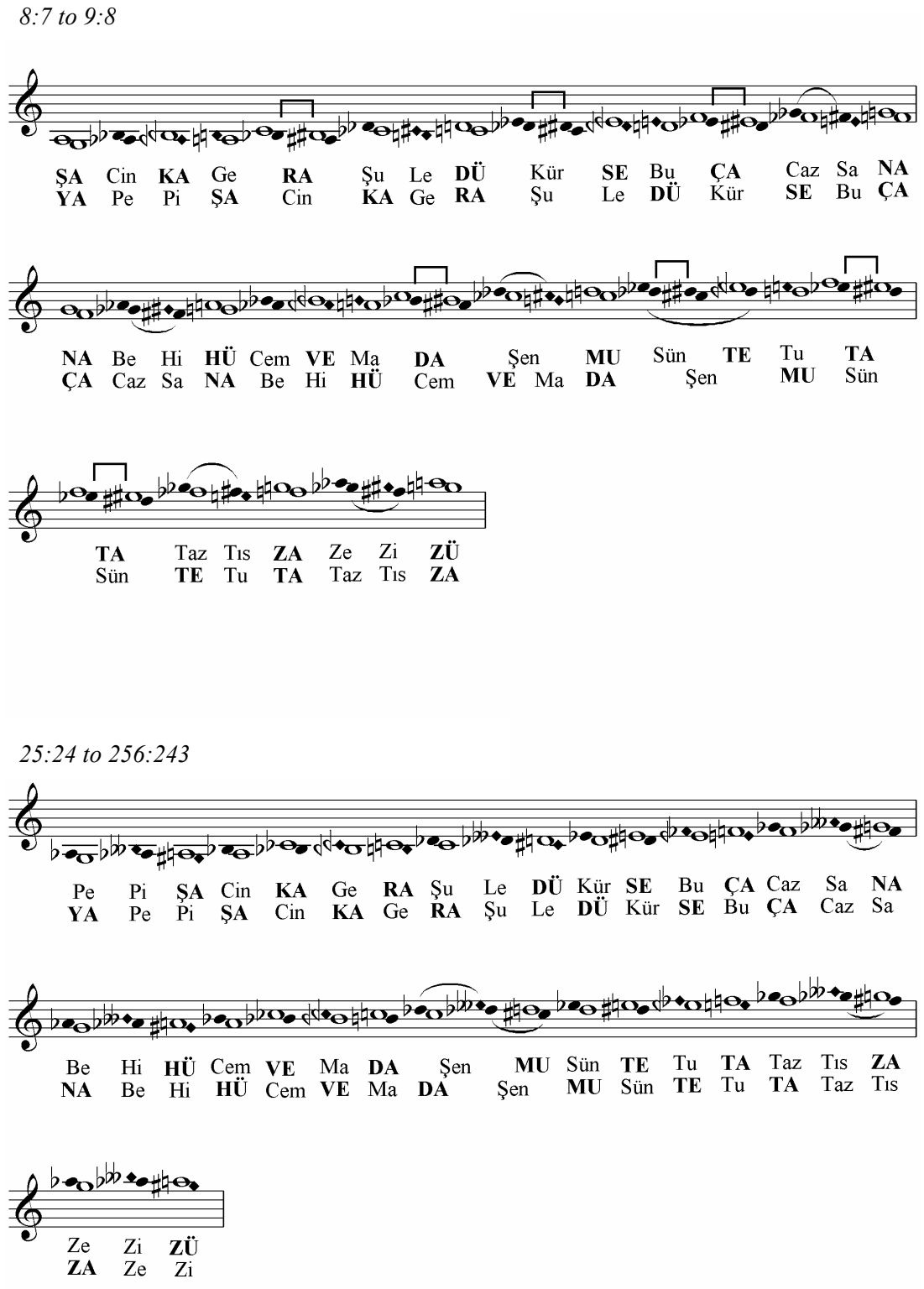


Figure 4.6: Staff Notation of *Nasır Dede*'s Consonances of Whole and Half Tones

Except the fairly unorthodox *perde* gestalt of *Nasır 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 4.6: Complete List of Dyads in the *Abjad* System

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

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.

[i] Inverted by the interval of repetition, which is the octave.

Table 4.7 contains an overview of Arabic Phonetics of *tanbur perde*s by *Kantemir* and *ney perde*s by *Osman Dede* [264-266]:

Table 4.7: *Kantemir* & *Osman Dede* Phonetic Notations of *Perde*s

Low Octave *Perdes* [i]	*Kantemir*'s Hints [ii]	***Kantemir***	***Osman Dede***
[**Nerm Çargâh**]		حه	
Yegâh		ى	ھ
'Aşiran		عہ	ش
Acem 'Aşiran	*Tetimme-i perde ve agaze-i Irak* (leading tone below **Irak**)	عه	ء
Irak		ق	ق
Rehavi / Geveşt	*na-ism* / Rehavi-i Cedid	ر	شت
Rast	***Sâba** perdesinin şeddi* (fourth below Sâba)	ر	ر
Zengule / Zirgule		ن	زیر
Dügâh		د	د
Nihavend [iii] / Kürdi	*Tetimme-i agaze-i Maqam-ı **Segâh*** – Maye (leading tone to **Segah**)	ھ	کو
Segâh		س	س
Buselik	Rehavi-i 'Atik / Nişabûr	ب	ن
Çargâh		حا	جا
Sâba / Hicaz		ص	حز
Uzzal		له	ز
Neva		ه	ن

[i] *Perde*s seperated by slashes are *Osman Dede*'s denominations. Bold terms indicate diatonic naturals yclept "*tam*". *Nerm çargah* is a drone mentioned by *Kantemir* alone.

[ii] Delitescent *nim perde*s, 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 *ırak*; *rehavi-i cedid* (new *rehavi*) a semitone below, and "*saba perdesinin şeddi*" (transposition of *perde saba*) above *rast*; "*tetimme-i agaze-i Maqam-ı Segah*" (leading tone of *Maqam Segah*'s cadence) also known as *maye* a semitone below, and *rehavi-i 'atik* (old *rehavi*) above *segah*; and *nişabur* in place of *buselik* when descending over *uzzal*.

[iii] *Kantemir* defines *nihavend* as a *perde* distinguished by its extreme proximity to *dügah* in *Maqam Kürdi* – aptly named *kürdi* by *Meragi* and *Osman Dede*, but possibly even lower in pitch than specified – which accords with *Nasır Dede*'s tendency to differentiate the two.

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

High Octave *Perdes* [i]	*Kantemir*'s Hints [ii]	***Kantemir***	***Osman Dede***
Neva		ه	ن
Bayati / Şuri		سا	ﻩ
Hisar		ح	حصر
Hüseyni		حـ	ح
Acem	*Tetimme-i agaze-i Maqam-ı* ***Evc*** (leading tone of **Evc**)	ء	ع
Evc		ا	و
Mahur	*na-ism*	ما	ما
Gerdaniye		ک	کر
Şehnaz		ـہ	شه
Muhayyer		م	مر [iii] [267] محـ
Sünbüle		لہ	له
Tiz Segâh		س	سَ
Tiz Buselik		ـبـ	نَ
Tiz Çargâh		ﻉ	جَا
Tiz Sâba / Tiz Hicaz		صه	حَز
Tiz Uzzal		له	زَ
Tiz Neva		ﻩ	نَ
Tiz Bayati / Tiz Şuri		ساه	ﻩَ
(Tiz Hisar) [iv] [268]		{خ}	حصَر
Tiz Hüseyni		حه	حَ

[i] *Perdes* seperated by slashes are *Osman Dede*'s denominations. Bold terms indicate diatonic naturals yclept "*tam*". Pitches above *tiz neva* belong to the III. Octave.

[ii] Delitescent *nim perdes*, to wit: "*tetimme-i perde ve agaze-i Maqam-ı Evc*" (leading tone of the cadence of *Maqam* of *Evc*) a semitone below, and "*na-ism*" (nameless) above *evc*.

[iii] As reported by *Yekta* in *La Histoire de la Musique*. (See, accompanying endnote)

[iv] 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 *perde*s from *rast* to *gerdaniye* – with the inclusion of *kürdi* [i] as distinct from *nihavend* – may be counted in the tables above, more interesting is the presence of 22 *perde*s lurking between *aşiran* and *hüseyni*, as shown in Table 4.8:

Table 4.8: Mixture of *Kantemir* & *Osman Dede Perde*s

#	Lower Octave *Perde*s	#	Higher Octave *Perde*s
1:	[**Nerm Çargâh**]		
2:	**Yegâh**		
3:	**'Aşiran**	26:	**Hüseyni**
4:	Tetimme-i Irak	27:	Tetimme-i Evc
5:	Acem 'Aşiran	28:	Acem
6:	**Irak**	29:	**Evc**
7:	Rehavi(-i Cedid) / Geveşt	30:	Mahur
8:	Na-ism		
9:	**Rast**	31:	**Gerdaniye**
10:	Şedd-i Saba [ii] [269] (Şuri)		
11:	Zengule / Zirgule	32:	Şehnaz
12:	**Dügâh**	33:	**Muhayyer**
13:	Tetimme-i Segâh (Maye) / Kürdi		
14:	Nihavend	34:	Sünbüle
15:	**Segâh**	35:	**Tiz Segâh**
16:	Buselik	36:	Tiz Buselik
17:	Nişabûr		
18:	Rehavi-i 'Atik		
19:	**Çargâh**	37:	**Tiz Çargâh**
20:	Sâba / Hicaz	38:	Tiz Sâba / Tiz Hicaz
21:	Uzzal	39:	Tiz Uzzal
22:	**Neva**	40:	**Tiz Neva**
23:	Bayati / Şuri	41:	Tiz Bayati / Tiz Şuri
24:	Hisar	42:	(Tiz Hisar)
25:	**Hüseyni**	43:	**Tiz Hüseyni**

[i] Which is none other than "*tetimme-i agaze-i Maqam-ı Segah*", or *maye* of *Kantemir*.

[ii] This *perde* must be *Nasır 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 *perde*s 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 *perde*s 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, *geveşt* is replaced by *rehavi*, *zirgule* with *zengule*, *kürdi* by *nihavend*, 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 perde*s (*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 ¢} - 6.637 ¢) and fifteen 168 cent ({11:10=165.004 ¢} + 2.996 ¢) 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*-*ırak*, *segah*-*çargah*, and three 4/5 tones between *aşiran*-*ırak*, *dügah*-*segah*, and *segah*-*nişabur*.

Table 4.9: Recapitulation of 22 *Kantemir* & *Osman Dede Perdes* in 50-EDO

Degree	Cents	*Tam* (Natural) *perdes*	*Nim* (Half) *perdes*	Intervals
0:	0.000	**0. *'Aşiran***		
1:	24.000			
2:	48.000			
3:	72.000		1. *Tetimme-i Irak*	72-120 ¢ down **Irak**
4:	96.000			
5:	120.000		2. *Acem 'Aşiran*	120 ¢ up **'Aşiran**
6:	144.000			
7:	168.000	**3. *Irak***		
8:	192.000			192 ¢ from **'Aşiran**
9:	216.000		4. *Rehavi(-i Cedid)* / *Geveşt*	72-96 ¢ down **Rast**
10:	240.000			
11:	264.000		5. *Na-ism*	72-96 ¢ up **Irak**
12:	288.000			
13:	312.000	**6. *Rast***		120 ¢ from **Irak**
14:	336.000			
15:	360.000			
16:	384.000		7. *Şedd-i Saba*	72-96 ¢ up **Rast**
17:	408.000			
18:	432.000		8. *Zengule* / *Zirgule*	72 ¢ down **Dügâh**
19:	456.000			
20:	480.000			
21:	504.000	**9. *Dügâh***		192 ¢ from **Rast**
22:	528.000			
23:	552.000			
24:	576.000		10. *Tetimme-i Segâh* (*Maye*) / *Kürdi*	72-120 ¢ down **Segâh**
25:	600.000			
26:	624.000		11. *Nihavend*	120 ¢ up **Dügâh**
27:	648.000			
28:	672.000	**12. *Segâh***		
29:	696.000			192 ¢ from **Rast**
30:	720.000		13. *Buselik*	96 ¢ down **Çargâh**
31:	744.000		14. *Nişabûr*	72 ¢ down **Çargâh**
32:	768.000		15. *Rehavi-i 'Atik*	72-96 ¢ up **Segâh**
33:	792.000			
34:	816.000	**16. *Çargâh***		120 ¢ from **Segâh**
35:	840.000			
36:	864.000			
37:	888.000		17. *Sâba* / *Hicaz*	72-96 ¢ up **Çargâh**
38:	912.000			
39:	936.000		18. *Uzzal*	72 ¢ down **Neva**
40:	960.000			
41:	984.000			
42:	1008.000	**19. *Neva***		192 ¢ from **Çargâh**
43:	1032.000			
44:	1056.000			
45:	1080.000		20. *Bayati* / *Şuri*	72-96 ¢ up **Neva**
46:	1104.000			
47:	1128.000		21. *Hisar*	72 ¢ down **Hüseyni**
48:	1152.000			
49:	1176.000			
50:	1200.000	**22. *Hüseyni***		192 ¢ from **Neva**

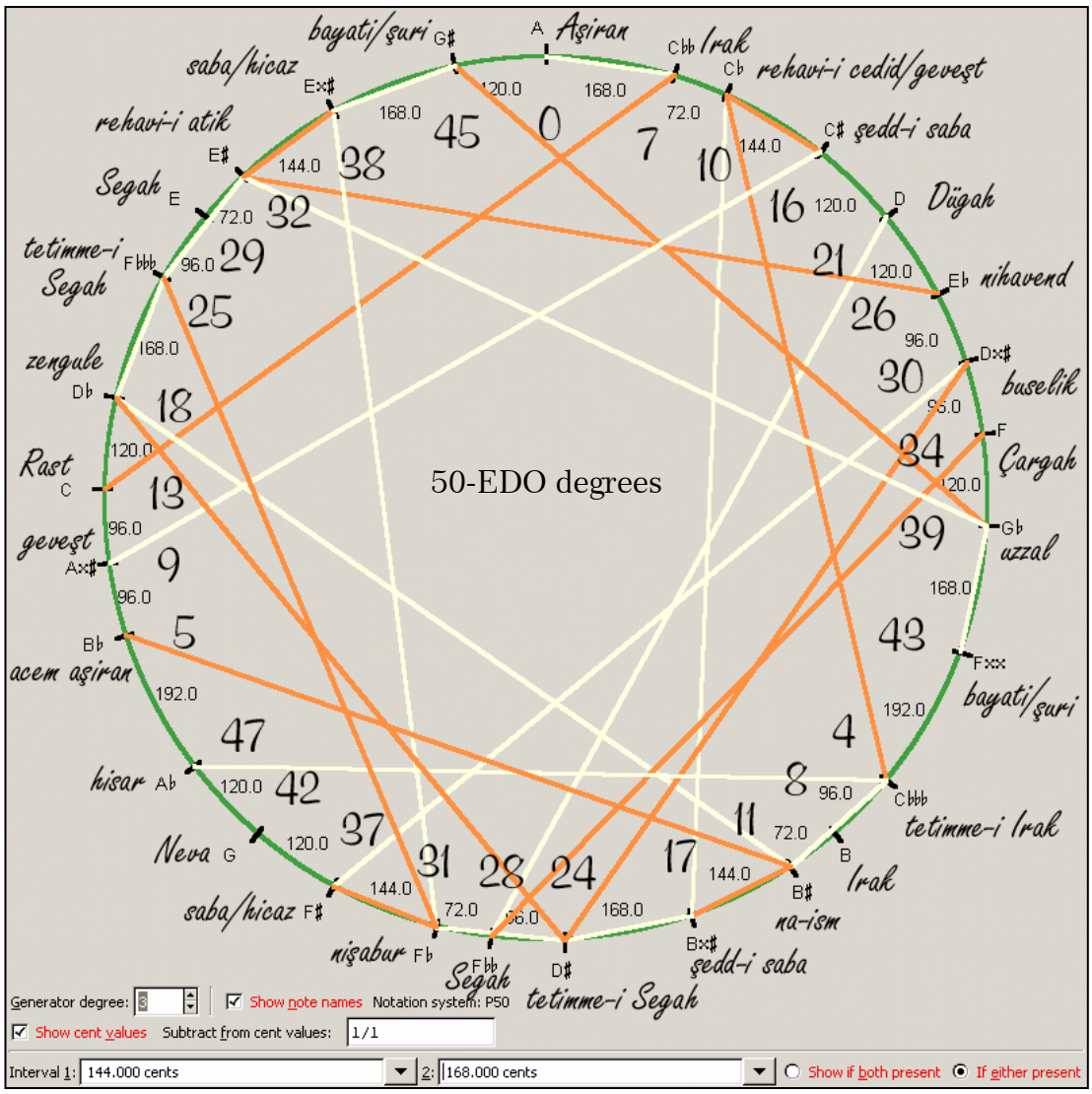


Figure 4.7: SCALA© [i] Tone-Circle of "Quarter-tones" betwixt A Blend of *Kantemir* & *Osman Dede Perde*s Mapped to Degrees of 50-EDO

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 perde*s may denote a general tendency to raise, right-hand-side *nim perde*s 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.

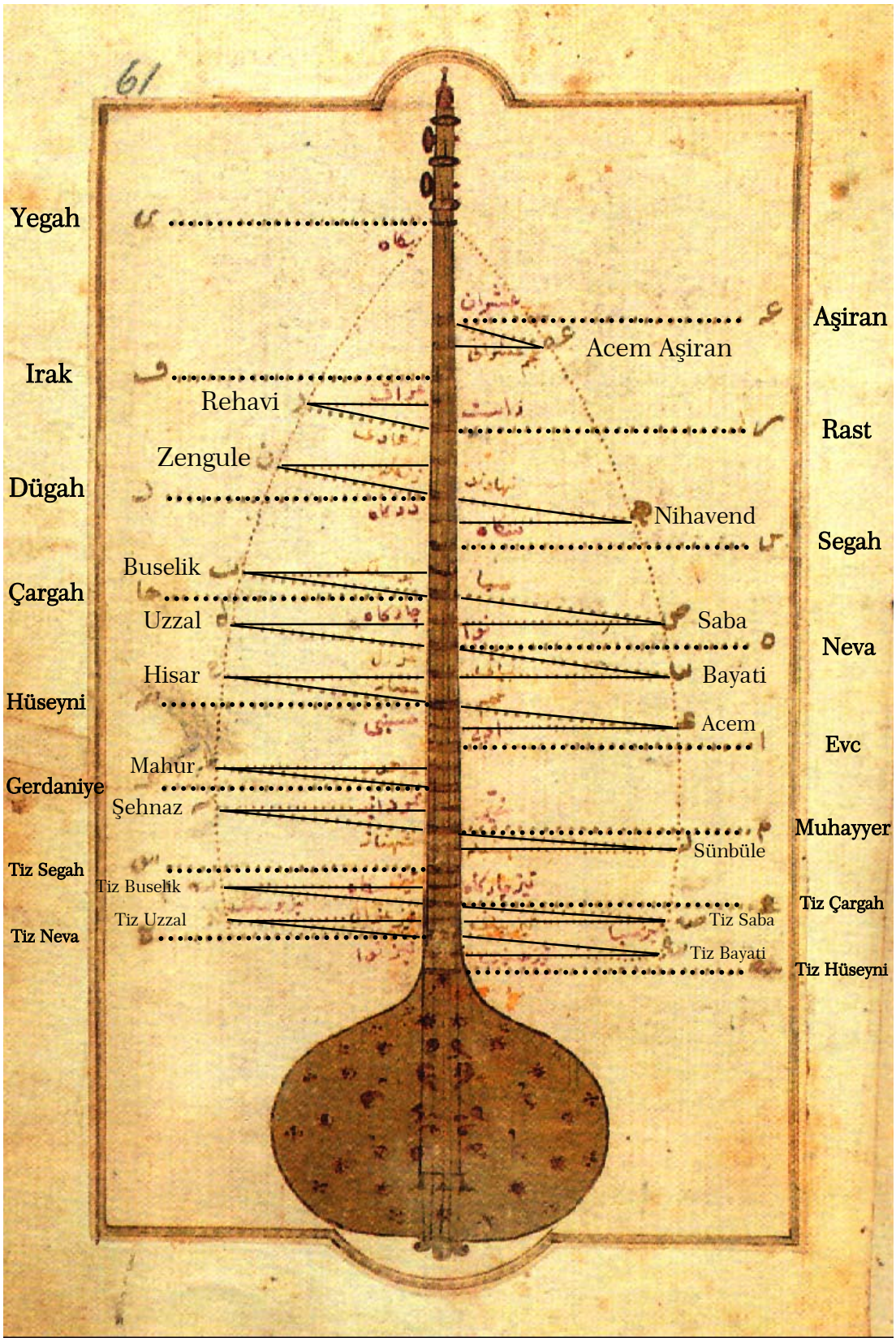

Figure 4.8: ***Kantemir*'s *Tanbur* from *Kitābu 'İlmi'l-Mūsīḳā ʻalā vechi'l-Ḥurūfāt*, p.131**

As for how traditional *perde*s 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 *Perde*s [i]

Letters		I. Octave Perdes	Letters		II. Octave	Letters		III. Octave
		Kaba Çargâh			*Çargâh*			*Tiz Çargâh*
		Pes Hicaz			Hicaz / Sâba			Tiz Hicaz / Sâba
		Yegâh			*Neva*			*Tiz Neva*
		Pes Hisar / Şorizen			Hisar / Beyati			Tiz Hisar
		(Hüseyni) Aşiran			*Hüseyni*			*Tiz Hüseyni*
		Acem Aşiran			Acem			Tiz Acem
		Arak			*Evc*			*Tiz Evc*
		Geveşt			Mahur			Tiz Mahur
		Rast			*Gerdaniye*			*Tiz Gerdaniye*
		Zirgûle			Şehnaz	Hamparsum's root diatonic symbols		
		Dügâh			*Muhayyer*			
		Kürdî / Nihavend			Sünbüle			
		Segâh			*Tiz Segâh*			
		Bûselik			Tiz Bûselik			

A twelve-tone plan is all but traceable in both, if not for the presence of Pythagorean-like *geveşt*/ (*tiz*) *buselik*/ (*tiz*) *mahur*: Nonetheless, it is suspect whether this 14-tone mould foments dodecaphony at all. Rather, the inclusion of Pythagorean-like *perde*s 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*.

[i] Denominations seperated by slashes and extended in paranthesis are *Harutin*'s. Shaded cells indicate *tam* (natural) *perde*s.

A final review of Phonetic Notations & *Abjad* is shown in Figure 4.9 below:

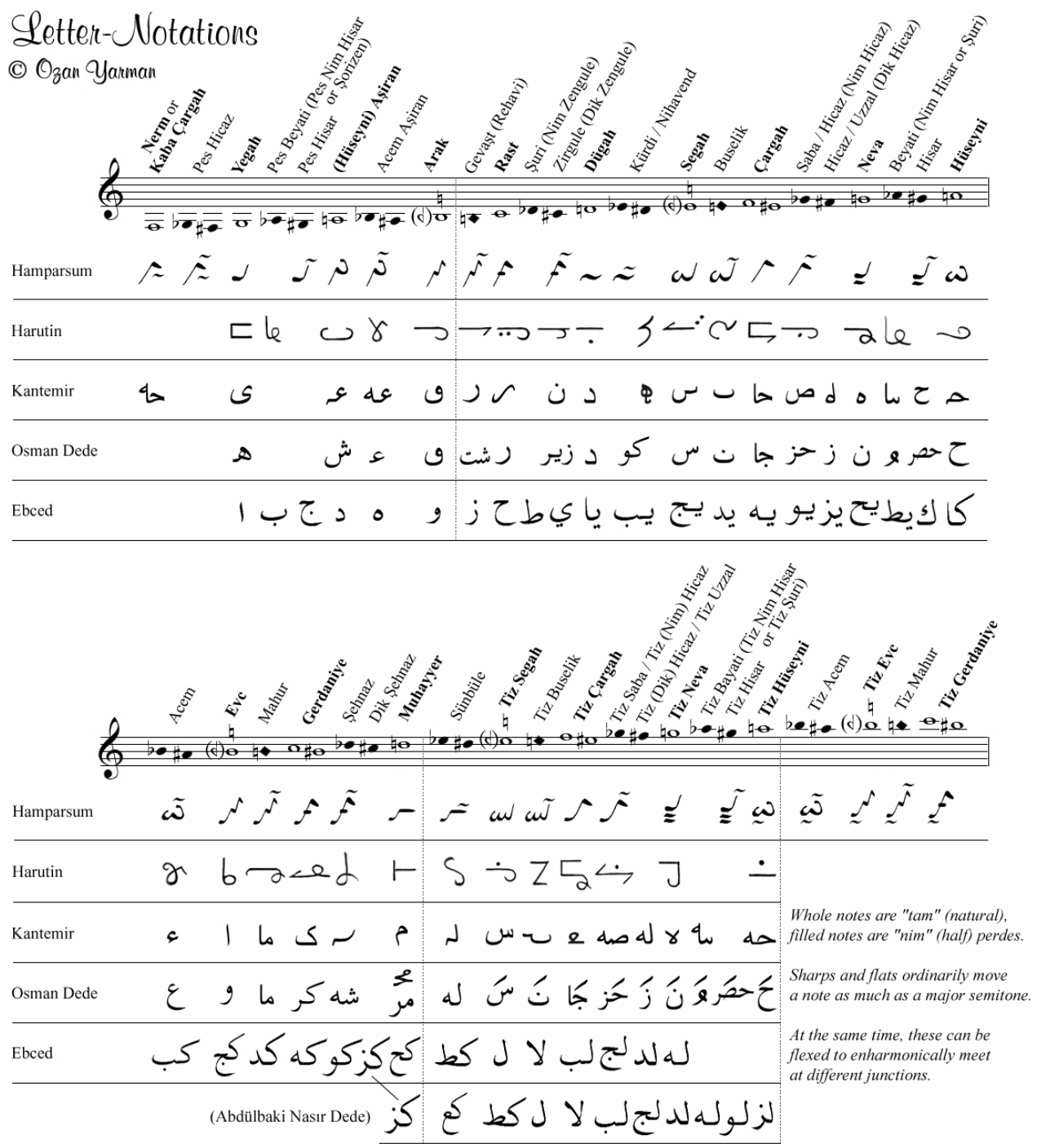

Figure 4.9: Final Review on Staff of Ottoman Phonetic Notations & *Abjad*

In this figure, *de facto* frequency ratios for whole natural notes known as *tam perde*s 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 perde*s, on the other hand, are literally quite loose. Flats often approach the notes preceding them, while sharps as well as *geveşt*/ (*tiz*) *buselik*/ (*tiz*) *mahur* incline toward their upper neighbours.

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

Unruly *perde*s acknowledged by *Kantemir* and shunned by *Nasır Dede* are disregarded.

No clear-cut tunings for Phonetic Notations are inferrable, aside from, perhaps, a rugged 50 equal divisions of the octave. Even *Nasır Dede*'s *Abjad* does not appear to abide with *Urmavi*'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 *Nasır 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 *perde*s [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 4.11: *Mushaqah*'s Quasi-Equal 24-tone System

#	*Perde*s of I. Octave	Frequency Ratios	Cents	Consecutive Intervals
0:	**YAK-GĀH (Sol)**	**3456 / 3456**	**0.000**	(with previous)
1:	Qarār Nīm Ḥiṣār	3456 / 3361	48.255	48.255 ¢
2:	Qarār Ḥiṣār	3456 / 3268	96.834	48.579 ¢
3:	Qarār Tik Ḥiṣār	3456 / 3177	145.726	48.892 ¢
4:	**ʻUŠAYRĀN (La)**	**3456 / 3088**	**194.917**	49.191 ¢
5:	Nīm ʻAjam-ʻUšayrān	3456 / 3001	244.392	49.475 ¢
6:	ʻAjam-ʻUšayrān	3456 / 2916	294.135	49.743 ¢
7:	**ʻIRĀQ (Si ♭)**	**3456 / 2833**	**344.127**	49.992 ¢
8:	Gavašt	3456 / 2752	394.347	50.220 ¢
9:	Tik Gavašt	3456 / 2673	444.772	50.425 ¢
10:	**RĀST (Do)**	**3456 / 2596**	**495.375**	50.603 ¢
11:	Nīm Zīrgūlah	3456 / 2521	546.129	50.754 ¢
12:	Zīrgūlah	3456 / 2448	597.000	50.871 ¢
13:	Tik Zīrgūlah	3456 / 2377	647.954	50.954 ¢
14:	**DŪ-GĀH (Re)**	**3456 / 2308**	**698.952**	50.998 ¢
15:	Nīm Kurdī	3456 / 2241	749.953	51.001 ¢
16:	Kurdī	3456 / 2176	800.910	50.957 ¢
17:	**SAH-GĀH (Mi ♭)**	**3456 / 2113**	**851.773**	50.863 ¢
18:	Būsalīk	3456 / 2052	902.487	50.714 ¢
19:	Tik Būsalīk	3456 / 1993	952.994	50.507 ¢
20:	**TŠAHĀR-GĀH (Fa)**	**3456 / 1936**	**1003.229**	50.235 ¢
21:	Nīm Ḥijāz	3456 / 1881	1053.124	49.895 ¢
22:	Ḥijāz	3456 / 1828	1102.605	49.481 ¢
23:	Tik Ḥijāz	3456 / 1777	1151.591	48.986 ¢
24:	**NAWĀ (Sol)**	**3456 / 1728**	**1200.000**	48.409 ¢

II. Octave	I. Octave	Intervals
24. *NAWĀ*	0. *YAKĀH*	(with previous)
25. *Nīm Ḥiṣār*	1. *Qarār Nīm Ḥiṣār*	48.255 ¢
26. *Ḥiṣār*	2. *Qarār Ḥiṣār*	48.579 ¢
27. *Tīk Ḥiṣār*	3. *Qarār Tīk Ḥiṣār*	48.892 ¢
28. *ḤUSAYNĪ*	4. *'USHAYRĀN*	49.191 ¢
29. *Nīm 'Ajam*	5. *Qarār Nīm 'Ajam*	49.475 ¢
30. *'Ajam*	6. *Qarār 'Ajam*	49.743 ¢
31. *AWJ*	7. *'IRĀQ*	49.992 ¢
32. *Nihūft*	8. *Gawasht*	50.220 ¢
33. *Tīk Nihūft*	9. *Tīk Gawasht*	50.425 ¢
34. *KURDĀN*	10. *RĀST*	50.603 ¢
35. *Nīm Shāhnāz*	11. *Nīm Zīrgūlah*	50.754 ¢
36. *Shāhnāz*	12. *Zīrgūlah*	50.871 ¢
37. *Tīk Shāhnāz*	13. *Tīk Zīrgūlah*	50.954 ¢
38. *MUḤAYYAR*	14. *DŪKĀH*	50.998 ¢
39. *Nīm Sunbulah*	15. *Nīm Kurdī*	51.001 ¢
40. *Sunbulah*	16. *Kurdī*	50.957 ¢
41. *BUZURK*	17. *SĪKĀH*	50.863 ¢
42. *Ḥusaynī Shadd*	18. *Būsalīk*	50.714 ¢
43. *Tīk Ḥusaynī Shadd*	19. *Tīk Būsalīk*	50.507 ¢
44. *MĀHŪRĀN*	20. *JAHĀRKĀH*	50.235 ¢
45. *Jawāb 'Arbā'*	21. *Nīm Ḥijāz ('Arbā')*	49.895 ¢
46. *Jawāb Ḥijāz*	22. *Ḥijāz*	49.481 ¢
47. *Jawāb Tīk Ḥijāz*	23. *Tīk Ḥijāz*	48.986 ¢
48. *RAMAL TŪTĪ*	24. *NAWĀ*	48.409 ¢

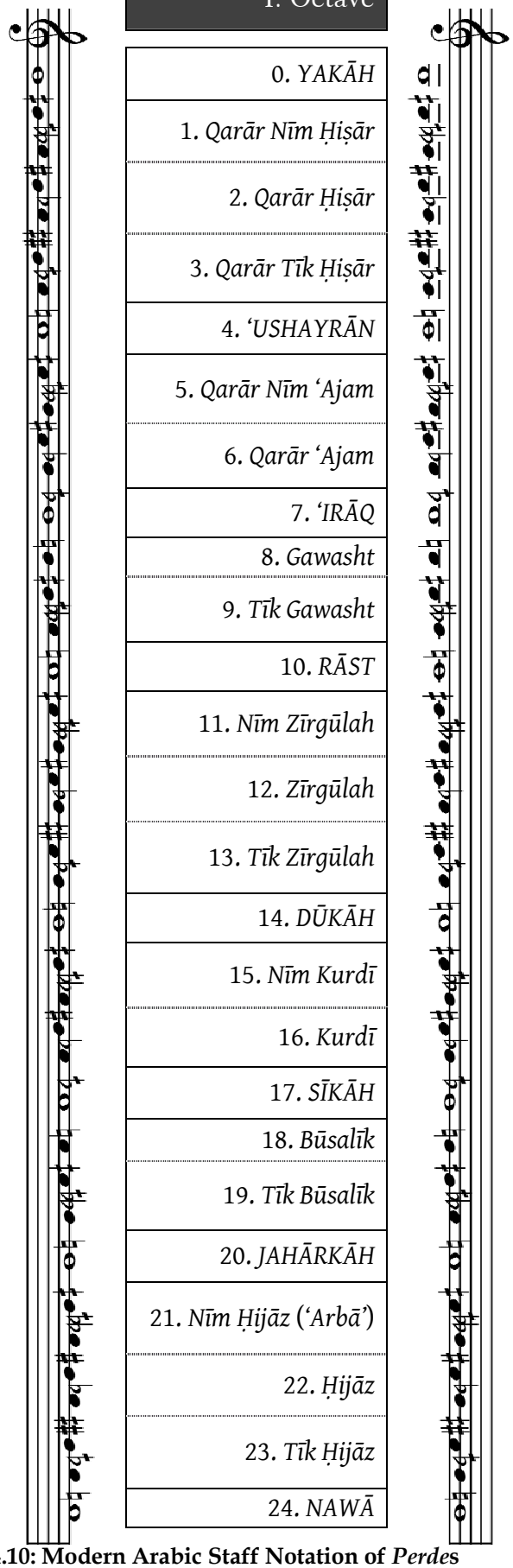

Figure 4.10: Modern Arabic Staff Notation of *Perde*s

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

#	*Perde*s of I. Octave	Frequency Ratios	Cents	Consecutive Intervals
0:	**YAK-GĀH (Sol)**	**1/1**	**0.000**	(with previous)
1:	Nīm Qarār Ḥiṣār	1053/1024	48.348	48.348 ¢
2:	Qarār Ḥiṣār	256/243	90.225	41.877 ¢
3:	Tik Qarār Ḥiṣār	12/11	150.637	60.412 ¢
4:	**'UŠAYRĀN (La)**	**9/8**	**203.910**	53.273 ¢
5:	Nīm 'Ajam-'Ušayrān	147/128	239.607	35.697 ¢
6:	'Ajam-'Ušayrān	32/27	294.135	54.528 ¢
7:	**'IRĀQ (Si ♭)**	**27/22**	**354.547**	60.412 ¢
8:	Gavašt	5/4	386.314	31.767 ¢
9:	Tik Gavašt	9/7	435.084	48.770 ¢
10:	**RĀST (Do)**	**4/3**	**498.045**	62.961 ¢
11:	Nīm Zīrgūlah	48/35	546.815	48.770 ¢
12:	Zīrgūlah	1024/729	588.270	41.455 ¢
13:	Tik Zīrgūlah	81/56	638.994	50.724 ¢
14:	**DŪ-GĀH (Re)**	**3/2**	**701.955**	62.961 ¢
15:	Nīm Kurdī	49/32	737.652	35.697 ¢
16:	Kurdī	128/81	792.180	54.528 ¢
17:	**SAH-GĀH (Mi ♭)**	**18/11**	**852.592**	60.412 ¢
18:	Būsalīk	27/16	905.865	53.273 ¢
19:	Tik Būsalīk	26/15	952.259	46.394 ¢
20:	**TŠAHĀR-GĀH (Fa)**	**9/5**	**1017.596**	65.337 ¢
21:	Nīm Ḥijāz	11/6	1049.363	31.767 ¢
22:	Ḥijāz	15/8	1088.269	38.906 ¢
23:	Tik Ḥijāz	35/18	1151.230	62.961 ¢
24:	**NAWĀ (Sol)**	**2/1**	**1200.000**	48.770 ¢

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 *perde*s 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 *perde*s 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:

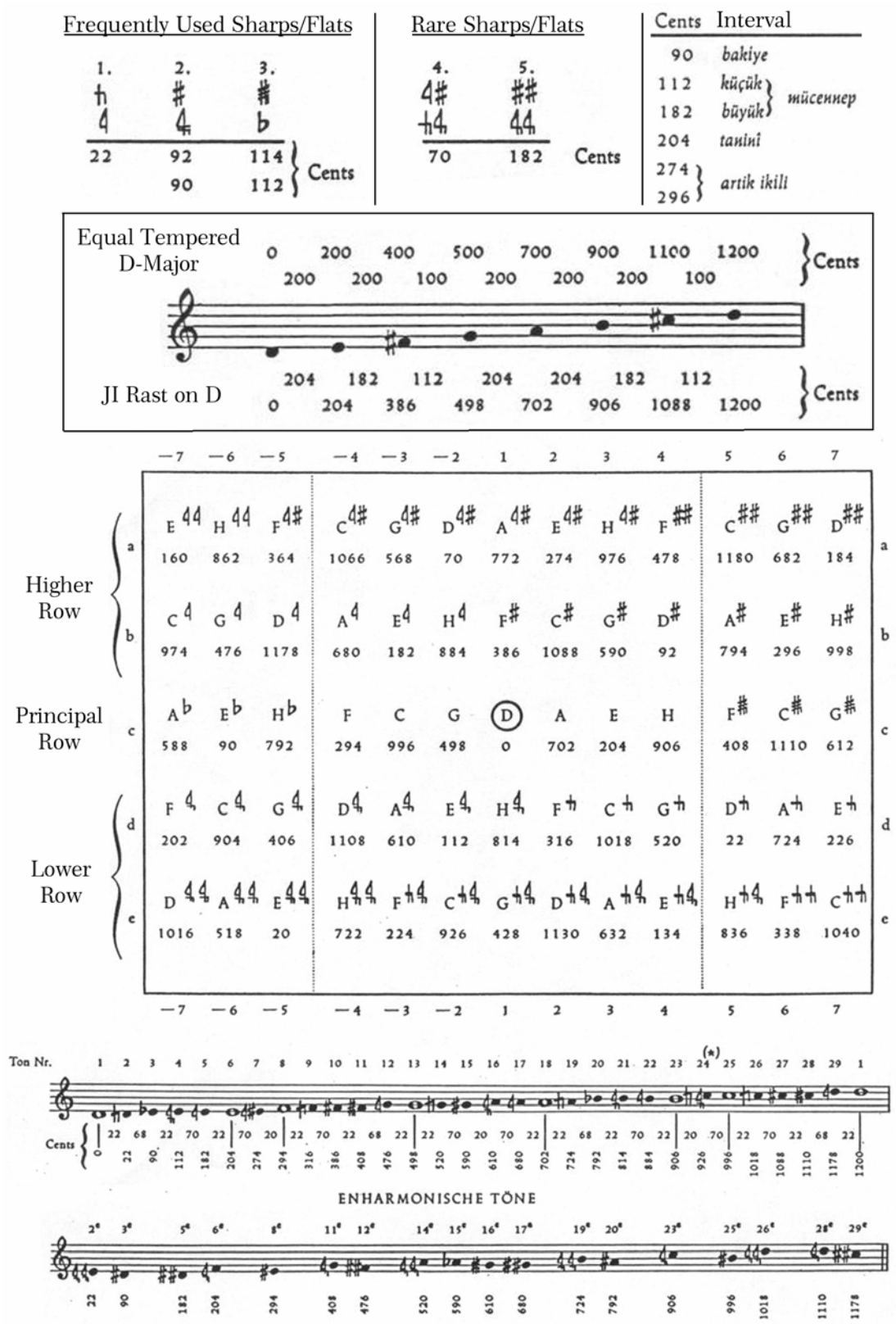

Figure 4.11: *Oransay*'s 29-tone System for Turkish *Maqam* Music [i] **[154]**

[i] Parts extracted from "*Das Tonsystem Der Türkei-Türkischen Kunstmusik*". Asterisk on the 24th tone denotes insertion to preserve symmetry. (See, accompanying endnote.)

Table 4.13: Details of *Oransay-29*

#	*Oransay* Cents	Implied JI Ratios	Cents	Difference	Consecutive Intervals
0:	**0 (D)**	**1/1**	**0.000**	0.000 ¢	(with previous)
1:	22	81/80	21.506	0.494 ¢	21.506 ¢
2:	90	256/243	90.225	-0.225 ¢	68.719 ¢
3:	112	16/15	111.731	0.269 ¢	21.506 ¢
4:	182	10/9	182.404	-0.404 ¢	70.673 ¢
5:	**204 (E)**	**9/8**	**203.910**	0.090 ¢	21.506 ¢
6:	274	75/64	274.582	-0.582 ¢	70.672 ¢
7:	**294 (F)**	**32/27**	**294.135**	-0.135 ¢	19.553 ¢
8:	316	6/5	315.641	0.359 ¢	21.506 ¢
9:	386	5/4	386.314	-0.314 ¢	70.673 ¢
10:	408	81/64	407.820	0.180 ¢	21.506 ¢
11:	476	320/243	476.539	-0.539 ¢	68.719 ¢
12:	**498 (G)**	**4/3**	**498.045**	-0.045 ¢	21.506 ¢
13:	520	27/20	519.551	0.449 ¢	21.506 ¢
14:	590	45/32	590.224	-0.224 ¢	70.673 ¢
15:	610	64/45	609.776	0.224 ¢	19.552 ¢
16:	680	40/27	680.449	-0.449 ¢	70.673 ¢
17:	**702 (A)**	**3/2**	**701.955**	0.045 ¢	21.506 ¢
18:	724	243/160	723.461	0.539 ¢	21.506 ¢
19:	792	128/81	792.180	-0.180 ¢	68.719 ¢
20:	814	8/5	813.686	0.314 ¢	21.506 ¢
21:	884	5/3	884.359	-0.359 ¢	70.673 ¢
22:	**906 (B)**	**27/16**	**905.865**	0.135 ¢	21.506 ¢
23:	926*	128/75	925.418	0.582 ¢	19.553 ¢
24:	**996 (C)**	**16/9**	**996.090**	-0.090 ¢	70.672 ¢
25:	1018	9/5	1017.596	0.404 ¢	21.506 ¢
26:	1088	15/8	1088.269	-0.269 ¢	70.673 ¢
27:	1110	243/128	1109.775	0.225 ¢	21.506 ¢
28:	1178	160/81	1178.494	-0.494 ¢	68.719 ¢
29:	**1200 (D)**	**2/1**	**1200.000**	0.000 ¢	21.506 ¢

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:

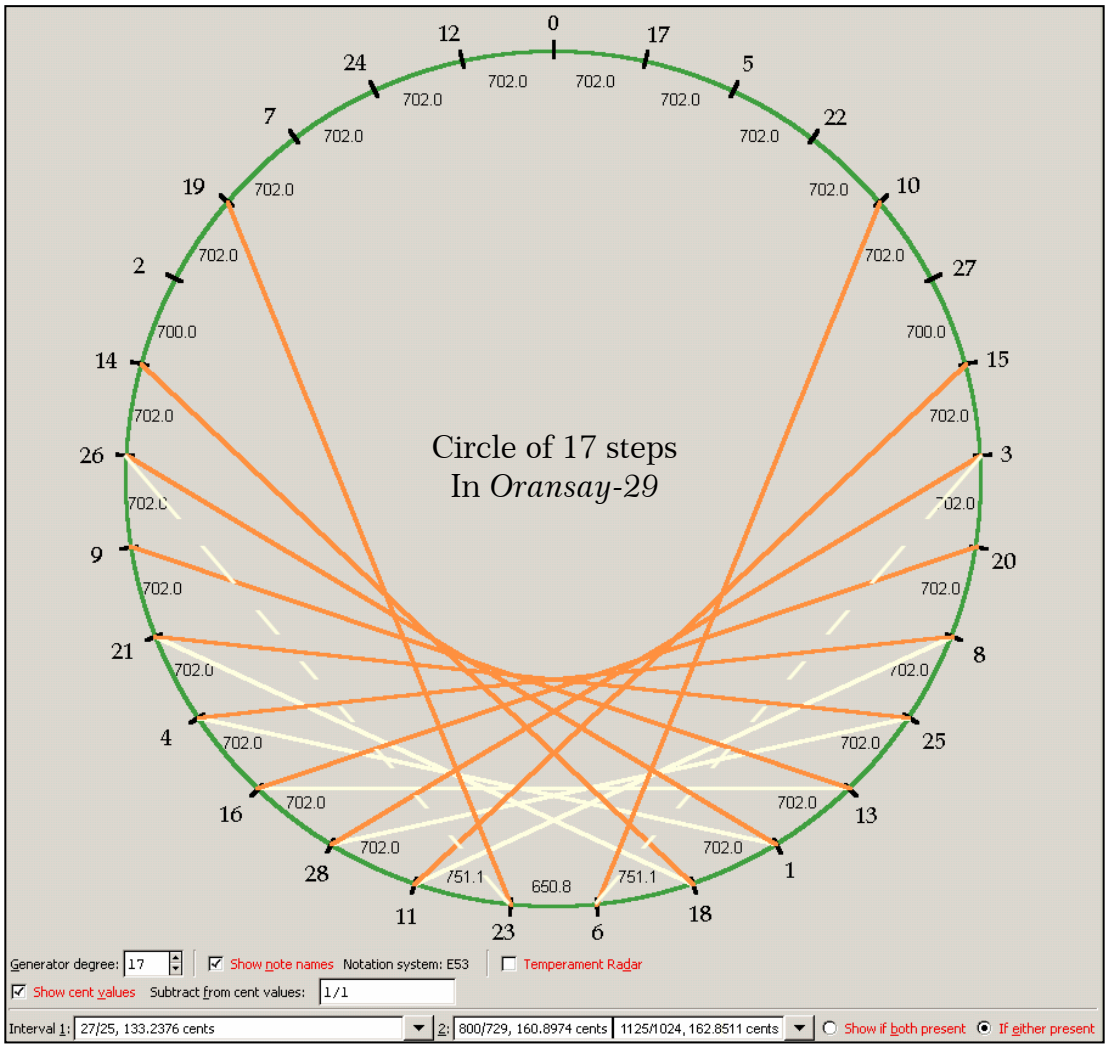

Figure 4.12: SCALA© Tone-Circle Showing 10 Instances of 2/3 Tones & 7 Instances of 4/5 Tones in *Oransay-29*

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]:

II. ½ Octave	I. ½ Octave	Commas	
21. *Hicaz*	0. *RAST*	(with previous)	
22. *Dikçe Hicaz*	1. *Nigâr*	1.5 Holderian	
23. *Sabâ*	2. *Dikçe Nigâr*	2.5	3
24. *NEVÂ*	3. *Nim Zengûle*	3.5	4
25. *Gülzar*	4. *Zengûle*	5	5.5
26. *Dikçe Gülzar*	5. *Dikçe Zengûle*	6.5	7
27. *Nim Hisar*	6. *Dik Zengûle*	7.5	8
28. *Hisar*	7. *DÜGÂH*	9	
29. *Dikçe Hisar*	8. *Dilârâ*	10.5	
30. *Hisârek*	9. *Dikçe Dilârâ*	11.5	12
31. *HÜSEYNÎ*	10. *Nim Kürdî*	12.5	13
32. *Dilâviz*	11. *Kürdî*	14	14.5
33. *Dikçe Dilâviz*	12. *Uşşak*	15.5	16
34. *ACEM*	13. *SEGÂH*	16.5	17
35. *Nevruz*	14. *Bûselik*	18	18.5
36. *Dikçe Nevruz*	15. *Dikçe Bûselik*	19.5	20
37. *Eviç*	16. *Dik Bûselik*	20.5	21
38. *Mâhur*	17. *ÇÂRGÂH*	22	
39. *Dikçe Mâhur*	18. *Niyaz*	23.5	
40. *Dik Mâhur*	19. *Dikçe Niyaz*	24.5	25
41. *GERDÂNİYE*	20. *Nim Hicaz*	25.5	26

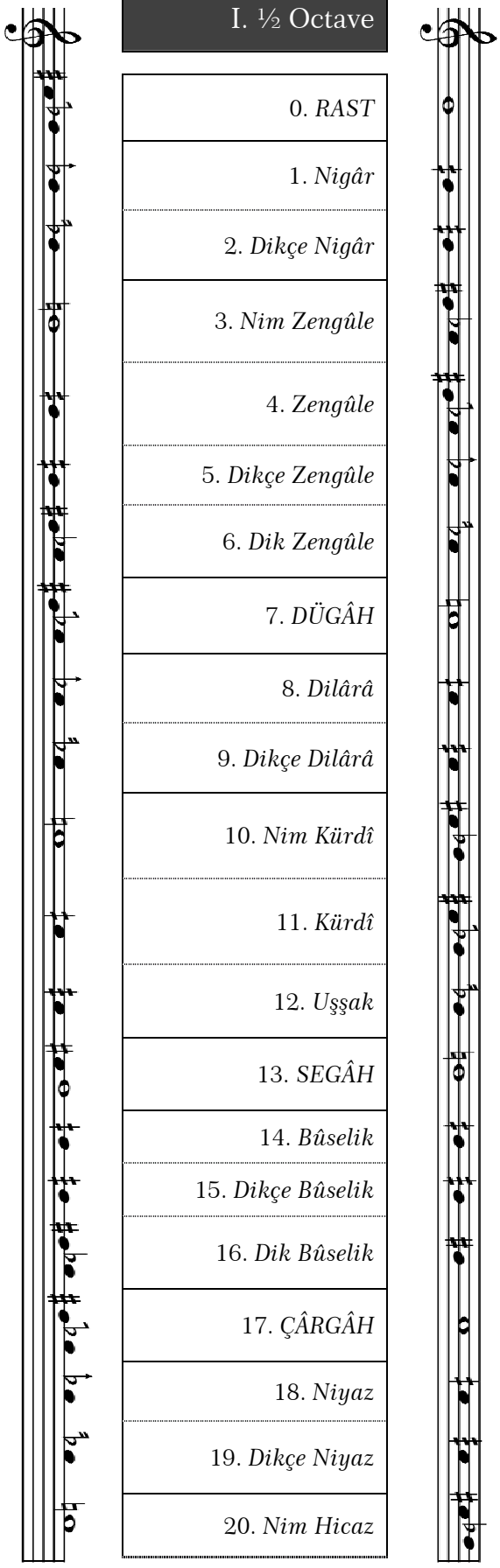

Figure 4.13: Staff Notation of *Töre-Karadeniz*

Table 4.14: Entire Range of *Perde*s in *Töre-Karadeniz*

Relative Frequency	Row # & 106-EDO Cents	I. Octave *Perdes*	II. Octave *Perdes*	III. Octave *Perdes*
1.00	**1: 0.000**	***Pest Rast***	***Rast***	***Gerdâniye***
1.02	13: 33.962	*Pest Nigâr*	*Nigâr*	*Tiz Nigâr*
1.04	25: 67.925	*Pest Dikçe Nigâr*	*Dikçe Nigâr*	*Tiz Dikçe Nigâr*
1.053	37: 90.566	*Pest Nim Zengûle*	*Nim Zengûle*	*Nim Şehnaz*
1.074	8: 124.528	*Pest Zengûle*	*Zengûle*	*Şehnaz*
1.096	20: 158.491	*Pest Dikçe Zengûle*	*Dikçe Zengûle*	*Dikçe Şehnaz*
1.110	32: 181.132	*Pest Dik Zengûle*	*Dik Zengûle*	*Dik Şehnaz*
1.125	**3: 203.774**	***Pest Dügâh***	***Dügâh***	***Muhayyer***
1.147	15: 237.736	*Pest Dilârâ*	*Dilârâ*	*Tiz Dilârâ*
1.170	27: 271.698	*Pest Dikçe Dilârâ*	*Dikçe Dilârâ*	*Tiz Dikçe Dilârâ*
1.185	39: 294.340	*Pest Nim Kürdî*	*Nim Kürdî*	*Nim Sünbüle*
1.209	10: 328.302	*Pest Kürdî*	*Kürdî*	*Sünbüle*
1.234	22: 362.264	*Pest Uşşak*	*Uşşak*	*Tiz Uşşak*
1.250	**34: 384.906**	***Pest Segâh***	***Segâh***	***Tiz Segâh***
1.274	5: 418.868	*Pest Bûselik*	*Bûselik*	*Tiz Bûselik*
1.299	17: 452.830	*Pest Dikçe Bûselik*	*Dikçe Bûselik*	*Tiz Dikçe Bûselik*
1.316	29: 475.472	*Pest Dik Bûselik*	*Dik Bûselik*	*Tiz Dik Bûselik*
1.333	**41: 498.113**	***Pest Çârgâh***	***Çârgâh***	***Tiz Çârgâh***
1.360	12: 532.075	*Pest Niyaz*	*Niyaz*	*Tiz Niyaz*
1.388	24: 566.038	*Pest Dikçe Niyaz*	*Dikçe Niyaz*	*Tiz Dikçe Niyaz*
1.406	36: 588.679	*Pest Nim Hicaz*	*Nim Hicaz*	*Tiz Nim Hicaz*
1.434	7: 622.642	*Pest Hicaz*	*Hicaz*	*Tiz Hicaz*
1.463	19: 656.604	*Pest Dikçe Hicaz*	*Dikçe Hicaz*	*Tiz Dikçe Hicaz*
1.481	31: 679.245	*Pest Sabâ*	*Sabâ*	*Tiz Sabâ*
1.500	**2: 701.887**	***Yegâh***	***Nevâ***	***Tiz Nevâ***
1.530	14: 735.849	*Pest Gülzar*	*Gülzar*	*Tiz Gülzar*
1.560	26: 769.811	*Pest Dikçe Gülzar*	*Dikçe Gülzar*	*Tiz Dikçe Gülzar*
1.580	38: 792.453	*Pest Nim Hisar*	*Nim Hisar*	*Tiz Nim Hisar*
1.612	9: 826.415	*Pest Hisar*	*Hisar*	*Tiz Hisar*
1.644	21: 860.377	*Pest Dikçe Hisar*	*Dikçe Hisar*	*Tiz Dikçe Hisar*
1.666	33: 883.019	*Pest Hisârek*	*Hisârek*	*Tiz Hisârek*
1.688	**4: 905.660**	***Hüseynî Aşîran***	***Hüseynî***	***Tiz Hüseynî***
1.721	16: 939.623	*Pest Dilâviz*	*Dilâviz*	*Tiz Dilâviz*
1.755	28: 973.585	*Pest Dikçe Dilâviz*	*Dikçe Dilâviz*	*Tiz Dikçe Dilâviz*
1.778	**40: 996.226**	***Acem Aşîran***	***Acem***	***Tiz Acem***
1.814	11: 1030.189	*Sûzidil*	*Nevruz*	*Tiz Nevruz*
1.850	23: 1064.151	*Dikçe Sûzidil*	*Dikçe Nevruz*	*Tiz Dikçe Nevruz*
1.875	35: 1086.792	*Arak*	*Eviç*	*Tiz Eviç*
1.911	6: 1120.755	*Geveşt*	*Mâhur*	*Tiz Mâhur*
1.948	18: 1154.717	*Dikçe Geveşt*	*Dikçe Mâhur*	*Tiz Dikçe Mâhur*
1.974	30: 1177.358	*Dik Geveşt*	*Dik Mâhur*	*Tiz Dik Mâhur*
2.000	**42: 1200.000**	***Rast***	***Gerdâniye***	***Tiz Gerdâniye***

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 3 3 2 2 3 3 2 3 3 2 2 3 3 2 3 3 2 3 3 2 3 3 2 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:

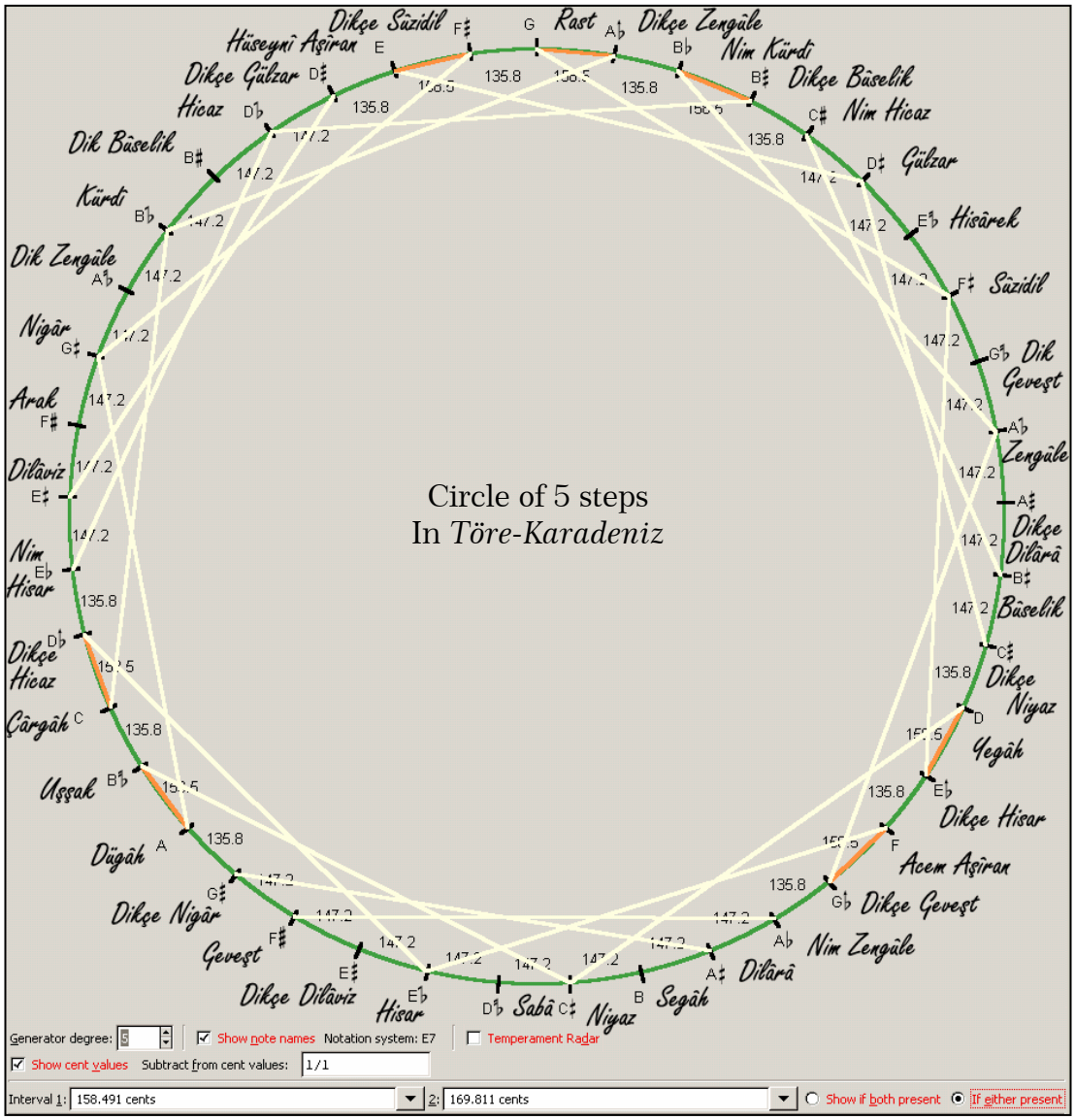

Figure 4.14: SCALA© Tone-Circle Showing 10 Instances of 2/3 Tones, 31 Instances of 3/4 Tones, and 20 Instances of 4/5 Tones in *Töre-Karadeniz*

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 *perde*s (*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 *tanbur*s in TRT [i] 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:

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[i] "Türkiye Radio Television" Institution.

Table 4.15: Comparison of Turkish Tunings in 106-EDO

106-EDO Degree & Cents	17-tone *Abjad*	*Yekta-24 & AEU*	*Oransay-29*	*Töre-Karadeniz*
-18: -203.774		**Kaba Çârgâh (C)**		**Pest Çârgâh (C)**
-17: -192.453				
-16: -181.132				
-15: -169.811				Pest Niyaz
-14: -158.491				
-13: -147.170				
-12: -135.849				Pest Dikçe Niyaz
-11: -124.528				
-10: -113.208		Kaba Nîm Hicâz		Pest Nim Hicaz
-9: -101.887				
-8: -90.566		Kaba Hicâz		
-7: -79.245				Pest Hicaz
-6: -67.925				
-5: -56.604				
-4: -45.283				Pest Dikçe Hicaz
-3: -33.962				
-2: -22.642		Kaba Dik Hicâz		Pest Sabâ
-1: -11.321				
0: 0.000	**Yegâh**	**Yegâh (D)**	**D**	**Yegâh(D)**
1: 11.321				
2: 22.642			*	
3: 33.962				Pest Gülzar
4: 45.283				
5: 56.604				
6: 67.925				Pest Dikçe Gülzar
7: 79.245				
8: 90.566	Pest Nim Hisar	Kaba Nîm Hisâr	Eb	Pest Nim Hisar
9: 101.887				
10: 113.208		Kaba Hisâr	*	
11: 124.528				Pest Hisar
12: 135.849				
13: 147.170				
14: 158.491				Pest Dikçe Hisar
15: 169.811				
16: 181.132	Pest Hisar	Kaba Dik Hisâr	*	Hisârek
17: 192.453				
18: 203.774	**Hüseyni Aşiran**	**Hüseynî Aşîrân (E)**	**E**	**Hüseynî Aşîran (E)**
19: 215.094				
20: 226.415				
21: 237.736				Pest Dilâviz
22: 249.057				
23: 260.377				
24: 271.698			*	Pest Dikçe Dilâviz
25: 283.019				
26: 294.340	Acem Aşiran	**Acem Aşîrân (F)**	**F**	**Acem Aşîran (F)**
27: 305.660				
28: 316.981		Dik Acem Aşîrân	*	
29: 328.302				Sûzidil
30: 339.623				
31: 350.943				

Table 4.15: Comparison of Turkish Tunings – Continued

106-EDO Degree	17-tone *Abjad*	*Yekta-24 & AEU*	*Oransay-29*	*Töre-Karadeniz*
32: 362.264				Dikçe Sûzidil
33: 373.585				
34: 384.906	**Arak**	**Irak (F#)**	F#	Arak
35: 396.226				
36: 407.547	Geveşt	Geveşt	*	
37: 418.868				Geveşt
38: 430.189				
39: 441.509				
40: 452.830				Dikçe Geveşt
41: 464.151				
42: 475.472		Dik Geveşt	*	Dik Geveşt
43: 486.792				
44: 498.113	**Rast**	**Râst (G)**	**G**	**Rast (G)**
45: 509.434				
46: 520.755			*	
47: 532.075				Nigâr
48: 543.396				
49: 554.717				
50: 566.038				Dikçe Nigâr
51: 577.358				
52: 588.679	Nim Zengule	Nîm Zirgûle	G#	Nim Zengûle
53: 600.000				
54: 611.321		Zirgûle	*	
55: 622.642				Zengûle
56: 633.962				
57: 645.283				
58: 656.604				Dikçe Zengûle
59: 667.925				
60: 679.245	Zengule	Dik Zirgûle	*	Dik Zengûle
61: 690.566				
62: 701.887	**Dügah**	**Dügâh (A)**	**A**	**Dügâh (A)**
63: 713.208				
64: 724.528			*	
65: 735.849				Dilârâ
66: 747.170				
67: 758.491				
68: 769.811				Dikçe Dilârâ
69: 781.132				
70: 792.453	Kürdi	Kürdî	Bb	Nim Kürdî
71: 803.774				
72: 815.094		Dik Kürdi	*	
73: 826.415				Kürdî
74: 837.736				
75: 849.057				
76: 860.377				Uşşak
77: 871.698				
78: 883.019	**Segah**	**Segâh (B)**	*	**Segâh (B)**
79: 894.340				
80: 905.660	Buselik	**Bûselik (B)**	**B**	Bûselik

Table 4.15: Comparison of Turkish Tunings in 106-EDO – Continued

106-EDO Degree	17-tone *Abjad*	*Yekta-24 & AEU*	*Oransay-29*	*Töre-Karadeniz*
81: 916.981				
82: 928.302			*	
83: 939.623				Dikçe Bûselik
84: 950.943				
85: 962.264				
86: 973.585		Dik Bûselik		Dik Bûselik
87: 984.906				
88: 996.226	**Çargah**	**Çârgâh (C)**	**C**	**Çârgâh (C)**
89: 1007.547				
90: 1018.868			*	
91: 1030.189				Niyaz
92: 1041.509				
93: 1052.830				
94: 1064.151				Dikçe Niyaz
95: 1075.472				
96: 1086.792	Nim Hicaz	Nîm Hicâz	C#	Nim Hicaz
97: 1098.113				
98: 1109.434		Hicâz	*	
99: 1120.755				Hicaz
100: 1132.075				
101: 1143.396				
102: 1154.717				Dikçe Hicaz
103: 1166.038				
104: 1177.358	Hicaz	Dik Hicâz	*	Sabâ
105: 1188.679				
106: 1200.000	**Neva**	**Nevâ (D)**	**D**	**Nevâ (D)**

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*s 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:

Figure 5.1: Picture of the 79-tone Turkish *qanun* manufactured by *Güleç & Sons*™

Instructions for implementing the 79-tone tuning were delivered by the author to *Güleç*, who laboriously affixed arrays of *mandal*s – i.e., metallic levers – underneath each course at locations designated by cent offsets input to a *Korg*™ type electronic tuner. A section of *mandal*s on the 79-tone *qanun* is shown in Figure 5.2:

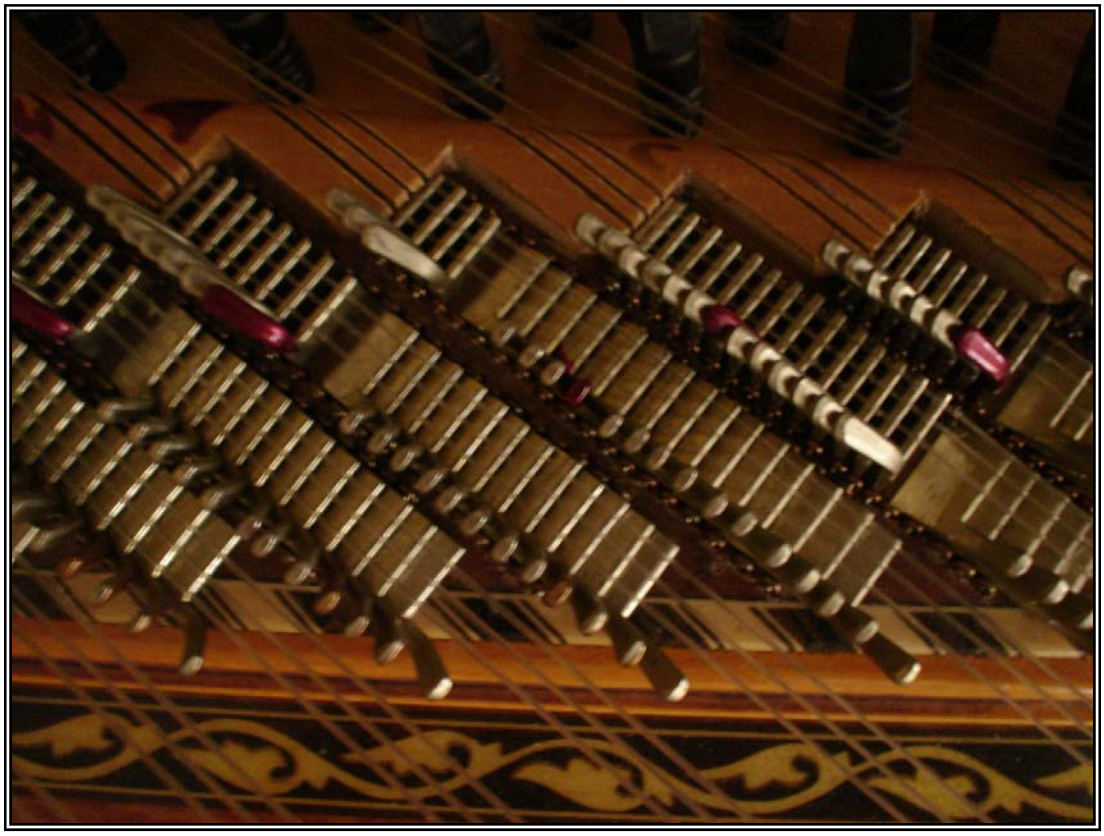

Figure 5.2: A Close-up of *mandal*s on the 79-tone *qanun*

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

Another unique feature of the 79-tone *qanun* is the addition, upon *Uğur 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:

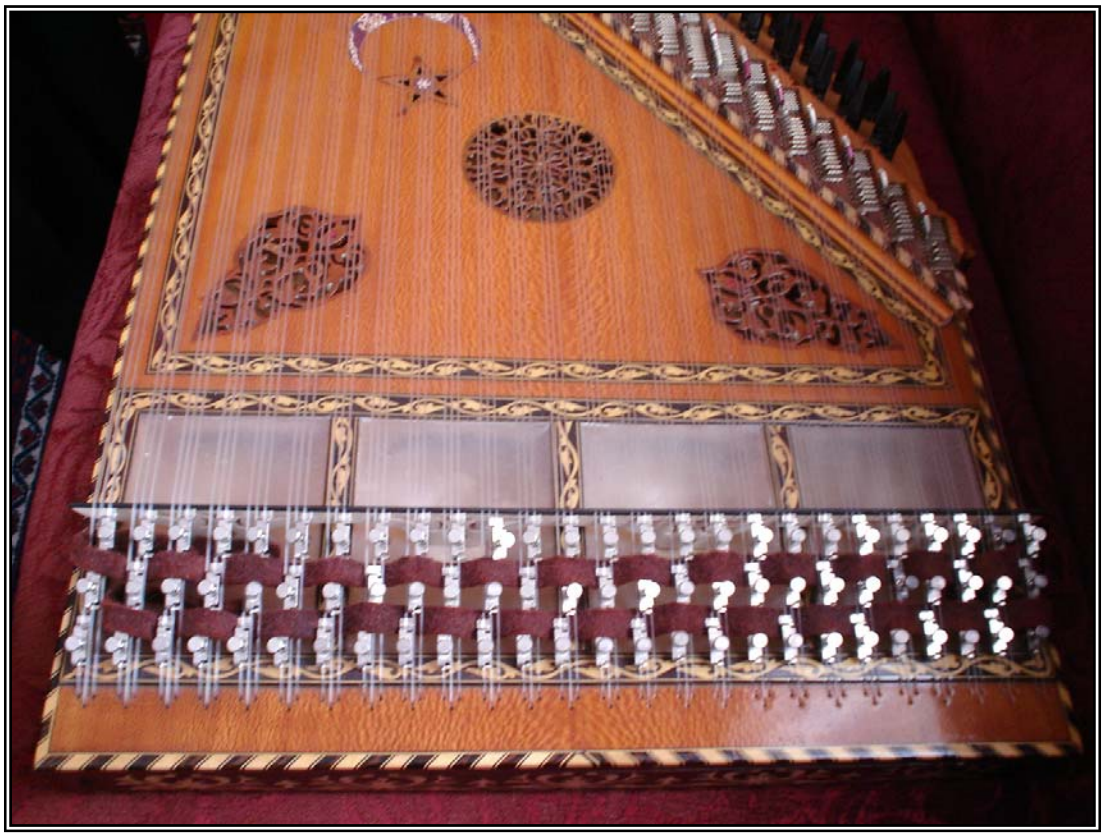

Figure 5.3: Picture of Fine-Tuners on the 79-tone *qanun*

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 tought 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 *perde*s 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 *perde*s 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 *mandal*s 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 equivalances) arriving at 72 or 84 equal divisions of the octave (a "derailléur" 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 pragmatical 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 cents}

2. Multiply the resultant comma 78 times,

   {15.0923 x 1 = 15.0923 cents
   15.0923 x 2 = 30.1845 cents
   15.0923 x 3 = 45.2768 cents
   etc…
   15.0923 x 78 = 1177.1973 cents}

3. Introduce an octave; a Holderian comma appears at the top,

{1200.0000 - 1177.1973 = 22.8027 cents}

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

{(15.0923 x 45) + 22.8027
= 679.1523 + 22.8027
= 701.955 cents
= [log_{10} (3:2) x 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 x 1) = 717.0473 cents
701.955 + (15.0923 x 2) = 732.1395 cents
701.955 + (15.0923 x 3) = 747.2318 cents
etc…
701.955 + (15.0923 x 33) = 1200.0000 cents}.

For 80 MOS 159-tET, simply add one extra fifth at [498.045 / 33] x 46 = 694.2445 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 3 2 2 2 2 2 2 2 2 2 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

Degree	Cents	159-tET	Difference	Approximated JI Ratios	*Perdes*
0:	**0.000**	**0**	**0.0000 ¢**	**1/1**	***Rast***
1:	15.092	2	0.0021 ¢	126/125,100/99,81/80	*Dik Rast*
2:	30.185	4	0.0041 ¢	64/63,3125/3072,55/54	*(Sarp Rast)*
3:	45.277	6	0.0062 ¢	128/125,36/35,33/32	*(Rast+irha)*
4:	60.369	8	0.0083 ¢	729/704,28/27,27/26	*(nerm Şuri)*
5:	75.461	10	0.0103 ¢	25/24,117/112,22/21	*Şuri*
6:	90.554	12	0.0124 ¢	20/19,256/243,135/128	*Nim Zengule*
7:	105.646	14	0.0145 ¢	17/16,16/15,2187/2048	*Zengule* cluster
8:	120.738	16	0.0165 ¢	15/14,14/13	
9:	135.830	18	0.0186 ¢	14/13,27/25,13/12	
10:	150.923	20	0.0207 ¢	88/81,12/11,35/32	
11:	166.015	22	0.0227 ¢	11/10,54/49	
12:	181.107	24	0.0248 ¢	65536/59049,10/9	*Zengule*
13:	**196.200**	**26**	**0.0269 ¢**	28/25,**9/8**	***Dügah***
14:	211.292	28	0.0289 ¢	9/8,26/23	*Dik Dügah*
15:	226.384	30	0.0310 ¢	256/225,8/7	*(Sarp Dügah)*
16:	241.476	32	0.0331 ¢	144/125	*Nim Kürdi*
17:	256.569	34	0.0351 ¢	37/32,81/70,125/108	*(Nim Nihavend)*
18:	271.661	36	0.0372 ¢	7/6	*Nerm Kürdi*
19:	286.753	38	0.0393 ¢	33/28,13/11,32/27	*Kürdi*
20:	301.845	40	0.0413 ¢	32/27,25/21,81/68	*Dik Kürdi*
21:	316.938	42	0.0434 ¢	6/5,19683/16384	*Nihavend*
22:	332.030	44	0.0455 ¢	63/52,40/33,17/14	*Hicazi Segah*
23:	347.122	46	0.0475 ¢	39/32,11/9,27/22	*Uşşaki Segah*
24:	362.215	48	0.0496 ¢	16/13,100/81,21/17	*Sabai Segah*
25:	377.307	50	0.0517 ¢	31/25,41/33,46/37,5/4	*Segahçe*
26:	**392.399**	**52**	**0.0537 ¢**	**5/4**,64/51,59/47	***Segah***
27:	407.491	54	0.0558 ¢	81/64,19/15,33/26	*Buselik*
28:	422.584	56	0.0579 ¢	14/11,23/18,32/25	*Nişabür*
29:	437.676	58	0.0599 ¢	9/7	*(Dik Nişabür)*
30:	452.768	60	0.0620 ¢	35/27,13/10	*(Buselik+irha)*
31:	467.860	62	0.0641 ¢	38/29,21/16	*(Nişabür+irha)*
32:	482.953	64	0.0661 ¢	33/25,37/28	*Nerm Çargah*
33:	**498.045**	**66**	**0.0682 ¢**	**4/3**	***Çargah***
34:	513.137	68	0.0703 ¢	39/29,35/26,27/20	*Dik Çargah*
35:	528.230	70	0.0723 ¢	19/14,49/36	*(Sarp Çargah)*
36:	543.322	72	0.0744 ¢	26/19,48/35,11/8	*Nim Hicaz*
37:	558.414	74	0.0765 ¢	11/8,29/21	*(Nim Saba)*
38:	573.506	76	0.0785 ¢	25/18,32/23,39/28	*Nerm Hicaz*
39:	588.599	78	0.0806 ¢	7/5,1024/729,45/32	*Hicaz*
40:	603.691	80	0.0827 ¢	24/17,17/12	*Uzzal*
41:	618.783	82	0.0847 ¢	10/7	*Saba*
42:	633.875	84	0.0868 ¢	23/16,36/25,49/34	*Saba* cluster
43:	648.968	86	0.0889 ¢	16/11,8192/5625,35/24	
44:	664.060	88	0.0909 ¢	22/15,69/47,72/49	
45:	679.152	90	0.0930 ¢	37/25,40/27	

Table 5.1: 79/80 MOS 159-tET – Continued

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

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.

*Perde*s 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 *perde*s 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 *perde*s 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/geveşt*,
7. *rast*,
8. *şuri*,
9. *zengule*,
10. *dügah*,
11. *kürdi/nihavend*,
12. *segah*,
13. *buselik*,
14. *çargah*,
15. *hicaz/uzzal*,
16. *saba*,
17. *neva*.

Table 5.2: Complete Range of Detailed Traditional *Perde*s in 79/80 MOS 159-tET

Degree	I. Octave *Perde*s	II. Octave *Perde*s	III. Octave *Perde*s
0:	***Pest Rast***	***Rast*** (7)	***Gerdaniye***
1:	*Pest Dik Rast*	*Dik Rast*	*Dik Gerdaniye*
5:	*Pest Şuri*	*Şuri* (8)	*Tiz Şuri*
6:	*Pest Nim Zengule*	*Nim Zengule*	*Nim Şehnaz*
7-11:	*Pest Zengule* cluster	*Zengule* cluster	*Şehnaz* cluster
12:	*Pest Zengule*	*Zengule* (9)	*Şehnaz*
13:	***Pest Dügah***	***Dügah*** (10)	***Muhayyer***
14:	*Pest Dik Dügah*	*Dik Dügah*	*Dik Muhayyer*
16:	*Pest Nim Kürdi*	*Nim Kürdi*	*Nim Sünbüle*
18:	*Pest Nerm Kürdi*	*Nerm Kürdi*	*Nerm Sünbüle*
19:	*Pest Kürdi*	*Kürdi* (11)	*Sünbüle*
20:	*Pest Dik Kürdi*	*Dik Kürdi*	*Dik Sünbüle*
21:	*Pest Nihavend*	*Nihavend*	*Sarp Sünbüle*
22:	*Pest Hicazi Segah*	*Hicazi Segah*	*Tiz Hicazi Segah*
23:	*Pest Uşşaki Segah*	*Uşşaki Segah*	*Tiz Uşşaki Segah*
24:	*Pest Sabai Segah*	*Sabai Segah*	*Tiz Sabai Segah*
25:	*Pest Segahçe*	*Segahçe*	*Tiz Segahçe*
26:	***Pest Segah***	***Segah*** (12)	***Tiz Segah***
27:	*Pest Buselik*	*Buselik* (13)	*Tiz Buselik*
28:	*Pest Nişabür*	*Nişabür*	*Tiz Nişabür*
32:	*Pest Nerm Çargah*	*Nerm Çargah*	*Tiz Nerm Çargah*
33:	***Pest Çargah***	***Çargah*** (14)	***Tiz Çargah***
34:	*Pest Dik Çargah*	*Dik Çargah*	*Tiz Dik Çargah*
36:	*Pest Nim Hicaz*	*Nim Hicaz*	*Tiz Nim Hicaz*
38:	*Pest Nerm Hicaz*	*Nerm Hicaz*	*Tiz Nerm Hicaz*
39:	*Pest Hicaz*	*Hicaz* (15)	*Tiz Hicaz*
40:	*Pest Uzzal*	*Uzzal*	*Tiz Uzzal*
41:	*Pest Saba*	*Saba* (16)	*Tiz Saba*
42-45:	*Pest Saba* cluster	*Saba* cluster	*Tiz Saba* cluster
46-47:	***Yegah*** (0)	***Neva*** (17)	***Tiz Neva***
48:	*Dik Yegah*	*Dik Neva*	*Tiz Dik Neva*
52:	*Pest Bayati* (1)	*Bayati*	*Bayati*
53:	*Pest Nim Hisar*	*Nim Hisar*	*Tiz Nim Hisar*
54-58:	*Pest Hisar/Hüzzam* cluster	*Hisar/Hüzzam* cluster	*Tiz Hisar/Hüz.* cluster
59:	*Pest Hisar(ek)* (2)	*Hisar(ek)*	*Tiz Hisar(ek)*
60:	***Aşiran*** (3)	***Hüseyni***	***Tiz Hüseyni***
61:	*Dik Aşiran*	*Dik Hüseyni*	*Tiz Dik Hüseyni*
63:	*Nim Acem Aşiran*	*Nim Acem*	*Tiz Nim Acem*
65:	*Nerm Acem Aşiran*	*Nerm Acem*	*Tiz Nerm Acem*
66:	*Acem Aşiran* (4)	*Acem*	*Tiz Acem*
67:	*Dik Acem Aşiran*	*Dik Acem*	*Tiz Dik Acem*
68:	*Sarp Acem Aşiran*	*Sarp Acem*	*Tiz Sarp Acem*
69-71:	*Arak* cluster	*Evc* cluster	*Tiz Evc* cluster
72:	*Nerm Arak*	*Nerm Evc*	*Tiz Nerm Evc*
73:	***Arak*** (5)	***Evc***	***Tiz Evc***
74:	*Rehavi* (6)	*Mahur*	*Tiz Mahur*
75:	*Geveşt*	*Dik Mahur*	*Tiz Dik Mahur*
79:	*Nerm Rast*	*Nerm Gerdaniye*	*Tiz Nerm Gerdaniye*
80:	***Rast*** (7)	***Gerdaniye***	***Tiz Gerdaniye***

The SCALA© [i] "*Farey* rational approximation" command for 79/80 MOS 159-tET based on "minimax interval difference" [ii] yields a subset of 1006-ADO [iii] as shown in Table 5.3:

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

Degree	79/80 MOS 159-tET	1006-ADO	Cents	Difference	Consecutive Intervals
0:	**0.000**	**1/1**	**0.000**	**0.000 ¢**	(with previous)
1:	15.094	1015/1006	15.419	-0.325 ¢	15.419 ¢
2:	30.189	1024/1006	30.702	-0.513 ¢	15.283 ¢
3:	45.283	1033/1006	45.852	-0.569 ¢	15.150 ¢
4:	60.377	1042/1006	60.870	-0.493 ¢	15.018 ¢
5:	75.472	1051/1006	75.759	-0.287 ¢	14.889 ¢
6:	90.566	1060/1006	90.521	0.045 ¢	14.762 ¢
7:	105.660	1069/1006	105.158	0.502 ¢	14.637 ¢
8:	120.755	1079/1006	121.277	-0.522 ¢	16.119 ¢
9:	135.849	1088/1006	135.658	0.191 ¢	14.381 ¢
10:	150.943	1098/1006	151.497	-0.554 ¢	15.839 ¢
11:	166.038	1107/1006	165.630	0.408 ¢	14.133 ¢
12:	181.132	1117/1006	181.199	-0.067 ¢	15.569 ¢
13:	**196.226**	**1127/1006**	**196.629**	**-0.403 ¢**	15.430 ¢
14:	211.321	1137/1006	211.922	-0.601 ¢	15.293 ¢
15:	226.415	1147/1006	227.082	-0.667 ¢	15.160 ¢
16:	241.509	1157/1006	242.110	-0.601 ¢	15.028 ¢
17:	256.604	1167/1006	257.009	-0.405 ¢	14.899 ¢
18:	271.698	1177/1006	271.781	-0.083 ¢	14.772 ¢
19:	286.792	1187/1006	286.428	0.364 ¢	14.647 ¢
20:	301.887	1198/1006	302.397	-0.510 ¢	15.969 ¢
21:	316.981	1208/1006	316.788	0.193 ¢	14.391 ¢
22:	332.075	1219/1006	332.481	-0.406 ¢	15.693 ¢
23:	347.170	1229/1006	346.626	0.544 ¢	14.145 ¢
24:	362.264	1240/1006	362.052	0.212 ¢	15.426 ¢
25:	377.358	1251/1006	377.342	0.016 ¢	15.290 ¢
26:	**392.453**	**1262/1006**	**392.498**	**-0.045 ¢**	15.156 ¢
27:	407.547	1273/1006	407.523	0.024 ¢	15.025 ¢
28:	422.642	1284/1006	422.418	0.224 ¢	14.895 ¢
29:	437.736	1295/1006	437.186	0.550 ¢	14.768 ¢
30:	452.830	1307/1006	453.155	-0.325 ¢	15.969 ¢

[i] See footnote to the first page of APPENDIX B.

[ii] 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.

[iii] 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

Degree	79/80 MOS 159-tET	1006-ADO	Cents	Difference	Consecutive Intervals
31:	467.925	1318/1006	467.664	0.261 ¢	14.509 ¢
32:	483.019	1330/1006	483.355	-0.336 ¢	15.691 ¢
33:	**498.113**	**1341/1006**	**497.615**	**0.498 ¢**	14.260 ¢
34:	513.208	1353/1006	513.038	0.170 ¢	15.423 ¢
35:	528.302	1365/1006	528.325	-0.023 ¢	15.287 ¢
36:	543.396	1377/1006	543.478	-0.082 ¢	15.153 ¢
37:	558.491	1389/1006	558.500	-0.009 ¢	15.022 ¢
38:	573.585	1401/1006	573.392	0.193 ¢	14.892 ¢
39:	588.679	1413/1006	588.157	0.522 ¢	14.765 ¢
40:	603.774	1426/1006	604.012	-0.238 ¢	15.855 ¢
41:	618.868	1438/1006	618.520	0.348 ¢	14.508 ¢
42:	633.962	1451/1006	634.101	-0.139 ¢	15.581 ¢
43:	649.057	1464/1006	649.542	-0.485 ¢	15.441 ¢
44:	664.151	1476/1006	663.675	0.476 ¢	14.133 ¢
45:	679.245	1489/1006	678.856	0.389 ¢	15.181 ¢
46:	**694.340**	**1503/1006**	**695.058**	**-0.718 ¢**	16.202 ¢
47:	**701.887**	**1509/1006**	**701.955**	**-0.068 ¢**	6.897 ¢
48:	716.981	1522/1006	716.806	0.175 ¢	14.851 ¢
49:	732.075	1536/1006	732.657	-0.582 ¢	15.851 ¢
50:	747.170	1549/1006	747.248	-0.078 ¢	14.591 ¢
51:	762.264	1563/1006	762.825	-0.561 ¢	15.577 ¢
52:	777.358	1576/1006	777.165	0.193 ¢	14.340 ¢
53:	792.453	1590/1006	792.476	-0.023 ¢	15.311 ¢
54:	807.547	1604/1006	807.653	-0.106 ¢	15.177 ¢
55:	822.642	1618/1006	822.698	-0.056 ¢	15.045 ¢
56:	837.736	1632/1006	837.613	0.123 ¢	14.915 ¢
57:	852.830	1646/1006	852.401	0.429 ¢	14.788 ¢
58:	867.925	1661/1006	868.106	-0.181 ¢	15.705 ¢
59:	883.019	1675/1006	882.637	0.382 ¢	14.531 ¢
60:	**898.113**	**1690/1006**	**898.072**	**0.041 ¢**	15.435 ¢
61:	913.208	1705/1006	913.370	-0.162 ¢	15.298 ¢
62:	928.302	1720/1006	928.534	-0.232 ¢	15.164 ¢
63:	943.396	1735/1006	943.566	-0.170 ¢	15.032 ¢
64:	958.491	1750/1006	958.470	0.021 ¢	14.904 ¢
65:	973.585	1765/1006	973.245	0.340 ¢	14.775 ¢
66:	988.679	1781/1006	988.869	-0.190 ¢	15.624 ¢
67:	1003.774	1796/1006	1003.388	0.386 ¢	14.519 ¢
68:	1018.868	1812/1006	1018.743	0.125 ¢	15.355 ¢
69:	1033.962	1828/1006	1033.963	-0.001 ¢	15.220 ¢
70:	1049.057	1844/1006	1049.050	0.007 ¢	15.087 ¢
71:	1064.151	1860/1006	1064.007	0.144 ¢	14.957 ¢
72:	1079.245	1876/1006	1078.835	0.410 ¢	14.828 ¢
73:	**1094.340**	**1893/1006**	**1094.453**	**-0.113 ¢**	15.618 ¢
74:	1109.434	1909/1006	1109.024	0.410 ¢	14.571 ¢
75:	1124.528	1926/1006	1124.373	0.155 ¢	15.349 ¢
76:	1139.623	1943/1006	1139.587	0.036 ¢	15.214 ¢
77:	1154.717	1960/1006	1154.668	0.049 ¢	15.081 ¢
78:	1169.811	1977/1006	1169.619	0.192 ¢	14.951 ¢
79:	1184.906	1995/1006	1185.310	-0.404 ¢	15.691 ¢
80:	**1200.000**	**2/1**	**1200.000**	**0.000 ¢**	14.690 ¢

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,

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

in the manner,

AB
AB AB AAB

AB AB AAB
AB AB

AB AB AAB
AB AB

AB AB AAB
AB AB

AB AB AAB
AB AB

AB AB AAB
AB AB

AB AB AAB
AB A

where,

(A*46)+(B*33) =
32289.93004 + 22910.09156 =
55200.0216 cents =
46 x 1200.00047 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 (occuring seventy-nine times) and 22.8021 cents (occuring 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

Degree	79/80 MOS 159-tET	Simple Frequencies	Cents	Difference	Consecutive Intervals	Fifth Beat Rates (*hz*)
0:	**0.000**	262 *hz* (C_4)	**0.000**	0.000 ¢	0.000 ¢	0
1:	15.094	264.5 *hz*	16.441	-1.347 ¢	16.441 ¢	-0.5
2:	30.189	266.75 *hz*	31.106	-0.917 ¢	14.665 ¢	-0.25
3:	45.283	269 *hz*	45.647	-0.364 ¢	14.541 ¢	0
4:	60.377	271.25 *hz*	60.068	0.309 ¢	14.420 ¢	0.25
5:	75.472	273.75 *hz*	75.951	-0.479 ¢	15.883 ¢	-0.25
6:	90.566	276.25 *hz*	91.689	-1.123 ¢	15.739 ¢	-0.75
7:	105.660	278.5 *hz*	105.733	-0.073 ¢	14.043 ¢	0
8:	120.755	281 *hz*	121.204	-0.449 ¢	15.471 ¢	-0.5
9:	135.849	283.5 *hz*	136.538	-0.689 ¢	15.334 ¢	-0.5
10:	150.943	286 *hz*	151.738	-0.795 ¢	15.200 ¢	-0.5
11:	166.038	288.5 *hz*	166.805	-0.767 ¢	15.067 ¢	-0.5
12:	181.132	291 *hz*	181.743	-0.611 ¢	14.937 ¢	-0.5
13:	**196.226**	293.5 *hz*	**196.552**	-0.326 ¢	14.810 ¢	-0.5
14:	211.321	296 *hz*	211.236	0.085 ¢	14.684 ¢	0
15:	226.415	298.75 *hz*	227.246	-0.831 ¢	16.010 ¢	-0.75
16:	241.509	301.25 *hz*	241.673	-0.164 ¢	14.427 ¢	0.25
17:	256.604	304 *hz*	257.405	-0.801 ¢	15.732 ¢	0
18:	271.698	306.5 *hz*	271.584	0.114 ¢	14.179 ¢	0
19:	286.792	309.25 *hz*	287.048	-0.256 ¢	15.464 ¢	-0.25
20:	301.887	312 *hz*	302.375	-0.488 ¢	15.327 ¢	-0.4444444
21:	316.981	314.75 *hz*	317.567	-0.586 ¢	15.192 ¢	-0.25
22:	332.075	317.5 *hz*	332.628	-0.553 ¢	15.060 ¢	-0.5
23:	347.170	320.25 *hz*	347.558	-0.388 ¢	14.930 ¢	-0.25
24:	362.264	323 *hz*	362.361	-0.097 ¢	14.803 ¢	0
25:	377.358	326 *hz*	378.366	-1.008 ¢	16.005 ¢	-0.5
26:	**392.453**	328.75 *hz*	**392.909**	-0.456 ¢	14.543 ¢	-0.75
27:	407.547	331.75 *hz*	408.636	-1.089 ¢	15.727 ¢	-0.75
28:	422.642	334.5 *hz*	422.927	-0.285 ¢	14.292 ¢	-0.5
29:	437.736	337.5 *hz*	438.385	-0.649 ¢	15.458 ¢	-0.5
30:	452.830	340.5 *hz*	453.706	-0.876 ¢	15.321 ¢	-1
31:	467.925	343.5 *hz*	468.892	-0.967 ¢	15.186 ¢	-1
32:	483.019	346.5 *hz*	483.946	-0.927 ¢	15.054 ¢	-1
33:	**498.113**	349.3333 *hz*	**498.045**	0.068 ¢	14.099 ¢	0
34:	513.208	352.5 *hz*	513.668	0.460 ¢	15.623 ¢	-0.5
35:	528.302	355.5 *hz*	528.339	0.037 ¢	14.671 ¢	-0.5
36:	543.396	358.75 *hz*	544.094	-0.698 ¢	15.755 ¢	-0.25
37:	558.491	361.75 *hz*	558.511	-0.020 ¢	14.417 ¢	-0.25
38:	573.585	365 *hz*	573.996	-0.411 ¢	15.484 ¢	0
39:	588.679	368.25 *hz*	589.342	-0.663 ¢	15.347 ¢	0.25
40:	603.774	371.25 *hz*	603.389	0.385 ¢	14.047 ¢	0.25
41:	618.868	374.75 *hz*	619.634	-0.766 ¢	16.245 ¢	-0.25
42:	633.962	378 *hz*	634.583	-0.621 ¢	14.949 ¢	0
43:	649.057	381.25 *hz*	649.405	-0.348 ¢	14.821 ¢	0.25
44:	664.151	384.75 *hz*	665.225	-1.074 ¢	15.821 ¢	-0.25
45:	679.245	388 *hz*	679.788	-0.543 ¢	14.562 ¢	0
46:	**694.340**	391.3333 *hz*	**694.597**	-0.257 ¢	14.810 ¢	0
47:	**701.887**	393 *hz*	**701.955**	-0.068 ¢	7.358 ¢	-5
48:	716.981	396.5 *hz*	717.305	-0.324 ¢	15.350 ¢	-5.5
49:	732.075	400 *hz*	732.520	-0.445 ¢	15.215 ¢	-5

Table 5.4: Simple Frequencies Approximation to 79/80 MOS 159-tET – Continued

Degree	79/80 MOS 159-tET	Simple Frequencies	Cents	Difference	Consecutive Intervals	Fifth Beat Rates (*hz*)
50:	747.170	403.5 *hz*	747.602	-0.432 ¢	15.082 ¢	-5.5
51:	762.264	407 *hz*	762.554	-0.290 ¢	14.952 ¢	-5
52:	777.358	410.5 *hz*	777.378	-0.020 ¢	14.824 ¢	-5.5
53:	792.453	414 *hz*	792.077	0.376 ¢	14.698 ¢	-5
54:	807.547	417.75 *hz*	807.688	-0.141 ¢	15.611 ¢	-5.25
55:	822.642	421.25 *hz*	822.132	0.510 ¢	14.444 ¢	-4.75
56:	837.736	425 *hz*	837.475	0.261 ¢	15.343 ¢	-5
57:	852.830	428.75 *hz*	852.684	0.146 ¢	15.209 ¢	-5.25
58:	867.925	432.5 *hz*	867.760	0.165 ¢	15.076 ¢	-5.5
59:	883.019	436.25 *hz*	882.706	0.313 ¢	14.946 ¢	-4.75
60:	**898.113**	440 *hz* (A_4)	**897.524**	0.589 ¢	14.818 ¢	-5
61:	913.208	444 *hz*	913.191	0.017 ¢	15.667 ¢	-5
62:	928.302	447.75 *hz*	927.752	0.550 ¢	14.561 ¢	-5.25
63:	943.396	452 *hz*	944.107	-0.711 ¢	16.355 ¢	-6
64:	958.491	456 *hz*	959.360	-0.869 ¢	15.253 ¢	-6
65:	973.585	459.75 *hz*	973.539	0.046 ¢	14.179 ¢	-5.25
66:	988.679	463.75 *hz*	988.537	0.142 ¢	14.997 ¢	-5.25
67:	1003.774	467.7778 *hz*	1003.508	0.266 ¢	14.971 ¢	-6
68:	1018.868	472 *hz*	1019.064	-0.196 ¢	15.556 ¢	-6
69:	1033.962	476 *hz*	1033.674	0.288 ¢	14.610 ¢	-6
70:	1049.057	480.25 *hz*	1049.063	-0.006 ¢	15.389 ¢	-5.75
71:	1064.151	484.5 *hz*	1064.316	-0.165 ¢	15.253 ¢	-6.5
72:	1079.245	488.75 *hz*	1079.436	-0.191 ¢	15.120 ¢	-6.25
73:	**1094.340**	492.75 *hz*	**1093.547**	0.793 ¢	14.111 ¢	-5.25
74:	1109.434	497.25 *hz*	1109.285	0.149 ¢	15.739 ¢	-6.75
75:	1124.528	501.5 *hz*	1124.019	0.509 ¢	14.734 ¢	-5.5
76:	1139.623	506 *hz*	1139.485	0.138 ¢	15.465 ¢	-6
77:	1154.717	510.25 *hz*	1153.965	0.752 ¢	14.480 ¢	-5.75
78:	1169.811	514.75 *hz*	1169.166	0.645 ¢	15.201 ¢	-5.25
79:	1184.906	519.25 *hz*	1184.235	0.671 ¢	15.069 ¢	-5.75
80:	**1200.000**	524 *hz*	**1200.000**	0.000 ¢	15.765 ¢	0

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

Degree	33 Equal Pure Fourth	159-EDO Subset	1006-ADO Approximation	19/53 Comma Temperament	Simple Frequencies
0:	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
1:	15.092	15.094	15.419	15.092	16.441
2:	30.185	30.189	30.702	30.185	31.106
3:	45.277	45.283	45.852	45.277	45.647
4:	60.369	60.377	60.870	60.369	60.068
5:	75.461	75.472	75.759	75.461	75.951
6:	90.554	90.566	90.521	90.554	91.689
7:	105.646	105.660	105.158	105.646	105.733
8:	120.738	120.755	121.277	120.738	121.204
9:	135.830	135.849	135.658	135.831	136.538
10:	150.923	150.943	151.497	150.923	151.738
11:	166.015	166.038	165.630	166.015	166.805
12:	181.107	181.132	181.199	181.107	181.743
13:	**196.200**	**196.226**	**196.629**	**196.200**	**196.552**
14:	211.292	211.321	211.922	211.292	211.236
15:	226.384	226.415	227.082	226.384	227.246
16:	241.476	241.509	242.110	241.477	241.673
17:	256.569	256.604	257.009	256.569	257.405
18:	271.661	271.698	271.781	271.661	271.584
19:	286.753	286.792	286.428	286.753	287.048
20:	301.845	301.887	302.397	301.846	302.375
21:	316.938	316.981	316.788	316.938	317.567
22:	332.030	332.075	332.481	332.030	332.628
23:	347.122	347.170	346.626	347.123	347.558
24:	362.215	362.264	362.052	362.215	362.361
25:	377.307	377.358	377.342	377.307	378.366
26:	**392.399**	**392.453**	**392.498**	**392.399**	**392.909**
27:	407.491	407.547	407.523	407.492	408.636
28:	422.584	422.642	422.418	422.584	422.927
29:	437.676	437.736	437.186	437.676	438.385
30:	452.768	452.830	453.155	452.769	453.706
31:	467.860	467.925	467.664	467.861	468.892
32:	482.953	483.019	483.355	482.953	483.946
33:	**498.045**	**498.113**	**497.615**	**498.045**	**498.045**
34:	513.137	513.208	513.038	513.138	513.668
35:	528.230	528.302	528.325	528.230	528.339
36:	543.322	543.396	543.478	543.322	544.094
37:	558.414	558.491	558.500	558.415	558.511
38:	573.506	573.585	573.392	573.507	573.996
39:	588.599	588.679	588.157	588.599	589.342
40:	603.691	603.774	604.012	603.691	603.389
41:	618.783	618.868	618.520	618.784	619.634
42:	633.875	633.962	634.101	633.876	634.583
43:	648.968	649.057	649.542	648.968	649.405
44:	664.060	664.151	663.675	664.061	665.225
45:	679.152	679.245	678.856	679.153	679.788
46:	**694.245**	**694.340**	**695.058**	**694.245**	**694.597**
47:	**701.955**	**701.887**	**701.955**	**701.955**	**701.955**
48:	717.047	716.981	716.806	717.047	717.305
49:	732.140	732.075	732.657	732.140	732.520

Table 5.5: Comparing Several Versions of 79/80 MOS 159-tET – Continued

Degree	33 Equal Pure Fourth	159-EDO subset	1006-ADO Approximation	19/53 Comma Temperament	Simple Frequencies
50:	747.232	747.170	747.248	747.232	747.602
51:	762.324	762.264	762.825	762.324	762.554
52:	777.416	777.358	777.165	777.416	777.378
53:	792.509	792.453	792.476	792.509	792.077
54:	807.601	807.547	807.653	807.601	807.688
55:	822.693	822.642	822.698	822.693	822.132
56:	837.785	837.736	837.613	837.786	837.475
57:	852.878	852.830	852.401	852.878	852.684
58:	867.970	867.925	868.106	867.970	867.760
59:	883.062	883.019	882.637	883.062	882.706
60:	**898.155**	**898.113**	**898.072**	**898.155**	**897.524**
61:	913.247	913.208	913.370	913.247	913.191
62:	928.339	928.302	928.534	928.339	927.752
63:	943.431	943.396	943.566	943.432	944.107
64:	958.524	958.491	958.470	958.524	959.360
65:	973.616	973.585	973.245	973.616	973.539
66:	988.708	988.679	988.869	988.708	988.537
67:	1003.800	1003.774	1003.388	1003.801	1003.508
68:	1018.893	1018.868	1018.743	1018.893	1019.064
69:	1033.985	1033.962	1033.963	1033.985	1033.674
70:	1049.077	1049.057	1049.050	1049.078	1049.063
71:	1064.170	1064.151	1064.007	1064.170	1064.316
72:	1079.262	1079.245	1078.835	1079.262	1079.436
73:	**1094.354**	**1094.340**	**1094.453**	**1094.354**	**1093.547**
74:	1109.446	1109.434	1109.024	1109.447	1109.285
75:	1124.539	1124.528	1124.373	1124.539	1124.019
76:	1139.631	1139.623	1139.587	1139.631	1139.485
77:	1154.723	1154.717	1154.668	1154.724	1153.965
78:	1169.815	1169.811	1169.619	1169.816	1169.166
79:	1184.908	1184.906	1185.310	1184.908	1184.235
80:	**1200.000**	**1200.000**	**1200.000**	**1200.000**	**1200.000**

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 [i] of a slightly modified Sagittal Notation® [ii] delineating the whole tone sector of 79/80 MOS 159-tET is shown in Figure 5.4:

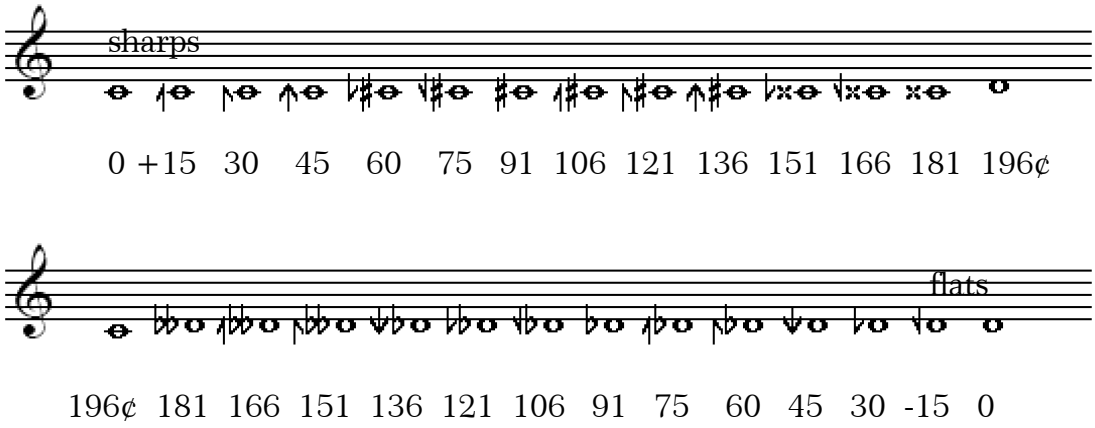

Figure 5.4: Sagittal Notation® of the Whole Tone Sector of 79/80 MOS 159-tET

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:

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[i] *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.

[ii] The modification involves the replacement of the "arcs" 𝄐 & 𝄑 (septimal or 7-comma, nominally at 64:63 and equalling 27.264 cents) with the "barbs" 𝄎 & 𝄏 (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 𐑅 & 𐑆 dubbed “left-barb” (so-called Didymus’ Dibbler; ASCII codes [i]: /| & \!).

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 𐑄 & 𐑇 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: 𐑅 + 𐑄 = ↑.

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[i] 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:

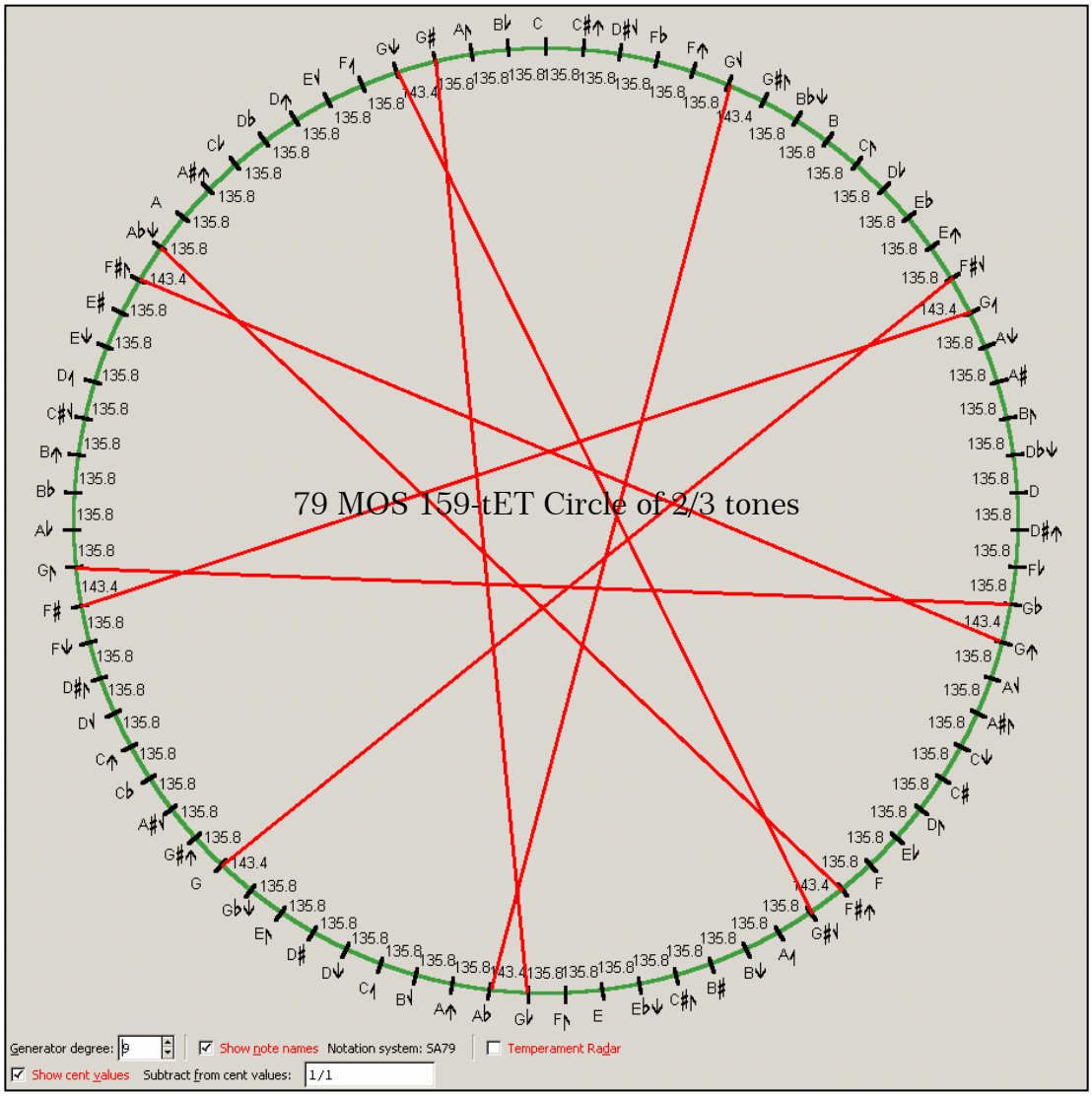

Figure 5.5: Tone-Circle of 2/3 Tones in 79 MOS 159-tET

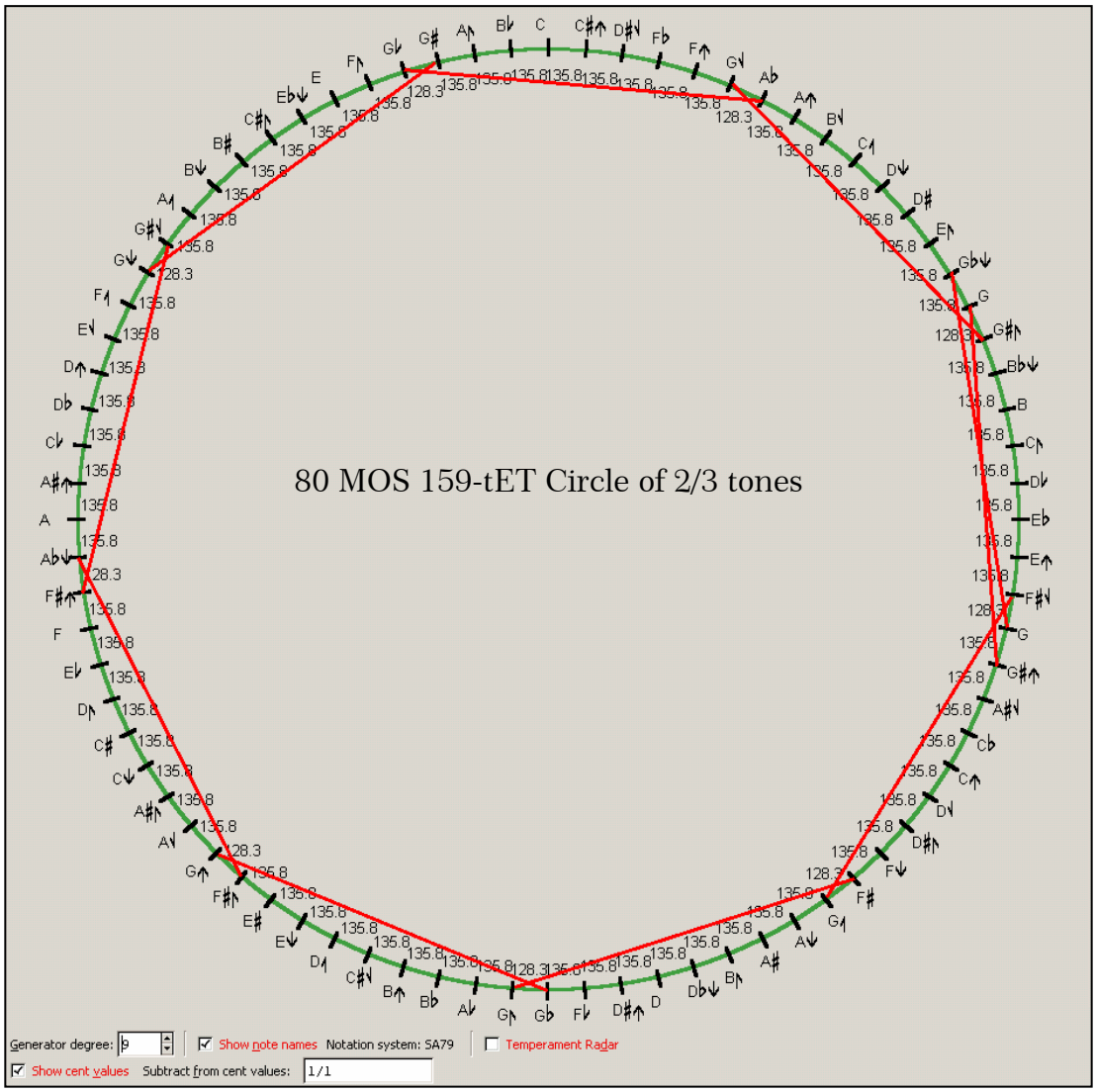

Figure 5.6: Tone-Circle of 2/3 Tones in 80 MOS 159-tET

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:

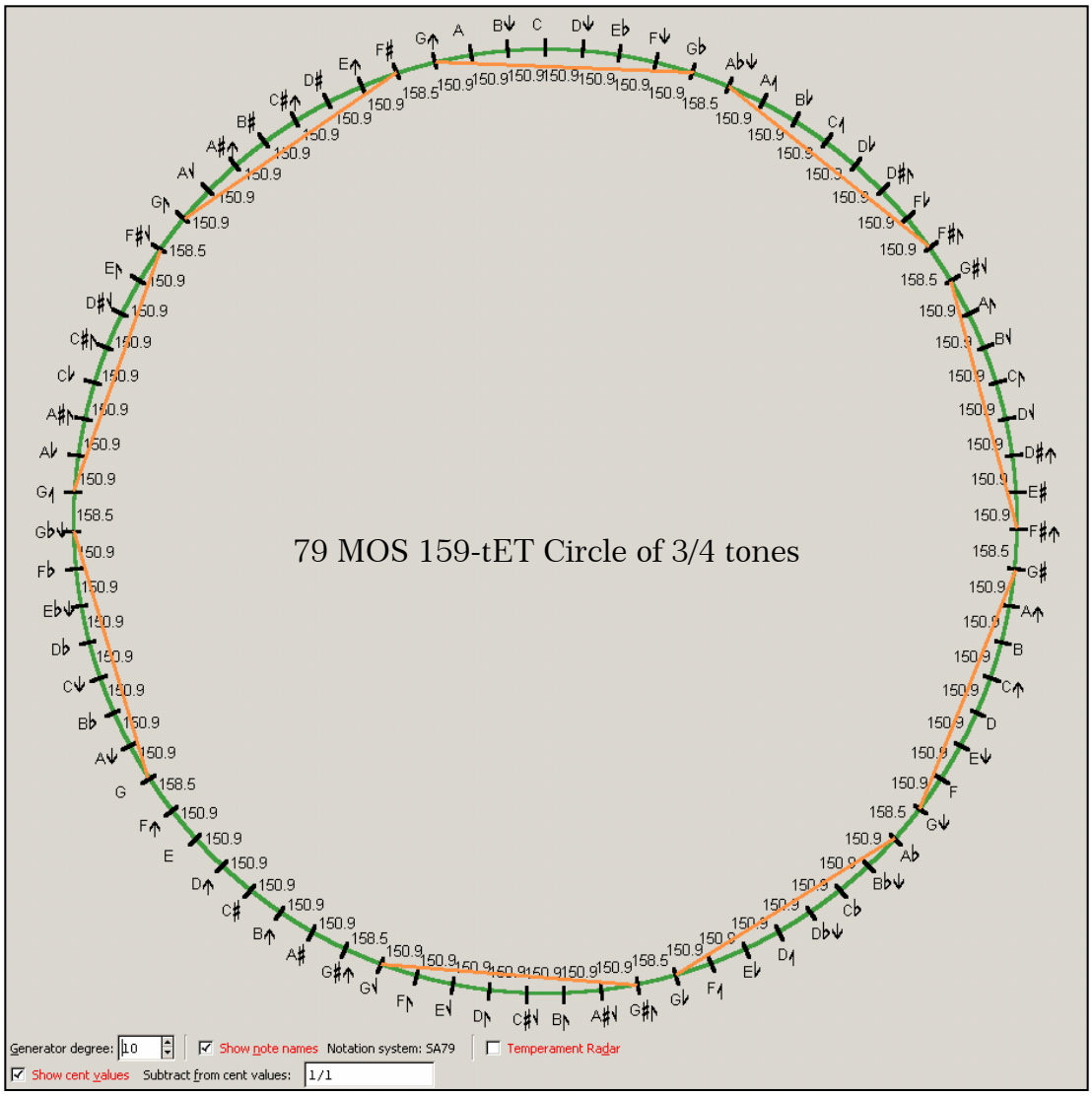

Figure 5.7: Tone-Circle of 3/4 Tones in 79 MOS 159-tET

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:

Figure 5.8: Tone Circle of Minor 3rds Showing Neutral Seconds in 80 MOS 159-tET

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:

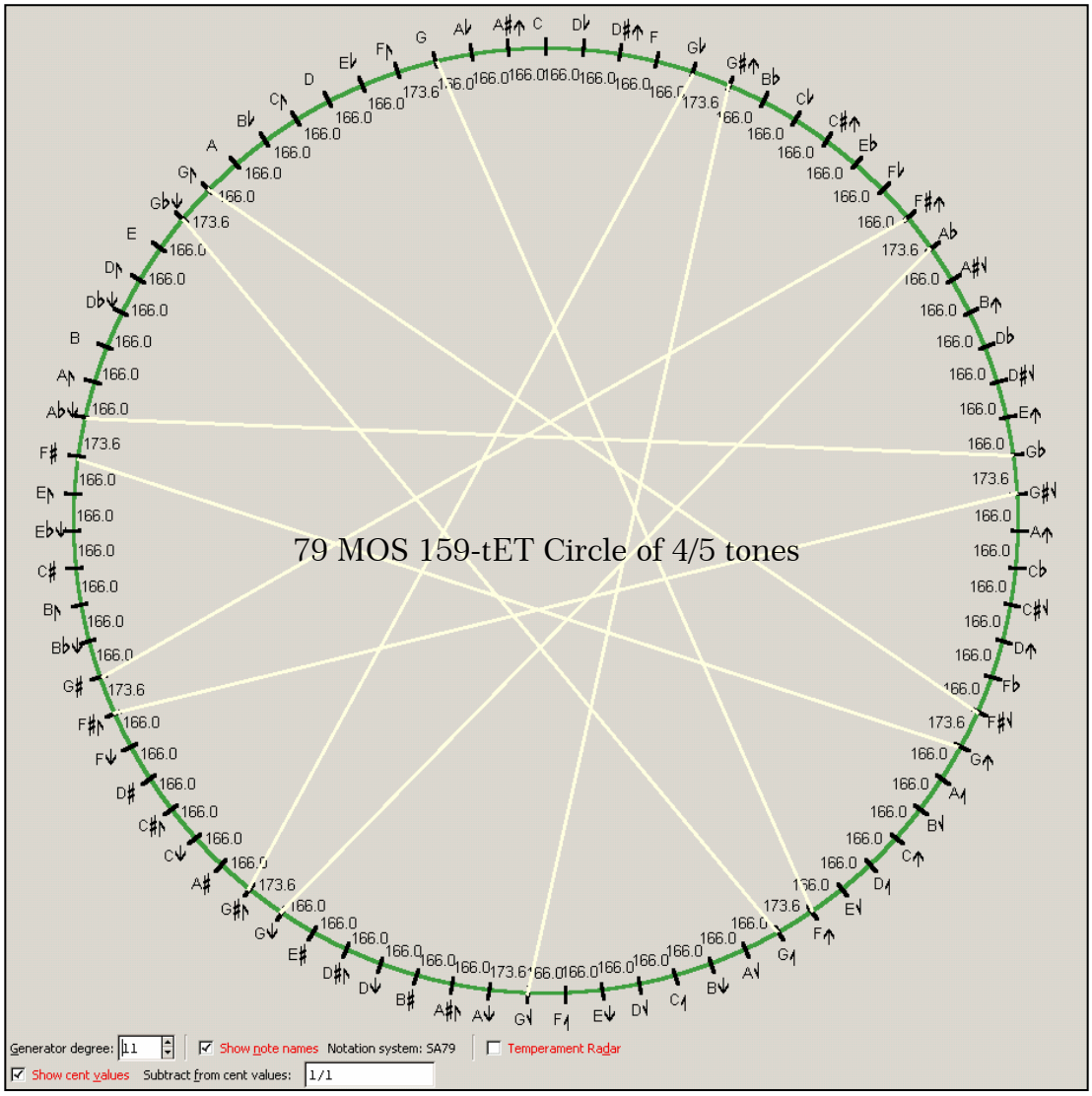

Figure 5.9: Tone-Circle of 4/5 Tones in 79 MOS 159-tET

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:

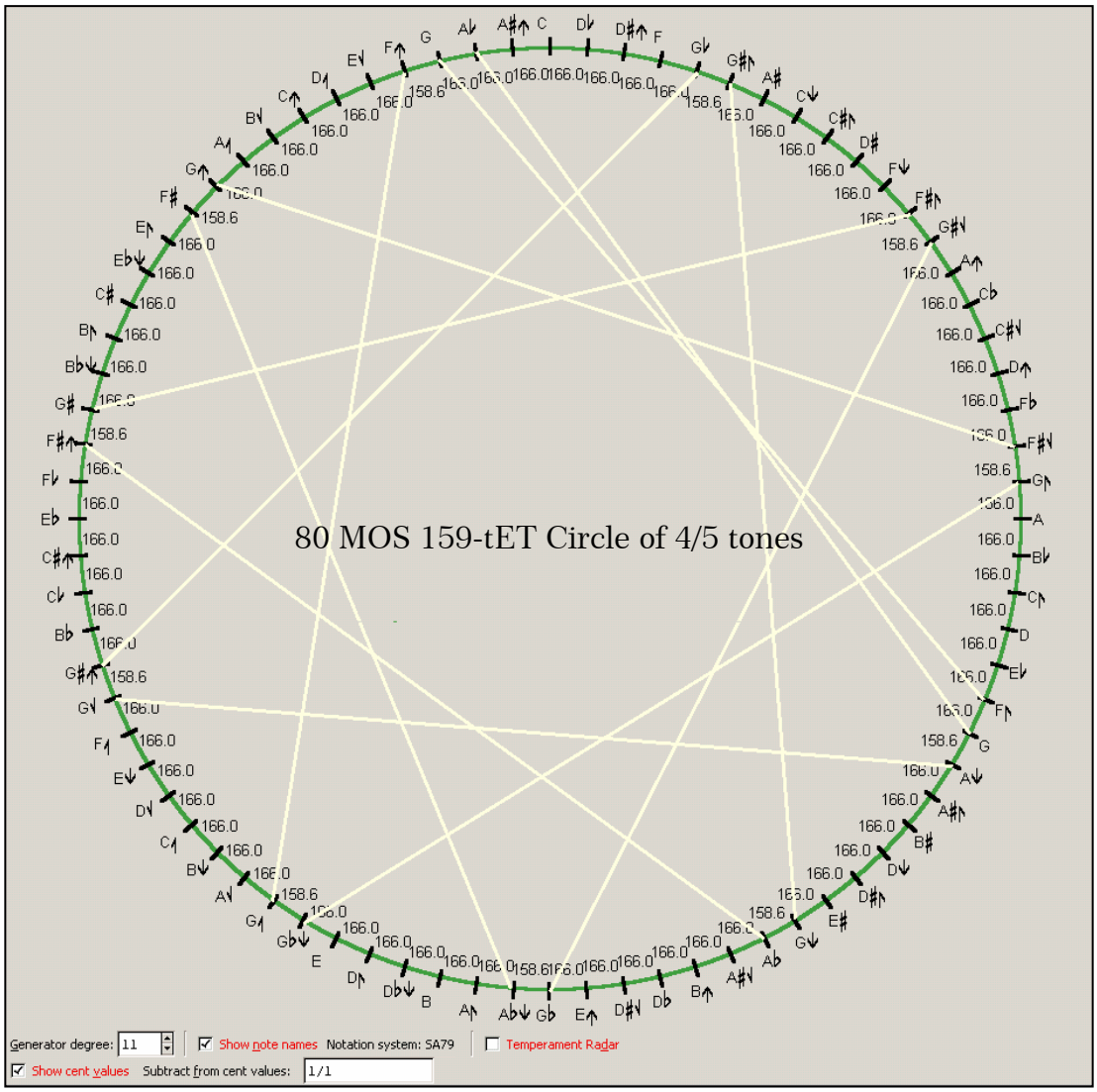

Figure 5.10: Tone-Circle of 4/5 Tones in 80 MOS 159-tET

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 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.

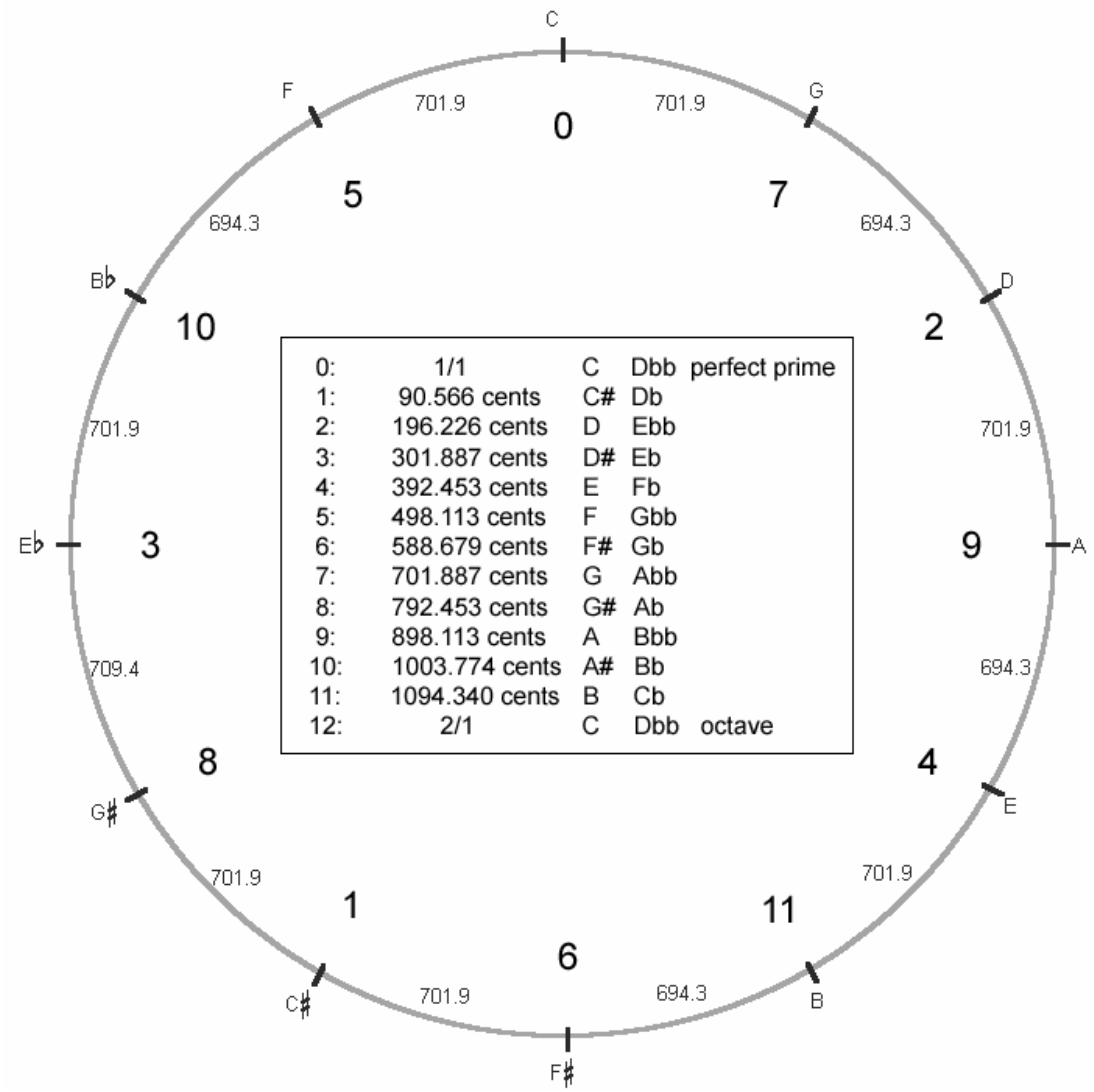

Figure 5.11: Twelve-tone Circle out of 79 MOS 159-tET

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 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

	C	C#	D	Eb	E	F	F#	G	G#	A	Bb	B
3/2	0	0	0	0	0	0	0	-8	-7	-8	-8	-8
5/4	6	21	6	14	14	14	29	6	21	6	6	21
6/5	-14	-14	-14	-29	-6	-21	-6	-14	-14	-14	-29	-14

Having provided some hints on transposition, it is now possible to begin formulating a new 79-tone theory for Turkish *Maqam* Music.

5.3. 79-tone Maqam Theory: A Trial

The author of this dissertation maintains that any attempt to overhaul the entire established theory of *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 *maqam* theory can be presented at this juncture.

As such, only a handful of *maqam*s 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 *seyir* [i] and *tavır* [ii].

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 *Maqam* Music.

In dealing with scale complexity, selected *maqam*s shall be divided into two branches titled "main" and "composite". The latter type is also known in historical usage as *terkib* or *mürekkeb* [iii] *maqam*.

In the author's view, criteria for categorizing a *maqam* as main should be three:

---

[i] i.e., the "procedure", or characteristic melodic unfolding of a *maqam*, which necessitates a good deal of *a priori* knowledge on the performance tradition.

[ii] Vocal or instrumental virtuosity, relying on improvisational technique, artistry, and above all, "mood" associated with the *maqam* being played.

[iii] Which one may roughly define as a combination of two or more *maqam* scales.

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:

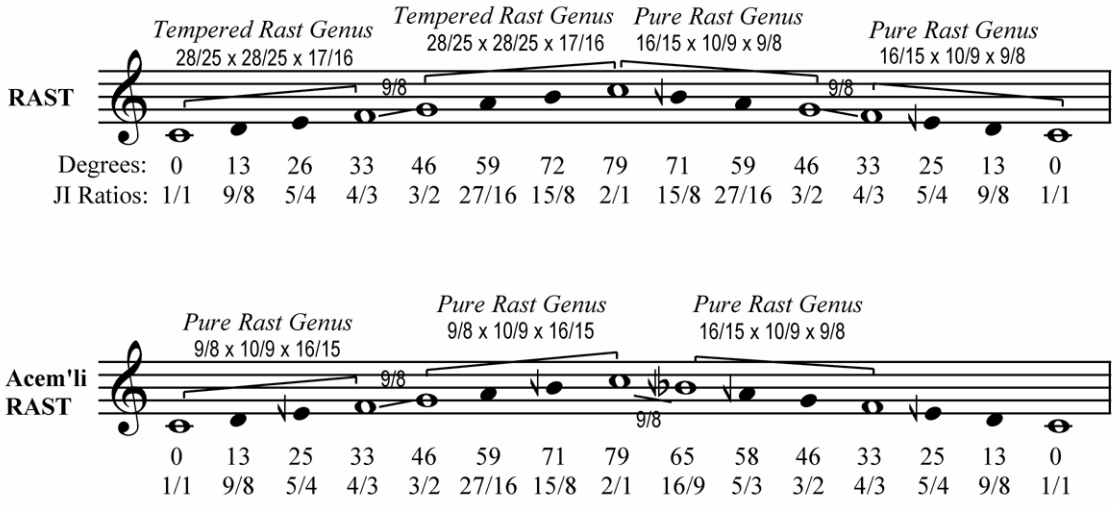

Figure 5.12: ***Maqam Rast*** **Notated in 79 MOS 159-tET**

In the figure, *Maqam Rast* ascends by consecutive steps [13 13 7] 13 [13 13 7] (corresponding to natural notes) and descends with [8 12 13] 13 [8 12 13], making [196+196+106]+204+[196+196+106] cents when ascending and [121+181+196]+204+[121+181+196] cents when descending.

Acem'li Rast is distinguished as a variant of *Rast* which uses *perde acem* instead of *evc* when descending. It rises with [13 12 8] 13 [13 12 8] steps and falls with [14 7 12] 13 [8 12 13] steps, equalling [196+181+121]+204+[196+181+121] cents when ascending and [211+106+181]+204+[196+181+121] cents when descending.

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

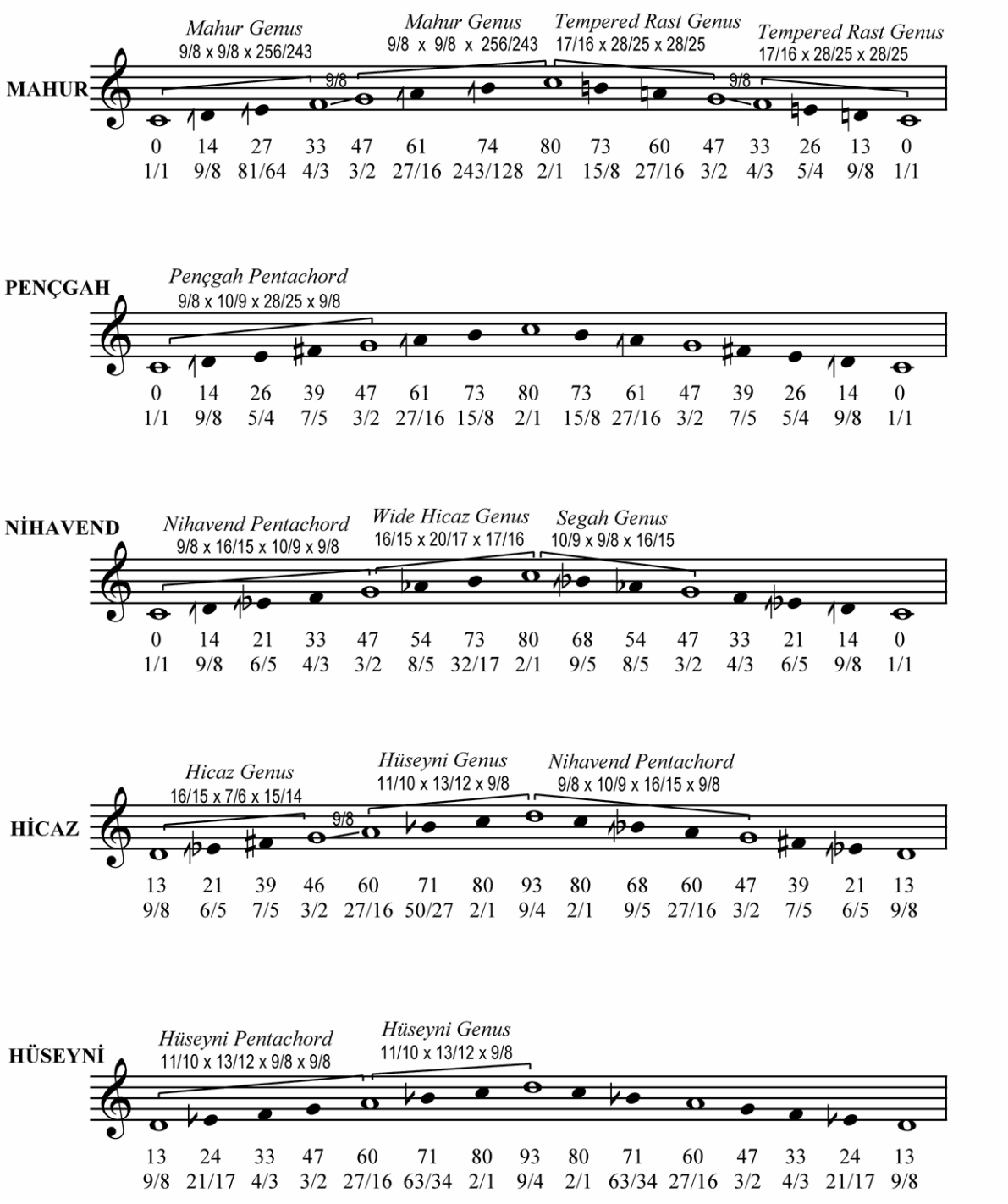

Figure 5.13: Some Main *Maqam*s of Moderate Complexity Notated in 80 MOS 159-tET

This time, for correct scale transpositions, 80 MOS 159-tET is employed.

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.

Pençgah 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.

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.

Hicaz ascends with [8 18 7] 14 [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, *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 abovegiven examples, these will be catalogued as composite:

A- *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 *maqam*s are provided in Figure 5.14.

In this figure, *Segah* ascends with (7) [7 14 12] 14 [7 19 7] steps or (106) [106 204 181] 211 [106 287 106] cents, using *perde kürdi* in paranthesis 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.

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

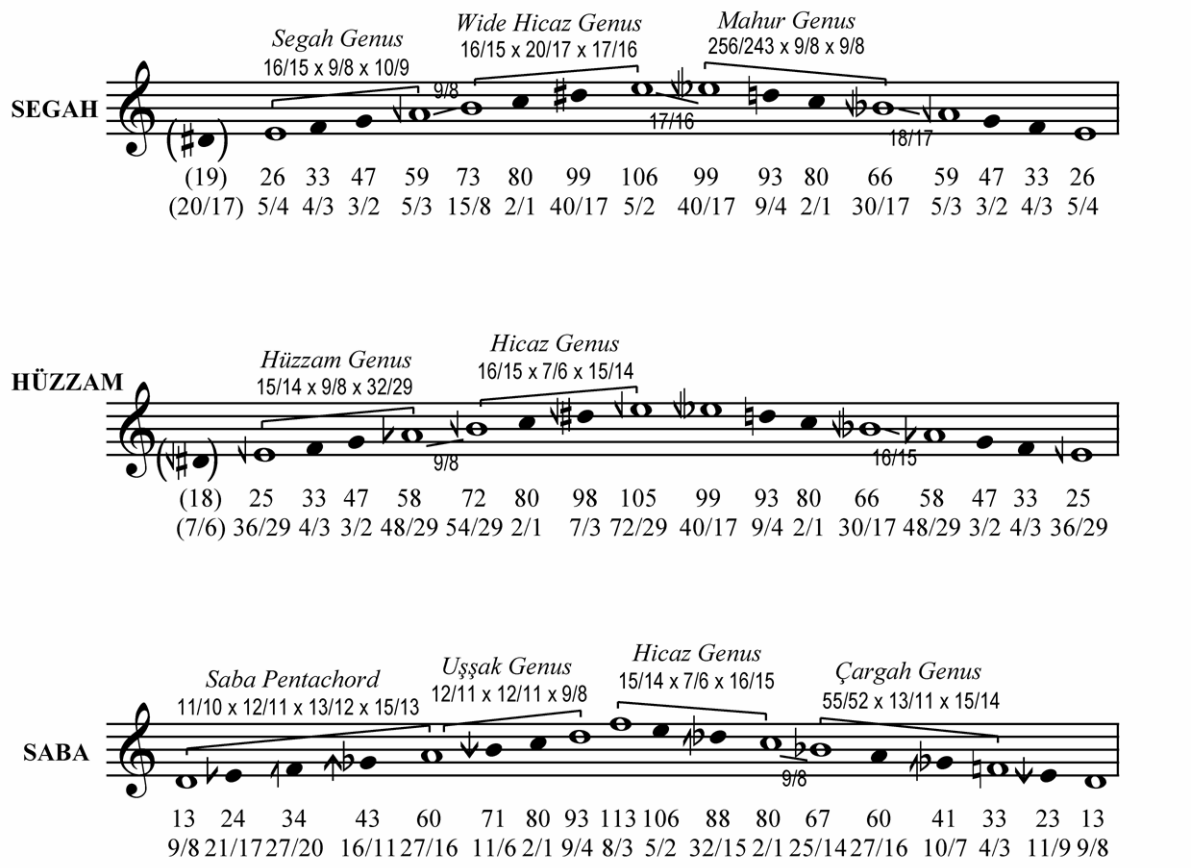

Figure 5.14: Some Composite *Maqam*s Notated in 80 MOS 159-tET

Hüzzam rises with (7) [8 14 11] 14 [8 18 7] steps or (106) [121 204 166] 211 [121 272 106] cents, using *perde nerm kürdi* in paranthesis as leading tone, and falls with 6 – [6 13 14] 8 [11 14 8] steps or 91 – [91 196 211] 121 [166 204 121] cents.

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 *perde*s 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 *perde*s 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 accomodating indispensible 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 *mandal*s 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 equivalances) arriving at 72 equal divisions of the octave (a “derailléur” 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 3 of 159-tone equal temperament from *yegah* to *neva*. In 80 MOS 159-tET, the 3 step gap at the end is replaced by 2+1 steps, yielding a meantone fifth beneath pure that is ascribed the same note. In other words, the larger step is reduced in size by 2/3 and becomes a “nanotone” of 8 cents.

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 *perde*s 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 *maqam*s, 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."

"Is it not possible to correct and meliorate these melodies?" [i]

"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] *i.e.*, "temper to twelve equidistant tones per octave and orchestrate them?"

Quote A.4: Adnan Saygun's thoughts on the abondonment 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] [i]; 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 '*hı*, *he*; *zel*, *ze*, *zı*; *elif*, *ayın*; *dat*, *dal*; etc…' [ii]. 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 *perde*s 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.)

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

[ii] 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 *Hafız Post* [i] [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 *Hafız 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?

…

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[i] *Tanburi/Hanende Mehmed Çelebi – Hafız 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 [i] [289]. 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 [ii]. I request that the Ministry of Cultural Affairs render due consideration to this, and that the public [iii] [290] assist her in it. …» (Ankara, November 1st, 1934.)

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[i] 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 [i] [291], during the time Turkish [*Maqam*] Music was banned and removed from the radios, *Yunus Nadi Bey* [ii] [292] made a request from *Atatürk*, and said:

"My dear *Pasha*, let them not deprive us of *Alla Turca şarkıs* and *türküs*; 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] [iii] [293].

…

One day, he goes on to say:

"What is the matter with this radio? Always lamenting, wailing *şarkıs*… 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 *şarkı*, 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' [iv] [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* [v] [295] says:

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[i] 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.)

[ii] *Yunus Nadi Abalıoğlu* (1880-1945); journalist, writer, and parliamentarian. (See, accompanying endnote.)

[iii] 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.)

[iv] 'Presidency *Fasıl*/*Saz* Ensemble' was a congregation of reputed musicians who catered to Atatürk's *Maqam* Music needs during his lifetime. (See, accompanying endnote.)

[v] *Mehmet Nuri Conker* (1882-1937); comrade-in-arms of *Atatürk*, Turkish military-man, administrator, and parliamentarian. (See, accompanying endnote.)

"'Imam verir talkını, kendi yutar salkımı.' [i] You removed *Alla Turca* [music] from the radio, let us see you not have it played then." [ii]

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."» (Ankara, *ca.*1935.)

---

[i] A famous Turkish proverb, which can be translated as: "Imam to others preaches, devours himself the peaches."

[ii] 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 Rıza 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 [i].
>
> Respected *Vasfi Rıza Zobu* [ii] [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 [iii] [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 [iv].
>
> 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* [v] [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.

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[i] 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 *Sultaniyegâh fasıl*, 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.

[ii] *Vasfi Rıza Zobu* (1902-1992); Turkish theatre and cinema artist. (See, accompanying endnote.)

[iii] The 'Çankaya Kiosk' is the official residence, since *Atatürk*, of Presidents of Türkiye. (See, accompanying endnote.)

[iv] 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.*)

[v] *Hâzım Körmükçü* (1898-1944); Turkish theatre and cinema artist. (See, accompanying endnote.)

'Twas way past midnight. [i] [299] 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*" [ii] *Kemal* [iii] [300].

[*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 İsmail 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. [iv] [301] 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. [v]

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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 *Vasfi Rıza 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 occurences – and with the purpose of making the greatest effort to prevent the advance – shall use even their positions to their advange. …
>
> …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 Européene", "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 [i] [302] 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 *şarkıs* 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 anteceded them, *e.g.* Pharaonic Egypt.

Turkish ingeniousity, which – just as it cannot be doubted that it existed in the era of *Al-Fârâbî* – 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 Merâgîs*, *Hâfız Posts*, *Itrîs* [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 [i] [302]. Although, Westerners, upon seeing the three types of accidentals between the natural notes of the Oriental music scale [ii] [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!

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[i] *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.)

[ii] 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 *şarkıs* 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 vehement 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 [i] [304,305], 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 voluptious 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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[i] 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 seperate 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 euolgy 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?

[*Yekta*]-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 *perde*s 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.

[*Cevad*]-Your opinion on the innovation that *Ali Rıfat* [*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"!...

[*Cevad*]-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*" [i] [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. …

…

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

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[i] *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.)

[Yekta]-…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 whensoever 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 *perde*s [determined by ratios] called "Intervalles 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 "*tanînî*" – 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 [i] {308,309}]
2- *Mücenneb-i Sagîr* / "Apotome" = 2187/2048 [113.685 ¢]
3- *Mücenneb-i Kebîr* / "Ton Mineur" = 65536/59049 [ii] [180.449 ¢]

Aside from these, also used [in the past] in Turkish [*Maqam*] Music are a variety of melodic intervals such as 7/6 [266.871 ¢], and 22/21 [80.537 ¢], and 12/11 [150.637 ¢] [iii] [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 [*Maqam*] Music>. Let not *Zeki Bey Efendi* make futile attempts towards absurd wishfulness. Turkish [*Maqam*] 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 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 x 1200=cents}, or {log_{10} R x (1200 / log_{10} 2)=cents}. The reverse operation is carried out by the formula {2^(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 *Maqam* 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 Kemâl* [*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 Sînâ*, *Abdülkadir* [*Merâgî*], *Safiyüddin* [*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 *Abdülkadir* 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*, *Ferahnâk*, *Ferahfezâ*, *Sûzidil* [etc…] and Arabic names as *Râhatülervah*, *Şevkutarab*, *Zevkutarab* [etc…] to *maqam*s 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 *maqam*s 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

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[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

> « …*Maqam*s [such as] *Çarigâh*, *kürdilî çarigâh*, *puselik*, *kürdî*, *uşşak*, *hüseyni*, *rast*, *acemli rast*, *hicazlar*, *karcıgar* 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 *maqam*s 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*, sheik *Celâlettin 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 *perde*s strapped within an octave to *tanbur*s 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 *tanbur*s 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].

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[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 muhalif*" (averse tuning) by *Bedr-i Dilşad* (*ca.*1440), court scribe and encyclopædist 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 *perde*s 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 tweny-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 *tanbur*s by a Turkic music pundit as the requirement of the constitutions of diverse *maqam*s 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.)

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

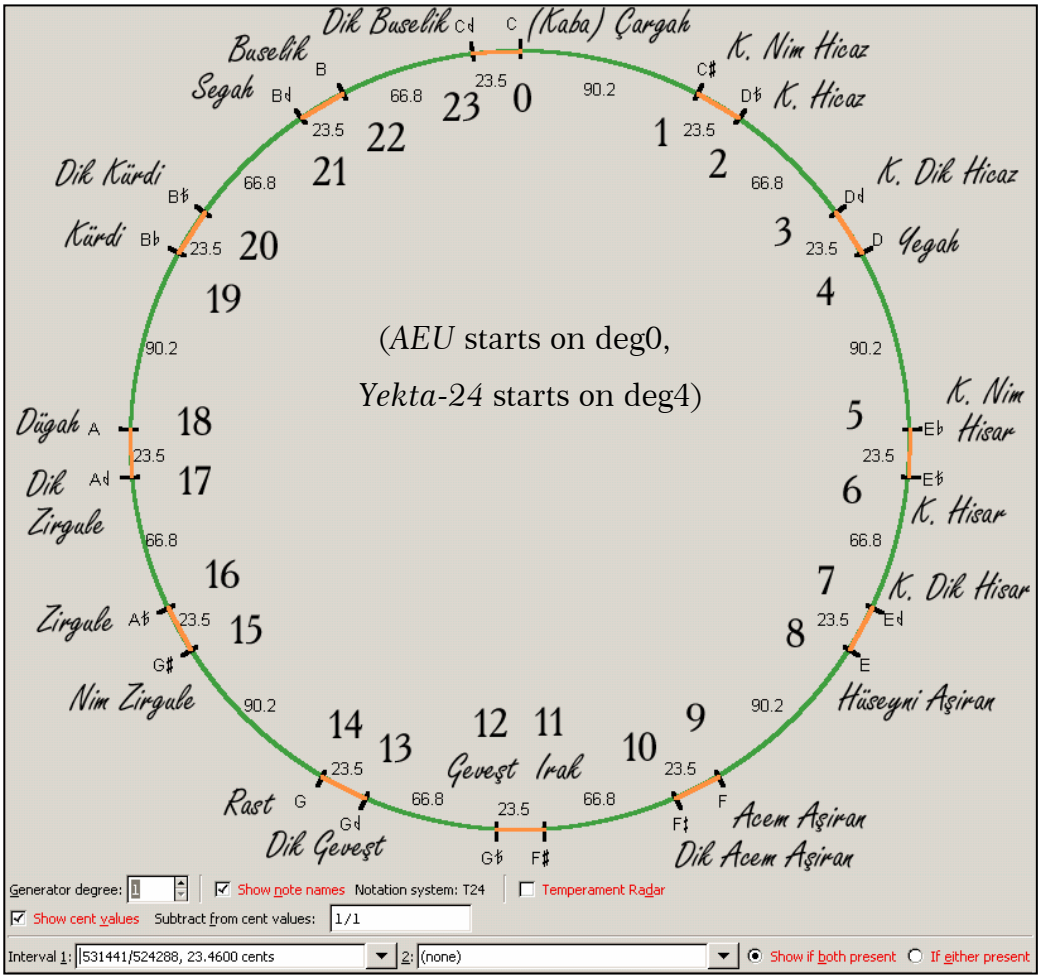

Figure B.1: Tone-Circle Showing 12 Pythagorean Commas in *AEU/Yekta-24*

[i] A powerfool 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:

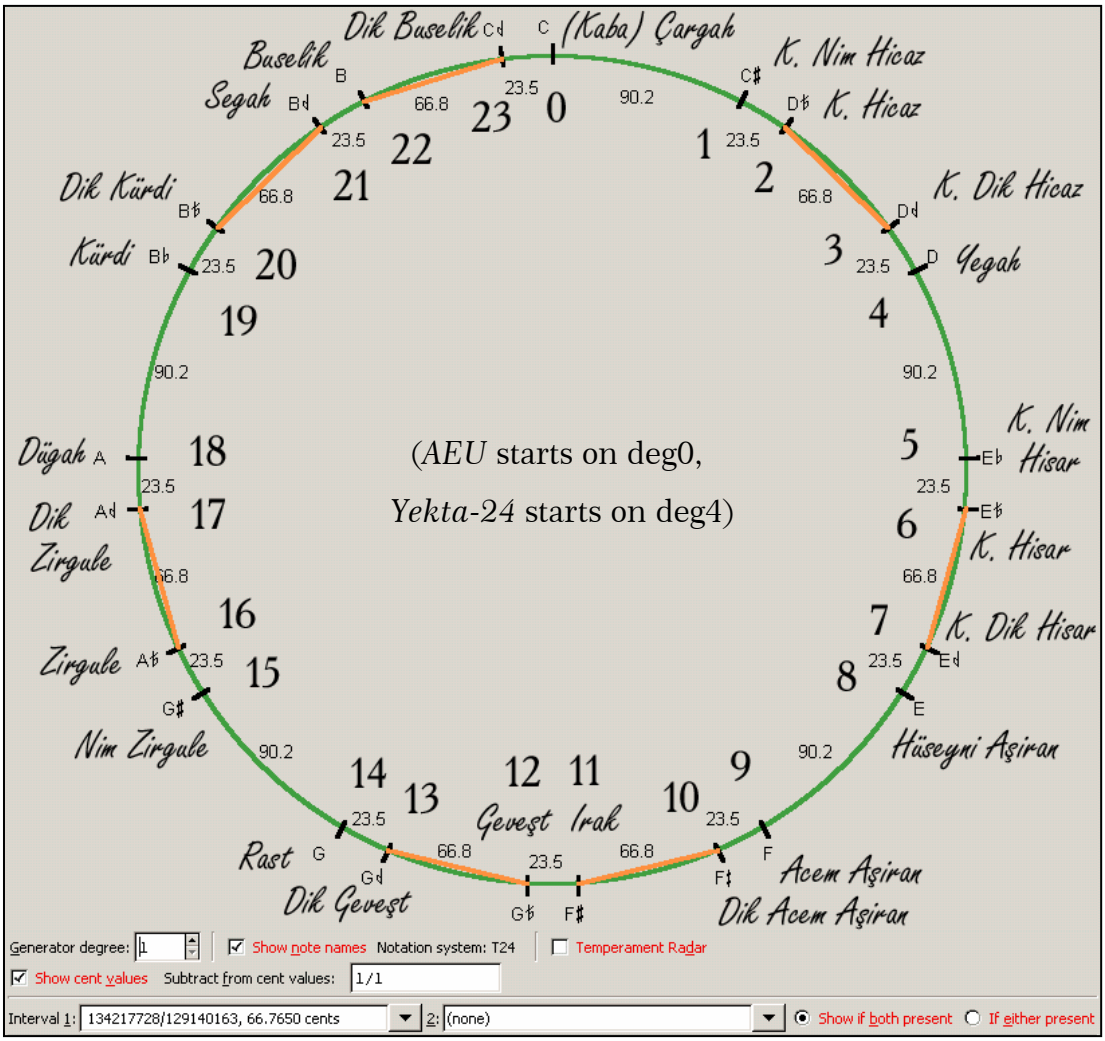

Figure B.2: Tone-Circle Showing 7 Pythagorean Double Diminished Thirds in *AEU/Yekta-24*

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:

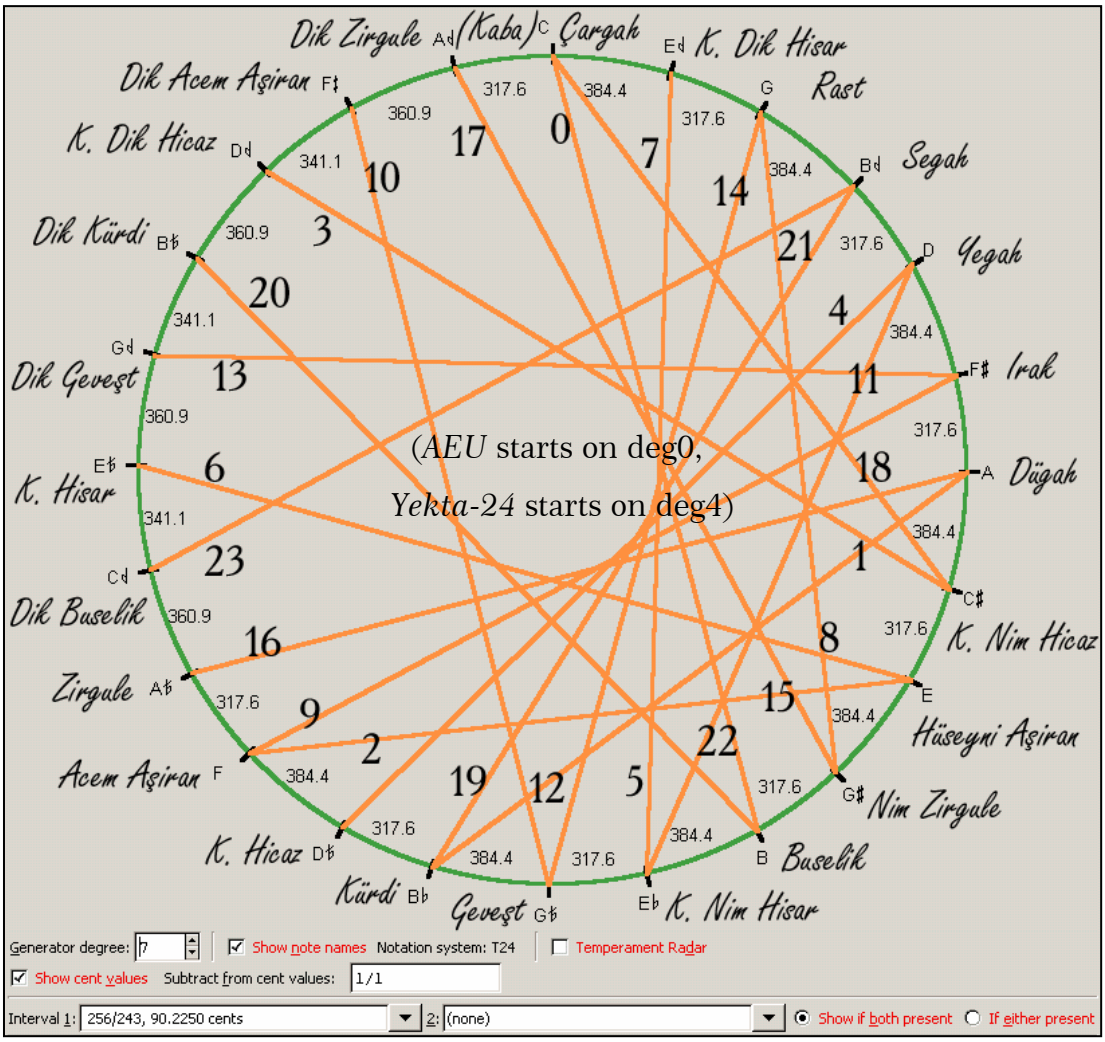

Figure B.3: Tone-Circle Showing 19 Pythagorean Minor Semitones in *AEU/Yekta-24*

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.

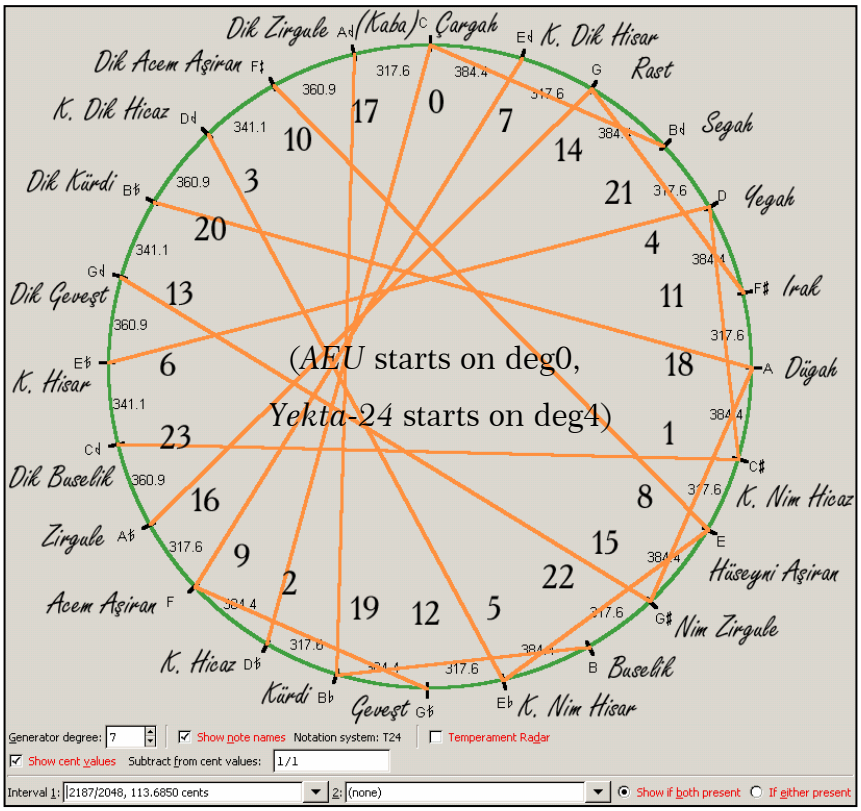

Figure B.4: Tone-Circle Showing 17 Apotomes in *AEU/Yekta-24*

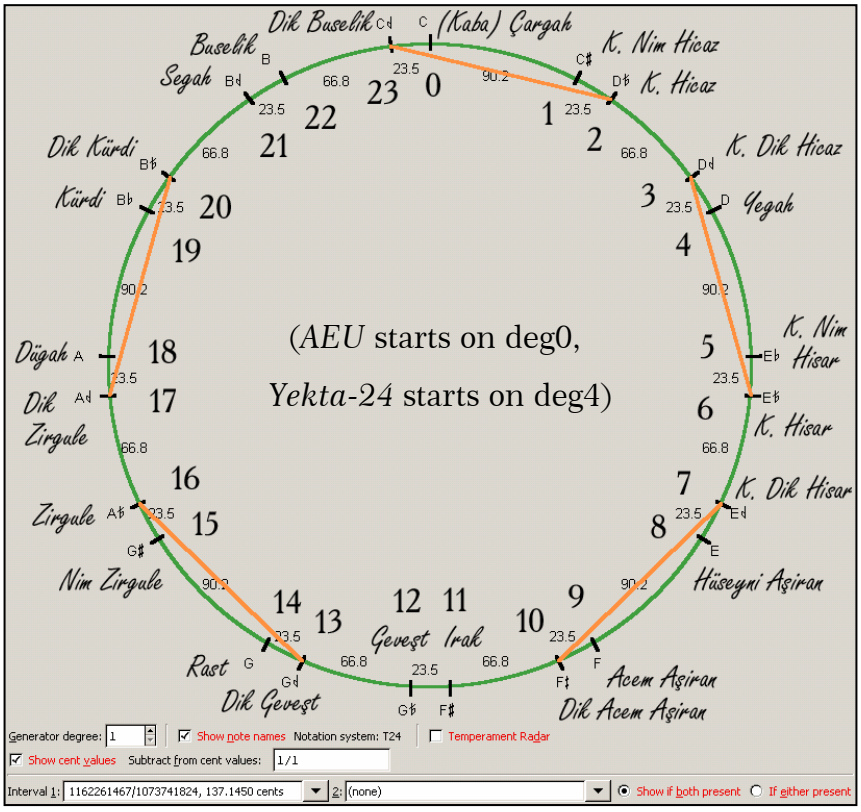

Figure B.5: Tone-Circle Showing 5 Two Third Tones in *AEU/Yekta-24*

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:

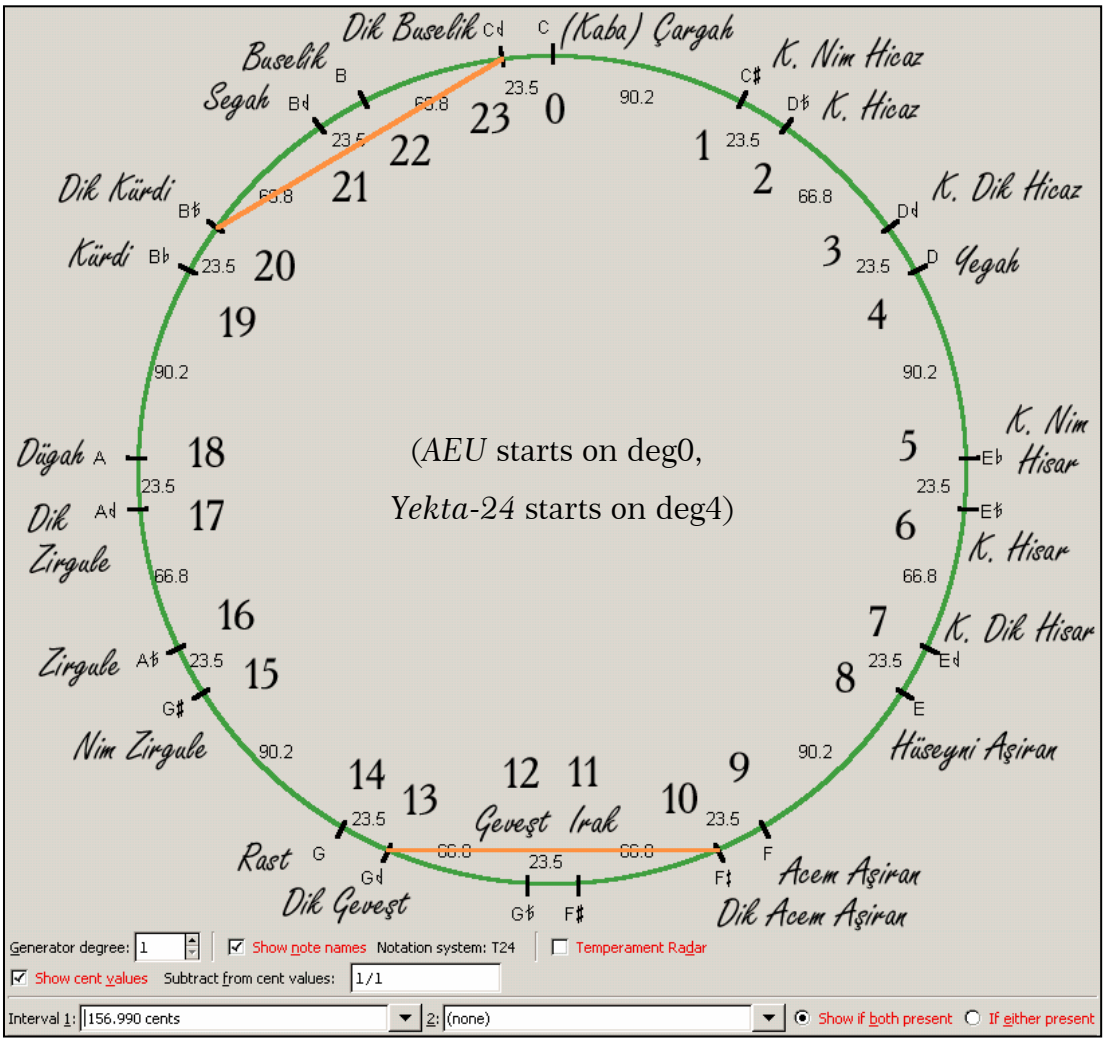

Figure B.6: Tone-Circle Showing 2 Three Fourth Tones in *AEU/Yekta-24*

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 electroacousically 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:

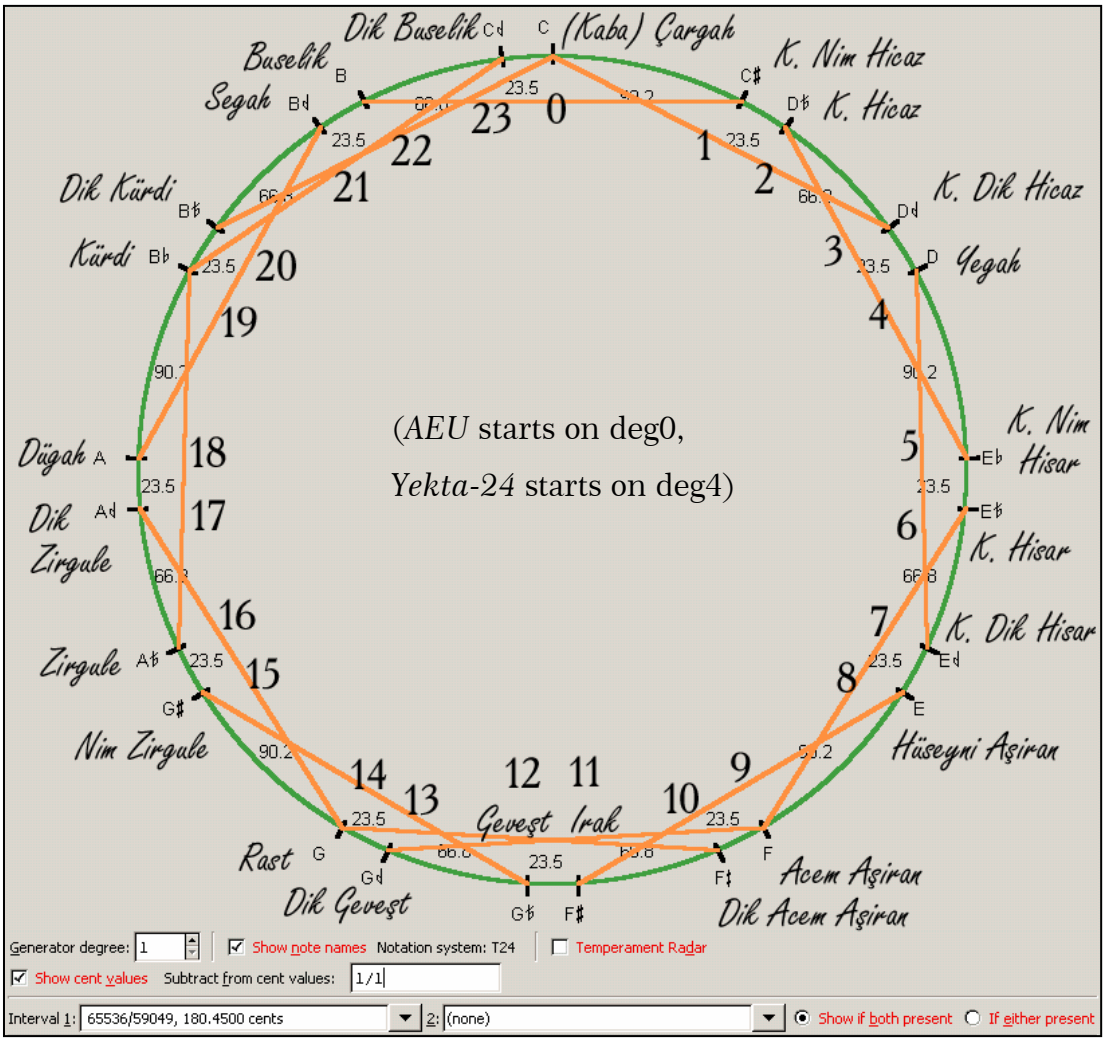

Figure B.7: Tone-Circle Showing 14 Pythagorean Diminished Thirds in AEU/Yekta-24

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.

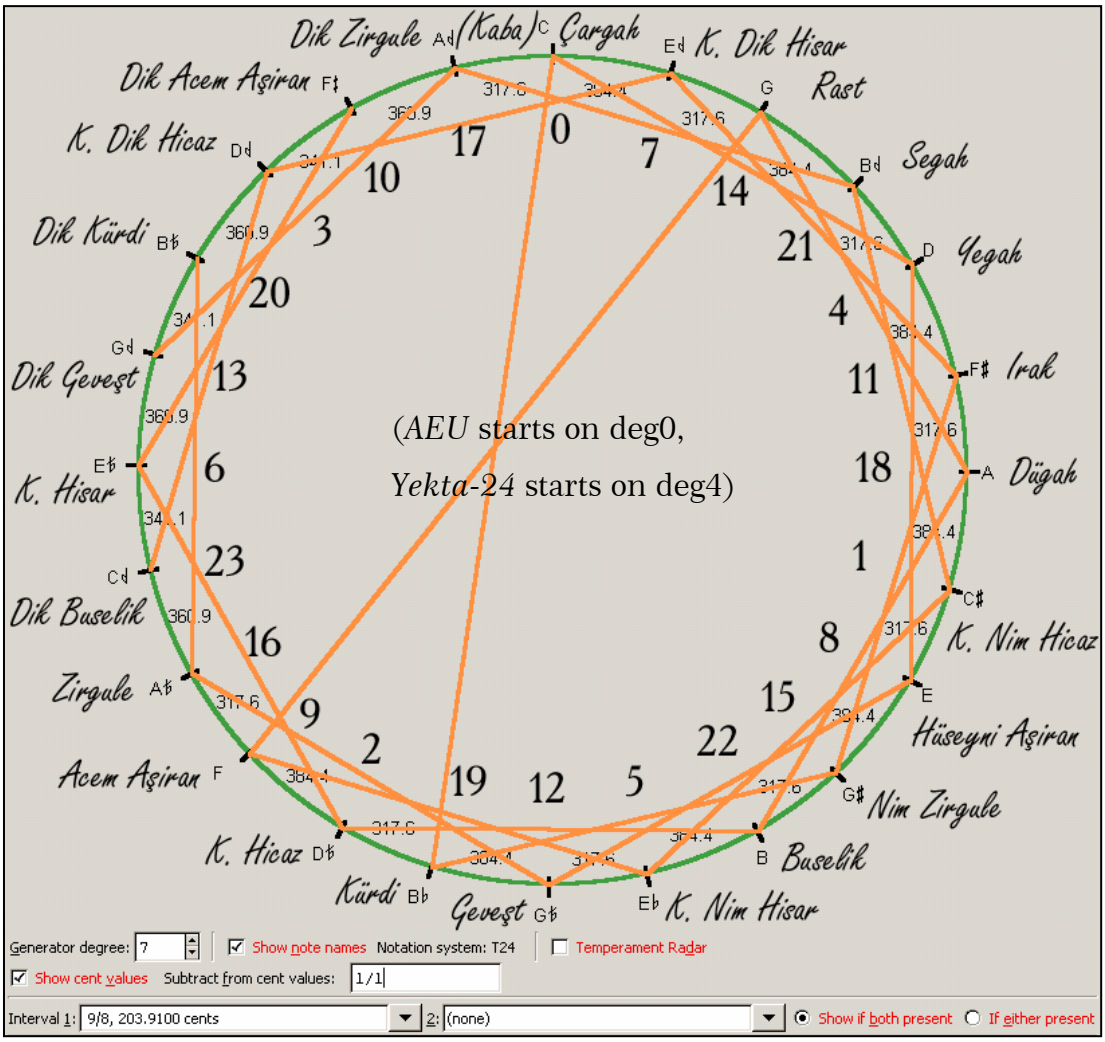

Figure B.8: Tone-Circle Showing 22 Major Whole Tones in *AEU/Yekta-24*

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:

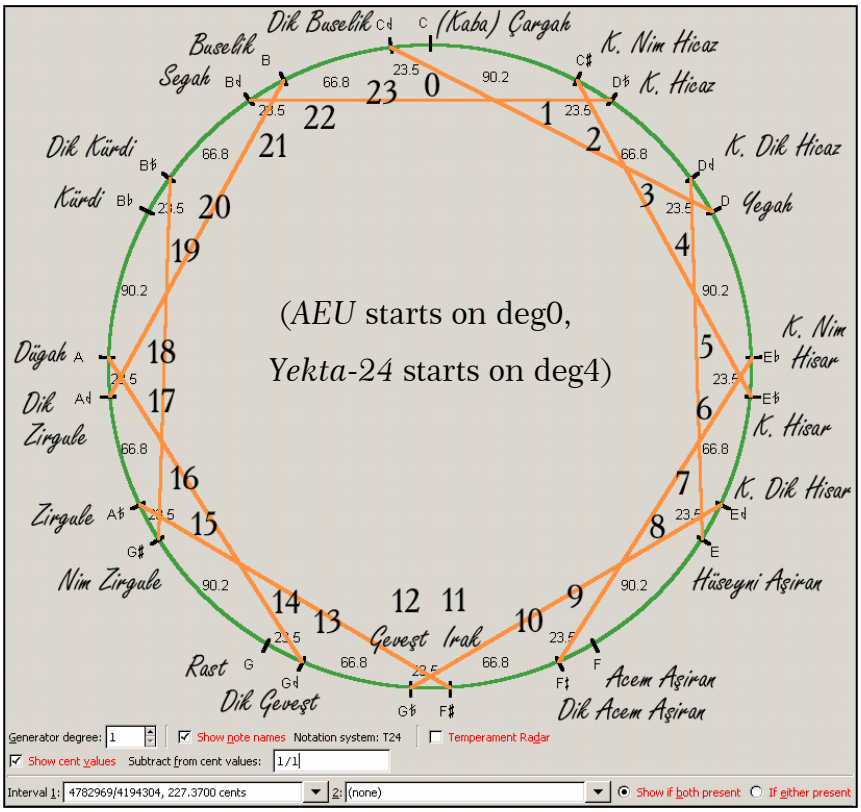

Figure B.9: Tone-Circle Showing 10 Pythagorean Double Augmented Primes in *AEU/Yekta-24*

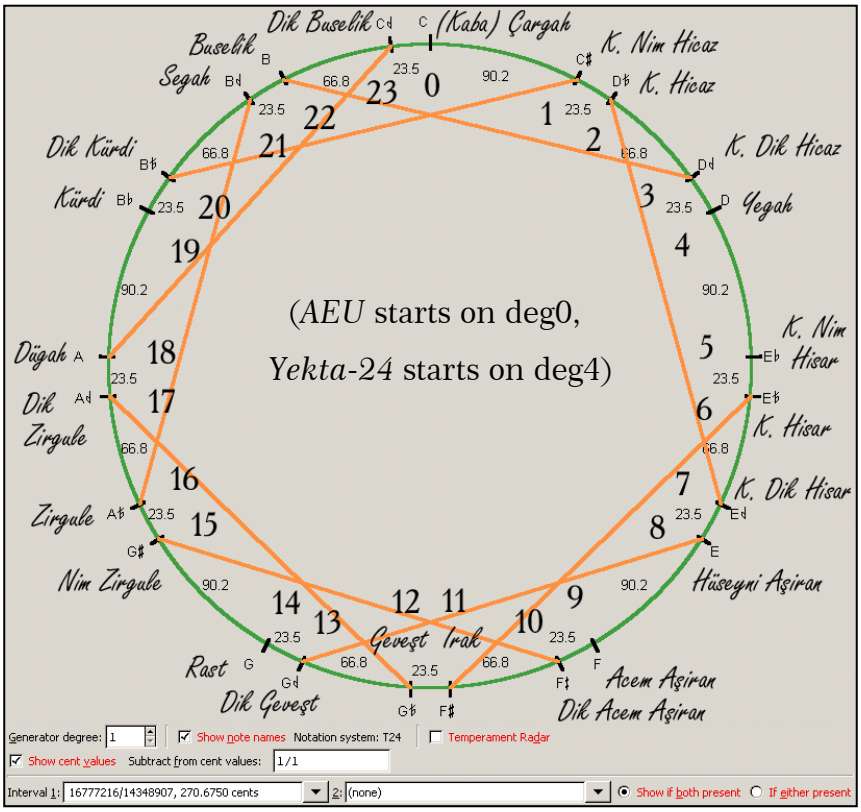

Figure B.10: Tone-Circle Showing 9 Pythagorean Double Diminished Fourths in *AEU/Yekta-24*

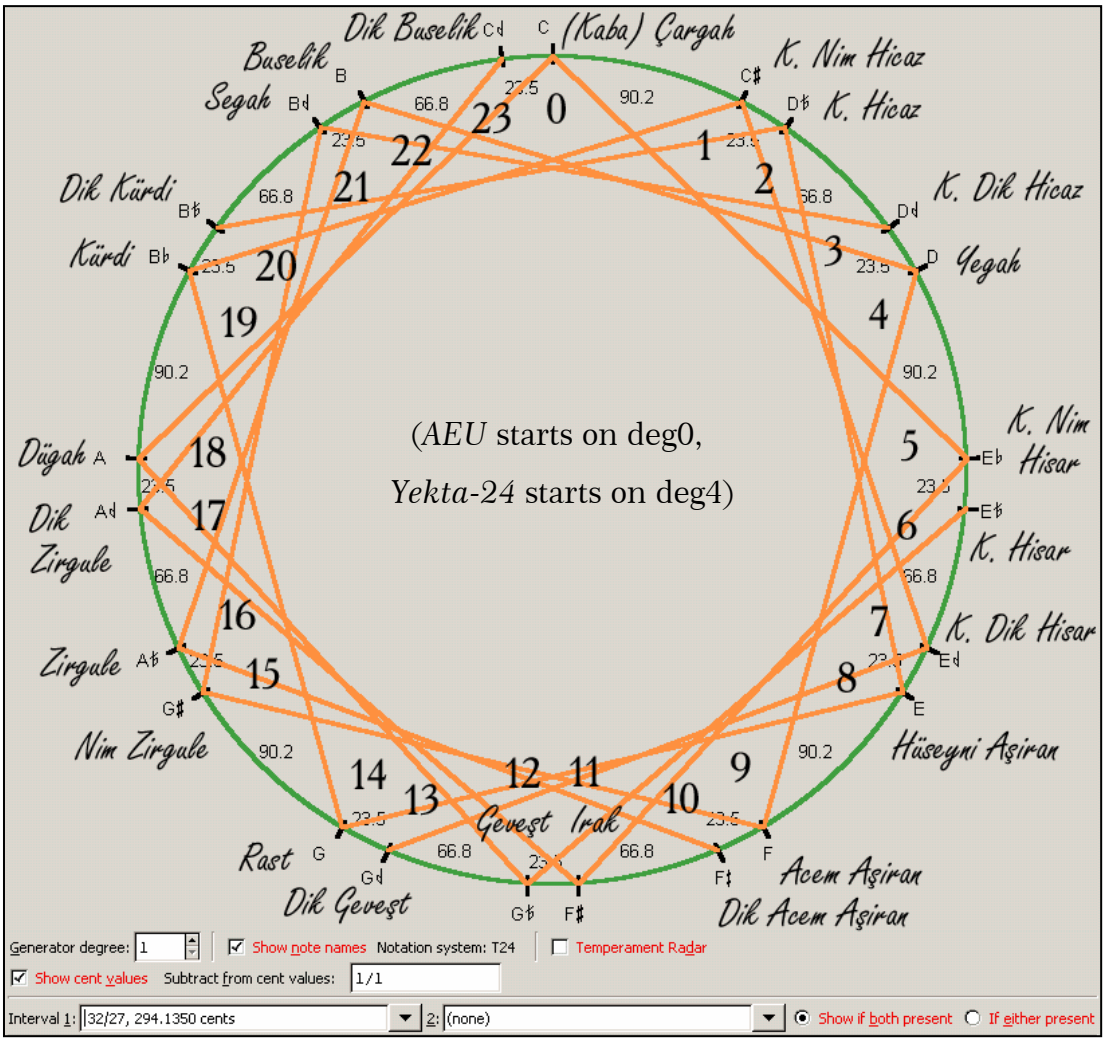

Figure B.11: Tone-Circle Showing 21 Pythagorean Minor Thirds in *AEU/Yekta-24*

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:

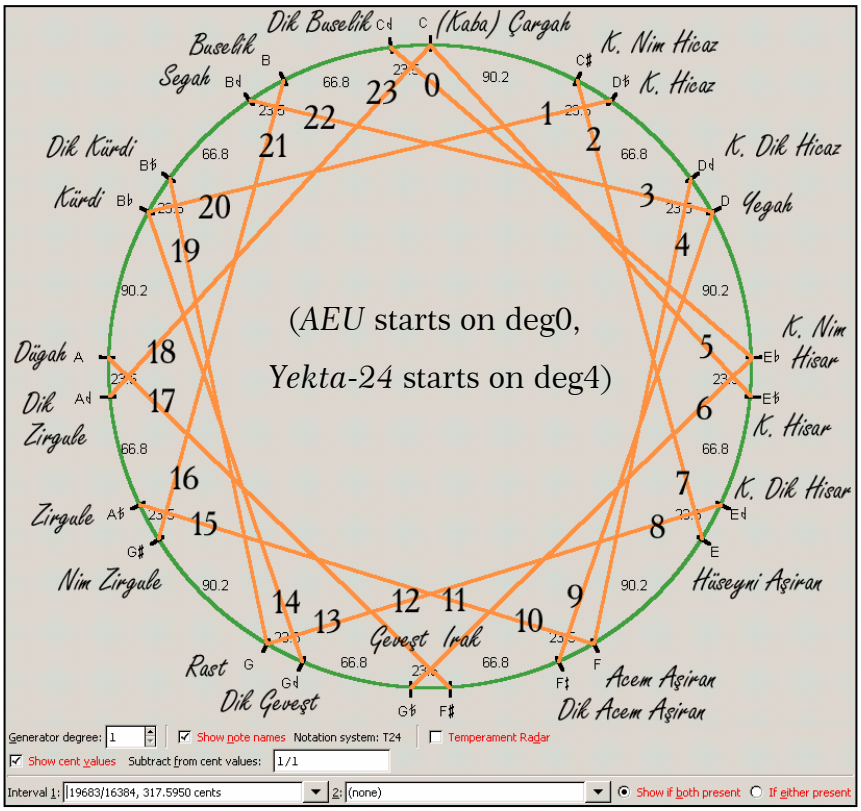

Figure B.12: Tone-Circle Showing 21 Pythagorean Augmented Seconds in *AEU/Yekta-24*

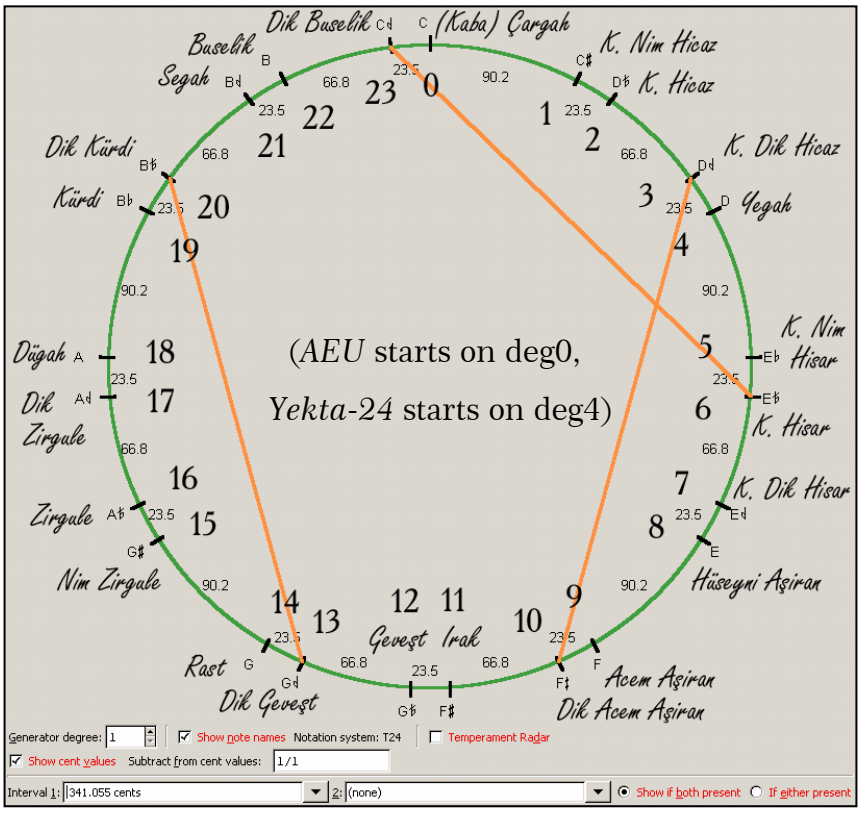

Figure B.13: Tone-Circle Showing 3 Comma-augmented Sesqui-tones in *AEU/Yekta-24*

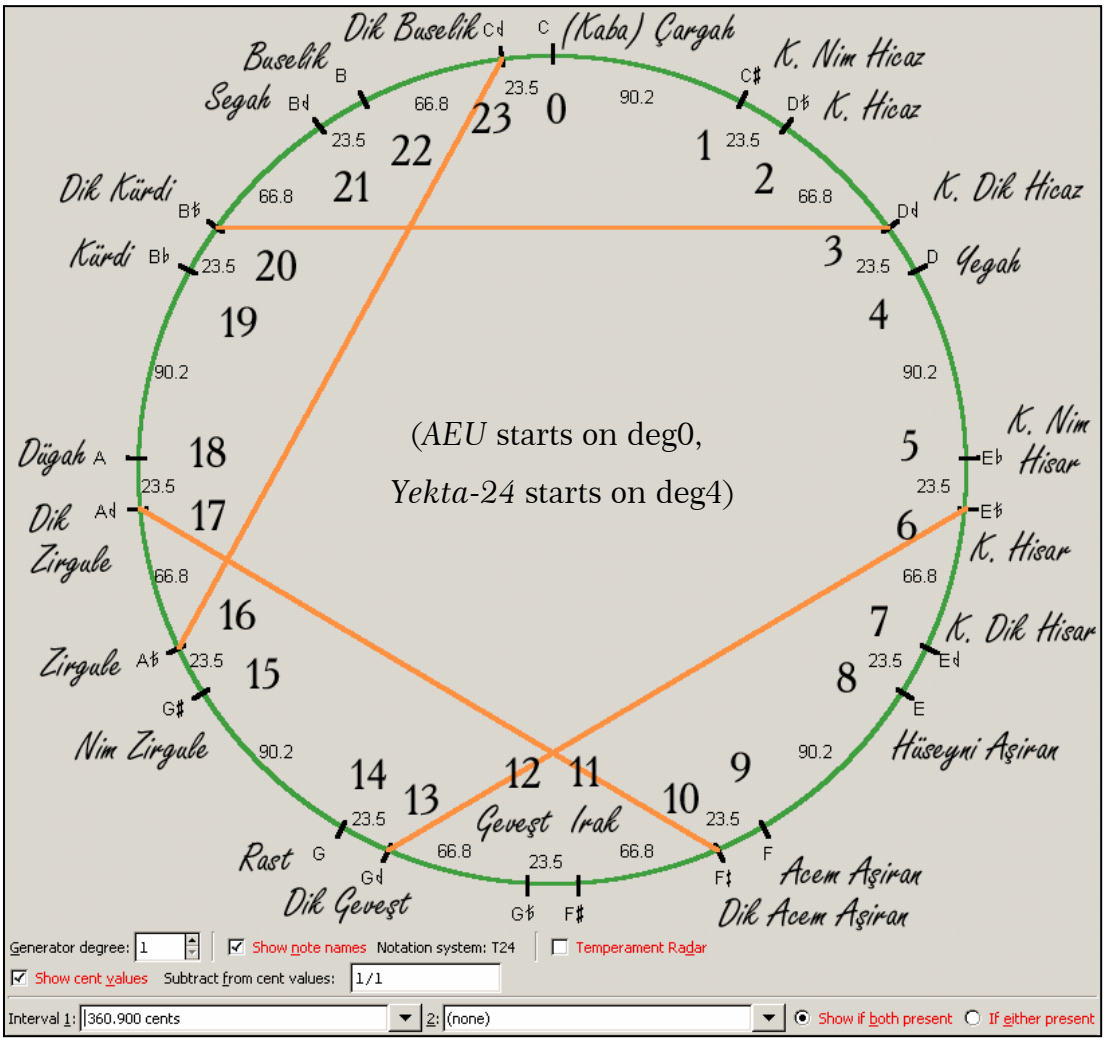

Figure B.14: Tone-Circle Showing 4 Middle Thirds in *AEU/Yekta-24*

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.

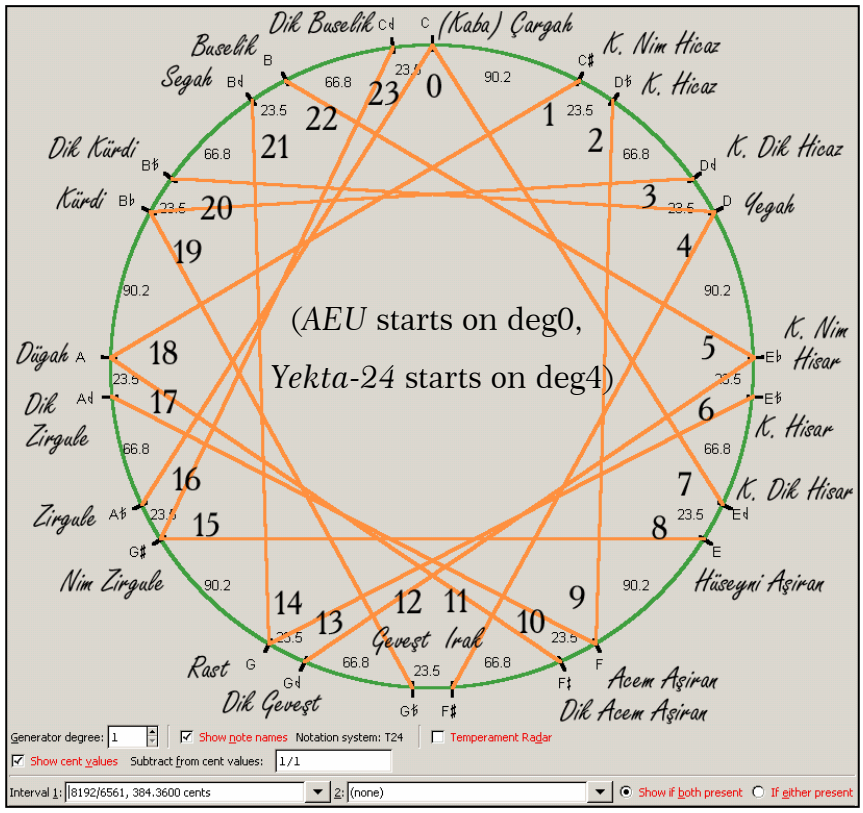

Figure B.15: Tone-Circle Showing 16 Pythagorean Diminished Fourths in *AEU/Yekta-24*

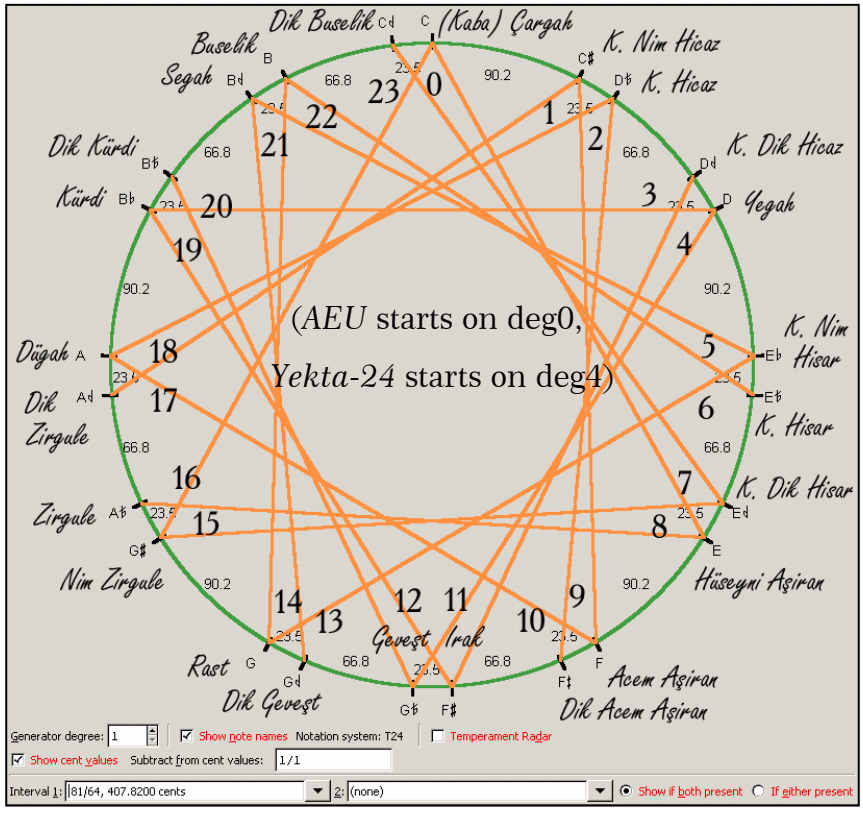

Figure B.16: Tone-Circle Showing 20 Pythagorean Major Thirds in *AEU/Yekta-24*

8 instances of 43046721:33554432 (Pythagorean double augmented second) equalling 431.28 cents each are given in Figure B.17:

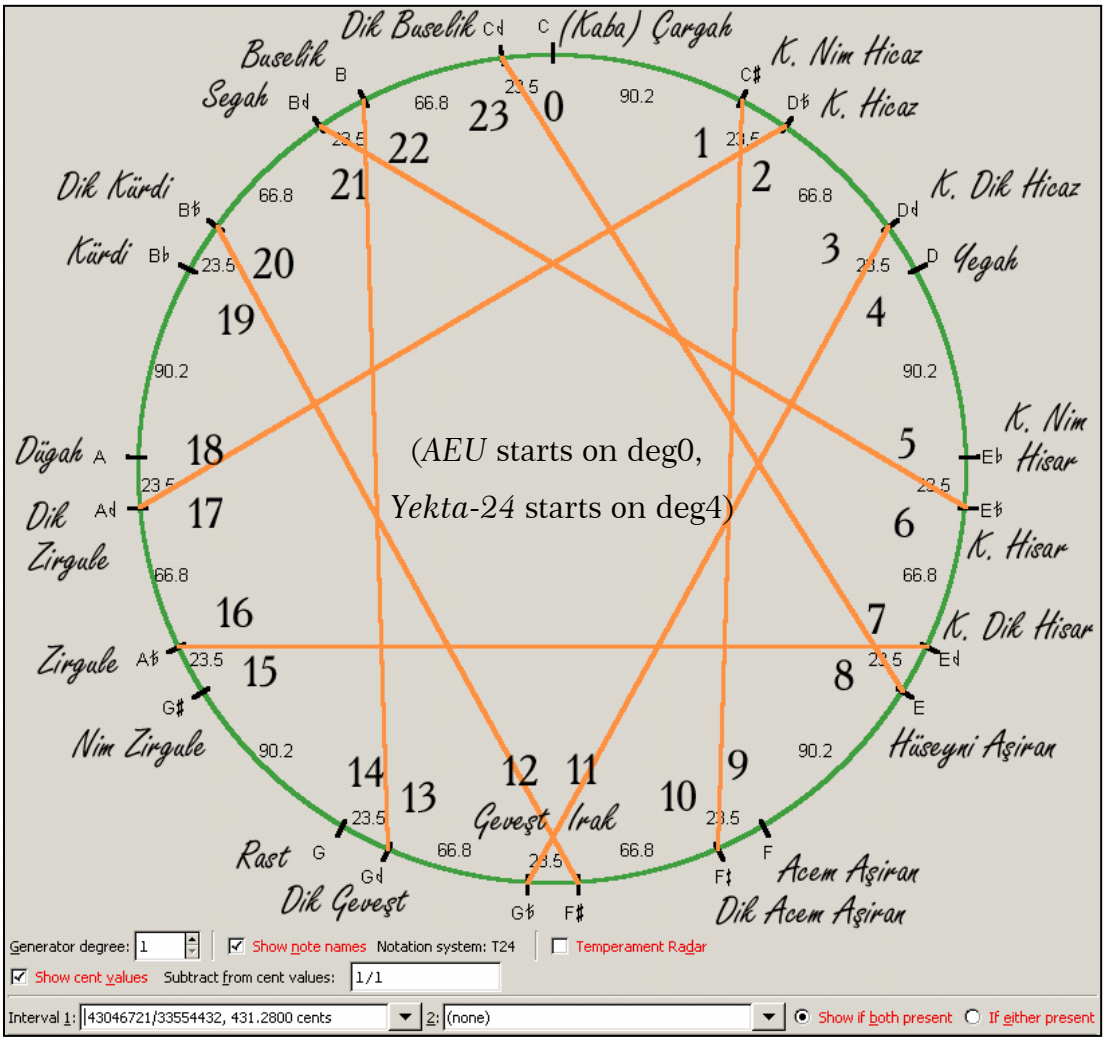

Figure B.17: Tone-Circle Showing 8 Pythagorean Double Augmented Seconds in *AEU/Yekta-24*

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:

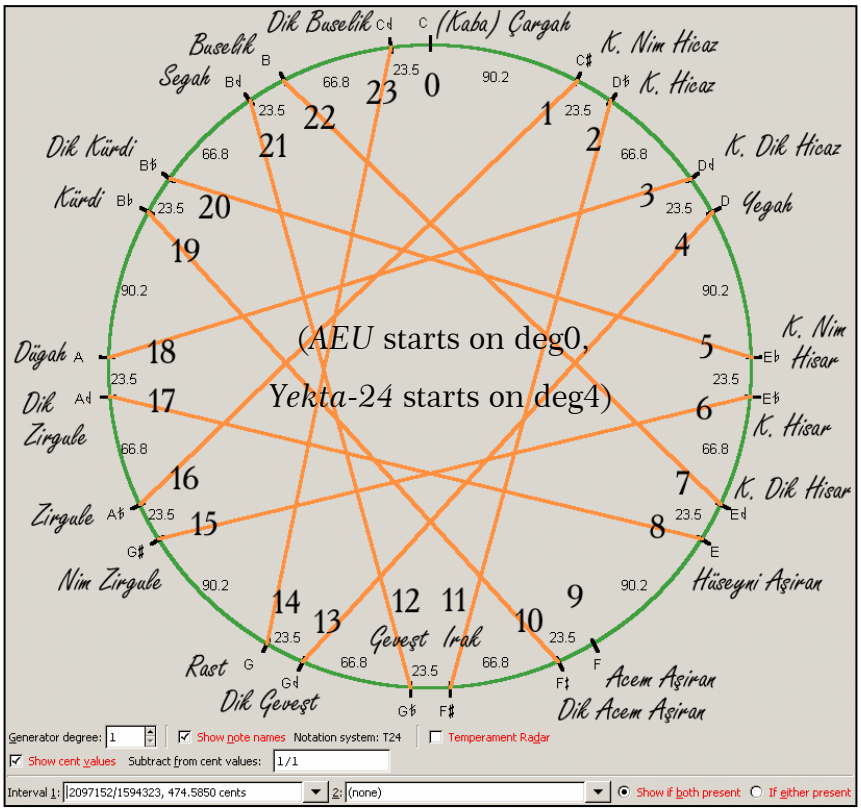

Figure B.18: Tone-Circle Showing 11 Pythagorean Double Diminished Fifths in *AEU/Yekta-24*

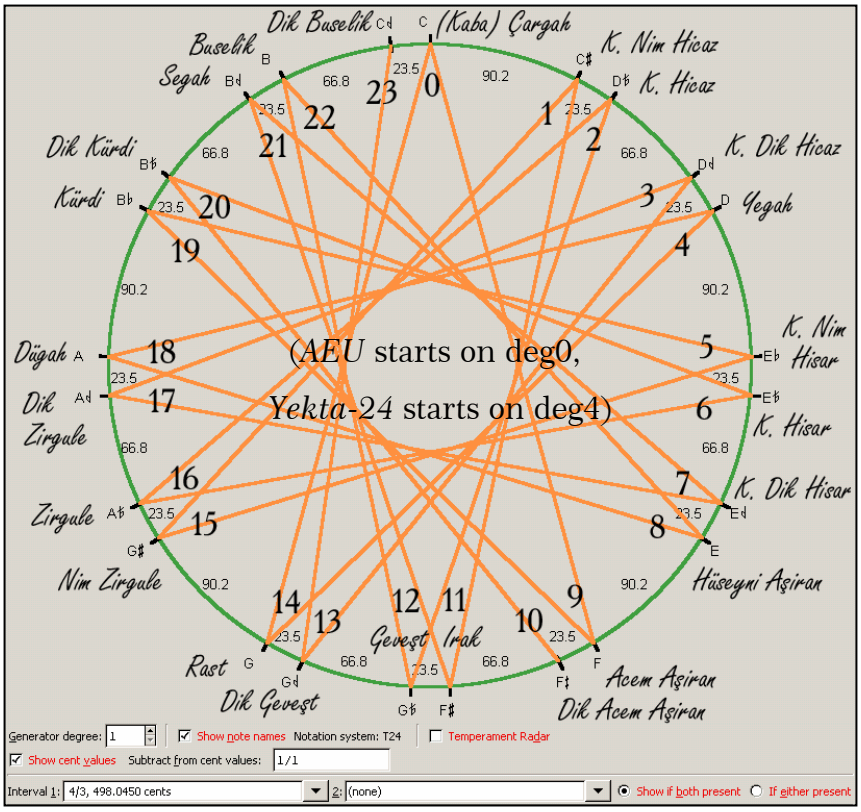

Figure B.19: Tone-Circle Showing 23 Perfect Fourths in *AEU/Yekta-24*

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 semi-diminished fifth.

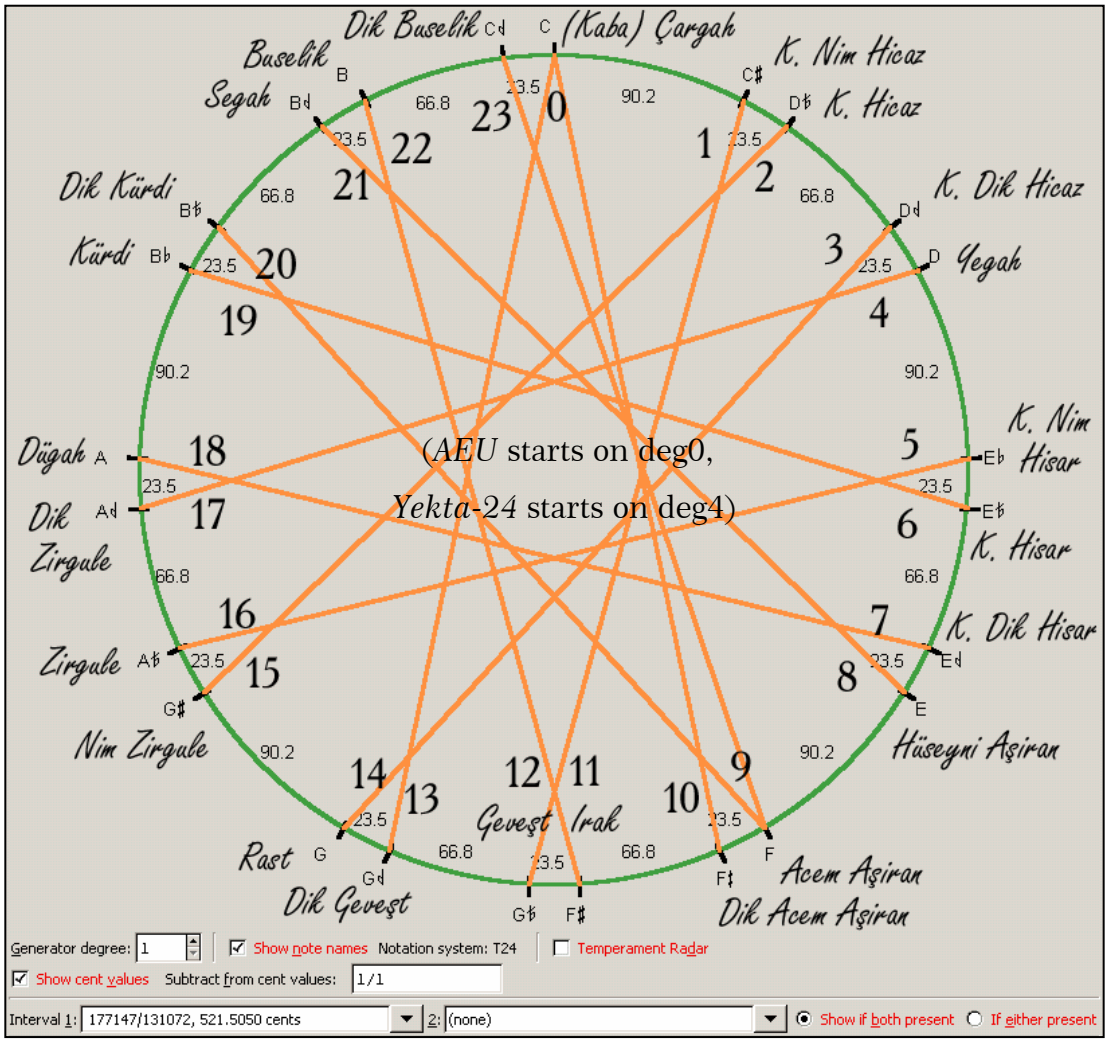

Figure B.20: Tone-Circle Showing 13 Pythagorean Augmented Thirds in *AEU/Yekta-24*

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:

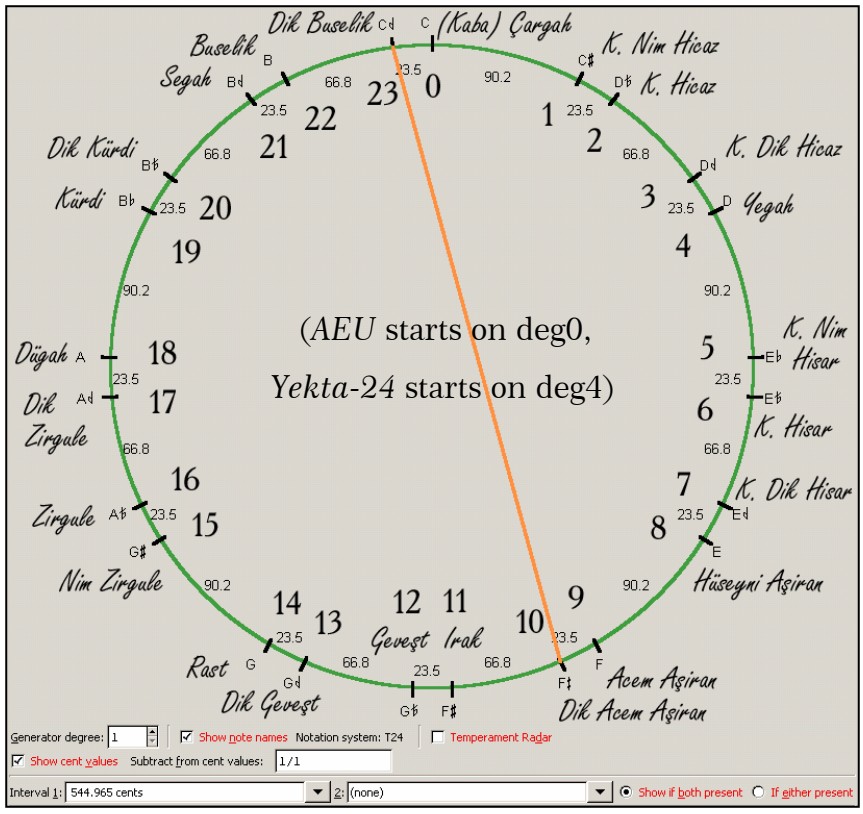

Figure B.21: Tone-Circle Showing a Semi-Diminished Fifth in *AEU/Yekta-24*

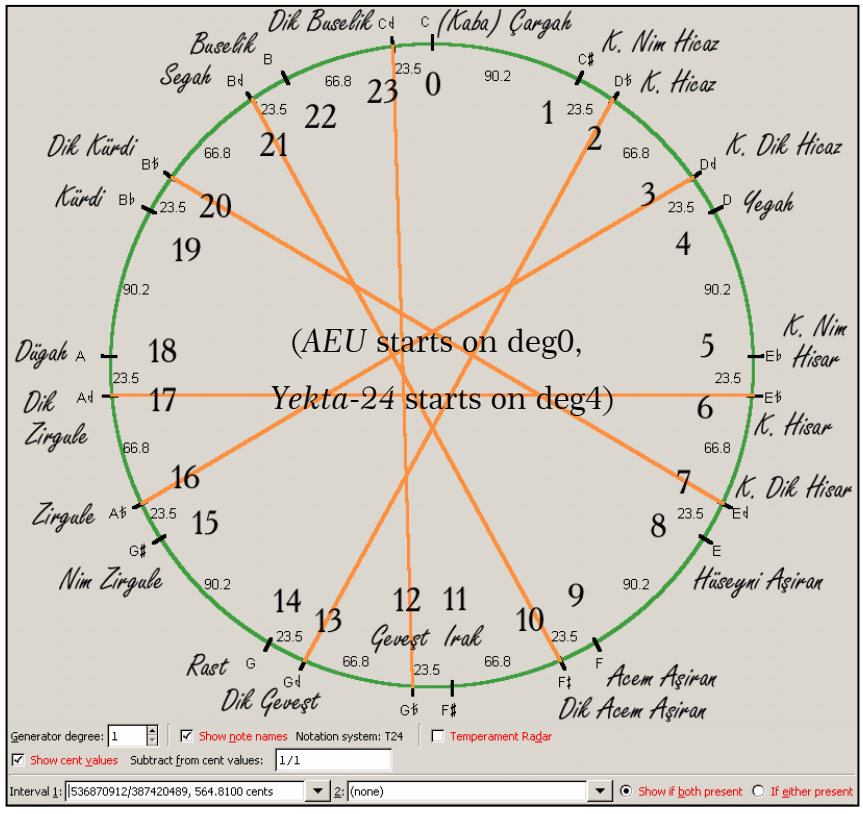

Figure B.22: Tone-Circle Showing a Pythagorean Double Diminished Sixth in *AEU/Yekta-24*

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:

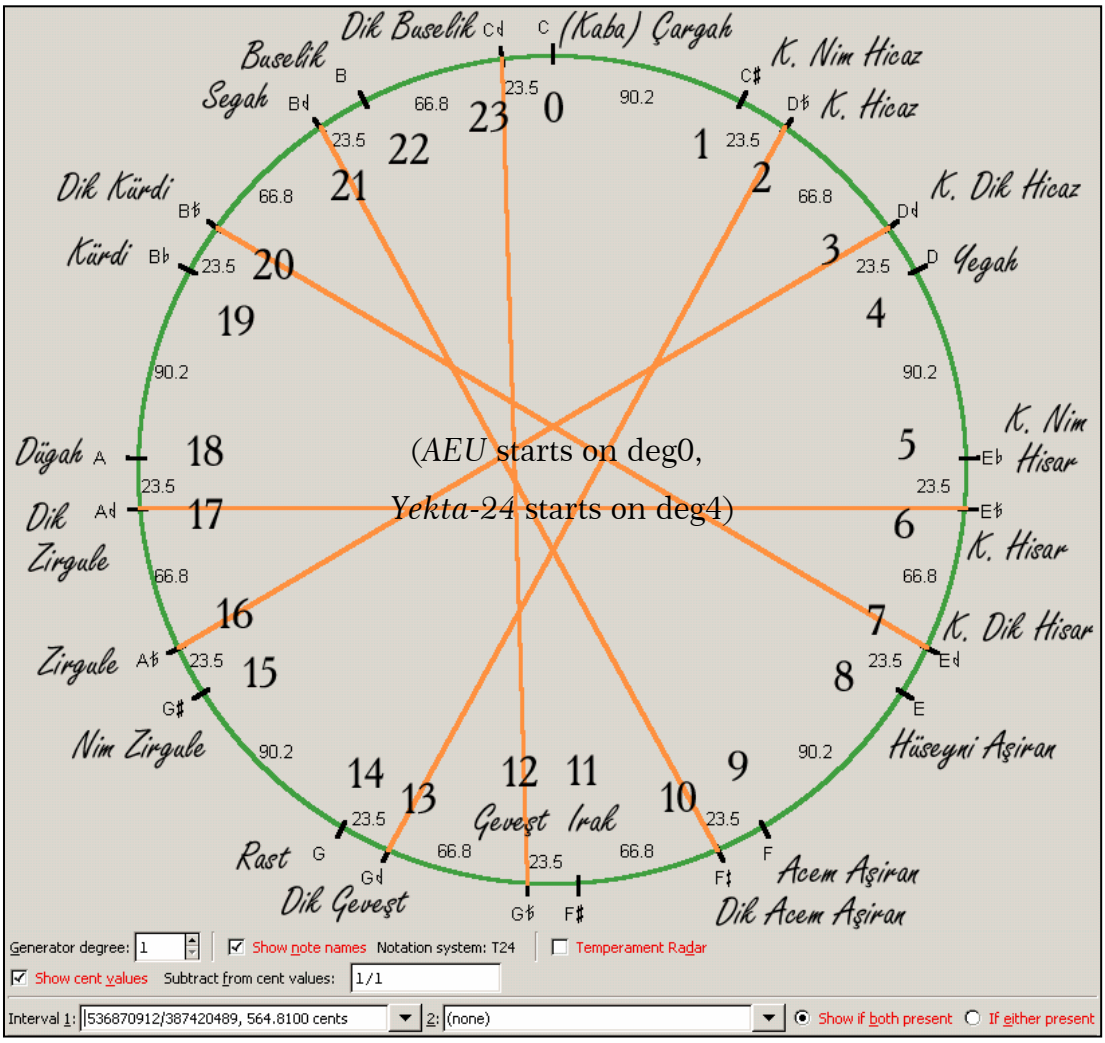

Figure B.23: Tone-Circle Showing a Pythagorean Diminished Fifth in *AEU/Yekta-24*

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

Interval Class+ # of occurence		Dyads up to Period	Cents	Mirrored [i]	Cents
0:	1 time	(1/1)	0.000	2/1	1200.000
1:	12 times	531441/524288	23.460	1048576/531441	1176.540
1:	7 times	134217728/129140163	66.765	129140163/6710886	1133.235
*: [ii]	19 times	256/243	90.225	243/128	1109.775
*:	17 times	2187/2048	113.685	4096/2187	1086.315
3:	5 times	1162261467/1073741824	137.145	n/a	1062.855
3:	2 times	n/a	156.990	n/a	1043.010
*:	14 times	65536/59049	180.450	59049/32768	1019.550
*:	22 times	9/8	203.910	16/9	996.090
5:	10 times	4782969/4194304	227.370	8388608/4782969	972.630
5:	9 times	16777216/14348907	270.675	14348907/8388608	929.325
*:	21 times	32/27	294.135	27/16	905.865
*:	15 times	19683/16384	317.595	32768/19683	882.405
7:	3 times	n/a	341.055	n/a	858.945
7:	4 times	n/a	360.900	n/a	839.100
*:	16 times	8192/6561	384.360	6561/4096	815.640
*:	20 times	81/64	407.820	128/81	792.180
9:	8 times	43046721/33554432	431.280	67108864/43046721	768.720
9:	11 times	2097152/1594323	474.585	1594323/1048576	725.415
*:	23 times	4/3	498.045	3/2	701.955
*:	13 times	177147/131072	521.505	262144/177147	678.495
11:	1 time	n/a	544.965	n/a	655.035
11:	6 times	536870912/387420489	564.810	387420489/268435456	635.190
*:	18 times	1024/729	588.270	729/512	611.730

[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 perde*s 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 [i] [326] a panoply detailing the *ney* and its *perde*s 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 "8^{va}" indicator above the G-clef.

Unconventional pedal tones – which are *perde*s below *yegah* – receive the prefix "*kaba*" (bass). Similarly, unconventional high notes – which are *perde*s 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 noticable effect.

The reason for the shifting of the last two *perde*s 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.

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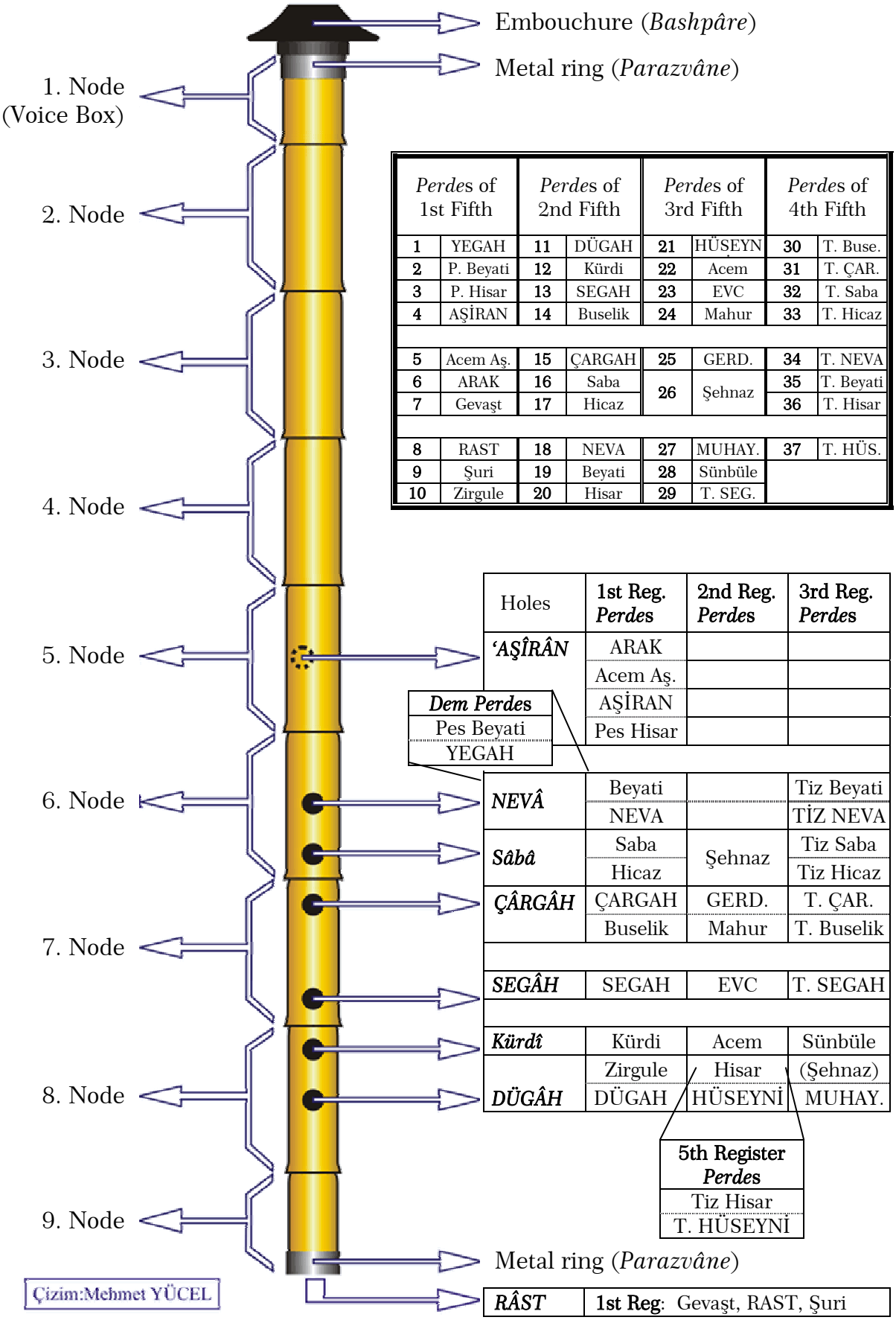
[i] The *ney* drawing in Figure C.1 is the art of Turkish Neymaker *Mehmet Yücel* and is borrowed from his website. (See, accompanying endnote.)



Perdes of 1st Fifth		*Perdes* of 2nd Fifth		*Perdes* of 3rd Fifth		*Perdes* of 4th Fifth	
1	YEGAH	11	DÜGAH	21	HÜSEYN	30	T. Buse.
2	P. Beyati	12	Kürdi	22	Acem	31	T. ÇAR.
3	P. Hisar	13	SEGAH	23	EVC	32	T. Saba
4	AŞİRAN	14	Buselik	24	Mahur	33	T. Hicaz
5	Acem Aş.	15	ÇARGAH	25	GERD.	34	T. NEVA
6	ARAK	16	Saba	26	Şehnaz	35	T. Beyati
7	Gevaşt	17	Hicaz			36	T. Hisar
8	RAST	18	NEVA	27	MUHAY.	37	T. HÜS.
9	Şuri	19	Beyati	28	Sünbüle		
10	Zirgule	20	Hisar	29	T. SEG.		

Holes	1st Reg. *Perdes*	2nd Reg. *Perdes*	3rd Reg. *Perdes*
'AŞÎRÂN	ARAK		
	Acem Aş.		
	AŞİRAN		
	Pes Hisar		
NEVÂ	Beyati		Tiz Beyati
	NEVA		TİZ NEVA
Sâbâ	Saba	Şehnaz	Tiz Saba
	Hicaz		Tiz Hicaz
ÇÂRGÂH	ÇARGAH	GERD.	T. ÇAR.
	Buselik	Mahur	T. Buselik
SEGÂH	SEGAH	EVC	T. SEGAH
Kürdî	Kürdi	Acem	Sünbüle
	Zirgule	Hisar	(Şehnaz)
DÜGÂH	DÜGAH	HÜSEYNİ	MUHAY.

Dem Perdes
Pes Beyati
YEGAH

5th Register *Perdes*
Tiz Hisar
T. HÜSEYNİ

RÂST	**1st Reg**: Gevaşt, RAST, Şuri

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

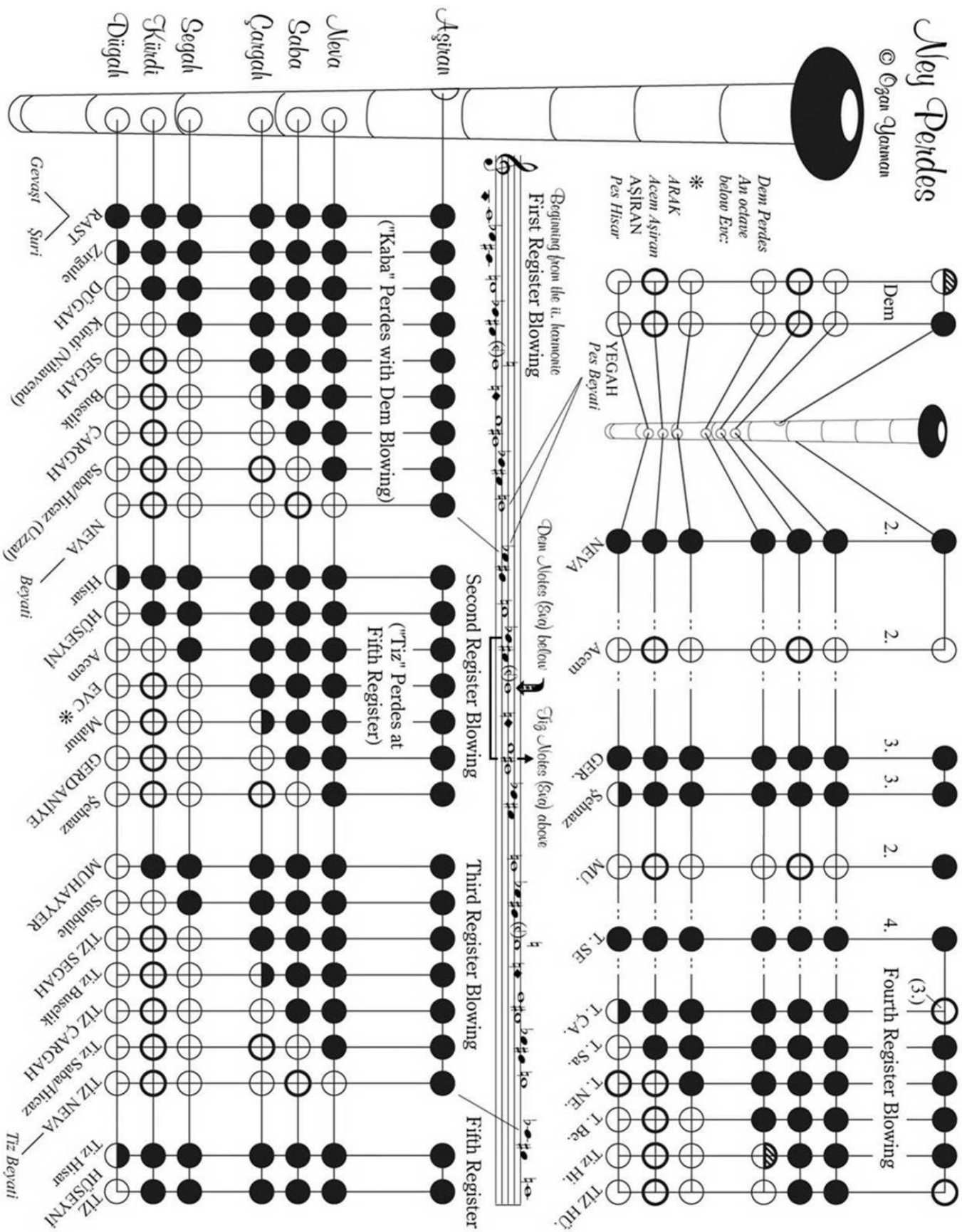


Figure C.2: Fingering Chart for *Ney Perdes* with Key-Transposing Staff Notation

Table C.1: Harmonics of the *Ney* expressed as *Perde*s of *Nasır Dede*

First Harmonic (Pedal Tones)	*Second Harmonic (1. Register)*	*Third Harmonic (2. Register)*	*Fourth Harmonic (3. Register)*	*Fifth Harmonic (4. Register)*	*Sixth Harmonic (5. Register)*
RAST					
(Kaba Gevaşt)	Gevaşt				
-8. KABA RAST	1. RAST	5. NEVA	8. GERDAN.	10. T. SEGAH	12. T. NEVA
Kaba Şuri	Şuri	Beyati			
DÜGAH					
K. Zirgule	Zirgule	Hisar	Şehnaz	11. T. ÇAR.	Tiz Hisar
-7. K. DÜGAH	2. DÜGAH	6. HÜSEYNİ	9. MUHAY.	Tiz Hicaz	13. T. HÜS.
Kürdi					
K. Kürdi	Kürdi	Acem	Sünbüle	12. T. NEVA	Tiz Acem
SEGAH					
-6. K. SEGAH	3. SEGAH	7. EVC	10. T. SEGAH	Tiz Beyati	14. TİZ EVC
ÇARGAH					
K. Buselik	Buselik	Mahur	T. Buselik	Tiz Hisar	Tiz Mahur
-5. K. ÇARGAH	4. ÇARGAH	8. GERDAN.	11. T. ÇAR.	13. T. HÜS.	15. T. GERD.
Saba					
K. Hicaz [i]	Hicaz	Şehnaz	Tiz Hicaz		
K. Saba/Uzzal	Saba/Uzzal		Tiz Saba/Uzzal		
NEVA					
-4. YEGAH	5. NEVA	9. MUHAY.	12. T. NEVA		
Pes Beyati	Beyati	Kürdi	Tiz Beyati		
(ACEM) AŞİRAN					
Pes Hisar	Hisar				
-3. AŞİRAN	6. HÜSEYNİ	T. Buselik	13. T. HÜS.		
Acem Aşiran	Acem	11. T. ÇAR.	Tiz Acem		
-2. ARAK	7. EVC	Hicaz			
*f*1	*f*2	*f*3	*f*4	*f*5	*f*6

Non-diatonic fingerhole

Askew insufflation

Vertical insufflation

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*:

[i] The reason for the precedence of *hicaz* over *saba* is due to its being a lower pitch in alignment with *Nasır Dede*'s derivation of these *perde*s 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

Fingerholes	*Ratios*	*Gökhan Özkök* [i]	*Deviations 1*	*Süleyman Erguner* [ii] [329]	*Deviations 2*
Dügah	**26/4**		1 mm down		1 to 2 mm down
Kürdi	26/5		(N/A)		1 to 2 mm down
Segah	**26/6**		1 mm up		1 to 2 mm up
Çargah	**26/8**		2 mm down		1 to 2 mm down
Hicaz (Saba)	26/9		(N/A)		1 to 2 mm up
Neva	**26/10**		1 mm up		2 to 3 mm up
Acem (Acem Aşiran)	26/13		3 mm up		1 to 2 mm up

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]:

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[i] 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 *aşiran* 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*

	ŞAH	*MANSUR*	*KIZ*
Length [i] :	26 x 33 mm (858mm)	26 x 31 mm (806mm)	26 x 27 mm (702mm)
F.hole radius:	9 to 9.5 mm	9 to 9.5 mm	9 mm
Embouchure	(dimensions may vary)		
Isthmus bore:	11 mm	10 mm	10 mm
Neva	33 mm	31 mm	27 mm
Saba/Hicaz			
Çargah	33 mm	31 mm	27 mm
	66 mm	62 mm	54 mm
Segah	33 mm	31 mm	27 mm
Kürdi			
Dügah	33 mm	31 mm	27 mm

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:

[i] 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

Bolahenk (cps)	neva A:432	hüsey. 486	evc 540	gerd. 576	muh. 648	t. seg. 720	t. çar. 768	t. nev. 864				Scale is based on the just ratios: 1, 9/8, 5/4, 4/3, 3/2, 5/3, 16/9, 2
Davud (cps)	x 9:8	neva B:486	hüsey. 546.75	evc 607.5	gerd. 648	muh. 729	t. seg. 810	t. çar. 864	t. nev. 972			
Şah (cps)		x 16:15	neva C:518.4	hüsey. 583.2	evc 648	gerd. 691.2	muh. 777.6	t. seg. 864	t. çar. 921.6	t. nev. 1036.8		
MANSUR (cps)			x 10:9	neva D:576	hüsey. 648	evc 720	gerd. 768	muh. 864	t. seg. 960	t. çar. 1024	t. nev. 1152	
Kız (cps)				x 9:8	neva E:648	hüsey. 729	evc 810	gerd. 864	muh. 972	t. seg. 1080	t. çar. 1152	t. nev. 1296
Müstahsen (cps)					x 16:15	neva F:691.2	hüsey. 777.6	evc 864	gerd. 921.4	muh. 1036.8	t. seg. 1152	t. çar. 1228.8	t. nev. 1382.4
Süpürde (cps)						x 10:9	neva G:768	hüsey. 864	evc 960	gerd. 1024	muh. 1152	t. seg. 1280	t. çar. 1365.333	t. nev. 1536

*Perde*s conforming to concert pitch on nine common types of *ney* enumerated by neyzen *Süleyman Erguner* are displayed in Table C.5 below [336]:

Table C.5: *Süleyman Erguner*'s Nine Common Types of *Ney* with *Perde*s yielding Concert Pitch

NEY TYPE / AHENK	*LENGTH (mm)*	*D [2] (mm)*	*A_4=440 cps*
Bolâhenk [i]	1014-1040	39-40	*neva*
Davud [i]	925-936	35.5-36	*çargah*
Şah-Dik [ii] *Şah*	858-884	33-34	*segah – buselik*
Mansur	780-806	30-31	*dügah*
Kız	702-715	27-27.5	*rast*
Yıldız [iii]	650-663	25-25.5	*arak*
Müstahsen	598-611	23-23.5	*acem aşiran*
Süpürde	572-585	22-22.5	*aşiran*
Bolâhenk Nısfiye [iv]	520-533	20-20.5	*yegah*

[i] It is almost impossible to perform on this size of *ney*, and it thus remains merely as a theoretical device.

[ii] *i.e.*, "acute" by at least a comma's worth.

[iii] Also called "*Kız-Müstahsen Mabeyn*" ("in between *Kız-Müstahsen*").

[iv] *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 [i], however, that the naming conventions of the *Ahenks* are incorrect. It would appear that *Yıldız* ought to be the namesake of *Bolahenk Nısfiye*, 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 C.6: Complete *Ney Ahenks* and their Measurements by Turkish Neymaker *Gökhan Özkök*

NEY TYPE / AHENK	*perde rast*	*A_4=440 cps*	*LENGTH (mm)*	*D^2 (mm)*
BOLAHENK	D_4 (Re)	*neva*	1,027-**1,040**-1,053	39,5-**40**-40,5
Bolahenk-Davut Mabeyn	D# / Eb	*hicaz*	949-**962**-988	36,5-**37**-38
DAVUD	E_4 (Mi)	*çargah*	897-**910**-936	34,5-**35**-36
ŞAH	F_4 (Fa)	*segah*	858-**871**-884	33-**33,5**-34
Şah-Mansur Mabeyn	F# / Gb	*kürdi*	819-**832**-845	31,5-**32**-32,5
MANSUR	G_4 (Sol)	*dügah*	767-**780**-793	29,5-**30**-30,5
Mansur-Kız Mabeyn	G# / Ab	*zirgule*	728-**741**-754	28-**28,5**-29
KIZ	A_4 (La)	*rast*	689-**702**-715	26,5-**27**-27,5
Kız-Müstahsen Mabeyn	A# / Bb	*arak*	637-**650**-663	24,5-**25**-25,5
MÜSTAHSEN	B_4 (Si)	*acem aşiran*	598-**611**-624	23-**23,5**-24
SÜPÜRDE (Mehtabiye)	C_5 (Ut)	*aşiran*	559-**572**-585	21,5-**22**-22,5
Süpürde-Yıldız Mabeyn	C# / Db	*pes hisar*	533-**546**-559	20,5-**21**-21,5
YILDIZ (Ahteri)	D_5 (Re)	*yegah*	507-**520**-533	19,5-**20**-20,5

Because *Maqam* Music *perde*s 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* countervails an embedded note whose frequency is readily transposed by a change of the *Ahenk* (*e.g.*, swapping one type of *ney* for another).

[i] Through personal correspondance with the author.

Since *perde* <u>*yegah*</u> is, by default, the fundamental tone with which the diatonic naturals commence, and *Süpürde* the only *Ahenk* which allows the notation of these *perde*s 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:

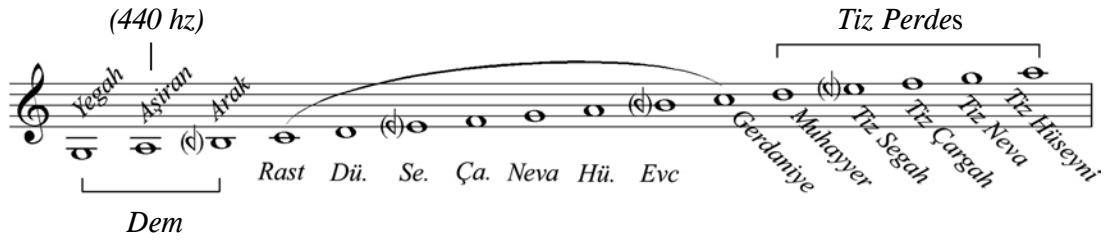

Figure C.3: Key-Transposing Staff Notation of *Nasır Dede*'s Natural *Perde*s Conforming to Concert Pitch in *Süpürde Ahenk* [i]

The principal mode in ascending order of *Maqam Rast* would thence be transcribed for all *Ahenks* the way extrapolated in Figure C.4:

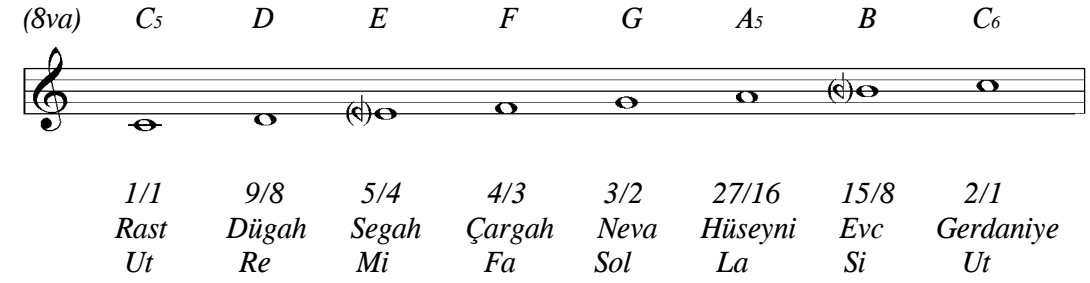

Figure C.4: Key-Transposing Staff Notation of the Principal *Rast* Mode in Ascending Order in Reference to the Concert Pitch [ii]

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:

---

[i] <u>*Aşiran*</u> – sounded with all fingerholes open – is at 440 hertz.

[ii] 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.

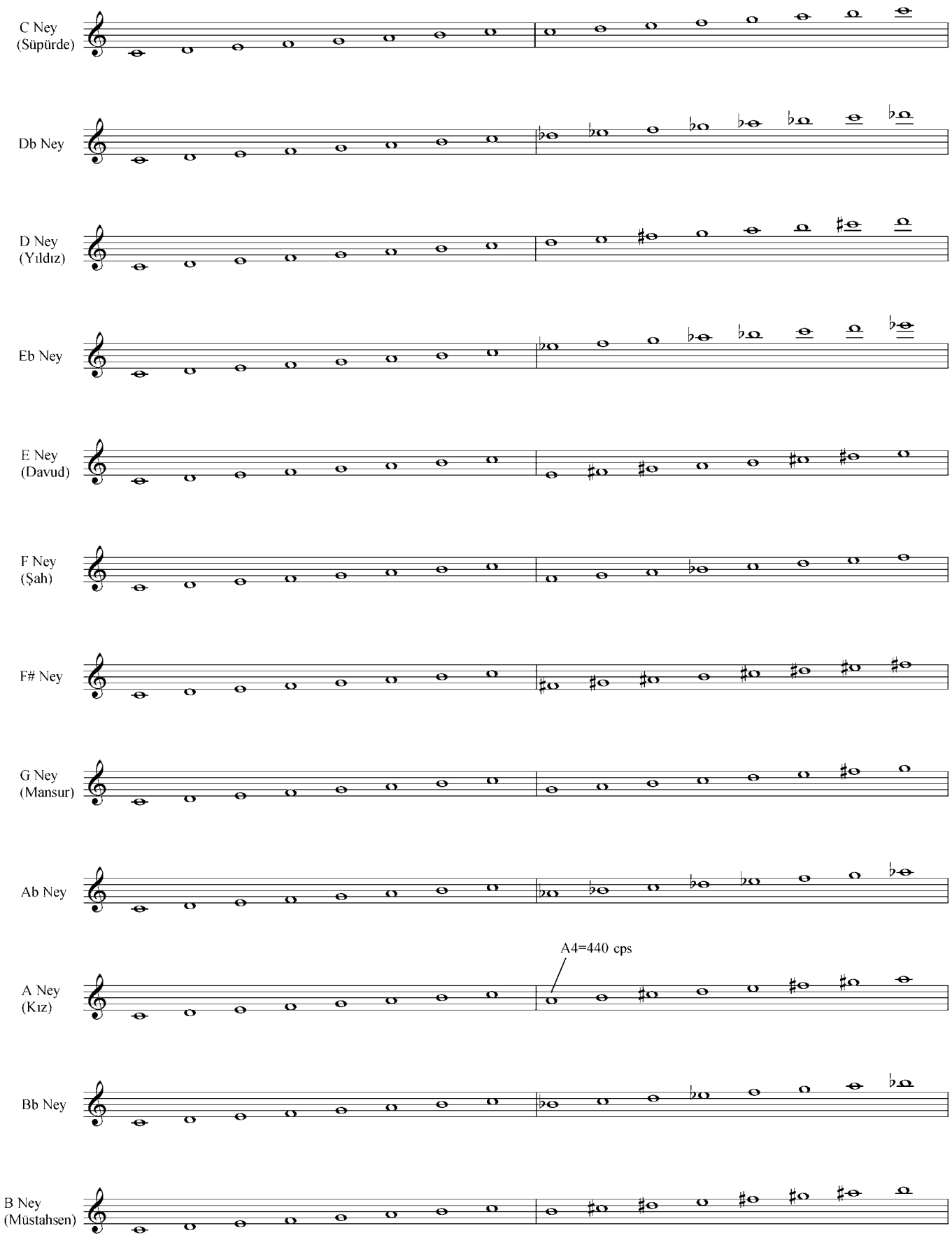

Figure C.5: Scoring of the Principal *Rast* Mode in Ascending Order for Key-Transposing vs Standard Diapason Instruments

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:

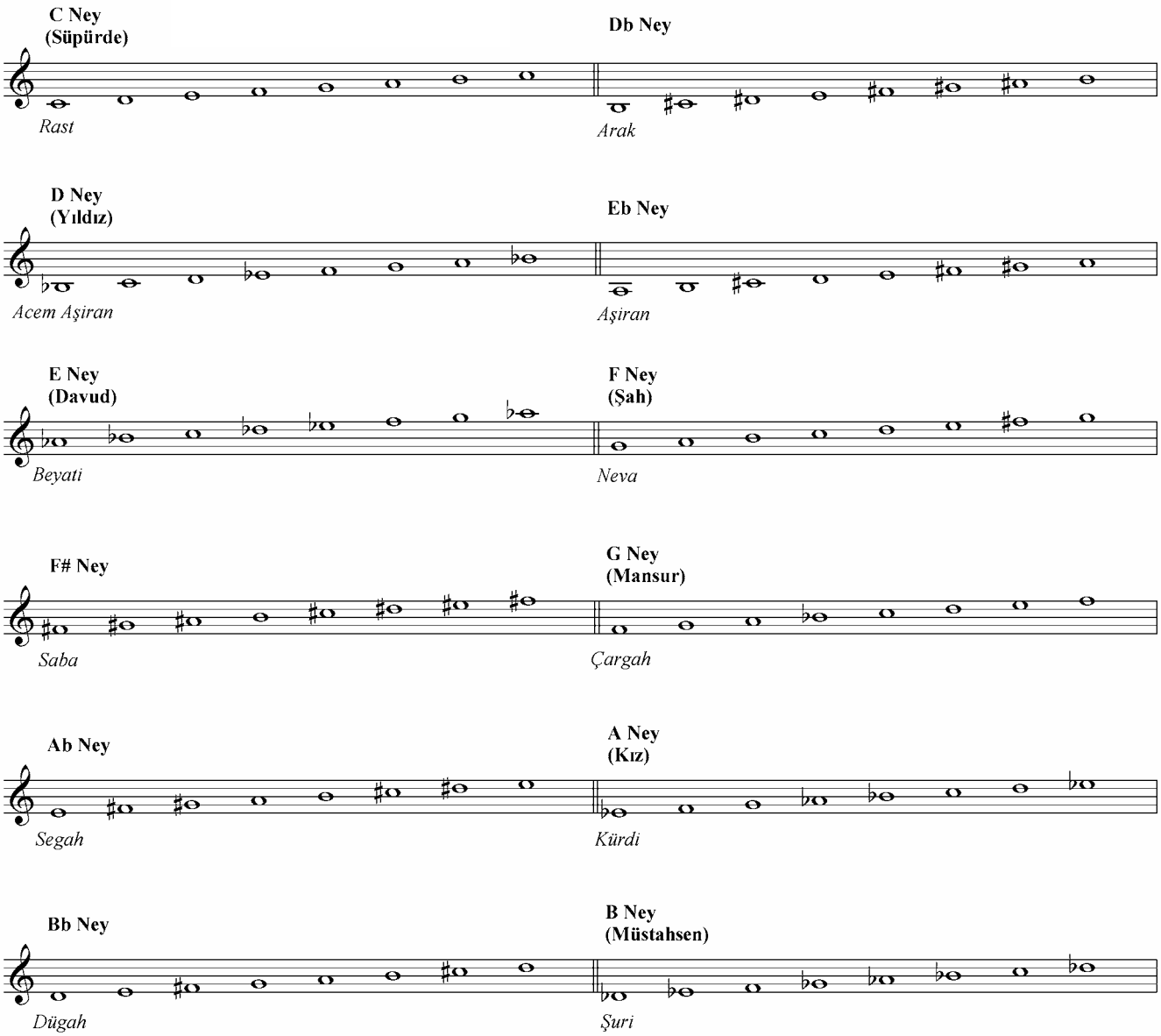

Figure C.6: In Unison Scoring of the Principal *Rast* Mode in Ascending Order at Concert Pitch for all *Ney Ahenks*

The reader must be reminded that this methodology is not yet accepted in Turkish *Maqam* Music circles.

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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 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 (~1.000578^1200=2). The equation for calculating the cent value of a given frequency ratio is {log_2 R x 1200=cents}, or {log_{10} R x (1200 / log_{10} 2)=cents}. The reverse operation is carried out by the formula {2^(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 phyrric, 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 pentatonal 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.

Terkib: 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 Doctore 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.