Microtonal Violin Pedagogy

Mastering the Neutral Second through Persian Dastgāhhā

by

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ABSTRACT

Most violinists of the Western classical tradition are untrained in the aural skills and left-hand techniques of microtonal intervals. This document surveys the nature of the problem and presents a manual for self-teaching the three-quarter tone step—the equal tempered 'neutral second' (N2) a quarter tone between the major and minor second intervals—through the melodic syntax of specific Persian classical music (PCM) modes. While the paper does not teach PCM performance, it does offer a method of melodic functional hearing through a new solmization system designed specifically for PCM. Additionally, the paper guides readers through the PCM repertoire by grouping modes with a shared functional usage of the N2. Combined with the pedagogical research of learning modalities and Edwin Gordon's Music Learning Theory, these tools provide violinists with a method for achieving the aural accessibility and performance mastery of the N2. This process serves as a future model for learning unfamiliar intervals both within and without the Western classical tradition.

DEDICATION

To my parents, Ann Louise and Sandy.

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CHAPTER 1

INTRODUCTION: THE PROBLEM

Persons trained in Western classical music value their ability to clearly identify any melodic and harmonic interval possible in the system of twelve semitones. These same musicians are largely unable to auralize—the ability to hear pitches accurately in the mind—intervals that use microtones.[1] Microtones are defined through the Western perspective as any interval smaller than a semitone, and microtonal intervals include any interval that diverges from any semitone-divisible interval by the addition of a microtone.[2] Western classical musicians lack the skill of auralizing microtonal intervals because European art music has not included microtones in its tonal systems since the Middle Ages,[3] instead relying on the diatonic major and minor scales which have predominated the European musical tradition since the late Renaissance Era.[4]

Current practice in Western classical music uses the tuning system of equal temperament in which each of the twelve semitones is just scant of one hundred cents apart so that octaves may as close as possible double in frequency as they ascend. Pitches beyond 12-tone equal temperament have been appearing more frequently in contemporary music since the early twentieth century, and yet the ability to auralize and

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[1] Gary S. Karpinski, *Aural Skill Acquisition: The Development of Listening, Reading, and Performance Skills in College-Level Musicians* (Oxford: Oxford University Press, 2000), 49.

[2] Sigrun Schneider, *Mikrotöne in der Musik des 20. Jahrhunderts: Untersuchungen zu Theorie und Gestaltungsprinzipien moderner Kompositionen mit Mikrotönen*, Orpheus-Schriftenreihe Zu Grundfragen Der Musik 15 (Bonn-Bad Godesberg: Verlag Für Systematische Musikwissenschaft, 1975), 9-10.

[3] Schneider, 18-19.

[4] Rudolf Rasch, "Tuning and Temperament," In *The Cambridge History of Western Music Theory*, edited Thomas Christensen (Cambridge: Cambridge University Press, 2002), 205-207.

audiate new pitches and intervals remains out of reach due to a dearth of pedagogical materials.[5] Sigrun Schneider notes that instruction in microtonal instrumental playing has largely been limited to fingering systems for woodwind instruments, leaving other instrumentalists and vocalists to invent their own techniques.[6] While there is abundant scholarship on the theories of tuning systems and their histories, the current materials for playing microtonal music is limited to computer software that generates alternative temperaments, retuned keyboard instruments, and refretted guitars.[7] As a result of the lack of teaching materials, microtones remain outside the standard university music curricula in ear training and music theory courses. Theoretically, a non-guitarist or non-pianist might teach themselves to auralize microtones on these differently tuned and fretted instruments or through individual listening to computer-generated sounds; in reality, exposure to such instruments cannot substitute solid pedagogy to master these new pitches.

In addition to the lack of sufficient resources for studying and mastering microtonal music, the present author sees the current imbalance with resources of the Common Practice Period as a convenient reason to maintain the status quo. Compared to the repertoire of microtonal Western music, the Common Practice Period has more than 500 years of diatonic repertoire that may all be performed in 12-tone equal temperament. While resources for studying microtonal music are evermore accessible through

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[5] George Whitman, *Introduction to Microtonal Music: For Composers and Instrumentalists in Conventional and Electronic Media* (London: Eveleigh Printing, 1970), 4.
[6] Schneider, 13-14.
[7] The websites "Encyclopedia of Microtonal Music", "Theory Making Microtonal Music", and "American Festival of Microtonal Music" provide mathematical, computer, and guitar-centric resources.

recordings and videos, the sheer volume is nowhere near comparable to those for the Common Practice Period.

Developmentally, most Western-trained musicians do not learn to recognize microtonal intervals as an additional category of intervals, and this lack of category inhibits perception.[8] Given that these same musicians may not even perceive a microtonal interval as a distinct category but rather as an out-of-tune semitone interval instead, the percentage of musicians who can first perceive and then auralize microtonal intervals at the moment is very small. Without accurate auralization, the musician is incapable of mastering the accurate production of those tones with their voice or on instruments where microtonal inflection is possible and intonation is dependant on production.[9]

MICROTONE USAGE IN WESTERN CLASSICAL MUSIC

At this point, it is important to define the treatment of microtones as two separate yet related concepts. These two concepts are reflected by the two categories of composers into which Schneider divides twentieth-century approaches to microtones: the "pure tones" and the "modernists." For the first category of composers, the twelve-note chromatic scale of semitones is sufficient but equal temperament is an obstacle to the beauty achieved by more refined tuning. The "pure tone" approach seeks to use microtonal adjustments to the standard pitches to create alternatives to equal temperament, be it through old systems such as Pythagorean or meantone tuning, or

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[8] Carol L. Krumhansl, "Music Psychology: Tonal Structures in Perception and Memory," *Annual Review of Psychology* 42 (1991): 282.

[9] By this the present author means to exclude keyboards, pedal harps, and synthesizers that are tuned before performance and are not dependent on the performer's control for tuning.

through scientific precision of the overtone series in just intonation.[10] While Schneider employs the term "pure tones" to describe a modern phenomenon, the present author sees utility in extending this category to others who sought the same goals before the twentieth century. Composers who fall into this category include Nicola Vicentino (1511-1576), Charles Luython (1557-1620), Christiaan Huygens (1629-1695), Adriaan Fokker (1887-1972), and Harry Partch (1901-1974).[11]

The "modernist" approach to microtones seeks an expansion of the possible pitches beyond the twelve-note chromatic scale so that music might be enriched. Some of these composers continued the premise of equal temperament by dividing the whole step into units smaller than the semitone such as into third, quarter, fifth, and sixth tones, including Willi Möllendorff (1872-1934), Richard H. Stein (1882-1942), Charles Ives (1874-1954), Ferruccio Busoni (1866-1924), Alois Hába (1893-1973), Ivan Wyshnegradsky (1893-1979), and Julián Carrillo (1875-1965); others sought to produce an infinite number of degradations of tones through the overtone series and spectralism, including Bjørn Fongaard (1919-1980), Gérard Grisey (1946-1998), Claude Vivier (1948-1983).[12]

While the music of the "pure tone" composers requires refinement of hearing and execution, it is much more accessible to performers who already understand and perceive

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[10] Schneider, 184.
[11] For an overview of composers of microtones, see Don Ellis, *Quarter Tones: A Text with Musical Examples, Exercises and Etudes* (New York: Harold Branch, 1975), 7-11 as well as Schneider. For a history of tuning, see Harry Partch, *Genesis of a Music: An Account of a Creative Work, Its Roots and Its Fulfillments*, *Second Edition* (New York: Da Capo Press, 1974), 361-397. Appendixes B and C provide more overview of microtonal composers in the Western classical tradition.
[12] See Ellis, Partch, and Schneider.

the traditional diatonic pitch relations as it preserves the identities of the twelve semitones. The current project seeks to render more accessible those pitches and intervals that are not part of the original twelve-tone semitone scale, taking steps towards the music of the "modernist" composers. However, in order to begin such an undertaking, the first and most simple step must first be mastered. For this reason, the project turns towards music beyond Western classical music where these other pitches, or microtones, are used idiomatically.

THE QUARTER TONE

One of the most widely used microtones throughout many traditions around the world is the quarter tone. In Western music, the quarter tone is understood as being exactly half that of the semitone, and thus would account for an additional twelve notes to make a twenty-four note chromatic scale in which each quarter tone interval is 50 cents apart. While Western music has a regular nomenclature for ntervals composed of semitones, it does not have a consistent labeling system for the intervals created by quarter tones. The composer and theorist Alois Hába suggested the term 'neutral' for the imperfect interval class one quarter tone between the major and minor intervals, thus naming the neutral third and neutral sixth intervals.[13] The present author will refer to quarter-tone intervals to mean the entire collection of intervals composed of multiple quarter tones, including the single quarter tone interval, the three-quarter tone interval, the five-quarter tone interval, etc. The melodic neutral intervals such as the neutral second and neutral third—composed of three quarter tones and seven quarter tones, respectively—are prevalent in numerous traditions including Turkish, Arab, and Persian

[13] Schneider, 139.

music. These traditions remain less accessible to the Western-trained musician due to the of the lack of the neutral interval category in the Western pedagogy of ear training.

In order to design new pedagogical material on the subject of quarter-tone intervals, the project's methodology is informed by the latest research in perception and cognition. Researchers have found that there are many tools that effectively improve one's ability to auralize including pitch matching, pitch memory, and solmization; beyond auralization, the process that truly reflects the mastery of one's ability to accurately produce specific tones is called audiation, the ability to analyze the function of auditory information melodically or harmonically.[14] The current research confirms that a unified musical grammar significantly increases the chances for a student to successfully train their ears in dictation and sight singing.[15] Because twentieth-century Western classical music's use of intervals composed of quarter tones does not constitute a unified grammar with sufficient material for immersion into a single, idiomatic style, the present author believes that the study of quarter-tones intervals for developing one's ear must be done through the lens of a specific cultural tradition that offers enough consistency and resources for study. A study of certain quarter-tone intervals could be achieved using the context of the Turkish, Arab, or Persian traditions given that each utilizes quarter-tone intervals idiomatically. While some Western Classical composers have developed their own idioms for incorporating quarter tones into the melodic functioning of their music, the degree of variation from one composer to the next does not establish a thorough

[14] Karpinski, 49-57.
[15] Ibid., 68.

context into which a learner may immerse themselves.[16] For this reason, the non-Western classical traditions offer greater possibilities for the learner of quarter-tone intervals given the current goal of self-training through context.

THE SCOPE OF THE PROJECT

This project will present the neutral second within the tradition of Persian classical music to provide the Western classically trained violinist with a method for the performance of this interval. The benefit of using an entire classical tradition to learn the neutral second is that the interval's usage is idiomatic within a singular cultural context, and there are countless hours of recordings and live performances available for reference. The focus on the neutral second rather than on the single quarter-tone step is due to the fact that the Persian, Arab, and Turkish traditions largely use only the former and not the latter. Just as the student learns to auralize diatonic steps before learning skips in ear training, the present author maintains that the three-quarter tone interval, the neutral second, functions as a microtonal stepping interval and thus ought to be mastered before all microtonal skipping intervals.[17]

The method of this study presents the Western-trained violinist with a limited selection of modal systems from Persian classical music that treat the neutral second interval in similar melodic functions. The present author created accompanying exercises

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[16] Julia Werntz, "Adding Pitches: Some New Thoughts, Ten Years After Perspectives of New Music's "Forum: Microtonality Today"," *Perspectives of New Music* 39, no. 2 (Summer, 2001): 160.

[17] The auralization and audiation of the single quarter-tone step is not included in the current project because it is not an idiomatic interval in Persian classical music. However, the five-quarters tone step, what Persian music calls the *plus second*, will be touched upon. While this project's methodology could be extended to teach musicians to audiate the seven-quarters tone, the *neutral third*, such microtonal skips are outside the current project's bounds.

that will encompass a self-directed ear-training method for the violinist to master the usage of this interval through a mixture of singing and playing, making use of up-to-date cognitive research.

The aim of this project is to introduce the sonic category of a new interval into the Western classical repertoire through its melodic context and function; it is not the aim of this project to be any of the following: a work of ethnomusicology that would unearth new insights into Persian culture; a work of Western music theory scholarship that would subject Persian classical music to inappropriate assumptions of tonal functioning; a work that intends to teach the Persian classical tradition to Western-trained violinists. This project will have succeeded if the reader, upon following the procedures and strategies outlined herein, is able to both accurately sing and play the neutral second interval. The introduction of microtonal pedagogy to the Western classically-trained musician not only offers an opportunity to attune one's ear to the level of precision necessary to execute microtonal Western music, but also presents a gateway to foster greater understanding and connectivity across cultures.

CHAPTER 2

PERSIAN CLASSICAL MUSIC

THE STRUCTURE OF THE TRADITION

The tradition of art music in Persia is centuries old, and yet the structure of its performance was solidified as recently as the nineteenth century during the Qajar dynasty.[18] The study of Persian music history is complicated by the fact that the tradition was entirely an oral one before recorded sound technologies and Western influences of notation in the twentieth century. Thus, most of the available historical data before this time comes from court records of employed musicians and treatises on music containing the names of modes and structures. This allows musicologists to speculate from etymological standpoints more than analytical comparisons of music texts. For a detailed investigation of the important musical thinkers within the scope of Persian history, see L.C. Miller's *Music and Song in Persia: The Art of Āvāz* (1999) and Hormoz Farhat's *The Dastgāh Concept in Persian Music* (1990).

Persian classical music presents the Western-trained musician with a unique pedagogical opportunity to learn the unfamiliar microtonal interval of the neutral second. Because of this, a brief explanation of Persian classical music is necessary. Firstly, Persian classical music does not use harmony: the notes of a melody do not imply chords within a tonality, and while there is a pitch center, one can speak neither of a tonic nor a dominant. Other terms to describe melodic functioning will be introduced presently. Secondly, the foundation of Persian classical music is not a scale like in the Western

[18] Lloyd Clifton Miller, *Music and Song in Persia: The Art of Āvāz*, Persian Art and Culture Series (Richmond: Curzon, 1999), 9.

tradition where the gamut of tones explicitly reveals all pitch possibilities within the hierarchy of tonality. Instead, Persian music uses modes for which each has a predetermined set of behaviors. In using the term 'mode,' it is important to clarify that the term has two meanings: either as a scale set with a pitch center, or as a particular "stylized song" that serves as a basis for elaboration.[19] While modern usage of the term 'mode' more often references this first meaning of scale, the music of the Persian classical tradition most closely resembles this second meaning of "stylized song" such that individual Persian modes evoke a particular character.

The set of behaviors that make up each Persian mode includes a mode's 1) range of pitches, 2) tessitura, 3) intervallic makeup, 4) hierarchy of pitches, and 5) traditions of performance. While a mode may have as many as three pitches or upwards of ten spanning beyond an octave, most center around a tetrachord. The tessitura is specific to a mode's character in that some modes are only to be performed in an instrumental or vocal low, central, or upper range. The concept of intervallic makeup is further diversified by the presence of not only whole and half steps but also select microtonal intervals, which will be discussed below. Persian mode pitch hierarchies are infinitely more diverse than those of Western tonality that consistently replicate relationships of tonic/dominant through perfect fourths and fifths. A mode's traditional performance involves a number of elements, including particular melodic shapes (upwards, downwards, leaping, oscillating) and rhythmic and/or melodic motives to evoke its particular character. Certain modes are also linked to extra-musical ideas through their names or associations

[19] R. P. Winnington-Ingram, *Mode in Ancient Greek Music* (Amsterdam: Adolf M. Hakkert, 1968), 2-3.

with specific poems in the Persian literary tradition. Thus, each mode imparts a particular flavor to a performance.[20] The epitome of Persian classical music is the act of choosing and ordering these modes to highlight a narrative, implicit or explicit, in the act of improvisation. The tradition of ordering modes to create modulations and overall structure along with the appropriate styles of improvisation is called a *radif*. There are many different radif given that there are many different teachers and schools of thought, although there are enough similarities between these schools that it is possible to speak broadly of *the radif*, meaning the most common application of stylistic decisions.[21]

The terms *dastgāh* and *gushe* are central to an understanding of Persian classical music, and the distinction between the mode of a dastgāh, a dastgāh as a system, and a gushe must be made. Note that the plurals are dastgāhhā and gushehā. A dastgāh has its own mode with its own set of characteristics, but the term dastgāh also references a system of many modes ordered by the radif. These other modes ordered within a dastgāh system are called gushehā, which are sometimes translated as 'pieces,' and they may vary in length from improvisations of less than thirty seconds to several minutes.[22] The mode of a dastgāh has its own characteristics and a cadential formula(e), and this mode sets the tenor of a performance through an introduction. After the introduction, the tradition of the radif determines a possible series of modulations to gushehā that are appropriate to that dastgāh system. The traditional order of gushehā in a dastgāh generally is designed such

[20] Ella Zonis, *Classical Persian Music: An Introduction* (Cambridge: Harvard University Press, 1973), 47-48.
[21] Miller, 57.
[22] Miller, 57.

that successive gushehā modulate to related tetrachords and have gradually higher tessituras, resulting in an ascent to a climax in the performance.[23]

To limit confusion, the present author will use 'dastgāh' to mean the whole system of the introductory piece(s) plus the traditional gushehā that may follow it in performance. Using the term 'dastgāh' to mean the entire system of performance means that the name of a dastgāh, such as Dastgāh-e Shur, refers to the entire collection of introductory pieces and its gushehā that follow when performing that particular dastgāh. In contrast, specifying 'the mode of the dastgāh,' e.g. 'the mode of Shur,' refers specifically to the mode of that dastgāh's introduction. The introduction, called a *darāmad*, to a performance of a dastgāh is in the mode of that dastgāh; thus the darāmad to Dastgāh-e Shur is in the mode of Shur.[24] It is helpful to say 'the mode of Shur' because often the home mode of a dastgāh is used as the basis of many different gushehā throughout the entire tradition of Persian classical music. This way, one can use a sort of shorthand to indicate some of the modal attributes of a gushe, which this project will do presently to locate specific melodic phenomena related to studying the neutral second (N2).[25]

This differentiation between using the word 'dastgāh' to mean a whole system of performance as opposed to referencing a scale or a mode comes directly from the

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[23] Hormoz Farhat, *The Dastgāh Concept in Persian Music* (Cambridge: Cambridge University Press, 1990), 19-25.

[24] The *-e* suffix denotes the possessive in Farsi and will be used for full titles of a dastgāh and of a gushe, e.g. Dastgāh-e Segāh and Gushe-ye Hesār.

[25] Table 2 at this chapter's end indicates many gushehā that are 'in the mode of Shur', for example, informing the reader that these gushehā will contain the N2 a step directly above the mode's pitch center, later defined as the *finalis*.

translation of the word 'dastgāh,' which means 'apparatus' or 'system.'[26] While traditions of Western classical music emphasize the taxonomy of modes, the precise identification of a mode in Persian music is of less importance than its functioning within a dastgāh. When moving from the dastgāh's darāmad to a gushe or from one gushe to another, there are three possible outcomes: 1) to remain in the same mode, 2) to modulate to a mode that resembles that of another dastgāh mode, or 3) to modulate to a mode that is unique and therefore called only by its gushe title. When modulating from the darāmad to a gushe or from one gushe to another, some gushehā will retain some of the five characteristics of a mode such as intervallic makeup and hierarchy of pitches, such that even a widening or narrowing of pitches employed or a change in tessitura will still reflect the mode of a dastgāh; in this case, one can refer to this gushe as being in the same mode as that dastgāh. Despite similarities that tempt theorists to classify mode into related categories, the full set of behaviors—pitch collection, tessitura, intervallic makeup, pitch hierarchy, and traditions of performance—make each gushe (and each mode of a dastgāh) distinct; even if two similar gushehā appear in different dastgāhhā, their perceived affects will differ by way of their individual juxtapositions within a performance. Because of the wide range of variety from one gushe or dastgāh to another, identifying the name of the gushe or dastgāh is more effective in understanding its modal makeup than trying to categorize gushehā or dastgāhhā by modal similarities. In limited cases for brevity, some gushehā may appear so similar to the mode of another dastgāh that it will make sense to use a shorthand as reference, and the present author has done so in Table 2 of this chapter.

[26] Miller, 63.

Some dastgāhhā have more gushehā than other dastgāhhā. Some gushehā may share modal characteristics with the mode of one dastgāh and yet only appear in another dastgāh collection.[27] Other gushehā have the same name in multiple dastgāhhā but are quite different as they adopt the intervallic makeup of the current dastgāh mode while maintaining characteristics such as pitch hierarchies and traditions of performance, e.g. Gushe-ye Neyriz in Dastgāh-e Navā compared to Gushe-ye Neyriz in Dastgāh-e Māhur. Also, see Table 2.

Persian theorists do not agree as to how many dastgāhhā and gushehā there are, partially because of a tendency to see intervallic similarities between dastgāhhā as a reason to consider them derivatives of each other. The appropriate analogy in Western music would be to say that the medieval modes of Dorian, Phrygian, etc., are derivatives of the Ionian mode by starting on different pitches in the same collection of intervals. Some Persian theorists and performers refer to these 'derivative modes' not as dastgāh but as *āvāz*. Farhat makes the compelling argument that these so-called derivatives are dastgāhhā in their own right given that they have their own distinct characteristics and traditions of specific ordered gushehā. Given that the nomenclature of *āvāz* is so widespread, it is helpful to include it here. Thus, the twelve dastgāhhā are:

Dastgāh-e Shur
Dastgāh-e Abuatā (or Āvāz-e Abuatā as a derivative of Shur)
Dastgāh-e Dashti (or Āvāz-e Dashti as a derivative of Shur)
Dastgāh-e Bayāt-e Tork (or Āvāz-e Bayāt-e Tork as a derivative of Shur)
Dastgāh-e Afshari (or Āvāz-e Afshari as a derivative of Shur)
Dastgāh-e Segāh
Dastgāh-e Chahārgāh
Dastgāh-e Homāyun

[27] There are many gushehā in the mode of Shur that appear in Dastgāh-e Navā that are never performed in Dastgāh-e Shur. See Table 2 under Navā.

Dastgāh-e Bayāt-e Esfahān (or Āvāz-e Bayāt-e Esfahān as a derivative of Homāyun)
Dastgāh-e Navā
Dastgāh-e Māhur
Dastgāh-e Rāst (or Rāst-Panjgāh)

While it is not necessary for the reader to be able to aurally distinguish between the twelve dastgāhhā, their names will be infinitely useful for locating recordings. Below, the present author has grouped together the dastgāhhā whose modes contain a specific melodic makeup integral to learning the N2 in Table 2.[28]

THE INTERVALS OF PERSIAN CLASSICAL MUSIC

The scale concept is not a relevant method for understanding Persian classical music because the dastgāh modes and gushehā do not directly traverse octave spaces in performance, with rare exceptions. The melodic action in a mode is often localized to the space of a tetrachord or pentachord and will not reach tones an octave higher without a modulation first to another gushe. Because of this, Farhat believes that the idea of the scale concept should be avoided altogether.[29]

While the idea of rejecting the scale is the most accurate to current tradition, other Persian musicians in the twentieth century have attempted to use the Western concept of the scale to explain Persian music. The most influential was Ali Naqi Vaziri (1886-1981) whose contact with European traditions led him to embrace equal temperament that included the 50-cent quarter tone between each semitone, resulting in a 24-quarter-tone scale, which may also be called 24-tone equal temperament (24TET for short).[30] Due to

[28] For more information regarding the qualities of each dastgāh, see Miller *Music and Song in Persia*, 74-78.
[29] Farhat, 16.
[30] Farhat, 8-9.

Vaziri's massive influence in Persian musical society—he created a European-style conservatory in Tehran, adapted Western notation to Persian music, and wrote method books comprised of scales and études for *tār* and *setār*—his theory of the 24-note scale is the most widely accepted view of Persian music today. Vaziri also termed the words *koron* and *sori* for accidentals that lowered and raised pitches, respectively, by a quarter tone, and these are now widely used in Persian music around the world.[31] Farhat rejects this 24-note scale on the basis that a direct quarter-tone step is never used in practice, so much so that the interval of a quarter-tone step remains mostly foreign to Persian music.[32]

Today in contemporary instruction of Persian classical music, Vaziri's influence is keenly felt in that the trend of using European-style exercises is common practice. Students are given dastgāhhā as scales and asked to traverse them in melodic sequences with the voice or on their instruments. While most contemporary players have adopted European names for notes (e.g. C is Do, D is Re, etc.), the adaptation of singing Persian music in Western solfège syllables does not appear to be widespread.[33] The European note names are employed to signify the finalis of a dastgāh, e.g. Māhur Do as Dastgāh-e Māhur with a finalis on C.

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[31] Farhat, 26.

[32] Farhat, 14. Also corroborated in Dariush Tala'i, *Traditional Persian Art Music: The "Radif" of Mirza Abdollah,* trans. Manoochehr Sadeghi (Costa Mesa: Mazda Publishers, 2000), 13. The present author located a single instance of a direct quarter-tone step in Gushe-ye Moālef in Dastgāh-e Homāyun, but even then this is only as a brief, optional grace note to a quarter-tone upper neighbor and does not constitute a functional pitch of that mode. See Farhat, 75.

[33] "Rhymitica" is an online platform for learning Persian music. By watching instructional videos of voice lessons, the current author concluded that solmization is not currently used for Persian music pedagogy. While other sources did not outright deny the use of solfège, anecdotes suggested that the master teacher uses a call and response form of learning, singing lines of poetry or playing fully formed melodies.

Table 1: Persian Classical Music Symbols for half-flat (quarter tone lower) and half-sharp (quarter tone higher)[34]

Koron	
Sori	

Therefore, instead of the scale, the intervals used in the Persian modes reveal the essence of melodic structures. Farhat measures the width of tones by comparing the frets on *tārhā* and *setārhā* of professional Persian musicians. What he found was that "the whole-tone and semi-tone are relatively stable" amongst musicians, explaining that musicians place their own frets before a performance.[35] Farhat found that the whole-tone was four cents larger than the Western equal-tempered one, 204 cents compared to 200 cents, and that the Persian semi-tone was ten cents smaller than the Western one, 90 cents compared to 100 cents.[36]

The measurement of the neutral tone steps—those that Vaziri created by adding equal 50-cent quarter tone steps together to make the neutral second made of three quarter tones, the plus tone made of five quarter tones, and the neutral third made of seven quarter tones—is much more complicated and fluid in performance than the whole

[34] PCM notation from "Two Other Music Accidentals. Iranian Accidentals," last modified July 22, 2011, https://musescore.org/en/node/11423.
[35] Farhat, 15.
[36] Farhat, 15. The Persian whole-tone interval of 204 cents is essentially that of two Pythagorean limmas plus one comma, while the 90-cent Persian semi-tone is equal to one limma. Note that Tala'i p. 10-11 accepts equal temperament for the whole tone, exemplifying the range of acceptable practice. Tala'i calculates the half step from *sabbābeh* fret to the *vostā* fret as being 80 cents, quite a bit smaller than equal temperament.

tone and semitone steps. The actual performance of these steps is very similar to the fluid intonation of major and minor thirds in Western classical music: similar to how the third in Western music is lowered in major and raised in minor by 15 cents, in Persian classical music the neutral second is 135 cents, 15 cents lower than an equal-tempered three quarters tone, being 150 cents. Farhat calls this 135-cent interval the "small neutral tone" and explains that it is often followed by a slightly larger neutral tone at 160 cents to fill out a combined minor third. For example, D-E koron-F spans a minor third between D and F, and D to E koron is a small neutral tone, while E koron to F is a "large neutral tone." When a neutral tone divides a major third, e.g. D-E koron-F sharp, the distance between the neutral tone and the upper third is about 270 cents. Farhat calls this a "plus-tone" and explains that it is larger than a whole tone but smaller than an augmented second. He also points out that the augmented second is not used in "authentic Persian music."[37]

The measurement of intervals is both confusing and meticulous. However, the present author suggests the following intuitive solution in light of the current project's goals. Since Western-music pedagogy only teaches the tempering of just thirds to the advanced-intermediate student, it should be sufficient to teach Western-trained violinists the equal-tempered neutral second first before suggesting the nuanced lowering to the "small neutral" second. Given this approach, the present author will continue in this project to introduce the equal-tempered neutral second and will guide learners towards appropriate next steps at the conclusion. After all, the goal of this project is to teach mastery of the neutral second tone; the reader may decide afterwards if they wish to

[37] Farhat, 16.

continue on a track towards learning the basics of Persian classical music, mastering other microtonal intervals in Western music, or pursuing both.

Therefore, the intervals of Persian music using a 24-tone equal-temperament framework include the major second (M2), minor second (m2), neutral second (N2), plus second (P2), major third (M3), minor third (m3), and neutral third (N3). Leaps of a perfect fourth (P4) and perfect fifth (P5) are less common but do occur. Because leaps of sixths, sevenths, and octaves are so rare in Persian music, they need not be considered here as essential building blocks of the tradition.

MELODIC FUNCTION WITHOUT TONALITY

Tonality in Western music determines the push and pull of tendency tones, creating melodic patterns that reinforce underlying harmonies. In contrast, Persian music is largely monophonic or heterophonic and does not imply harmonies through a tonal hierarchy. While Persian classical music lacks tonal signifiers such as tonic and dominant, its modes nevertheless have their own hierarchies of pitches.

The *finalis* is a term that Farhat uses to refer to the concluding note of a mode. This note is the final note of a mode's *forud*, meaning cadential formula. Sometimes a medial phrase will not end on the finalis, but instead on another note that offers a secondary conclusion; this note is called the *ist*, meaning 'rest' or 'stop.' The note in the phrase that serves as a point of accentuation and is central to the ornamentation is called the *shāhed*, meaning 'witness.' Each dastgāh mode and gushe has a finalis, but not every

mode has an ist and a shāhed as well; some have only a finalis, others have a finalis and a shâhed, and still others have all three.[38]

Farhat's use of the term finalis reflects a deliberate choice to avoid the word 'tonic' and all of the implications that would be attached to it. Nooshin indicates that the shāhed, and not the finalis, provides a "modal pitch center."[39] As the finalis is the note upon which a phrase ends, the present author believes that it provides the greatest accessibility for the Western-trained listener. Additionally, while some modes do not have a specified shāhed at all, they all contain a finalis. Thus the project will continue to use the finalis as the key point of focus.

Farhat explains that there are two other functional notes, the *āqāz* and the *moteqayyer*. The āqāz is the note on which the mode begins and it is usually a note other than the finalis. The moteqayyer, meaning 'changeable,' is a note that may be raised or lowered by a quarter tone in certain situations.[40] In some modes, a single note serves as the finalis, āqāz, and shāhed all together while in other modes they may all be on different pitches. In short, among the twelve modes of the dastgāhhā and the hundreds of gushehā, there are many pitch hierarchy variations. Just as the Western-trained musician learns to recognize a piece's tonic, they may also learn to identify a mode's finalis, shāhed, and ist as a performance unfolds. As the listener becomes more attuned to this

[38] Farhat, 24.
[39] Farhat, 24. Note that, according to Laudan Nooshin, the term finalis is not used by Persian musicians. Instead, many musicians use the term *forud-e kāmel*, meaning 'note of conclusion.' See Laudan Nooshin, *Iranian Classical Music: The Discourses and Practice of Creativity* (Surrey: Ashgate Publishing, 2015), 101.
[40] Farhat, 24.

process, it becomes increasingly easier to recognize these melodic functions in Persian music.

THE NEUTRAL SECOND AS IDIOMATIC FUNCTION

At the crux of this project is the observation that many of the dastgāh modes and gushehā have a neutral second step directly above the finalis. By identifying the dastgāh modes and gushehā with this particular trait, the present author renders them available for study with the express goal of internalizing the neutral second. Armed with the knowledge that these specific dastgāhhā and gushehā contain this characteristic, the reader will be able to locate hundreds of hours of strategic listening material.[41] This breadth of listening material for such a specific aural skill is more prolific than the collected repertoire of Western classical music that employs neutral seconds in that it seeks to present the neutral second with a consistent melodic function across listening examples. By melodic function, the present author does not mean to imply that the neutral second located a second above the finalis is a tendency tone that must resolve down; however, as it is most common for a dastgāh's finalis to be approached by step either from above or below, this interval will signal to the listener that the finalis is a step below.[42] Chapter 3 expands on the research into the science of learning new aural skills.

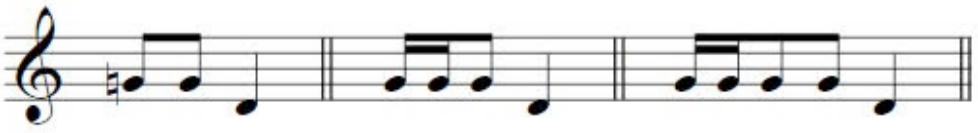
The following tables are divided into levels of difficulty and utility. In Table 2, the present author has both organized the dastgāh modes by those that contain a neutral second directly above the finalis as well as sequenced the modes from easiest to hardest

[41] Recordings of Persian classical music often list the darāmadhā and gushehā as separate tracks. As long as these tracks are also written with English letters as a transliteration, readers should have hours of potential listening at their disposal.

[42] The forud patterns of Dastgāh-e Chahārgāh and Dastgāh-e Segāh do not approach their finales by step but rather by leap from a neutral third from below. See Table 2.

regarding audiation and execution of the N2 on the violin. Table 2 also includes modal characteristics that were presented by Farhat: the stepwise intervals in the tetrachord above the finalis; the area of melodic concentration and its intervallic makeup (if other than the tetrachord above the finalis); the positions of the functional tones of the āqāz (A), shāhed (S), ist (I), and moteqayyer (M); and the forud (cadential) patterns. The various diatonic steps are represented with the following abbreviations that again come from Farhat: "small neutral" (*n*), "large neutral" (*N*), "plus tone" (*P*), major second (*M)*, and minor second (*m*). All interval collections are written in ascending order. To convert Farhat's intervals into the 50-cent equal tempered quarter tone system, the small neutral" (*n*) and the "large neutral" (*N*) would both be rendered as the same: the "neutral second" (N). The finalis is abbreviated as (F). The cadential formula of the *Bāl-e Kabutar* is a distinctive melodic motif in which the line starts on the finalis, leaps up a perfect fourth, and then leaps back to the finalis. Figure 1 demonstrates possible forms of the Bāl-e Kabutar.

Figure 1: Bāl-e Kabutar, a common cadential pattern[43]



[43] Farhat, 28.

Table 2: Dastgāh Modes with N2 Directly above Finalis

Dastgāh	Tetrachord above Finalis	Melodic concentration	Positions of Functional Tones Āqāz, Shāhed, Ist, Moteqayyer	Forud (Cadential) Patterns	Level of Difficulty for learning N2 on violin
Shur	*n-N-M*	F to 4th above	A: 2nd below S: none I: none M: 5th above	approach from 2nd below, 3rd & 2nd below, 2nd above, or Bāl-e Kabutar	Beginner
Abuatā	*n-N-M*	2nd above F to 4th above	A: 2nd above or 4th above S: 4th above I: 2nd above M: none	same as Shur without Bāl-e Kabutar	Beginner after Shur: F mostly excluded
Dashti	*n-N-M*	3rd above to 7th above F (*M-M-m-M-M)*	A: 3rd above S: 5th above I: none M: 5th above	same as Shur without Bāl-e Kabutar	Beginner after Shur: F mostly excluded, dance rhythms make more accessible
Homāyun	*n-P-m*	3rd below to 2nd above F (*N-M-n)*	A: 3rd below S: 2nd above I: 2nd below M: none	approach from 2nd below, 2nd above, or Bāl-e Kabutar	Intermediate: 2 N2's in melodic concentration , P2 3rd above F
Chahārgāh	*n-P-m*	4th below to F (*n-P-m)* and F to 4th above (*n-P-m)*	A: 3rd below S: none I: none M: none	approach from 3rd below leap (N3)	Advanced: melodic concentration contains 2 N2's, forud contains leap of N3

Table 2: Dastgāh Modes with N2 Directly above Finalis (continued)					
Dastgāh	Tetrachord above Finalis	Melodic concentration	Positions of Functional Tones Āqāz, Shāhed, Ist, Moteqayyer	Forud (Cadential) Patterns	Level of Difficulty for learning N2 on violin
Segāh	*N-M-n*	F to 4th above	A: same as F S: same as F I: none M: none	approach from 3rd below leap (N3)	Advanced: F is a neutral tone, melodic concentration contains 2 N2's, forud contains leap of N3

The present author arrived at this particular sequencing of these six dastgāhhā that contain the N2 a step directly above the finalis by considering both the melodic and violin-technical complexities at hand. The mode of Shur consistently orbits around the N2 and the finalis in its melodic design in addition to presenting certain opportunities in the hand frame of its tetrachord, which will be explained in Chapter 3. The modes of Abuatā and Dashti use similar pitch collections to that of Shur, capitalizing again on the repetition of a certain hand frame, but their melodic concentration returns less often to the N2 and finalis. The mode of Homāyun presents an intermediate level of challenge for the Western-trained violinist. While the area of melodic concentration is centralized around the finalis and the N2 as in Shur, the third above is a M3, creating a Plus second (P2) from the second above the finalis to the third above. This highly distinctive interval which the Western-trained listener may mistake for an augmented second will be indispensable for locating one's place in the mode, especially given the added difficulty of a second N2 a third below the finalis. The P2 in the mode of Homāyun will create

some new difficulties for the violinist's hand frame. More on hand frame will be discussed in Chapter 3.

The modes of Chahārgāh and Segāh should be approached last in this sequence as they include elements that are even more difficult. While the mode of Chahārgāh uses the same tetrachord as seen in Homāyun, the performance of the mode has nearly double the range in its melodic concentration, spanning a seventh. The melodic range below the finalis is composed of an identical tetrachord to the one above. This means that the listener will need to take note that only one of these tetrachords contains the finalis even though intervallically the two are identical. This layer of complexity is compounded by the fact that the performance of the mode requires a leap from the third below in the cadential pattern. This third below is a N3 (in 24-tone equal temperament of quarter tones, this would be an interval of five quarter tones), and it will be very difficult to audiate this interval without sufficient exposure to stepwise ascending and descending motion through this mode. The mode of Segāh is the most difficult of the six dastgāh modes that contain the N2 above the finalis for the Western-trained violinist to play. Not only does it contain two N2 intervals and a leap of a N3 like in Chahārgāh, but it places the finalis of Segāh on a koron (half-flat) pitch. While hypothetically Persian classical music may be transposed to place the finalis wherever is most comfortable for the accompanying singer's voice, in practice most instruments are only tuned in a few ways. Edith Gerson-Kiwi, in her survey of recordings by Persian classical performances, notes

that a majority of performances place the finalis on D or A.[44] Up until this point, this project's treatment of Persian classical music has maintained a fully transposable perspective, and while that is not incorrect, most often the finalis of Dastgāh-e Segāh is placed on a koron note so as not to require retuning given its intervallic makeup.[45] Note that the step above the finalis in Segāh is a large neutral second (*N*) as compared to the other five selected modes whose second above is a small neutral second (*n*). The hand frame for Segāh will mirror that of Shur although the finalis is different.[46] Especially on the violin, the reader will find the non-koron pitches easier to auralize than the koron pitches because of how they resonate, making the finalis of Segāh elusive to the Western-trained ear and therefore far more difficult than the other five dastgāhhā in Table 2.

In Table 3, the present author has consulted Farhat's lists of each dastgāh's most common gushehā and selected only those that contain a neutral second directly above the finalis. Note that in Table 3, many dastgāh modes do not contain the neutral second a step above the finalis, and yet they still modulate to gushehā that do. For the reader, this means that they will need to listen for modulations to these select gushehā, waiting through the darāmad that do not contain the neutral second in this specific position. From a practical standpoint, Table 2 offers a more immediate listening guide since the melodic phenomenon in question will be immediately accessible at the performance's outset, while listening material presented in Table 3 requires that the listener note modulations to

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[44] Edith Gerson-Kiwi, *The Persian Doctrine of Dastga-Composition: A Phenomenological Study in the Musical Modes* (Tel-Aviv: Israel Music Institute, 1963), 31.
[45] Farhat, 51.
[46] In the Shur hand frame where the finalis was on the index, in Segāh the finalis would be on the middle finger. The following chapter explains the different hand frames and their classifications.

specific gushehā.[47] Gushehā without any specific notes maintain the mode of their home dastgāh. An asterisk on a dastgāh name indicates a dastgāh whose mode does not have the N2 directly above the finalis.

Table 3: Gushehā with N2 Directly above Finalis

In Dastgāh:	Gushe	Notes
Shur	Golriz	F on 4th above that of Shur
	Bozorg	F on 4th above
	Khārā/Qajar	F on 4th above
	Ozzāl	Octave higher than darāmad
	Shahnāz	F on 4th above
	Qarache	F on 4th above
	Hoseyni	
	Gereyli	Folk dance
Abuatā	Sayakhi	
	Hejāz	Also a Turko-Arab maqām, melodic activity from 4th to 8th above F
	Chahār Bāq	Folk dance in triple meter, in mode of Hejāz
	Gabri	in mode of Hejāz

[47] On recordings where gushehā are listed as separate tracks, this material remains readily accessible.

Table 3: Gushehā with N2 Directly above Finalis (continued)		
In Dastgāh:	Gushe	Notes
Dashti	Oshshāq	Also a Turko-Arab maqām, in the mode of Shur with range 2nd below finalis to 4th above; Oshshāq may conclude a performance of Homāyun, Bayāt-e Esfahān, Rāst, or Navā, but may never conclude Shur.
Afshāri*	Rohāb	in mode of Shur
	Masihi	in mode of Shur
Segāh	Zang-e Shotor	Pedal point with leaps
	Zābol	emphasis on 3rd above
	Muye	emphasis 3rd-5th above
	Hesār	F on 5th above which is raised by a quarter tone
Chahārgāh	Zābol	emphasis on 3rd above
	Hesār	F on 5th above, m2 below F and N2 above finalis create a "small third", enharmonic to a Plus tone
	Hodi	
	Pahlavi	
	Rajaz	
	Mansuri	like Hesār but F on that of Chahārgāh, m2 below F and N2 above finalis create a "small third", enharmonic to a Plus tone

Table 3: Gushehā with N2 Directly above Finalis (continued)		
In Dastgāh:	Gushe	Notes
Homāyun	Chahārgāh	m2 below F and N2 above finalis create a "small third", enharmonic to a Plus tone
	Chakāvak	N2 mostly only in forud
	Abolchap	N2 mostly only in forud
	Tarz	N2 mostly only in forud
	Leyli-o Majnun	N2 mostly only in forud
	Ozzāl	in mode of Shur
	Shushtari	2nd above is the ist
	Mansuri	like Hesār with F on 4th above, m2 below F and N2 above finalis create a "small third", enharmonic to a Plus tone
	Bakhtiāri	
	Moālef	ornamental quarter tone upper neighbor, the only example of a direct quarter tone step
Bayāt-e Esfahān*	Oshshāq	Also a Turko-Arab maqām, in the mode of Shur with range 2nd below finalis to 4th above; see Dashti
	Shāhkhatāi	like Oshshāq plus Shur given the 5th above is Moteqqayer

Table 3: Gushehā with N2 Directly above Finalis (continued)		
In Dastgāh:	Gushe	Notes
Navā*	Oshshāq	Also a Turko-Arab maqām, in the mode of Shur with range 2nd below finalis to 4th above
	Hoseyni	in mode of Shur
	Busalik	in mode of Shur
	Neyriz	in mode of Shur
	Rahāvi	in mode of Shur
	Nāqus	in mode of Shur
	Takht-e Tāqdis	in mode of Shur
Māhur*	Delkash	F on 5th above, above F in mode of Shur, below F in mode of Māhur
	Neyriz	different intervals than in Navā by keeping mode of Māhur below F
Rāst*	Neyriz	
	Zābol	F on 3rd above which is lowered by a quarter tone
	Panjgāh	
	Qarache	

There are many other dastgāhhā and gushehā that contain the neutral second in other positions relative to the finalis, and in fact only the mode of Māhur is completely void of neutral intervals. However, it is the goal of this project to direct the reader to a

particular idiomatic usage of the neutral second, and it is the present author's belief that a mastery of such is essential before exploring repertoire where this melodic tendency is absent.

CHAPTER 3

PEDAGOGY OF THE NEUTRAL SECOND

THE PROBLEM REVISITED VIA PEDAGOGY

This chapter uses the research of aural skills to develop a structure of microtonal pedagogy that is accessible to the Western-trained musician. Much of the research in effective teaching methods for Western music aural skills presents valuable insights for developing the mastery of the neutral second (N2) through exercises designed to mimic Persian classical music. In order to perform the N2, the musician must first be able to conceptualize this new interval. The research on musical perception indicates that learned interval categories determine a musician's ability to auralize that interval. Western-trained musicians can identify intervals composed of semitones, but are inconsistent when given intervals composed of quarter tones or other tones smaller than a semitone given that these types of intervals are not included in traditional Western-classical pedagogy.[48] Conceptualization of the neutral second interval is measured through one's ability to audiate it. Edwin E. Gordon, a prolific researcher in music education, coined the term 'audiate' as a foundational concept of his 'Music Learning Theory' for children and adults with regard to Western tonal music. Gordon defines audiation as comprehending that which we hear in the mind, known as auralization.[49] Thus while auralization of the N2 is the desired goal, audiation of the N2 ensures its mastery. Given that Persian

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[48] Carol L. Krumhansl, "Music Psychology: Tonal Structures in Perception and Memory," *Annual Review of Psychology* 42 (1991): 282-283. For more regarding the lack of microtonal pedagogy, see Chapter 1.

[49] Edwin E. Gordon, *Learning Sequences in Music: Skill, Content, and Patterns; A Music Learning Theory* (Chicago: GIA Publications, 2003), 4.

classical music does not use tonality, the present author has adapted Gordon's approach to audiation to reflect melodic rather than tonal patterns.

To complement Gordon's six stages and eight types of audiation, the current project will employ multiple learning modalities, including exercises for visualizing, hearing, and feeling melodic structure. While not everyone shares the same preference for a particular learning style, exposure to multiple styles ensures a deeper network of connections and allows the learner to use these exercises as a point of further departure.[50]

This study assumes that the reader interested in mastering the N2 is already proficient in sight singing and ear-training of diatonic major and minor Western music, be it through moveable or fixed *do* systems. The reader should be able to infer pitch collections, locate tonic, and fluidly sing diatonic and chromatic steps and leaps up to a fifth.[51] The Western-trained musician will be able to locate the finalis of the dastgāh by using their training in identifying a pitch collection's tonic; the finalis will be the pitch at recurring phrase endings and exhibit the feeling of pitch centricity.[52] For remedial studies, the present author recommends Lars Edlund's *Modus Vetus* (1974) for sight singing and Gary Karpinski's *Aural Skills Acquisition* for methods for locating pitch

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[50] Walter B. Barbe, and Michael N. Milone, Jr., "What We Know about Modality Strengths," *Educational Leadership* 38, no. 5 (February 1981): 378. Updated scholarship on modality strengths reveals that there is much left to explore in this area and that the categories devised by different methods require more research evidence. Nevertheless, while the science of categorizing learners is still changing, the concept that a mixture of different learning modalities can strengthen learning outcomes remains the same. See Stan D. Ivie, "Learning Styles: Humpty Dumpty Revisited" *McGill Journal of Education* 44, no. 2 (Spring 2009): 177-192. http://doi-org.ezproxy1.lib.asu.edu/10.7202/039031ar.

[51] See intervals used in Persian classical music, Chapter 2.

[52] Although the shāhed may serve more as a pitch center in extended passages, the melodies composed by the present author will be short enough for the finalis to retain the pitch center.

centers.[53] What the reader must be attentive to, however, is that the pitch center in Persian music is not the tonic and therefore the reader cannot expect leading tones, dominants at the fifth or mediants at the third to have those same functions here. The most notable difference between Western and Persian music aural skills will be that the latter does not imply tonality.

The Western-trained ear is so accustomed to searching for the interval of a fifth upon which to project an expectation of dominant/tonic relationship that it may be difficult for the learner to let go of those assumptions. In any particular moment within a Persian music improvisation, the music may modulate from one mode to another in which its five behaviors partially or completely change.[54] While the Western-trained listener may perceive this modulation as a shift in tessitura or accidentals, they may not be attuned to the behaviors of the new mode whose pitch hierarchies may contrast subtly with those hierarchies of the previous mode, e.g. the establishing of a new finalis or shāhed. Therefore, until the reader becomes more familiar with the structures of gushehā, they will need to maintain an open curiosity to the unfolding of Persian classical music so that they may discover these modulating pitch hierarchies through listening.

HOW TO LISTEN

This open curiosity is necessary so that the reader may develop new strategies for listening to this particular style of music.[55] Even before the reader picks up their violin, it is necessary that they spend some time listening to Persian classical music. In a 2018

[53] Karpinski, 44-48.
[54] See Chapter 2 for the five characteristics of a Persian classical mode.
[55] The following sections outline a list of steps and the research behind them for mastering the N2. For a concise list of these steps, see the opening of Chapter 4.

study by Yvonne Leung and Roger Thornton Dean, persons without musical training were able to differentiate between pitches that belonged to a microtonal collection after only thirty minutes of exposure.[56] It is fair to assume that Western-trained musicians will be able to establish their own familiarity with Persian classical pitch collections likely in even less time. The present author has assembled names of dastgāhhā and gushehā in Chapter 2 to aid the reader's focus in listening to works that will all include the interval of the N2 directly above the finalis. In addition, the present author has curated playlists on his YouTube channel, "Michael DiBarry," that present multiple recordings of the recommended dastgāhhā that include the N2 interval a step above the finalis. Gary Karpinski notes that pitch collection identification and tonic inference are separate skills.[57] Given this, the listener should occasionally pause the recordings and try to sing up and down through the pitch collection at hand. Afterwards, they should sing from the upper range of the pitch collection downwards until they perceive the N2 interval stepping downwards.[58] When the reader steps a N2 below they will reach the note that is lowered by a koron, or half flat. For example, in the ascending collection D, E koron, F, there is a N2 step down from F to E koron. The note directly below this half-flat pitch is the finalis if it both exerts a sense pitch centricity and is the place where most phrases come to a rest. In the same example collection, D, the note below the E koron, will be the finilis if the phrases consistently end on D. The reader should then practice singing or

[56] Yvonne Leung, and Roger T. Dean, "Learning Unfamiliar Pitch Intervals: A Novel Paradigm for Demonstrating the Learning of Statistical Associations Between Musical Pitches," *PLoS ONE* 13, no. 8 (2018): https://doi.org/10.1371/journal.pone.0203026.
[57] Karpinski, 40.
[58] Karpinski, 44.

humming the finalis along with recordings, testing the feeling of pitch centricity and phrase ending.

Gordon explains that he designed his six stages of audiation to be mastered sequentially but his eight types of audiation may be applied out of order.[59] As noted in Chapter 2, Persian classical music does not utilize tonality; the reader therefore ought to substitute the word "tonal" in Table 4 for "melodic" to adapt Gordon's theory for non-tonal music. The present author posits that the goal of this project—the mastery of the N2—necessitates that the reader at least work through the first four stages of audiation utilizing types 1, 2, 4, and 6. The remaining stages and types, while all truly central to deeply learning a style of music, would help the interested learner achieve a level of musical mastery of Persian music beyond the scope of this project. Types 3 and 5 may be perused on one's own by listening to and engaging with recordings.

[59] Gordon, 13.

Table 4: Gordon's Stages and Types of Audiation[60]

Stages of Audiation (Sequential)	Types of Audiation (Non-Sequential)
1. Momentary retention	1. Listening to familiar or unfamiliar music
2. Imitating and audiating tonal patterns and rhythm patterns and recognizing and identifying a tonal center and macrobeats	2. Reading familiar or unfamiliar music
3. Establishing objective or subjective tonality and meter	3. Writing familiar or unfamiliar music from dictation
4. Retaining in audiation tonal patterns and rhythm patterns that have been organized	4. Recalling and performing familiar music from memory
5. Recalling tonal patterns and rhythm patterns organized and audiated in other pieces of music	5. Recalling and writing familiar music from memory
6. Anticipating and predicting tonal patterns and rhythm patterns	6. Creating and improvising unfamiliar music while performing or in silence
	7. Creating and improvising unfamiliar music while reading
	8. Creating and improvising unfamiliar music while writing

The first four stages of Gordon's audiation track a progression in listening skills that, for Persian classical music, go from the momentary retention of pitch matching to the identification of pitch center to the understanding of melodic functioning. In the four types of audiation selected for this project—types 1, 2, 4, and 6—the reader will progress from responding to external stimuli to auralizing interally, such that they can actively recreate the melody in their mind.

[60] Gordon, 13-23.

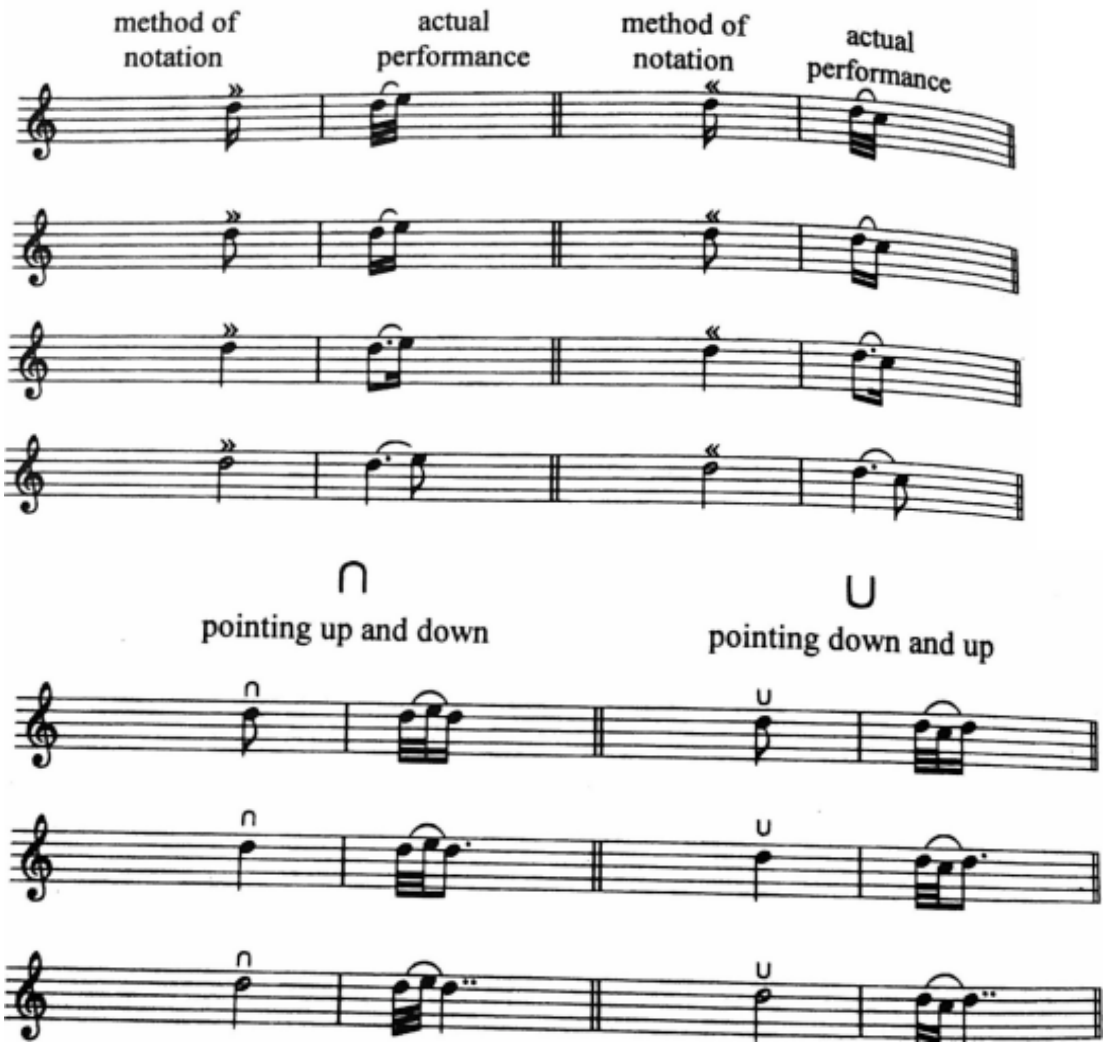
In the listening phase of type 1, in addition to identifying the finalis, the reader should listen to individual phrases and form a mental image of the melodic contour, either by drawing their hand through the air or on paper with a writing instrument. Listen to the phrase and then rehearse the contour silently directly after listening. Check the listening example again to revise your contour. This process, using the finalis as a grounding point of reference and shaping the contour, is referred to as creating an "auditory image" which will help guide future audiation.[61] In a similar fashion, the listener should visualize the underlying rhythmic structure, including forwards and backwards movement in their drawing of contour through the air to represent strong and weak beats, respectively. The rhythms of Persian instrumental classical music, while often unmeasured, mimic the practice of singing Persian poetry and thus reflect the complexities of Persian poetic meters.[62] This project will not seek to study the rhythm of Persian classical music although such a step would be necessary for the full audiation of this repertoire. Rhythm is, however, a crucial part of aiding in pitch memory and structural analysis. Research shows that adding rhythm to a musical example allows persons without musical training to remember upwards of 45% more notes than without rhythm.[63] The present author assumes that this percent increase when rhythm is included in melody would be even higher in trained musicians. Because of this, the rhythms present in the transcriptions of the dastgāhhā from Farhat and Tala'i serve as the basis for the rhythmic material of the present exercises. The essence of these rhythms can be

[61] Dale L. Bartlett, "Tonal and Musical Memory," In *Handbook of Music Psychology, Second Edition,* ed. Donald A. Hodges, 177-196. San Antonio: IMR, 1996, 177-178.
[62] Zonis, 59-61.
[63] Karpinski, 71.

gleaned from Tala'i's guide to ornamentation that lays out a series of upper and lower neighbor gestures in primarily trochaic and dactylic rhythms, placing structural importance on shorter, stressed pitches.[64] While these ornaments could be implemented to closer approximate Persian classical music in the exercises, the present author has chosen to leave the melodies in a simplified, under-ornamented presentation to highlight the underlying structure. This choice to leave the melodies under-ornamented does reflect a Eurocentric perspective on music given that the ornamentation of the classical Persian *radif* is not *ornamental* in the sense of an unnecessary extra, but rather it is much closer to the idea of *supplemental*, that which is both added and simultaneously a necessity—the way vitamins are to one's health. It is the present author's aim to simplify the concepts such that Western-trained readers gain a sense of context and function without getting lost.

[64] Tala'i, 34.

Figure 2: Tala'i's Symbols for Ornamentation[65]



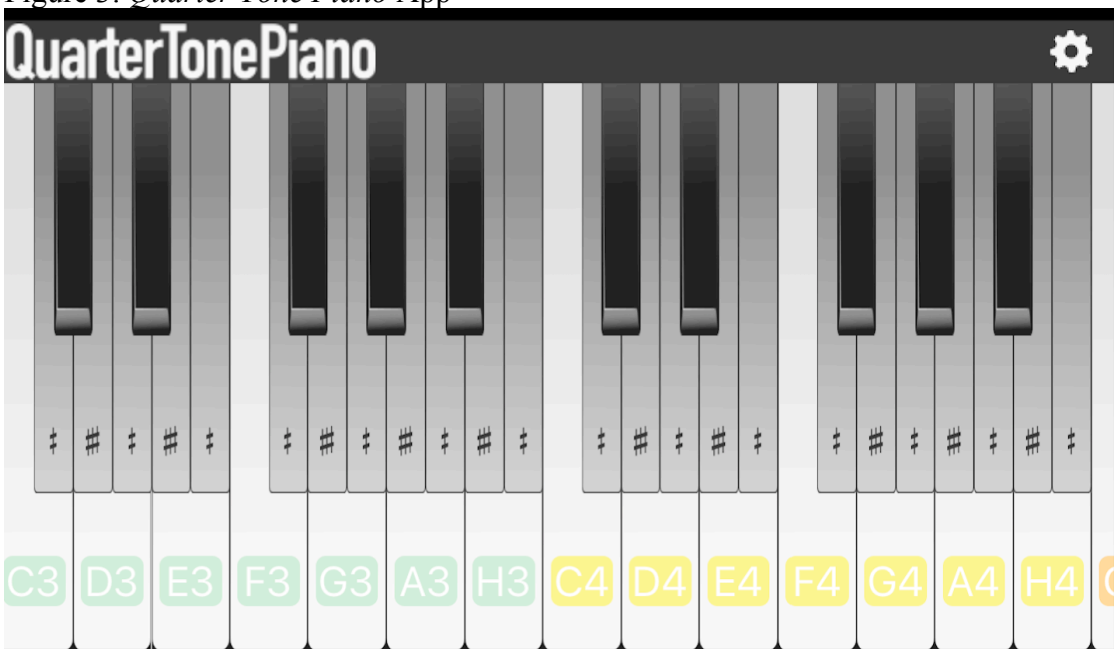
PITCH MATCHING

In type 2 of Gordon's audiation, "reading familiar or unfamiliar music," the interested reader is recommended to use a free application available through the App Store, Google Play, and APKPure.com called *Quarter Tone Piano* by Satoshi Nakadate. With a pair of headphones or earbuds, one may use this app to play the first selection of melodies in Chapter 4 by the present author. These preliminary melodies are designed to

[65] Tala'i, 34.

highlight the N2 directly above the finalis of the given mode while presenting stylistically appropriate rhythms and melodic structures. The present author composed these melodies by consulting Hormoz Farhat's analysis and musical examples from his book *The Dastgāh Concept in Persian Music*, Dariush Tala'i's transcriptions in his book *Traditional Persian Art Music: The Radif of Mirza Abdollah*, as well as numerous recordings of the dastgāhhā. As the present author lacks training in Persian classical music, his compositions for this study are only intentional imitations of darāmadhā.

Figure 3: *Quarter Tone Piano* App[66]



After playing these short melodies on the "Quarter Tone Piano" app, the reader is asked to practice pitch matching with the voice. Pitch matching demonstrates a musician's ability to momentarily retain what they hear, accomplishing Gordon's first

[66] Satoshi Nakadate, *Quarter Tone Piano*, v. 1.0.1, 2019, iOS 12.1 or later, compatible with iPhone, iPad, iPod Touch.

stage of audiation. As the reader is able to retain larger chunks of melody, they reach Gordon's second stage, that of imitating melodic patterns. The reader should play notes one at a time and match their pitch afterwards. Research shows that listening to model performances alone does not increase a player's accuracy of intonation[67], and also that familiarity of timbre also correlates to one's ability to determine registrar placement.[68] Given these studies, it is important for the reader to then locate the N2 on their own instrument to then practice pitch matching their voice with the violin, ensuring that the reader is practicing hearing the N2 on the *Quarter Tone Piano*, their voice, and their violin. The following steps alternate between isolated pitch matching and melody performing. As the melody provides "context and contour", the action of playing full melodies adds layers of information to perception, further cementing the aural concepts at hand.[69]

What follows is a set of instructions to locate the N2 on the violin using specific hand frames. The first and third fingers frame a minor third and the fourth finger is a whole step from the third, creating a perfect fourth between the index and pinky. The player can locate a 50-cent equal tempered N2 with the second finger by placing it exactly halfway between fingers one and three. The intervals of this tetrachord are thus a neutral second, neutral second, and a major second (N-N-M).[70] To aid in the placement of the second finger in this hand frame, the present author recommends taking the instrument off their shoulder, bringing the violin in front of them so that the scroll is in

[67] Karpinski, 36.
[68] Karpinski, 14.
[69] Karpinski, 39.
[70] This position will presently be called the Shur tetrachord, but for this part of the process the hand frame is more important than the name.

front of their left shoulder and the chin rest is in front of the right shoulder, and verifying that the second finger is exactly halfway between the first and third. This will allow the violinist to then play the first set of small melodies within this hand frame. Once again, the reader should practice matching individual pitches of these melodies with their voice, but this time they will use the violin as the pitch generator instead of the *Quarter Tone Piano* app. These steps have all amounted to the auralization and execution of the N2, but without comprehending the musical structure, these practices of auralization are otherwise unsustainable.

Figure 4: Framing the Shur Tetrachord Without the N2, first with fingers 1, 3, and 4 framing the m3 and P4

Figure 5: Framing the Shur Tetrachord with the N2 placed equidistant between the m3

SOLMIZATION

In order to achieve stages 3 and 4 of Gordon's audiation guidelines that specify establishing pitch centers and melodic patterns, solmization is crucial for its ability to bring melodic functioning to the foreground. Solmization was not needed prior to this point because the practicing of pitch matching, pitch memory, or pitch collections can all be performed without it.[71] Solmization's ability to cement audiation comes from the fact that it serves to focus the performer on the intonation and function of the notes, and "as long as something is kept 'in mind,' it remains active in the neural networks."[72] Given this potential for expanding the audiation neural networks, the present author has invented a new solmization system for Persian classical music. Of the current solmization systems in use in Western classical music—fixed *do*, moveable *do*, Latin letter names, scale degree numbers—each presents certain problems. Each one implies tonal harmony and does nothing to provide an aid for N2 intervals; in addition, each one is scale-centric and inappropriate for the functioning of Persian classical music. One concept that is closest to the needs of Persian classical music is that of the medieval hexachord *ut* through *la* that can be transposed from the *naturale* hexachord without accidentals to the *molle* and *durum* hexachords with an added flat and sharp, respectively. This practice was developed as early as the 10th Century by Guido d'Arezzo and was taught and furthered

[71] Karpinski, 57.
[72] Donald A. Hodge, "Neuromusical Research: A Review of the Literature," In *Handbook of Music Psychology, Second Edition,* ed. Donald A. Hodges (San Antonio: IMR, 1996), 206.

by Johannes de Garlandia, Tinctoris, Bermuda, Guilliaud, and Yssandon.[73] These musicians established conventions for modulating between these three hexachords with the following rules: *re* after *sol* in ascending in the direction of *molle* to *naturale* to *durum*; *re* after *fa* in ascending in the direction of *durum* to *naturale* to *molle*; *la* after *fa* in descending in the direction of *molle* to *naturale* to *durum*; *la* after *mi* in descending in the direction of *durum* to *naturale* to *molle*.[74]

The new system of solmization utilizes the following names for fingerings on *'ūd* found in medieval treatises by Farabi, Safi ed-Din, and Maraghi: *Motlaq*, *Zāed*, *Sabbābeh*, *Vostā*, *Benser*, and *Khenser*.[75] Motlaq, Sabbābeh, Vostā, Benser, and Khenser correspond to the open string, index, middle, ring, and pinky fingers, respectively, while Zāed represented another fret position.[76] The present author has decided to incorporate the transliteration with the line above for *Zāed* to clarify the round and dark vowel akin to saying the English word 'father' in the back of the mouth, as well as to use Tala'i's *Benser* and *Khenser* to create the opportunity for greater vowel variation in new solfège syllables created by the present author for Persian classical music.[77] These six fingering positions on *'ūd* combine into four different tetrachords, or *dāng* in Farsi. Figure 6 is a recreation of a chart from Tala'i that shows the four tetrachord combinations, their names

[73] Gaston G. Allaire, *The Theory of Hexachords, Solmization and the Modal System: A Practical Application*, Musicological Studies and Documents 24 (Dallas?: American Institute of Musicology, 1972), 43-44.
[74] Ibid., 46-48.
[75] Tala'i, 10.
[76] The transliteration of these fingering names comes from Tala'i except for that of *Zāed* which comes from Farhat. Farhat's transliterations are *Motlaq, Sabbābe, Vostā, Bansar, and Xansar* where the *X* and the *Kh* are synonymous.
[77] Farhat, 10-11.

according to which dastgāh they belong, and the cent measurements between each step.[78] Figure 7 modifies Tala'i's measurements of the steps to fit Farhat's calculations. Figure 8 models the note names if the Motlaq begins on D, showing that the Zāed is a N2 above, the Sabbābeh a M2 above, the Vostā a m3 above, the Benser a M3 above, and the Khenser a P4 above the Motlaq.[79] While the P4 between the Motlaq and Khenser appears stable, in performance some of these steps would be widened or narrowed by one to four cents.[80]

Figure 6: The Four Tetrachords in Persian Music According to Tala'i

Motlaq		*Zāed*		*Benser*		*Khenser*	Dāng-e Chahārgāh
I	140	I	240	I	120	I	
Motlaq		*Zāed*		*Vostā*		*Khenser*	Dāng-e Shur
I	140	I	140	I	220	I	
Motlaq		*Sabbābeh*		*Vostā*		*Khenser*	Dāng-e Dashti
I	200	I	80	I	220	I	
Motlaq		*Sabbābeh*		*Benser*		*Khenser*	Dāng-e Māhur
I	200	I	180	I	120	I	

[78] Tala'i, 11.
[79] Farhat's measurements for the most common whole tone, semitone, small neutral, large neutral, and plus tone all reflect his calculated average of these tones in performance. See Chapter 2 for Intervals of Persian Music.
[80] Farhat, 15-18.

Figure 7: The Four Tetrachords According to Farhat's Measurements

Motlaq		*Zāed*		*Benser*		*Khenser*		Dāng-e Chahārgāh
I	135	I	270	I	90	I		
Motlaq		*Zāed*		*Vostā*		*Khenser*		Dāng-e Shur
I	135	I	160	I	204	I		
Motlaq		*Sabbābeh*		*Vostā*		*Khenser*		Dāng-e Dashti
I	204	I	90	I	204	I		
Motlaq		*Sabbābeh*		*Benser*		*Khenser*		Dāng-e Māhur
I	204	I	204	I	90	I		

Figure 8: The Four Tetrachords with Mo Starting on D

Motlaq		*Zāed*		*Benser*		*Khenser*		Dāng-e Chahārgāh
D	135	Ep	270	F#	90	G		
Motlaq		*Zāed*		*Vostā*		*Khenser*		Dāng-e Shur
D	135	Ep	160	F	204	G		
Motlaq		*Sabbābeh*		*Vostā*		*Khenser*		Dāng-e Dashti
D	204	E	90	F	204	G		
Motlaq		*Sabbābeh*		*Benser*		*Khenser*		Dāng-e Māhur
D	204	E	204	F#	90	G		

According to these four possible tetrachords, the present author has shortened the medieval fingering names to form the new solmization syllables: *mo*, *zā*, *sa*, *vo*, *be*, *khe*. As noted in Chapter 2, the quarter tone step is not idiomatic in Persian classical music, and thus *zā* and *sa* are never consecutive. Figure 9 illustrates the solfège of the four tetrachords.

Figure 9: The Four Tetrachords Starting on D on the Staff with New Solmization

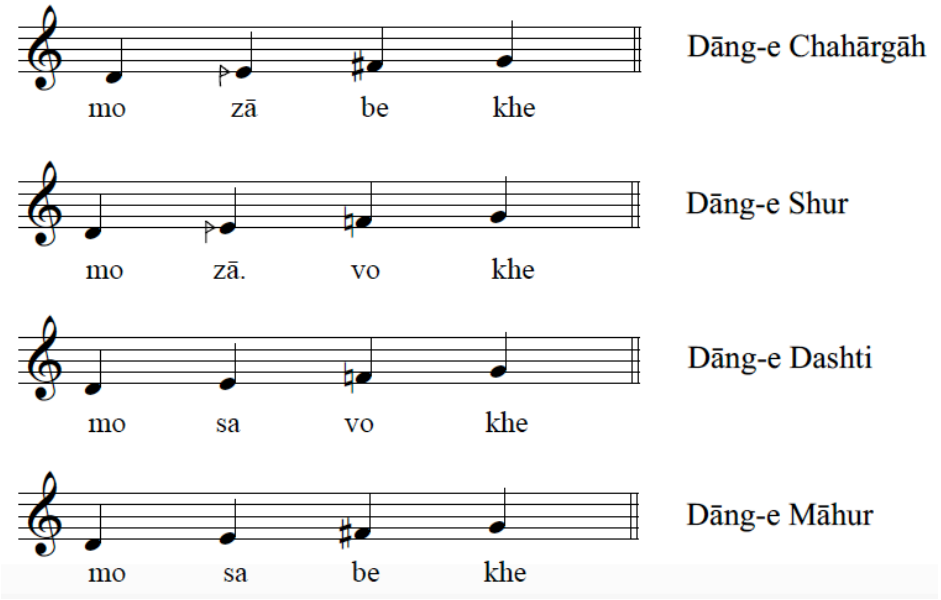


Table 5 illustrates how one could solfège the intervals of Persian music within the tetrachords, and so the P5 is excluded here because it would require modulation.

Table 5: Intervals of Persian Classical Music Within the Tetrachords. Tetrachords of Chahārgāh, Shur, Dashti, and Māhur represented with the letters C, S, D, and M, respectively, the parentheses enclose possible solfège for those intervals[81]

Interval	Can be sung as:
m2	D (*sa-vo*), C/M (*be-khe*)
M2	S (*vo-khe*), D/M (*mo-sa*)
N2	C/S (*mo-zā*) the "small neutral", S (*zā-vo*) the "large neutral"
P2	C (*zā-be*)
m3	S/D (*mo-vo*), D/M (*sa-khe*)
M3	C/M (*mo-be*)
N3	C/S (*zā-khe*)
P4	C/S/D/M (*mo-khe*)

As with the solmization of the medieval European hexachords, the singer ought to maintain the same tetrachord for as long as possible. For individual steps above or below the Persian tetrachord, Table 6 presents the following recommendations. When these steps fall outside of the current tetrachord, these recommendations create guidelines for modulations, e.g. stepping below *mo* or above *khe*.

[81] *N.B.* that for this project the reader may treat the small and large neutral seconds as equivalent 150-cent steps even though this system of solmization may perfectly preserve the unequal relationship of these two intervals according to Farhat.

Table 6: Steps above and below *Mo* and *Khe*. Modulations in bold

To…	From *Mo*	From *Khe*
Lower m2	***Be***	*Be*
Lower M2	***Vo***	*Vo*
Lower N2	***Zā***	*Zā*
Upper m2	*Vo*	***Vo***
Upper M2	*Sa*	***Sa***
Upper N2	*Zā*	***Zā***

The previous step in the learning of the N2 interval was pitch matching with the voice against individual notes on the reader's violin. In the next step, the reader pitch matches again with the violin at hand while singing the new solfège syllables for Persian classical music. The syllables are provided underneath the same first melodies that they have already played. The reader is then asked to determine the correct syllables using the unmarked version in "Pitch Matching." Although the correct answers are provided on the following page, it is important to check for understanding by attempting to use the new system. When the reader can solfège these melodies without the help of the violin, they will have audiated the N2 interval.

MASTERY OF THE NEUTRAL SECOND

Audiating the N2 through successful solfège and performance is a great first step towards mastery. The next steps include the production of these melodies with different fingerings. Because long-term memory requires sufficient repetition of recalling and the process of "weighting"—calculating the relevancy of information—mapping the N2

between each finger combination will encode the concept on a deeper kinesthetic level.[82] The N2 that appears a step above the finalis may be executed on four different fingerings as well as on a fifth fingering for transpositions that place the dastgāh's finalis on one of the violin's open strings. The most accessible sequencing of these combinations should be, in order from easiest to hardest, from fingers 1-2, 2-3, 0-1 when available, 4-1, and 3-4. In the first two fingerings, the hand may frame a m3 between fingers 1 and 3 or between 2 and 4, respectively.[83] As discussed earlier, this allows the violinist to use the visual cue of placing the N2 directly equidistant within that m3. Fingerings 0-1, 4-1, and 3-4 rely more heavily on the direction of the ear, although they may also frame a m3 between 0 and 2, 4 and 2, or 3 and 1, respectively. In these fingerings, the m3 may be played linearly, placing the N2 by recalling the same sound of the linear m3 followed by the N2 on the previous two fingerings.

The next step towards mastery of the N2 is achieved by performing the melodies in a series of transpositions, thereby detaching the melodic structure from its previous pitch center and casting the entire melodic functioning as a single idea. The sequencing of these transpositions is designed to use the features of the violin to allow for increasing complexity. The first group of transpositions with the finalis on G, D, A, then E utilizes the violin's open strings to practice all five N2 fingerings. The second group with the finalis on C, F, then B is quite manageable with tetrachords starting on two different octaves while employing relatively low positions, the highest necessary position being fifth position to place the N2 between fingers 2-3 with the finalis on B. The final group of

[82] Hodge, 206.
[83] See Figure 3 for an example of this hand frame.

transpositions with the finalis on F#, Bb, C#/Db, D#/Eb, and G#/Ab ring significantly less on the violin. While these transpositions are certainly within reach, they are slightly more cumbersome.

The first grouping of melodies are all based on Dastgāh-e Shur because the tetrachord of Shur contains key features upon which the Western-trained violinist may rely. These features include the embedded m3 and P4 that serve as a continuous reference. In Chapter 2, Table 1 outlined the dastgāhhā that contain the N2 directly above the finalis and ordered them from most accessible to most challenging. After presenting the melodies based on Dastgāh-e Shur, Chapter 4 presents the reader with a second grouping of melodies based on Dastgāh-e Homāyun that the present author deems as being of an intermediate level of difficulty. Dastgāh-e Homāyun can be constructed from the Chahārgāh tetrachord ascending from the finalis plus the Shur tetrachord below the finalis. The tetrachord above the finalis in Dastgāh-e Homāyun contains a M3 rather than a m3, and therefore violinists will need to frame the m3 first as a reference for initial placement of the N2. Naturally, the greater the player's familiarity with the N2, the less they will need to rely on the visual and/or kinesthetic framing of the m3 beforehand.

Figure 10: Framing Dastgāh-e Homāyun with the Chahārgāh Tetrachord

The reader may access Gordon's 4th type of audiation by memorizing these melodies. The present author invites the reader to explore even further by improvising similar melodies. By listening to more Persian classical recordings and mimicking the rhythmic structure, melodic motives, and rhetoric of the individual dastgāhhā, the reader may learn to write their own phrases. The solmization system may be used to heighten a sense of melodic structure and intonation but, as with the use of the medieval hexachords, is not mandatory beyond a certain level of fluidity.[84] The reader may also achieve Gordon's 6th type of audiation by listening to recordings and imagining potential successive phrases by pausing the performance and singing.

However, seeing as the goal of this project is the mastery of the N2 and not the complete audiation of Persian classical music, the next steps for the violinist interested in further expanding their quarter-tone interval capabilities would be to practice the N2 in rapidly transposing sequences. For this purpose, the present author has included some

[84] Allaire, 44.

final exercises that leave the realm of Persian classical music behind in Chapter 5. The reader will find, however, that these final exercises do make significant use of the new solmization. For a continued discussion of future pedagogical directions, see Chapter 5.

CHAPTER 4

ETUDE FOR THE NEUTRAL SECOND

THE PROCESS

The following process may be applied to the entirety of this document.

1. Listen to recordings of the dastgāh at hand, both for first impressions and then with an analytical ear.
2. Practice pitch matching your voice to a quarter tone piano using an app to play the phrases composed by the present author in that same dastgāh.
3. Use your violin as the pitch generator to which you can again practice matching your voice to the same phrases as before.
4. Use the solmization system presented in Chapter 3 to solfège all the phrases of the dastgāh at hand, stringing them together to perform a single darāmad.
5. Play the darāmad on the violin with the first recommended fingering.
6. Play the same darāmad on the violin with a sequence of different fingerings.
7. Play the darāmad transposed to different pitch centers in multiple fingerings.

STEP 1: LISTENING

Before singing or playing these new notes on the violin, the first step is listening to unfamiliar music (Gordon's Type 1 of audiation). The present author has created two playlists of Persian classical music on his YouTube channel called "Michael DiBarry," each organized by a different dastgāh: "Dastgāh-e Shur" and "Dastgāh-e Homāyun." These dastgāhhā have been selected to reflect a specific phenomenon: that is the interval of a N2 one pitch above the pitch center, called the finalis. Refer back to Chapter 2 for a

detailed explanation of the sequencing of these six dastgāhhā from easiest to hardest for the violinist wishing to learn to master the N2.

The first dastgāh that the present author recommends the reader to listen to is called Dastgāh-e Shur. Before continuing, please spend somewhere between fifteen and thirty minutes listening to the playlist called "Dastgāh-e Shur".[85] While listening, the reader should do the following: use a writing instrument to trace the melodic contour in the air and punctuate forwards and backwards in the air to imitate feelings of rhythmic stress and release. The process of beginning to embody this music is more important than performance accuracy.

After the first fifteen minutes of listening, the reader should read the section "Melodic Functioning Without Western Tonality" in Chapter 2 if they have not already done so. This should key the reader into the concept of the finalis that serves as the pitch center. Armed with this information, the listener should occasionally pause the recordings and try to sing up and down through the pitch collection at hand. Afterwards, they should sing from the upper range of the pitch collection downwards until they perceive the N2 interval stepping downwards.[86] When the reader sings a N2 below they will reach the note that is lowered by a koron, or half flat. The note directly below this will likely be the finalis. This is qualified with likely because there may be other N2 steps at the upper and lower ranges of the mode of Shur. However, only the finalis will be the place to which most phrases come to a rest. Also, the finalis will likely feel sufficiently like a pitch center, but please note that in expanded passages other notes will take on the role of pitch

[85] Given that the reader has musical training, the process of becoming familiar with a new pitch collection should require thirty minutes or less, according to a 2018 study by Leung.
[86] Karpinski, 44.

center. Therefore, locating the finalis will require a combination of locating the N2 and navigating the feeling of pitch centricity. The reader should then practice singing or humming the perceived finalis along with recordings, testing the feeling of pitch centricity and phrase ending.

Having identified the finalis, listen to the phrases again, pause the recording, and then rehearse the contour silently. Check the listening example again to revise your contour. This process uses the finalis as a grounding point of reference for your contour. Do this process with three to five tracks, searching for a level of confidence in your contour. Work only on one phrase at a time and spend approximately five focused minutes with this exercise.

STEP 2: PITCH MATCHING TO THE *QUARTER TONE PIANO*

Using your tablet or smartphone, download the free app called *Quarter Tone Piano* by Satoshi Nakadate. Available through the App Store, Google Play, and APKPure.com, this app will allow you to play equal tempered quarter tones with a pair of headphones or earbuds. Using this app, play the first selection of melodies below. Note that while this app uses quarter-tone notation common to Western music, these melodies will continue to use the koron and sori in place of the Western half-flat and half-sharp, respectively. See Table 7 for a comparison. In these phrases, the finalis is indicated in green so as to keep the reader engaged with the melodic functioning.

Table 7: Western and Persian Classical Music Notation[87]

	In Western Music	In Persian Music
Quarter tone lower	 Quarter flat	 Koron
Three quarter tones lower	 Three Quarters flat	NA
Quarter tone higher	 Quarter sharp	 Sori
Three quarter tones higher	 Three Quarters sharp	NA

After playing the melodies on the "Quarter Tone Piano", practice pitch matching your voice on a neutral syllable such as 'la' with the app, one note at a time. Because you are familiar with Western diatonic sight singing, the main challenge will be to sing the koron notes with excellent intonation.

STEP 3: PITCH MATCHING TO THE VIOLIN

In step three, the violin is used like a monochord so that the reader may practice pitch matching their voice to a different timbre while becoming acquainted with the physical layout of the hand frame. In the first version of the Dastgāh-e Shur, the finalis is G. The first finger will begin on the finalis, placing the violinist in third position on the D string. The Shur tetrachord is formed with the following steps: three quarters tone, three

[87] WCM notation from A. Eric Heukeshoven, "West Meets East – Notation & Playback of Quarter Tone Music Using Sibelius," last modified June 11, 2012, https://www.rpmseattle.com/of_note/west-meets-east-notation-playback-of-quarter-tone-music-using-sibelius/, and PCM notation from "Two Other Music Accidentals. Iranian Accidentals," last modified July 22, 2011, https://musescore.org/en/node/11423.

quarters tone, whole tone. In ascending intervals from the finalis, this is: N2, N2, M2. In measuring each finger from the finalis, the second finger is a N2 above, the third finger is a m3 above, and the fourth finger forms a P4 above. With the finalis on G, the notes of the Shur tetrachord are: G, A koron, B flat, C.

The following steps are repeated from Chapter 3. In order to form the Shur tetrachord, place fingers 1, 3, and 4 on the finalis G, the m3 on B flat, and the P4 on C. See Figure 11.

Figure 11: Shur Tetrachord Without 2nd Finger

Next, place the second finger equidistant between fingers 1 and 3. This is the location of the A koron forming a N2 from G to A koron and another N2 from A koron to B flat, as in Figure 12. Play the A koron and listen for the pitches distinct identity.

Figure 12: Shur Tetrachord with Neutral Second

Play the phrases in Shur on the violin staying in the same position the entire time, playing the F in 3rd position on the G string. Match the pitch of your voice to each consecutive note of the phrase, recognizing the spacing of the N2 in your voice.

A NOTE ON RHYTHM

As this project is primarily concerned with intonation of an unfamiliar interval and pitches, the focus has hitherto been placed solely on processes of intonation and melodic theory. However, studies show that rhythm is essential to strengthening pitch memory as well as "weighting" the importance of elements in a musical phrase.[88] Therefore, these melodies should be performed with a rhythm and not all as equal whole notes, although at the initial pitch matching stages such equal playing and singing may be a necessity.

[88] See Krumhansl, "Music Psychology", 297-298; Karpinski, 71; and Hodge, 206.

The meters of Persian classical music fall into three categories: free meter, semi-metered, and strict meter.[89] The phrases composed by the present author seek to portray the semi-metered music by having bar lines and different durations of notes. The first note following a bar line is intended to have the most stress as with an accent or a *tenuto*. On the violin this stress will translate into an increase of bow speed on this note. The half notes are meant to be the longest notes while the quarter notes represent the second longest notes. The sixteenth notes are to be played as grace notes, and the eighth notes are meant to be short. In the case of consecutive eighth notes, the listener may instinctually apply a 'snowball effect', creating a slight accelerando through a melismatic passage. With these guidelines in mind, the melodies in this project should not be counted precisely. Therefore, the time signature is irrelevant.

At this point in the process, incorporate the rhythmic proportions and stress the first note after the bar line as you play the phrases on the violin, aiming to pitch match simultaneously. Likely you will need to do this slowly at first.

STEP 4: SOLMIZATION

The new system of solmization devised for this project employs a transposable tetrachord. The syllables are in ascending order are *mo*, *zā* (vowel rounded and dark as in English 'father'), *sa*, *vo*, *be* (vowel as in 'bed'), and *khe* (the 'kh' is a guttural 'h' as in the Hebrew 'challah'). *Mo* to *zā* is a N2; *mo* to *sa* is a M2; *mo* to *vo* is a m3; *mo* to *be* is a M3; and *mo* to *khe* is a P4. For a complete explanation of how to use this system, including how to modulate to pitches below *mo* or above *khe*, see Chapter 3. Note that

[89] Miller, 57.

this system does not explicitly state the mode's finalis, shāhed, or any other functional melodic pitch in Persian music. This is why the finalis is indicated in green.

On the following page the phrases of Dastgāh-e Shur are presented with the solfège syllables. The Shur tetrachord will use only the syllables *mo*, *zā*, *vo*, and *khe*. The reader should try their hand at determining the correct syllables, using the previous iteration as a workspace and the following page with the syllables written underneath as an answer sheet. The present author recommends singing up and down the given tetrachord to familiarize oneself with its structure.[90]

The reader should now solfège the phrases of the current dastgāh using this system, checking for intonation as necessary with their violin at hand. At this point, all of the phrases will include the solfège syllables to keep the intonation and location in the tetrachord active in the mind. After the reader can sing all of the phrases, they are ready to perform them on the violin.

STEP 5: PLAY WITH FINGERING I

The reader is now ready to perform the phrases of the current dastgāh in their entirety as a complete darāmad on the violin. The first recommended fingering places the finalis on the first finger. Since the phrases in Shur place the finalis on G to start with, this means that the violinist will begin in third position just as they did in Step 3 of this chapter. Remain in this position throughout the entirety of the phrases.

[90] See Figure 9 in Chapter 3 for an example of the four tetrachords and their solfège syllables.

STEP 6: PLAY WITH FINGERINGS II-V

Just like other étude books that cement ideas through dexterity exercises, this project recommends a sequencing of fingerings that will practice placing the N2 between every possible finger combination. In the second fingering, the violinist places the finalis on the second finger. For example, if the finalis is on G, then the violinist will be in the second position on the D string. When playing on the second fingering in which the finalis is played with the second finger, first frame the m3 between fingers 2 and 4 before placing the N2 equidistant between them with the third finger. See Figures 13 and 14.

Figure 13: Shur Tetrachord in Second Position, *Mo* on the Second Finger, framing the m3

Figure 14: Shur Tetrachord in Second Position, *Mo* on Second Finger, N2 Placement

The third fingering places the finalis on the open string if possible. With the finalis on G, many phrases are not possible that would have had an F below the finalis. The subsequent fingerings place the finalis on the third finger and then on the fourth finger. In this way, the material sounds the same but feels different in the hand. Table 8 reiterates this order and clarifies the fingerings and positions to be utilized.

Table 8: Sequencing of Fingerings by Placement of the Finalis

Fingering Order	Finalis on:	Position for Finalis on G
I	1st finger	3rd position
II	2nd finger	2nd position
III	open string (if available)	1st position (phrases down the octave)
IV	3rd finger	1st position
V	4th finger	4th position

STEP 7: PLAY IN TRANSPOSITIONS

The final step to ingrain the performance of the N2 is to perform the darāmad of the current dastgāh in various transpositions. This follows the same ordering of fingerings such that the first fingering in the new transposition will place the finalis on the first finger before then practicing with the finalis on all other fingers.

The remaining transpositions in the first group place the finalis on D, A, and E. The second group of transpositions places the finalis on C, F, and B. The final group transposes to the finalis on F sharp, B flat, C sharp/D flat, D sharp/E flat, and G sharp/A flat. This project will only write out the transpositions for the first group but highly encourages the reader to pursue the rest.

STEP 8: REPEAT STEPS 1-7 WITH THE NEXT DASTGĀH

This document includes phrases that amount to darāmadhā in both Dastgāh-e Shur and Dastgāh-e Homāyun. After completing all of the transpositions and fingerings in Shur, the reader should continue to use the same process with Homāyun, starting with listening to the YouTube playlist called “Dastgāh-e Homāyun” and continuing through the pitch matching and solfège steps.

The hand frame of Homāyun is similar to that of Shur but replaces the m3 between *mo* and *vo* with a M3 between *mo* and *be*. The Homāyun tetrachord is formed with the following steps: three quarters tone, five quarters tone, and semitone. In ascending intervals from the finalis, this is: N2, P2, m2. In measuring each finger from the finalis, the second finger is a N2 above, the third finger is a M3 above, and the fourth finger forms a P4 above. With the finalis on G, the notes of the Homāyun tetrachord are: G, A koron, B natural, C. Thus, the solfège syllables of this tetrachord starting with the

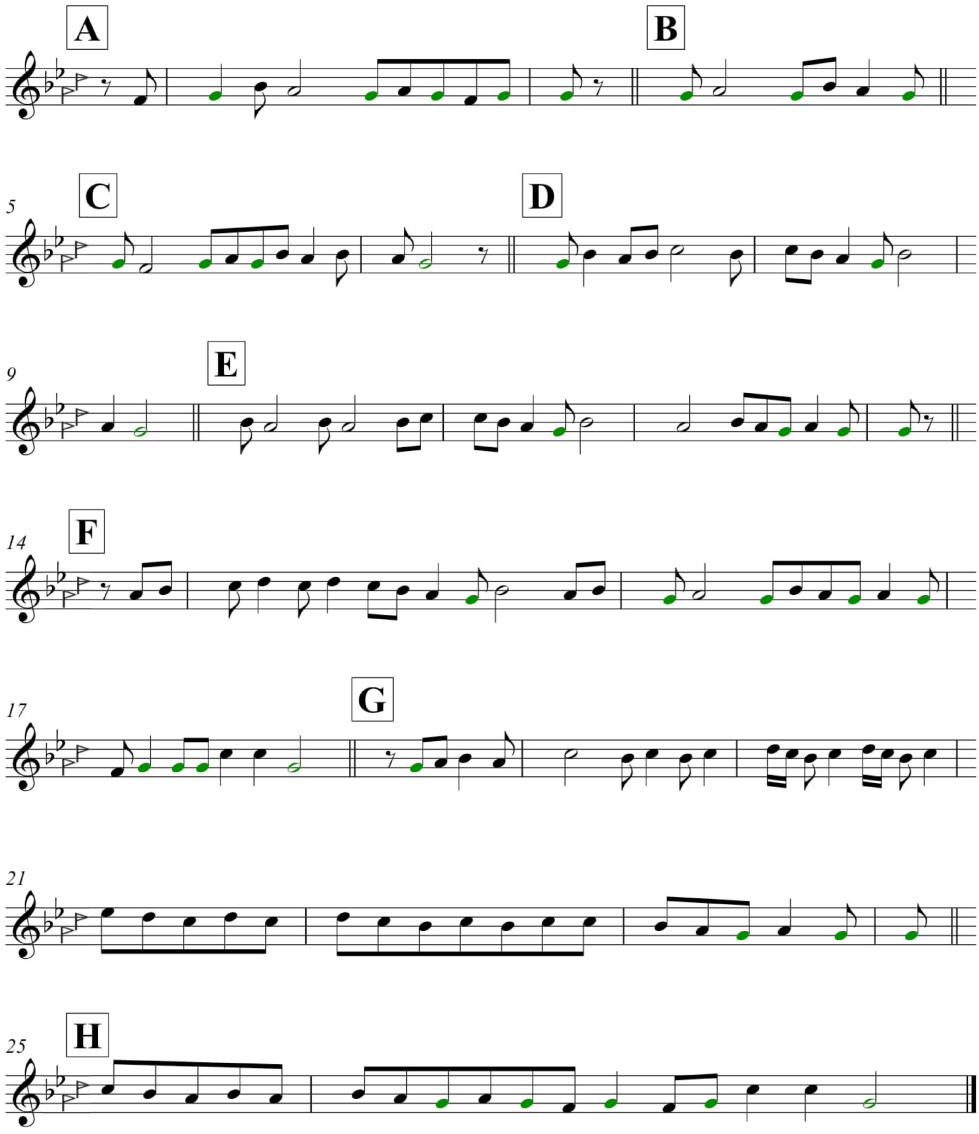
finalis on *mo* will be *mo*, *zā*, *be*, *khe*. However, note that the step above khe in the mode of Homāyun is a M2, and the step above that note is a m2; for these two pitches, *sa* and *vo* will be used respectively.

To form the hand frame of Homāyun's with *mo* on the first finger, use the same steps for locating the N2 between a m3 as in the Shur tetrachord. Then, raise the m3 to a M3. See Figure 15.

Figure 15: Tetrachord for Dastgāh-e Homāyun with *Mo* on the First Finger

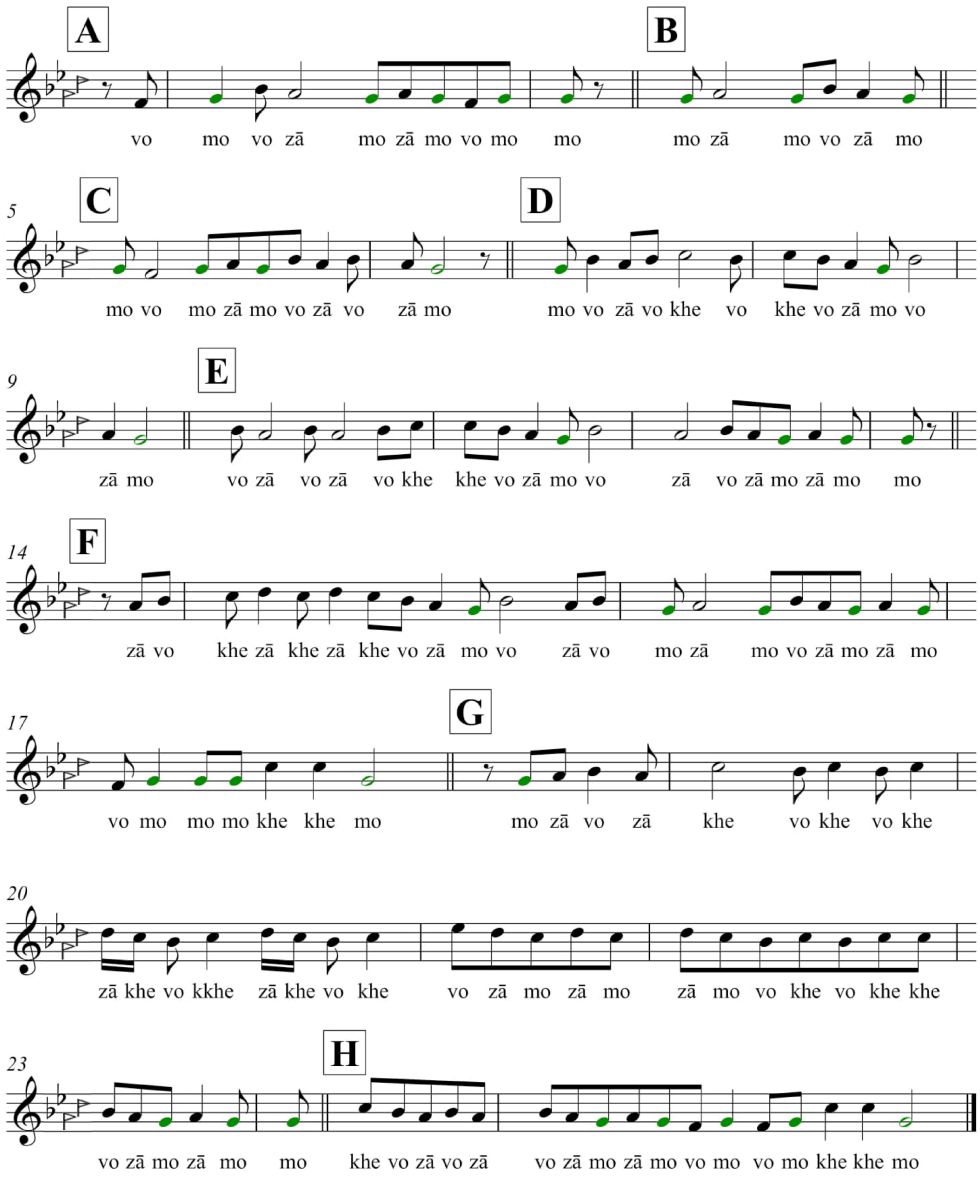
Shur on G

Pitch Matching: First, match your voice to the Quarter Tone Piano App. Then, match your voice to your violin, playing entirely in 3rd position.



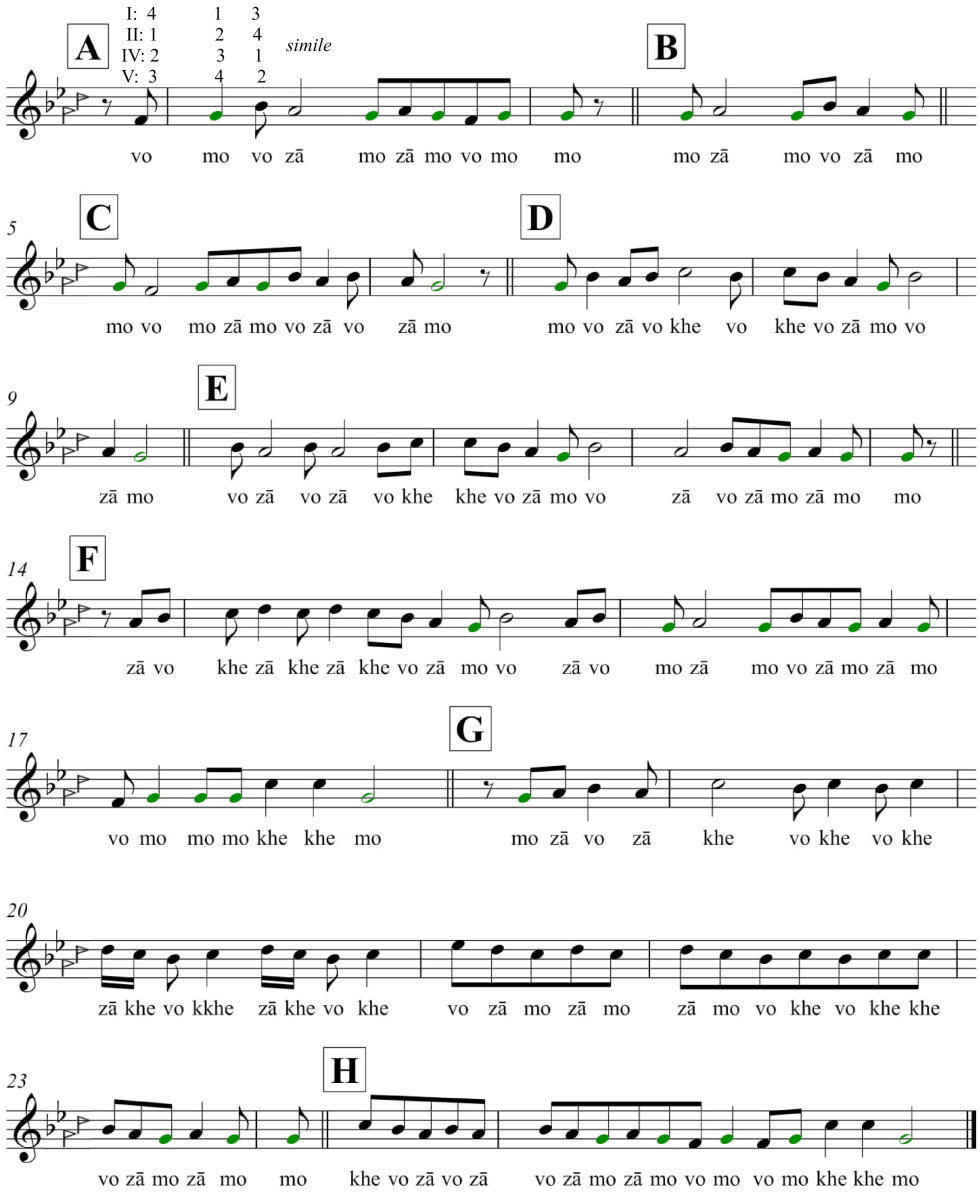
Shur on G

Solfège: Sing the phrases with the syllables written below. Then practice solfège-ing the previous unmarked page to check for understanding of the solmization system.



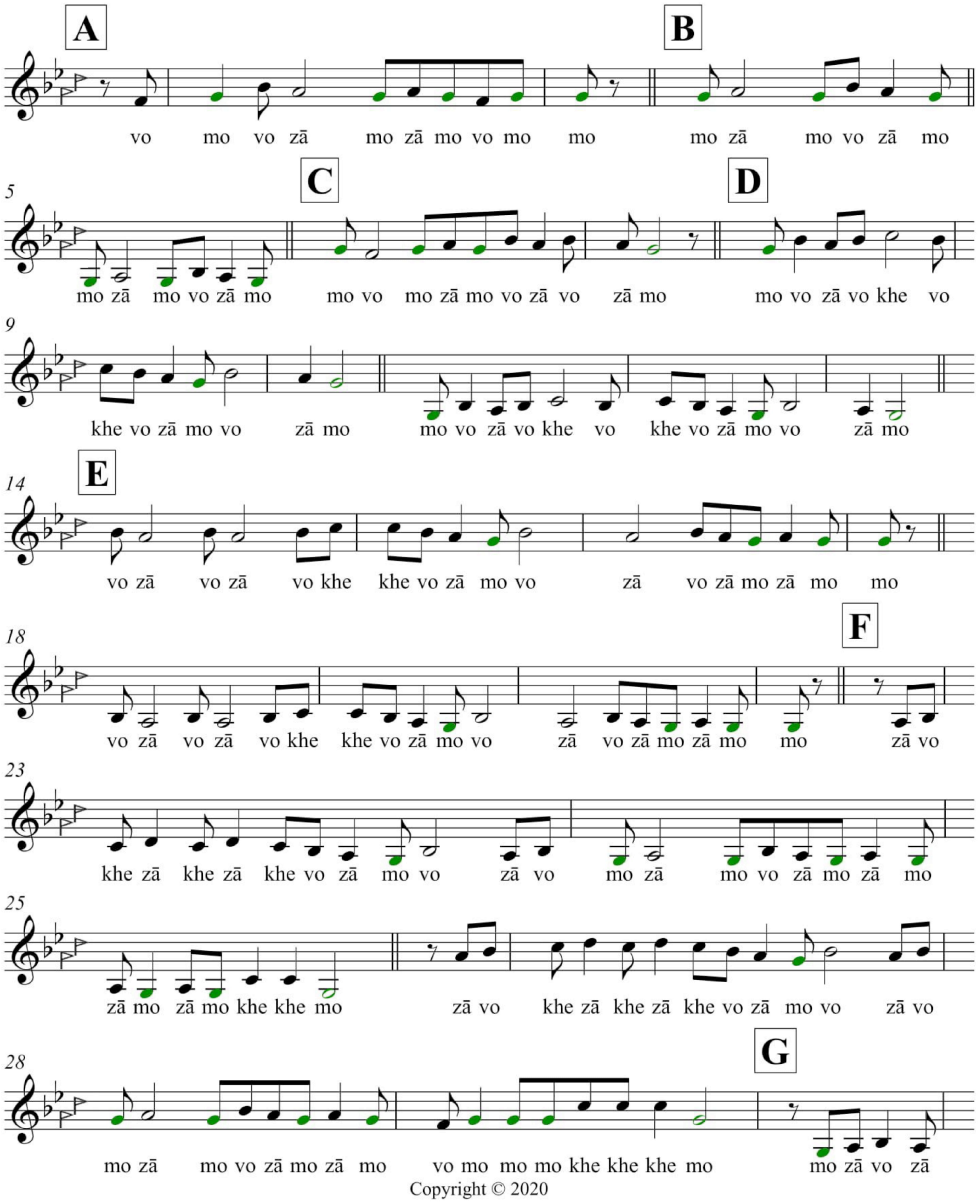
Shur on G

Multiple Fingerings: Use this page for Fingerings I (finalis on 1, 3rd po.) and II (finalis on 2, 2nd po.). Next, use the next exercise, Shur on G Octave Down, for Fingering III. Then use this page for Fingerings IV (finalis on 3) and V (finalis on 4).

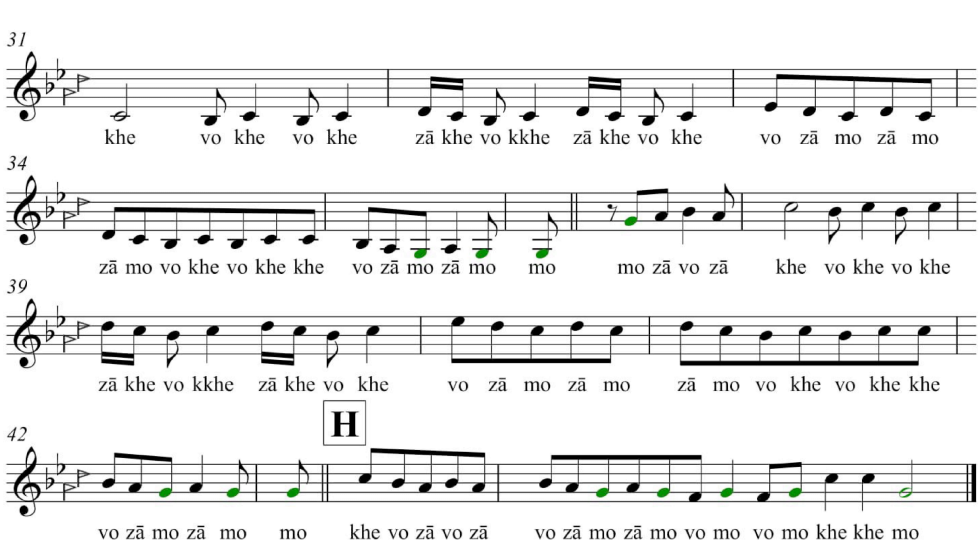


Shur on G Octave Down

When the finalis drops an octave to the open G, play Fingering III in the first position. Otherwise, use Fingerings I or II.

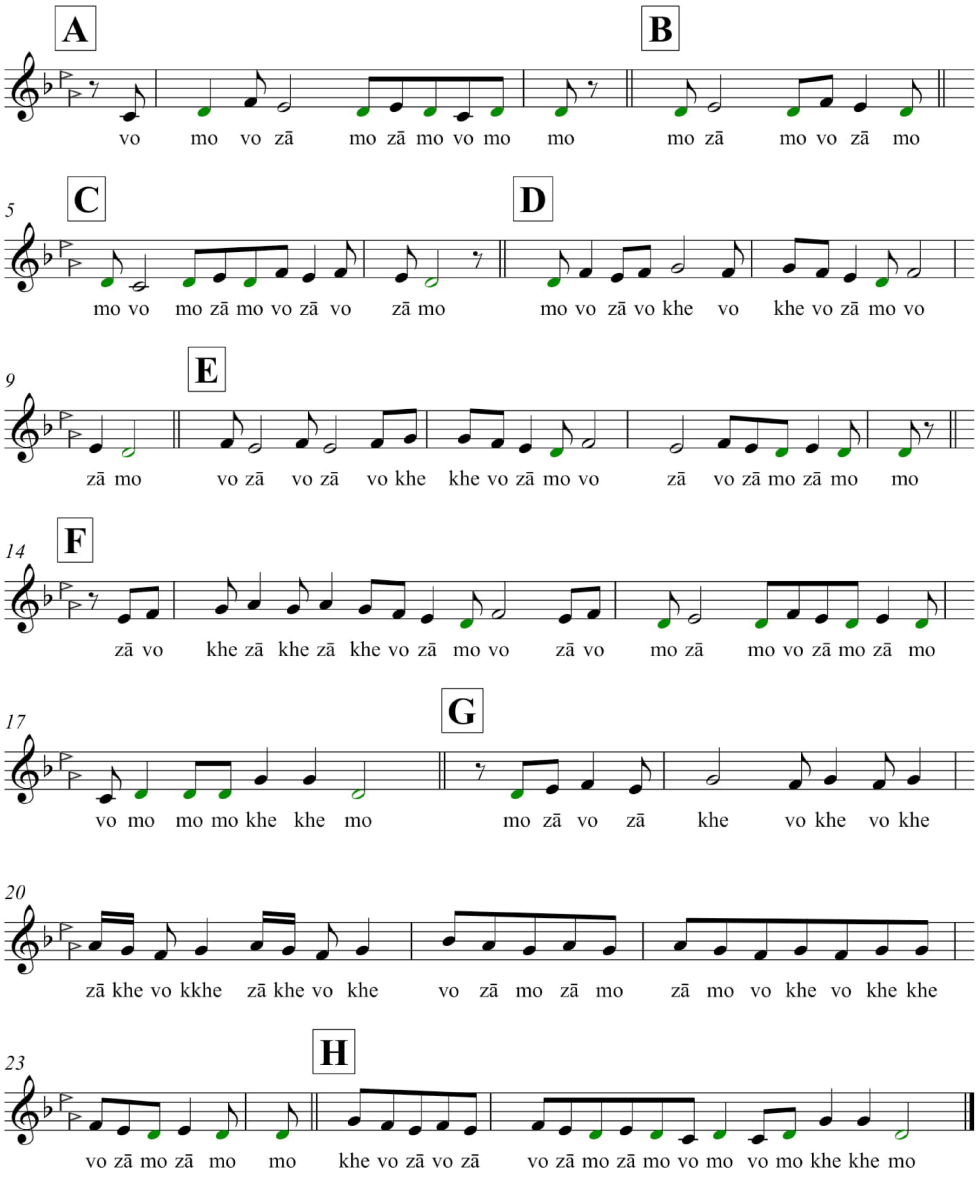


2


31
khe vo khe vo khe zā khe vo kkhe zā khe vo khe vo zā mo zā mo
34
zā mo vo khe vo khe khe vo zā mo zā mo mo mo zā vo zā khe vo khe vo khe
39
zā khe vo kkhe zā khe vo khe vo zā mo zā mo zā mo vo khe vo khe khe
42
H
vo zā mo zā mo mo khe vo zā vo zā vo zā mo zā mo vo mo vo mo khe khe mo

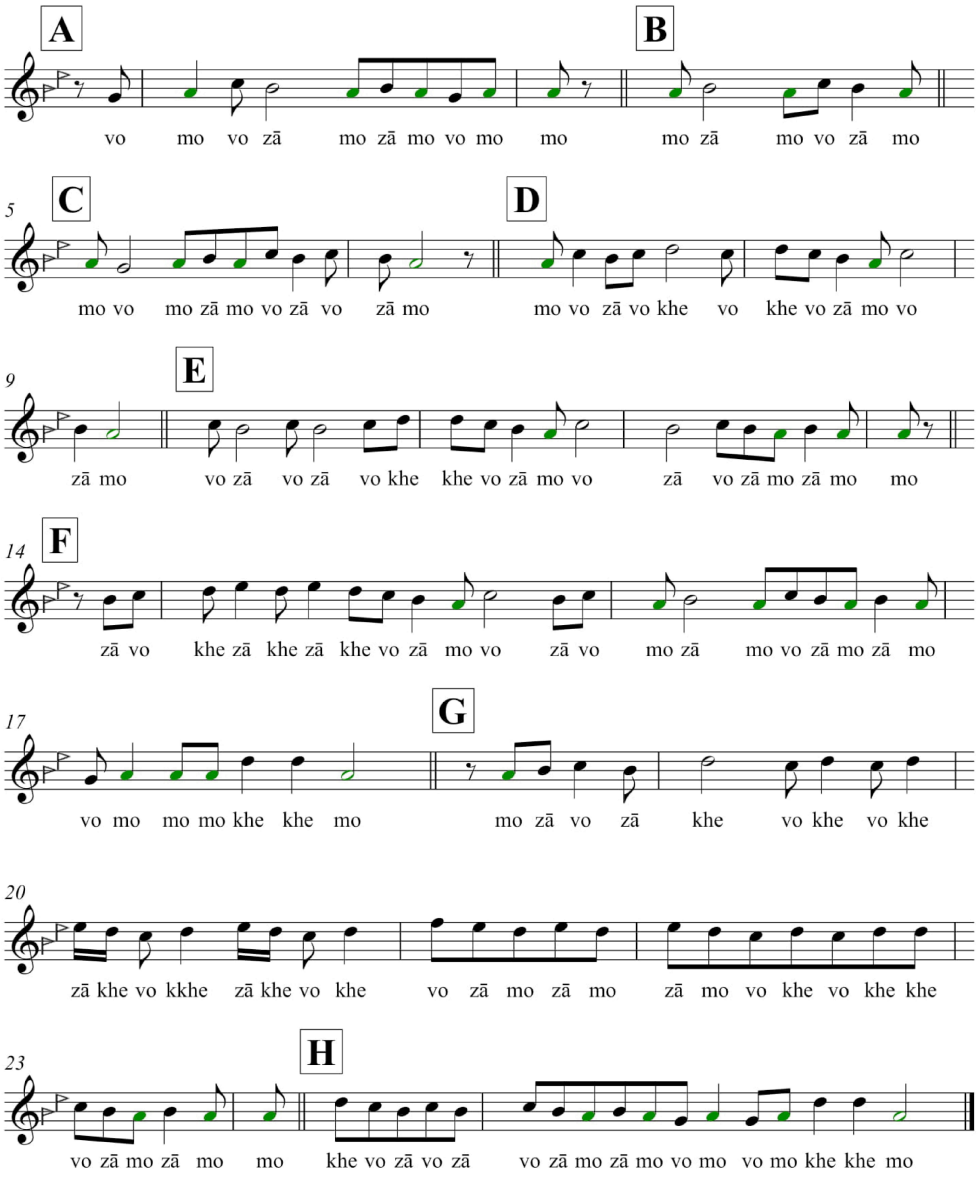
Shur on D

Use Fingerings II, III, IV, and V in a single position. For Fingering I, some shifting is necessary to play the C below the finalis D.



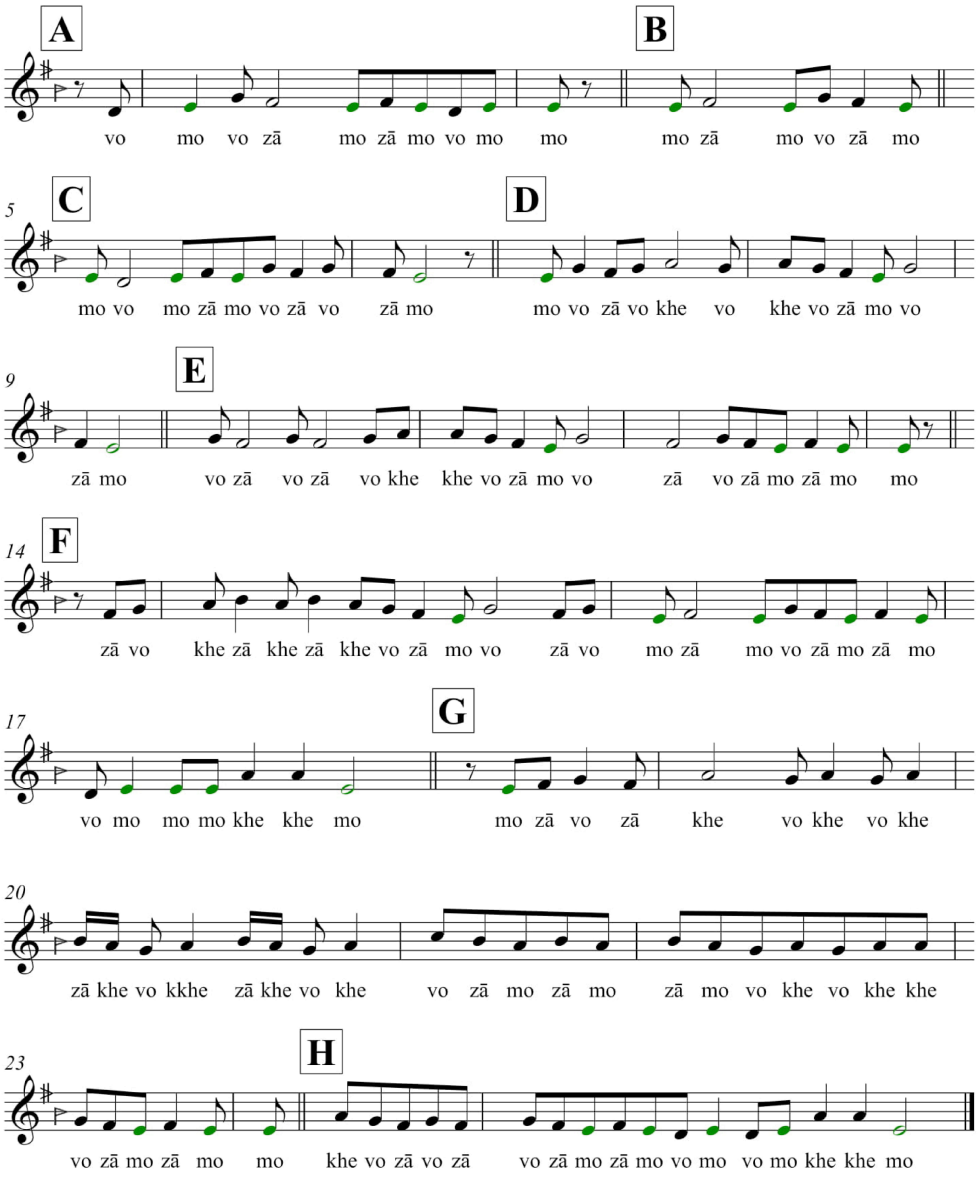
Shur on A

Use Fingerings I-V.



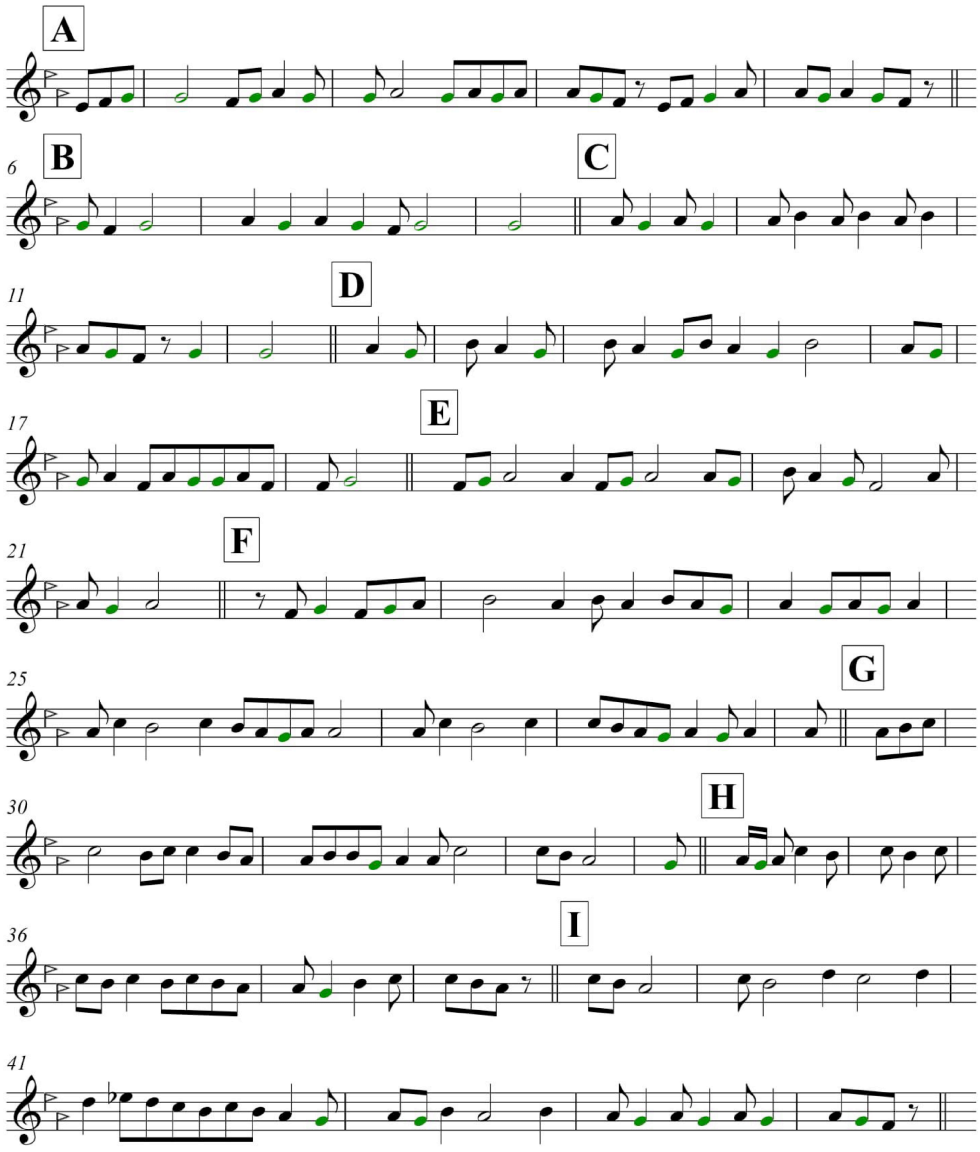
Shur on E

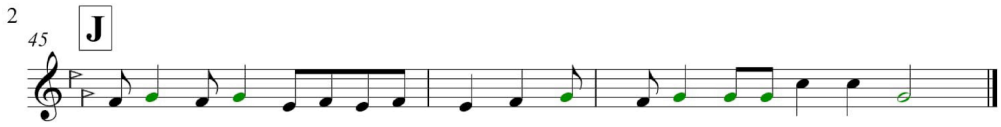
Use Fingerings I, II, IV, and V. For Fingering III,
transpose all material up an octave.



Homāyun on G

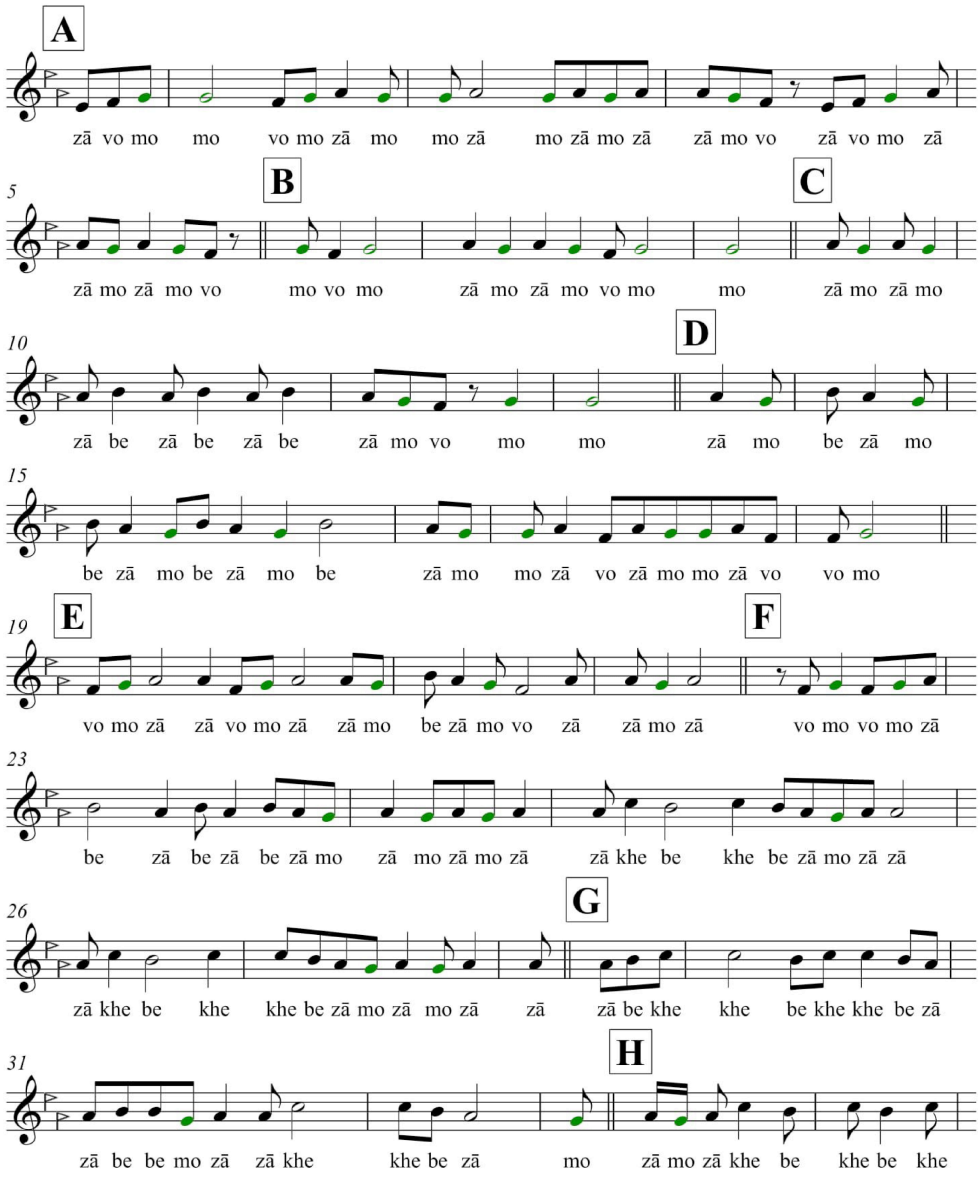
Pitch Matching: First, match your voice to the Quarter Tone Piano App. Then, match your voice to your violin, playing entirely in 3rd position.



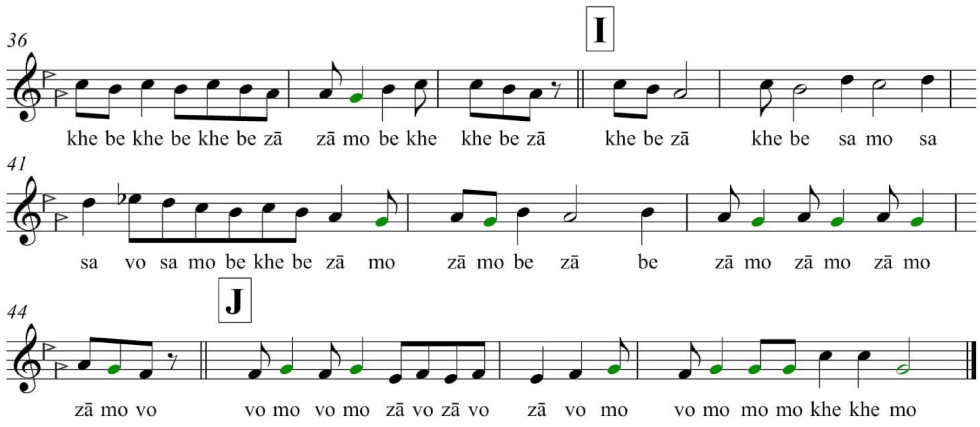

2
45
J

Homāyun on G

Solfège: Sing the phrases with the syllables written below. Then practice solfège-ing the previous unmarked page to check for understanding of the solmization system.

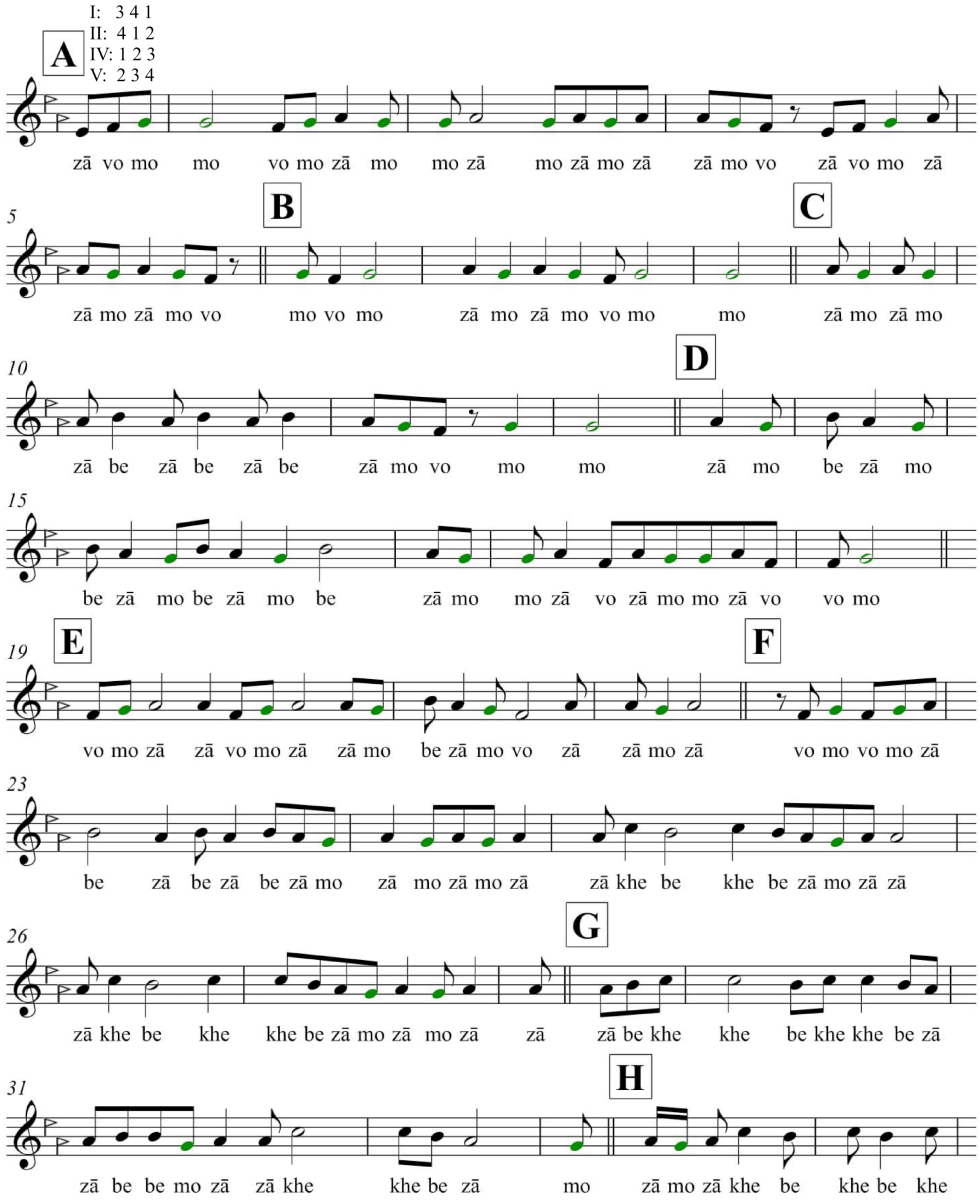


2

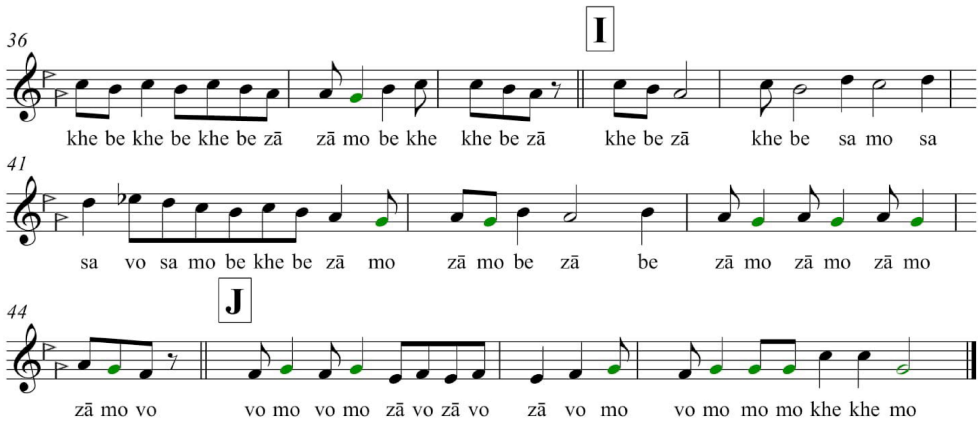

36
I
khe be khe be khe be zā zā mo be khe khe be zā khe be zā khe be sa mo sa
41
sa vo sa mo be khe be zā mo zā mo be zā be zā mo zā mo zā mo
44
J
zā mo vo vo mo vo mo zā vo zā vo zā vo mo vo mo mo mo khe khe mo

Homāyun on G

Multiple Fingerings: Use this page for Fingerings I (finalis on 1, 3rd po.) and II (finalis on 2, 2nd po.). Next, use the next exercise, Homāyun on G Octave Down, for Fingering III. Then use this page for Fingerings IV (finalis on 3) and V (finalis on 4).

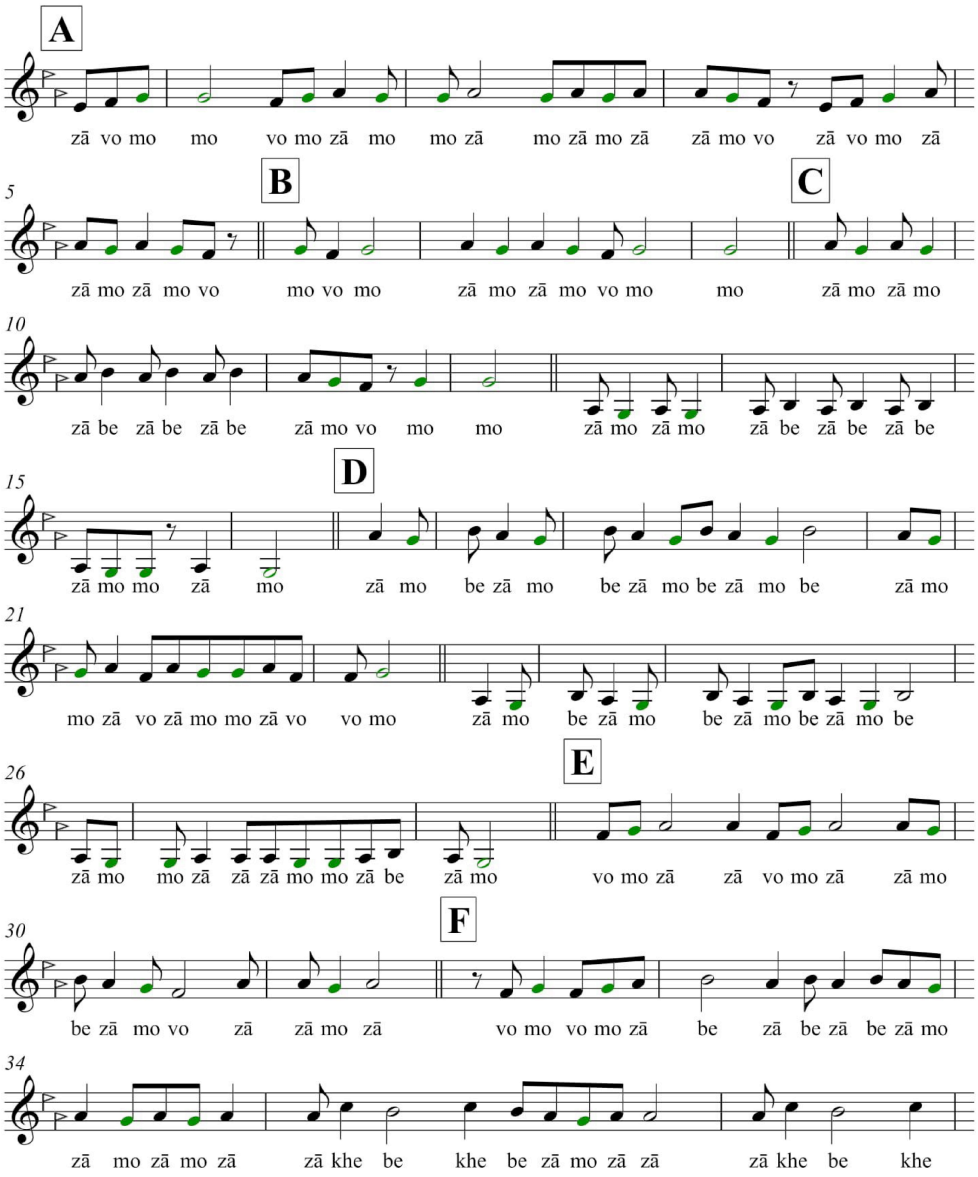


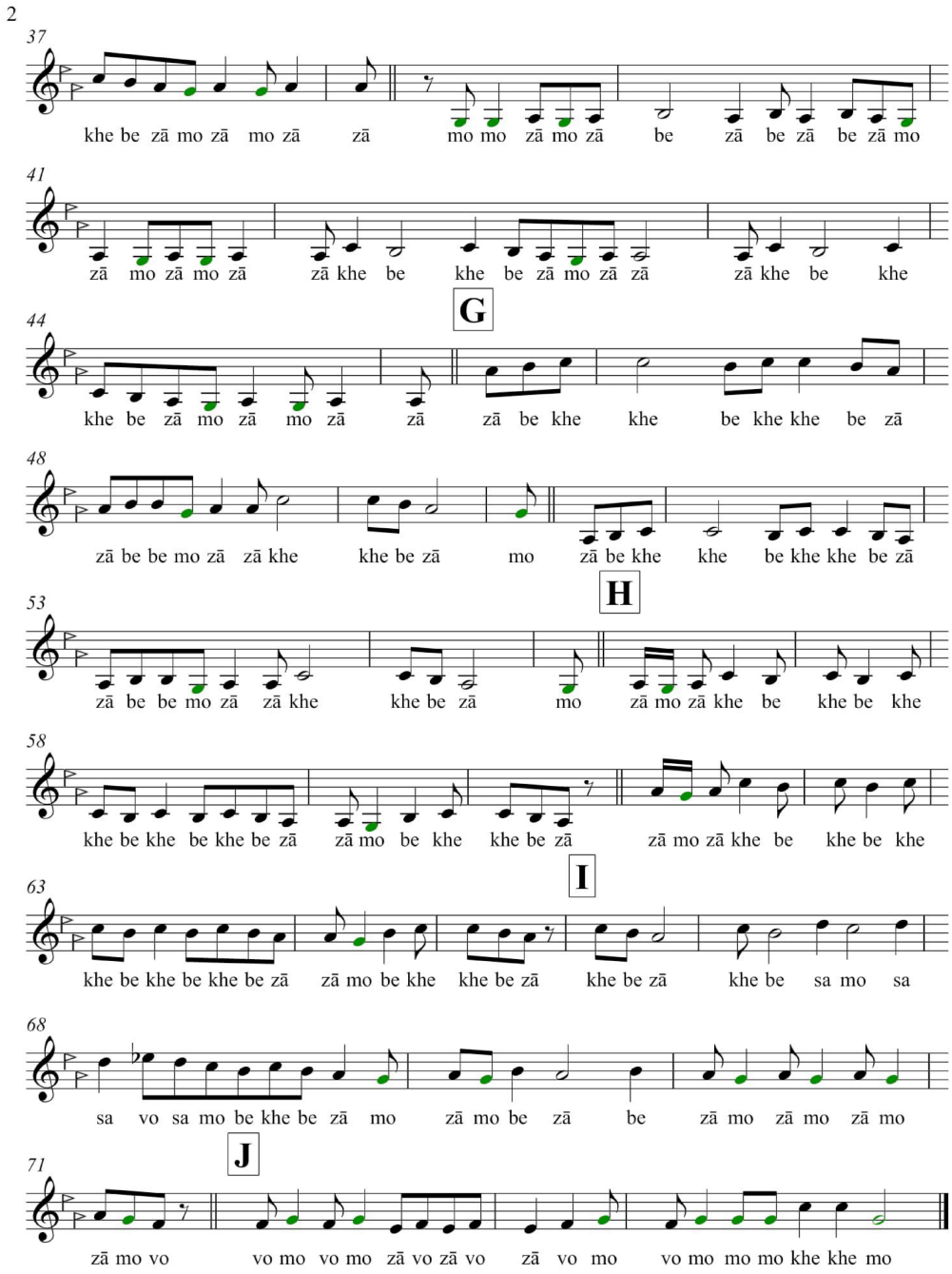
2


36
I
khe be khe be khe be zā zā mo be khe khe be zā khe be zā khe be sa mo sa
41
sa vo sa mo be khe be zā mo zā mo be zā be zā mo zā mo zā mo
44
J
zā mo vo vo mo vo mo zā vo zā vo zā vo mo vo mo mo mo khe khe mo

Homāyun on G Octave Down

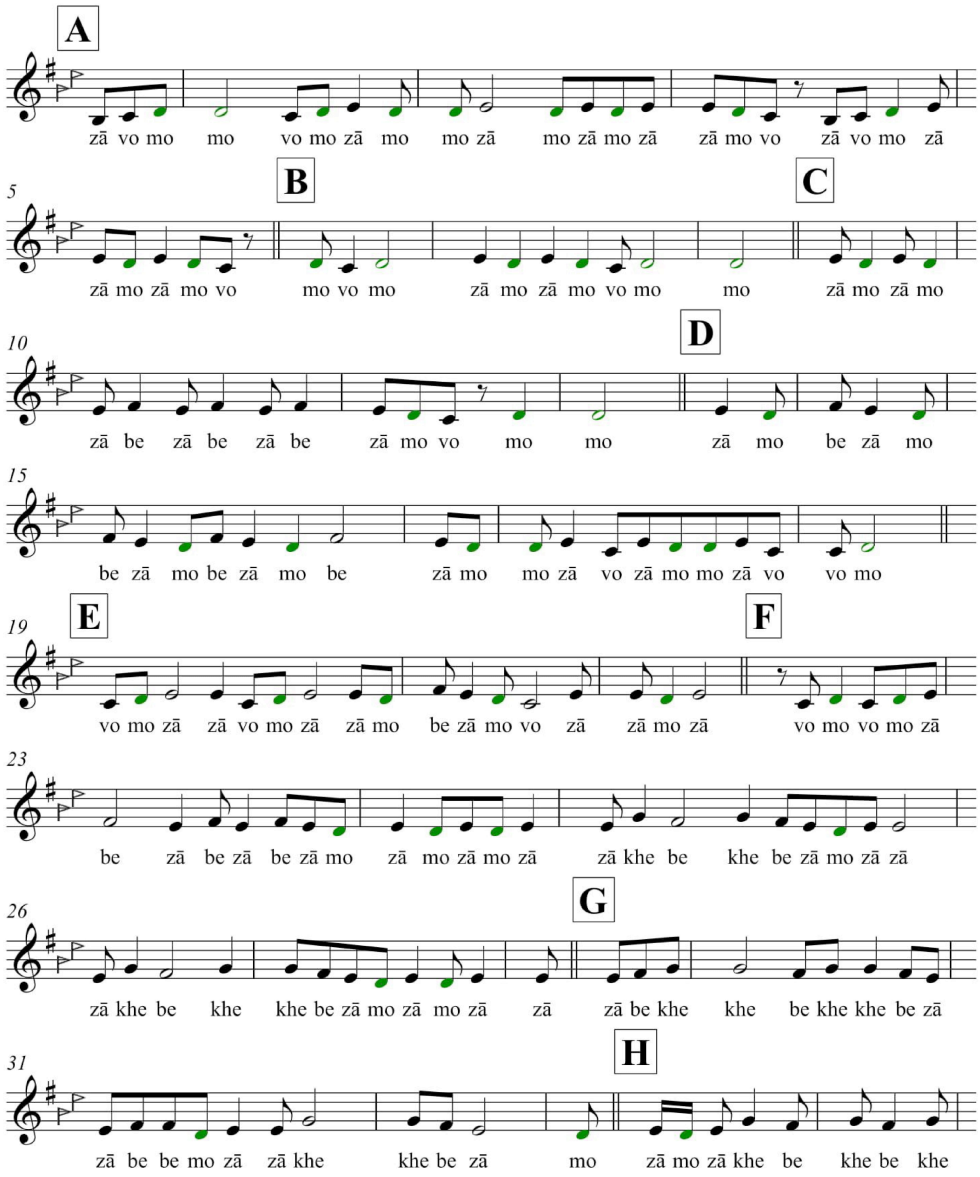
When the finalis drops an octave to the open G, play Fingering III in the first position. Otherwise, use Fingerings I or II.



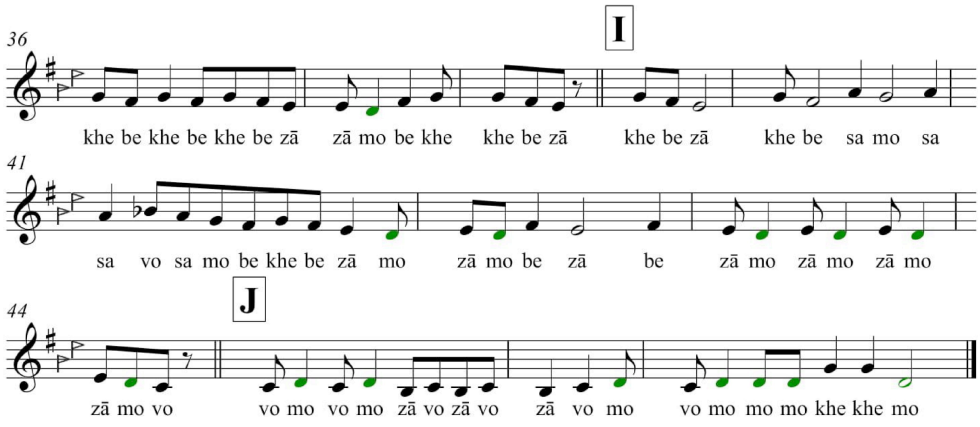

2
37
khe be zā mo zā mo zā zā mo mo zā mo zā be zā be zā be zā mo
41
zā mo zā mo zā zā khe be khe be zā mo zā zā zā khe be khe
G
44
khe be zā mo zā mo zā zā zā be khe khe be khe khe be zā
48
zā be be mo zā zā khe khe be zā mo zā be khe khe be khe khe be zā
H
53
zā be be mo zā zā khe khe be zā mo zā mo zā khe be khe be khe
58
khe be khe be khe be zā zā mo be khe khe be zā zā mo zā khe be khe be khe
I
63
khe be khe be khe be zā zā mo be khe khe be zā khe be zā khe be sa mo sa
68
sa vo sa mo be khe be zā mo zā mo be zā be zā mo zā mo zā mo
J
71
zā mo vo vo mo vo mo zā vo zā vo zā vo mo vo mo mo mo khe khe mo

Homāyun on D

Use Fingerings III, IV, and V in a single position. For Fingerings I and II, some shifting is necessary to play the B koron and C below the finalis D.

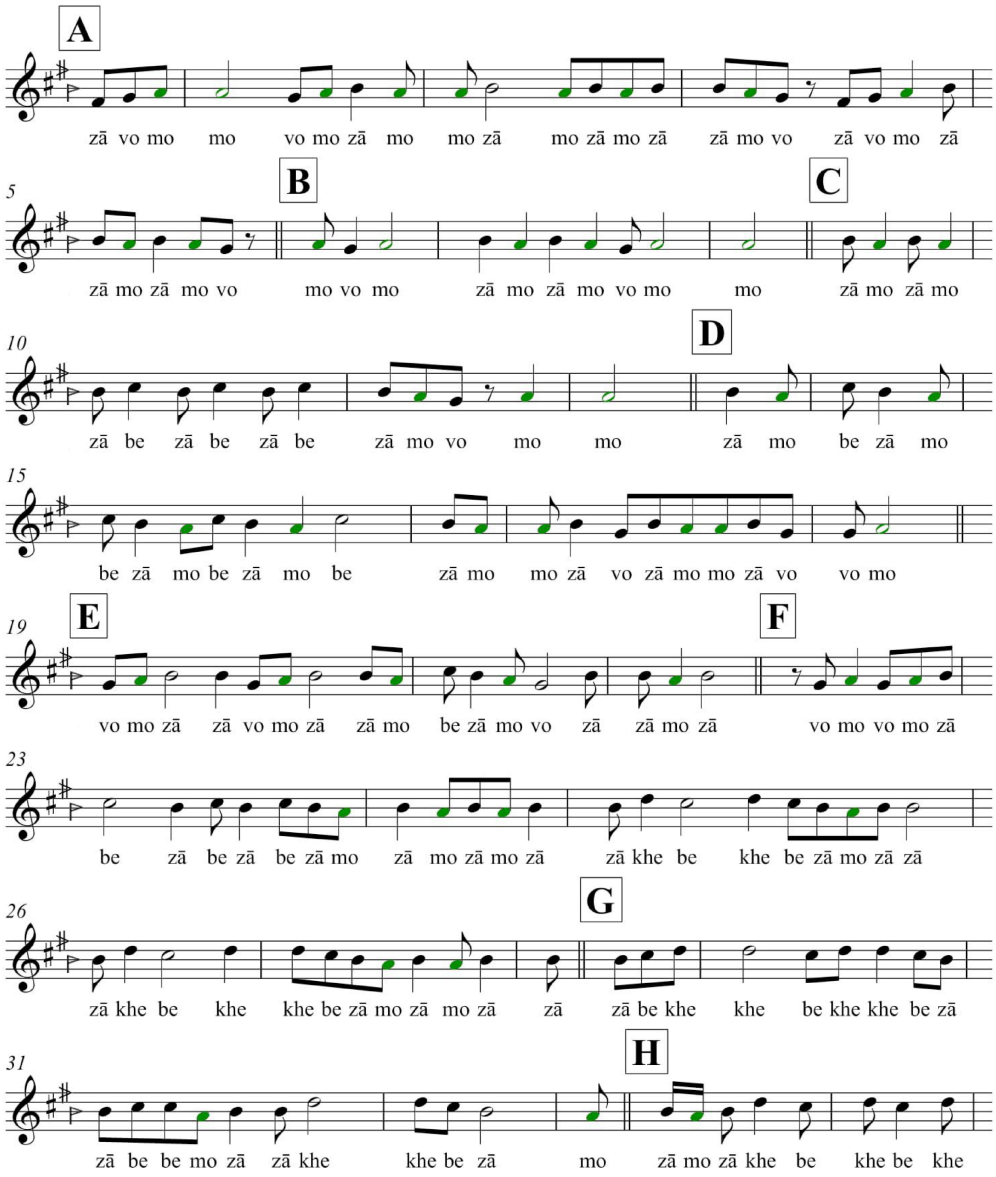


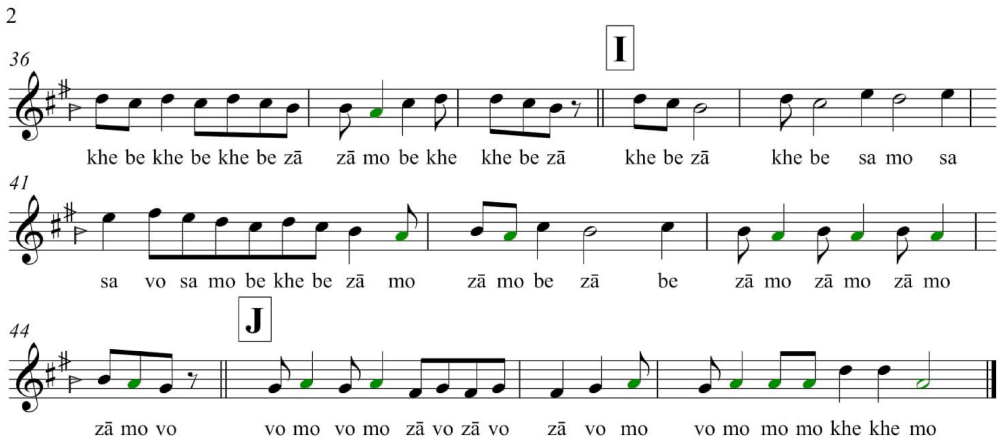
2


36
I
khe be khe be khe be zā zā mo be khe khe be zā khe be zā khe be sa mo sa
41
sa vo sa mo be khe be zā mo zā mo be zā be zā mo zā mo zā mo
44
J
zā mo vo vo mo vo mo zā vo zā vo zā vo mo vo mo mo mo khe khe mo

Homāyun on A

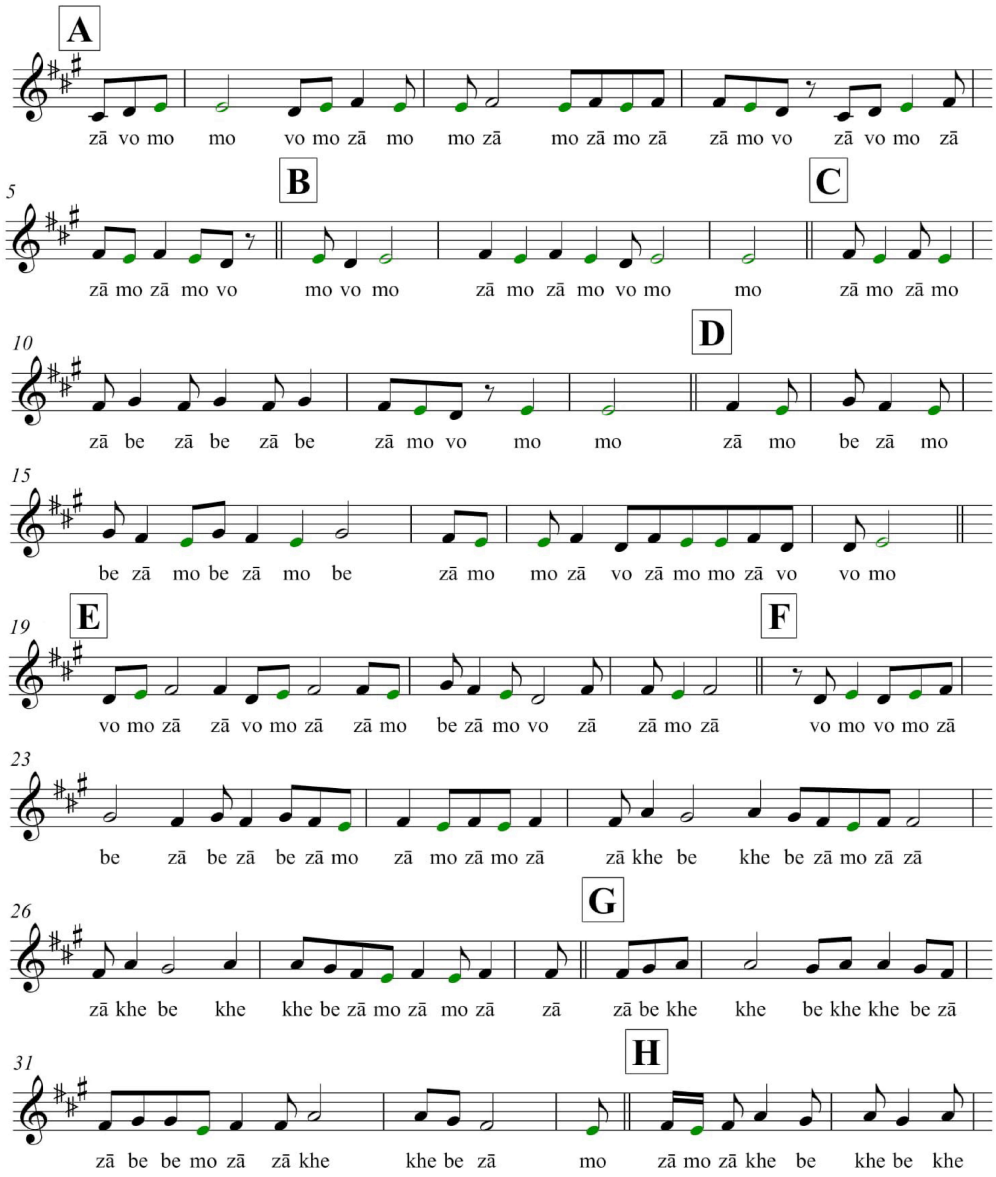
Use Fingerings I-V.

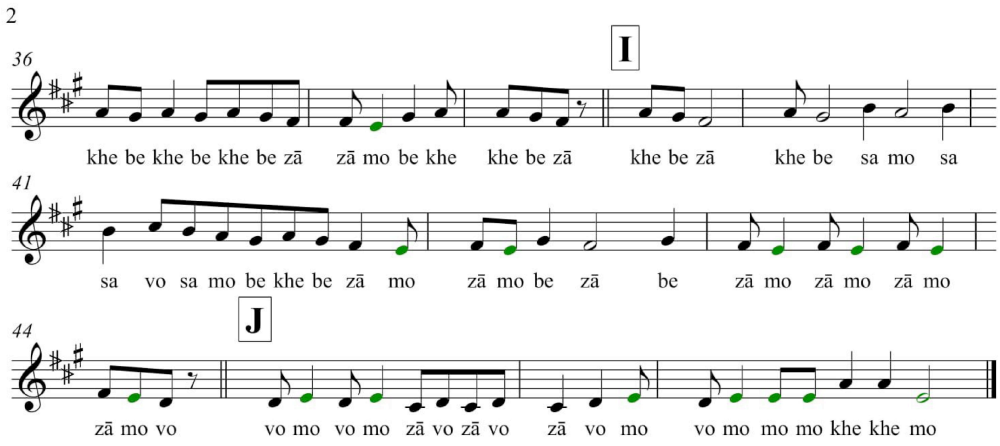



2
36
I
khe be khe be khe be zā zā mo be khe khe be zā khe be zā khe be sa mo sa
41
sa vo sa mo be khe be zā mo zā mo be zā be zā mo zā mo zā mo
44
J
zā mo vo vo mo vo mo zā vo zā vo zā vo mo vo mo mo mo khe khe mo

Homāyun on E

Use Fingerings I, IV and V in a single position. For Fingering II, some shifting is necessary to play the C sori below the finalis E. For Fingering III, transpose all material up an octave.




2
36
I
khe be khe be khe be zā zā mo be khe khe be zā khe be zā khe be sa mo sa
41
sa vo sa mo be khe be zā mo zā mo be zā be zā mo zā mo zā mo
44
J
zā mo vo vo mo vo mo zā vo zā vo zā vo mo vo mo mo mo khe khe mo

CHAPTER 5

CONCLUSION: NEXT STEPS

This project seeks to give classically trained violinists the ability to master a microtonal interval, the neutral second (N2) step made of three quarter tones, which current trends in pedagogy omit. The logic for why musicians would not or should not play microtonal intervals is often circular. Musicians insist that microtonal intervals are infrequently employed in Western classical music and therefore not worthwhile to master, while simultaneously composers avoid employing them because musicians are ill-equipped to play them. The ability to play microtonal intervals made of quarter tones not only opens the door to new possibilities in contemporary Western classical music production, but also renders possible a dialogue across cultural traditions of the West and the Middle-East.

The present author discovered that there is a dearth of existing pedagogy of quarter tones for Western Musicians. Beyond the designs for keyboard instruments with new tunings and/or additional notes, as well as the fingering systems for woodwind and some brass instruments, a pedagogy of microtones is largely missing. Equally missing is a pedagogy incorporating singing, auralizing, and audiating microtonal intervals. In lieu of all of these foundations, this project presents a path for developing quarter-tone aural skills. Such a pathway might be extended in the future for other instruments, but for the time being is presented here for the benefit of violinists. This project may provide a suitable course of study for violists as well given that they would replace the transpositions to the dastgāhhā on E with transpositions to dastgāhhā on C.

PATH 1: EQUAL TEMPERAMENT AND CONTEMPORARY WESTERN CLASSICAL MUSIC

There are two paths from which the reader may continue beyond this project, although they are not mutually exclusive. The first path is a return to Western classical music's equal temperament of quarter tones. From the germ of audiation that produced the consecutive neutral seconds (N2) using the syllables *mo-zā-vo*, the Western violinist may construct entire chains of N2's. In Figure 16, the *vo* at the end of a *mo-zā-vo* structure is reinterpreted as a new *mo* until reaching the octave above the starting position. By reinterpreting *vo* as *mo*, the reader can generate a scale of eight distinct pitches. Figure 16 shows the transition from the Persian classical solfège to a scale composed entirely of N2's.

Figure 16: From Solfège to Neutral Second Scale

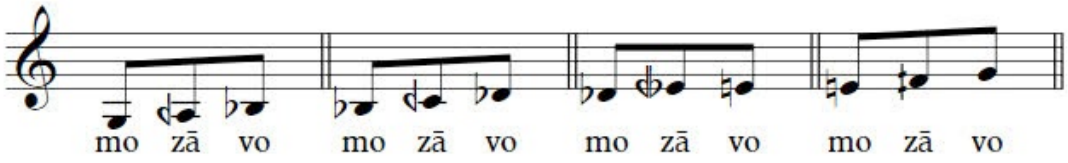
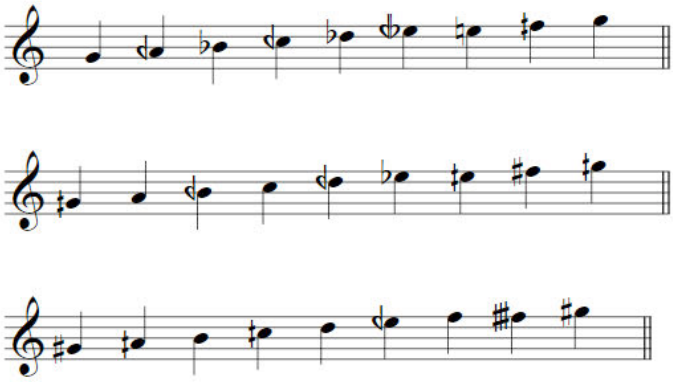


Figure 17 illustrates the three possible transpositions of the N2 scale. A third transposition up a quarter tone reproduces the pitch collection of the first version.

Figure 17: The Three Transpositions of the Neutral Second Scale



The N2 scale includes two fully diminished seventh chords separated by a N2 and has eight pitch classes. The reader may choose to practice this scale by alternating between these two diminished seventh chord collections.

Continuing on the path of equal temperament, the interested composer or improviser might choose to construct new scales from the permutations of the four Persian tetrachords. While the scalar concept is beyond the tradition of Persian classical music, these tetrachords may provide inspiration for contemporary performance given the reader's new ability to perform the N2.

PATH 2: UNEQUAL TEMPERAMENT, THE SMALL AND LARGE NEUTRAL SECONDS

While there are plenty of musicians practicing Persian classical music who have adopted equal temperament following the instructions of Vaziri, the current practice of

Persian classical music differentiates between a small and a large neutral second.[91] Just as the Western classical musician only learns to temper the major and minor thirds down and up, respectively, by 15 cents when they have reached an intermediate-advanced level of musicianship, so too does the present author recommend that the interested reader only seek to pursue the differentiation between small and large neutral seconds after the mastery of the equal-tempered one.

The small neutral second is 15 cents lower while the large one is 15 cents higher. The present author recommends doing the following. Frame a m3 and place the equal-tempered N2 directly in between, creating a *mo-zā-vo* fingering. Play these three notes ascending and then descending, *mo-zā-vo* and *vo-zā-mo*. Next, lean the *zā* note slightly lower and again ascend and descend. The small neutral second note will be only slightly lower and yet should retain the character of the *zā*. When the note has been lowered too far, it will feel like a high version of the *mo* rather than a slightly lowered *zā.* This is the small neutral second. The large neutral second is the space created by the lowered *zā* to the *vo*. In the present author's solfège system, the small neutral second is always sung *mo-zā* while the large neutral second is always *zā-vo*.

CONCLUDING REMARKS

The above two paths present opportunities for the reader to further advance their musicianship. Just as the professional musician must navigate easily between equal and unequal temperaments, the present author believes in the ability for contemporary musicians to be similarly versed in equally and unequally-tempered quarter tones and microtones. Central to this project is the belief that dialogues across cultural traditions

[91] Farhat 7-10, 15-18.

have the capacity to begin both to bring people together and to build understanding, compassion, and collaboration. With persistence and openness, musicians can serve this higher purpose while sharing a sense of beauty and collective humanity.

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APPENDIX A

GLOSSARY OF TERMS

Abbreviations: Western Classical Music (WCM), Persian Classical Music (PCM)

12 Tone Equal Temperament (12TET) - tuning system of twelve semitones of 100 cents each, used for most WCM

24 Tone Equal Temperament (24TET) - tuning system of 24 *quarter tones* of 50 cents each, used by WCM 20th/21st C and used by some PCM

Auralization (auralize, the verb) - hearing pitches in the mind

Audiation (audiate, the verb) - comprehending music *auralized*, a term by Edwin E. Gordon, a music education researcher in WCM

Āqāz - the first note of a mode in PCM

Āvāz (āvāzhā, plural) - singing in PCM, often for tradition of singing in contrast instrumental tradition of *Dastgāh* performance

Bāl-e Kabutar - "Pigeon's Wing", a *forud* pattern common to many different *dastgāhhā* in PCM

Benser (Bansar) - "ring finger", a medieval fret indication for *'ūd*

Be - a solfège syllable for PCM designed by present author after *benser*, pronounced with vowel as in English 'bed'; a major third (M3) above *mo* or a minor second below *khe*

Dāng - a tetrachord in PCM

Darāmad (darāmadhā, plural) - the introduction to a *dastgāh* performance, in the mode of that *dastgāh* in PCM

Dastgāh (dastgāhhā, plural) - a system of performance that has its own mode in the introduction followed by a series of modulations to *gushehā* to form a complete performance; there are 12 *dastgāhhā* (or 7 *dastgāhhā* and 5 *āvāzhā*)

Equal Temperament - a system of tuning in which each pitch is equidistant from each other; sometimes used as a shorthand for *12TET* in WCM

Finalis (Forud-e kāmel) - note of conclusion in a PCM mode, (often called forud-e kāmel by PCM, but here called Finalis after Farhat for disambiguation from *forud*)

Forud - cadence in PCM

Gushe (gushehā, plural) - a piece that may have its own mode or share the mode of a *dastgāh*; ordered in a performance to create a complete presentation of a *dastgāh*

Ist - a note of medial conclusion in PCM

Just Intonation - a tuning system that builds a scale through small ratios of the overtone series

Khe - a solfège syllable for PCM designed by present author after *khenser*, 'kh' pronounced with guttural 'h' as in 'challah', vowel as in English 'bed'; the top of a tetrachord, a perfect fourth (P4) above *mo*

Khenser (Xansar) - "pinky finger", a medieval fret indication for *'ūd*

Large Neutral Second - an interval in PCM that is about 160 cents, compare to the equal-tempered *neutral second*; in solfège of present author, between *zā* and *vo*

Microtone - any note that falls outside of *12TET*

Mo - a solfège syllable for PCM designed by present author after *motlaq*; the bottom of a tetrachord and the syllable for the *finalis* in a majority of modes

Mode - either as a scale-set with a pitch center as in WCM, or as a framework for a stylized melody as in PCM and Ancient Greek music

Modernists - WCM musicians who explored microtones to expand the number of pitches used beyond 12TET in the 20th C, according to Schneider

Moteqayyer - a tone in PCM that can vary by a quarter tone up or down depending on melodic context

Motlaq - "open string", a medieval fret indication for *ʻūd*

Neutral Interval - an interval that is between the category of major and minor, both from Alois Hába in WCM and PCM tradition

Neutral Second (N2) - an interval between the major and minor second; in *24TET* is composed of three quarter tones at 150 cents, and in PCM varies from about 135-160 cents, see *large neutral second* and *small neutral second*

Neutral Third (N3) - an interval between the major and minor third; in *24TET* is composed of seven quarter tones at 350 cents, and in PCM varies between 360-365 cents

Plus Second (P2) - an interval between the major and augmented second; in *24TET* is composed of five quarter tones at 250 cents, and in PCM varies between 240-270 cents

Pure Tones - WCM musicians who explored the perfection of the seven-note diatonic major and minor scales through microtonal adjustment during the 20th C, according to Schneider

Pythagorean Tuning - a tuning system that builds a scale through a series of perfect fifths

Quarter Tone - a note that is a distance of half a semitone away from another note; also used to describe that same distance

Radif - in PCM the traditional collection of pieces and their ordering upon which all improvisation is an embellishment

Sa - a solfège syllable for PCM designed by present author after *sabbābeh*; a major second (M2) above *mo* or *khe*

Sabbābeh - "index finger", a medieval fret indication for *'ūd*

Setār - a plucked three-string instrument in PCM

Small Neutral Second - an interval in PCM that is about 135 cents, compare to the equal-tempered *neutral second*; in solfège of present author, between *mo* and *zā*

Shāhed - a note of emphasis within a phrase of PCM

Tār - a plucked two-string instrument of PCM

'Ūd - a plucked Arab instrument that predates the WCM lute

Vo - a solfège syllable for PCM designed by present author after *vostā*; a minor third (m3) above *mo* or a major second (M2) below *khe*

Vostā - "middle finger", a medieval fret indication for *'ūd*

Zā - a solfège syllable for PCM designed by present author after *zāed*, vowel pronounced round and dark as in English 'father' in the back of the mouth; a *small neutral second* above *mo*, a *large neutral second* below *vo*, or a *plus second* below *be*

Zāed - a medieval fret indication for *'ūd* that does not indicate a particular finger

APPENDIX B

TIMELINE OF WESTERN CLASSICAL MUSIC MICROTONES

Abbreviations: Sigrun Schneider, *Mikrotöne in der Musik des 20. Jahrhunderts* (S); Don Ellis, *Quarter Tones* (E)

Medieval to Preclassical

Montepellier Codex S 11th Century *diesis* or microtones as diatonic

Medieval theorists: S Regino von Prüm, Guido, Enelbert von Admont, Simon Tunstede

Nicola Vicentino (1511-1576) E, S, theorized and composed a 31 tones/octave replicating Ancient Greek theory's *Diesis*, divided tone into 5 parts for a large and small *Diesis*, creating a large and small semitone, invented the Arcicembalo and Arciorgano instruments

Charles Luython (1557-1620) E, 18 tones/octave to perfect modulation

Lemme Rossi (1601-1673) E, theorized Equal tempered quarter tones system

Christiaan Huygens (1629-1695) E, S, designed 31 tones/octave theory for perfect modulation, also divided tone into 5ths

1860-1920

Michael Meshaquah (before 1847) E, theorized 24 equal quarter tones

Hermann Helmholtz (1821-1894) theorized/wrote in 1863 *Die Lehre von dem Tonempfindungen als physiologische Grundlage für die Theorie der Musik* (Trans. Alexander J. Ellis in 1875 as *On the Sensations of Tone*)

Behrens-Senegalden 1892 E, first patented quarter tone piano

Julian Carrillo (1875-1965) in 1895 E, composed quarter tone string quartet

Ferruccio Busoni (1866-1954) in 1911 E, suggested use of third tones

Max F. Meyer (1873-1967) in 1920 E, invented quarter tone harmonium

Willy Möllendorff (1872-1934), S entire passages in quarter tone transposition

Richard H. Stein (1882-1942), S quarter tones as glide notes between semitones

1920-1945

Charles Ives (1874-1954) E, composed with two pianos tuned a quarter tone apart

Ivan Wyschnegradsky (1893-1979), 1926 E, composed with quarter, thirds, sixths, other tones, wrote a treatise called the Manuel

Alois Hába (1893-1973) E, composed with quarter, third, sixths, other, wrote a treatise called *Neue Harmonielehre*, invented microtonal keyboards, trumpets, clarinets

Hans Barth (1897-1956) 1930 E, composed quarter tones for piano inspired by Busoni

Joseph Yasser (1893-1981) 1932 E, theorized 19 tones/octave

1945-1975

Adriaan Fokker (1887-1972) E 31 tones/octave for Just Intonation

Harry Partch (1901-1974) E, composed and theorized 43 tone octave

Lou Harrison (1917-2003) composed in Just Intonation

Björn Fongaard (1919-1980) S, invented microtonal guitar

Ton de Leeuw (1926-1996) S composed Just Intonation plus microtonal expansion

Krystof Penderecki (1933-2020) E, composed quarter tone clusters and graphic notation

1975-Present

Claude Vivier (1948-1983) composed artificial timbre with quarter tones and harmonics

Gérad Grisey (1946-1998) composed using Spectralism

Wolfgang von Schweinitz (b 1953) composer, theorist, Just Intonation notation

Unsuk Chin (b 1961) composes using Spectralism

Marc Sabat (b 1965) composer, theorist, Just Intonation notation

Julian Anderson (b 1967) composes in Just Intonation

Thomas Adès (b 1971) composes using a quarter tone lowered piano

Jacob Collier (b 1994) composes using quarter tone modulations

APPENDIX C

TRANSLATED SECTIONS OF SIGRUN SCHNEIDER'S *MIKROTÖNE IN DER MUSIK DES 20. JAHRHUNDERTS*

The following extracts from Schneider's book were essential to this project's understanding of the context of Western classical music's legacy of microtones. While this book was published in 1973, Schneider's thoroughness on the subject remains unmatched. As there is no published translation of this work in English, the present author carefully typed the overview portions that directly spoke to trends in instrumental design, theory, and composition of microtonal music in the West, as well as their background contexts. The present author does not take credit for this translation, as "Google Translate" provided it. Page numbers of the book are preceded by 'p' while footnotes markers appear in parenthesis as per the original. The italicized portions served a crucial role in the genesis of the current project's thesis ideas.

p. 6 Inhaltsverzeichnis D. Untersuchungen zur Kompositionstechnik mit Mikrotönen I. Erwiterte Tonalität 1. Mikrotonale Gleittöne 2. Funktionsgebundene Harmonik 3. Tonzentralität 4. Freie Ultrachromatik II. Verfremdungsmittel 1.Ton schwankungen 2. Tonvariationen 3. Indetermination der Tonhöhe P. 7 III. Reihentechnik IV. Klangverdichtung 1. Clustertechnik 2. Mikrotonale Klangdurchdringung	p. 6 Table of Contents D. Studies on composition technique with microtones I. Expanded tonality 1. Microtonal sliding tones 2. Functional harmonics 3. Sound centrality 4. Free ultrachromatic II. Alienation 1. Sound fluctuations 2. Tone variations 3. Indetermination of the pitch P. 7 III. Serialism IV. Sound compression 1. Cluster technology 2. Microtonal sound penetration

V. Integration historischer und außereuropäischer Systeme 1. Die 31-Ton-Stimmung 2. Einbeziehung orientalischer Tonsysteme IV. Historische Gliederung p.13 3. Überblick über bisherige Literatur	V. Integration of historical and non-European systems 1. The 31-tone mood 2. Inclusion of oriental sound systems IV. Historical structure p.13 3. Overview of previous literature
Eine Gesamtdarstellung der Mikrotöne in der Musik gibt es bis jetzt noch nicht, auch nicht eine genauere Untersuchung, die speziell den Zeitraum des 20. Jahrhunderts behandeln würde, in dem Mikrotöne eine immer größere Bedeutung erlangten. Zu den einzelnen oben genannten und in dieser Arbeit behandelten Teilgebieten sind bis jetzt ebenfalls keine Gesamt- oder wenigstens grösere Teildarstellungen erschienen. Aus historischer Sicht versuchte Lotte Kallenbach-Greller einen Überblick zu geben.(9) Da aber nicht genügend Einzeluntersuchungen als Vorarbeiten vorhanden waren, musste er unvollständig bleiben. - Die Notation der Mikrotöne wurde von Erhard Karkoschka in seinem einführenden Werk über Notationen des 20. Jahrhunderts (10) mehr am Rande behandelt; es finden sich dort nur sehr wenige von den vielen verschiedenartigen Zeichen, die in den theoretischen und musikalischen Quellen vorkommen. P. 14. Einige der Alterationszeiche für Mikrotöne untersuchte Siegfried Palm (11) hinsichtlich ihrer Zweckmäßigkeit für den Interpreten. - Musikinstrumente, die speziell zum Spiel von Mikrotöne konstruiert wurden, sind - wenigstens teilweise - von ihren Erfindern oder Konstrukteuren selbst beschrieben worden.(12) Im Bereich der herkömmlichen Instrumente wurden genauere Spiel- und Griffvorschriften bisher nur für die Holzblasinstrumente gegeben. (13) Spieler anderer Instrumente müssen sich auf ihr	*There is still no overall representation of microtones in music, nor is there any more detailed investigation that would specifically deal with the period of the 20th century, in which microtones became increasingly important*. For the individual sub-areas mentioned above and dealt with in this work, no total or at least larger partial representations have also appeared up to now. From a historical point of view, Lotte Kallenbach-Greller tried to give an overview. (9) However, since there were not enough individual examinations as preliminary work, he had to remain incomplete.- Erhard Karkoschka treated the notation of microtones more in passing in his introductory work on 20th century notations (10); there are very few of the many different characters found in the theoretical and musical sources. P. 14. Siegfried Palm (11) examined some of the alteration signs for microtones with regard to their suitability for the interpreter. - Musical instruments that have been specially designed to play microtones have - at least in part - been described by their inventors or designers themselves. (12) *In the area of conventional instruments, more precise playing and grip instructions have so far only been given for woodwind instruments. (13) Players of other instruments have to rely on their own skill, unless at least some hints can be found in the scores themselves. - Studies of the theories about micro tones developed in this century are even in the beginning missing. The*

eigenes Geschick verlassen, sofern nicht wenigstens in den Partituren selbst einige Hinweise zu finden sind. - Untersuchungen der in diesem Jahrhundert entwickelten Theorien über Mikrtöne fehlen sogar in Ansätzen. -Auf die kompositorische Verwendung von Mikrotönen wird gelegentlich in Einzeldarstellungen eingegangen. Dabei werden aber häufig nicht viel mehr als Hinweise auf die bloße Präsenz von Mikrotönen gegeben, zuweilen werden sogar falsche Informationen vermittelt. Die vorliegende Arbeit stützt sich, da nur wenig ergiebige Spezialliteratur vorhanden ist, in der Hauptsache auf Quellenmaterial, vor allem also auf Kompositionen und Musiktheorien. Den Anspruch auf bibliographische Vollständigkeit erhebt diese Arbeit nicht, vielmehr wurde eine exemplarische Darstellung der hauptsächlichen Theorien und kompositorischen Techniken mit Mikrotönen angestrebt.	*compositional use of microtones is occasionally discussed in detail. Often, however, not much more is given as an indication of the mere presence of microtones, sometimes even incorrect information is conveyed. The present work is based on the fact that only little productive specialist literature is available, mainly on source material, especially on compositions and music theories*. This work does not claim to be bibliographical completeness, rather an exemplary representation of the main theories and compositional techniques with microtones was sought.
P. 15 Da Theorien und kompositionstechnische Mittel im Gebrauch der Mikrotöne bis jetzt noch so wenig erforscht sind, scheint das Aufzeigen von Hauptströmungen und ihre Einordnung in ein Gesamtbild der Musik des 20. Jahrhunderts vorrangig vor bibliographischer Lückenlosigkeit zu sein, die bei der Fülle des vorliegenden Quellenmaterials ohnehin nicht zu erreichen wäre.	P. 15 *Since theories and compositional means in the use of microtones have so far been little researched, the main trends and their classification into an overall picture of the music of the 20th century seem to be more important than bibliographical gaps, which, given the abundance of the present Source material would not be available anyway.*
P. 17 A. Mikrotöne in musikhistorischen Zeugnissen bis 1900	P. 17 A. Microtones in musical history certificates up to 1900
Mikrotöne in der Musik sind nicht neu, sie sind keine "revolutionäre" Erfindung des 20. Jahrhunderts. Sie haben eine lange Tradition in der Volks- und Kunstmusik und in der Musiktheorie bis in die älteten Zeiten der Überlieferung zurück. Dafür finden sich Zeugnisse in unserem wie in anderen	Microtones in music are not new, they are not a "revolutionary" invention of the 20th century. They have a long tradition in folk and art music and in music theory dating back to the ancient times of tradition. Evidence of this can be found in both our and other cultures.

Kulturkreisen.	
Durch zahlreiche Forschungen auf dem Gebiete der Musikethnologie wurde gezeigt, dass mikrotonale Intervalle in der Musik verschiedener aussereuropäischer Kulturen nicht nur vorkommen, sondern einen strukturtragenden Bestandteil der - meist einstimmigen - melodik bilden. Als besonders typisch dafür sei nur die Musik des Vorderen und Mittleren Orients erwähnt. Die Tonsysteme der orientalischen Musik sind reicher und vielgestaltiger an möglichen mikrotonalen Intervallen als die bisher in Europa gebräuchlichen Mikrotonsysteme. Von der orientalischen Musik her lassen sich allerdings keine direkten historisch begründbaren Verbindungslinien zu der mikrotonalen Kunstmusik des Abendlandes ziehen. Die aus orientalischen Tonsystemen übernommenen Intervalle in der Musik Ton de Leeuws sind nur eine Ausnahmeerscheinung und auf seine persönlichen Studien zurückzuführen. Über de Leeuws eigene Musik hinaus haben sie bisher kaum Bedeutung gewonnen.	Numerous researches in the field of music ethnology have shown that microtonal intervals not only occur in the music of various non-European cultures, but also form a structural component of the - mostly unanimous - melody. Only the music of the Middle East is mentioned as particularly typical of this. The sound systems of oriental music are richer and more varied in possible microtonal intervals than the microtone systems that have been used in Europe up to now. From oriental music, however, there are no direct historically justifiable connecting lines to the microtonal art music of the West. The intervals in Ton de Leeuw's music taken from oriental sound systems are only an exception and can be traced back to his personal studies. So far, they have hardly gained any importance beyond de Leeuw's own music.
Die für das Abendland ersten Zeugnisse kleinerer Tonstufen als der des Halbtons finden sich bei den griechischen Musiktheoretikern und in spärlichen Funden praktischer Musikstücke. (1) Das Hauptgewicht der Information liegt dabei bei den Theoretikern, da nur sehr wenige Tondenkmäler überliefert sind. (2) Alle Tonschritte, die kleiner als ein Halbton sind, wurden von den späteren griechischen Theoretikern "Diesis" (auszusprechen: di-e-sis) genannt. (3) In der pythagoräischen Zeit wurde mit "Diesis" allerdings der diatonische Halbtonschritt 256:243 bezeichnet, der dann später den Namen "Leimma" bekam. (4) P. 18 Zu den Diesen wurden dann nur noch die chromatischen und enharmonischen	The first evidence for the western world of lower tones than that of the semitone can be found in the Greek music theorists and in sparse finds of practical pieces of music. (1) The main emphasis of the information lies with the theoreticians, since only very few clay monuments have survived. (2) All tone steps smaller than a semitone were called "diesis" (to pronounce: di-e-sis) by the later Greek theorists. (3) In the Pythagorean period, however, "Diesis" was used to denote the diatonic semitone step 256: 243, which was later given the name "Leimma". (4) P. 18 Among these, only the chromatic and enharmonic tone steps were counted, which were smaller than the semitone. "Diesis" was initially a very general definition. For a more

Tonschritte gezählt, die kleiner als der Halbton waren. "Diesis" war also zunächst eine ganz allgemeine Bestimmung. Zur näheren Definition der von den verschiedenen Theoretikern als "Diesis" benannten Tonschritte bedarf es deshalb jeweils der Angabe der Schwingungsverhältnisse oder der Centzahlen. (5) Vogel erklärt die enharmonische Musik der Griechen als eine Musik in der "die Töne in Harmonie zueinander" standen, d.h. in den Beziehungen der reinen Stimmung. (6) Die Anwendung der reinen Stimmung, insbesondere die Anerkennung der Naturseptime 7/4, führt zu enharmonischen Schritten im Tonsystem. (7) Aber das "Wesen" der griechischen Enharmonik liegt - wie Vogel betont - nicht so sehr im "Viertelton" als vielmehr in "dem für das griechische Geistesleben so bedeutsamen Begriff der Harmonia". (8) "Die enharmonische Diesis ist im Rahmen der reinen Stimmung nur akzidentell." (8)	detailed definition of the tone steps designated by the various theoreticians as "diesis", it is therefore necessary to specify the vibration ratios or the cent numbers. (5) Vogel explains the enharmonic music of the Greeks as music in which "the tones were in harmony with one another", i.e. in relationships of pure mood. (6) The use of pure mood, especially the recognition of natural septime 7/4, leads to enharmonic steps in the sound system. (7) But, as Vogel emphasizes, the "essence" of the Greek Enharmonic is not so much in the "quarter tone" as in "the concept of harmonia so important for the Greek intellectual life". (8) "The enharmonic diesis is only accidental in the context of the pure mood." (8th)
Kleine melische Distanzen weist auch der im Vorderen Orient beheimatete frühchristliche Kirchengesang auf. Sie haben sich bis in die mittelalterliche Choralpraxis gerettet, wo sie notiert und damit nachweisbar sind. Zeugnisse über selbständig vorkommende Mikrotöne sind in Choralhandschriften und bei theoretikern des Mittelalters zu finden. Joseph Gmelch hat in seiner Schrift "Die Vierteltonstufen im Meßtonale von Montpellier" (9) anhand dieses wichtigsten Denkmals des 11. Jahrhunderts auf die Bedeutung kleinerer Intervalle als der Halbtöne für die einstimmige Choralpraxis des Mittelalters hingewiesen. Die Bezeichnung "Vierteltonstufe" erschien Gmelch für diese zwischen den Halbtöne gelegenen Tonstufen nicht nur am einfachsten, sondern auch am korrektesten zu sein, obwohl er betonte, daß es sich nicht um mathematisch genau abgemessene Viertel	The early Christian church singing, located in the Middle East, also shows small melonic [sic] distances. They have saved themselves in medieval choral practice, where they are noted and can therefore be traced. Evidence of independently occurring microtones can be found in chorale manuscripts and from medieval theorists. In his work "The quarter-tone steps in the measuring tone of Montpellier" (9), Joseph Gmelch pointed out the importance of shorter intervals than semitones for the unanimous choral practice of the Middle Ages on the basis of this most important monument of the 11th century. The term "quarter-tone step" seemed to Gmelch to be not only the simplest but also the most correct for these tone steps between the semitones, although he emphasized that these are not mathematically precisely measured quarters of an entire tone. These intermediate levels were identified by the following

eines ganzen Tones handelt. Bezeichnet wurden diese Zwischenstufen durch folgende Zeichen : [SYMBOLS] P.19 Sie stehen immer nur stellvertretend für diejenigen Tonstufen, deren nächst höhere einen Halbton entfernt ist. Peter Wagner, der Gmelchs Untersuchungen bestätigte, warnte davor, irgendeine Verbingdungslinie dieser im Mittelalter gebräuchlichen Abweichungen von der Diatonik mit antiker oder moderner Chromatik sehen zu wollen. (10)	characters: [SYMBOLS] P.19 They only represent the tone levels whose next higher level is a semitone away. Peter Wagner, who confirmed Gmelch's investigations, warned against wanting to see any connection between these deviations from diatonics, which were common in the Middle Ages, with ancient or modern chromatics. (10)
Diese "Vierteltöne" des Mittelalters waren eng an die einstimmige Choralpraxis geknüpft. Die besonders seit dem 12. Jahrhundert aufblühende mehrstimmige Musik hatte für die feineren melischen Distanzen keinen Platz mehr. Auch die Orgel als Begleitinstrument wirkte dem Gebrauch mikrotonaller Intervalle entgegen. Der bereits im 10. Jahrhundert einsetzende Kampf für oder gegen das Chroma endete schließlich zugunsten der Gegner, wie dies Handschriften der späteren Zeiten beweisen, wodurch natürlich zuerst das "auffallendste Chroma", jener "Viertelton", betroffen wurde. Einen weiteren Grund für das Verschwinden des Vierteltons sah Gmelch in der Einführung des Vierliniensystems, "das nur für diatonische Verhältnisse geschaffen war und darum auch die endgültige Diatonisierung des lateinischen Kirchengesanges herbeiführte". (11)	These "quarter tones" of the Middle Ages were closely linked to the unanimous choral practice. The polyphonic music, which had flourished particularly since the 12th century, no longer had any space for the finer melonic distances. The organ as an accompanying instrument also counteracted the use of microtonal intervals. The struggle for or against the chroma, which started as early as the 10th century, ended in favor of the opponents, as evidenced by manuscripts of later times, which of course affected the "most striking chroma", that "quarter tone". Gmelch saw another reason for the disappearance of the quarter tone in the introduction of the four-line system, "which was only created for diatonic conditions and therefore also brought about the final diatonization of the Latin church chant". (11)
Mikrotöne in der mittelalterlichen Musik sind aber nicht nur in Zeugnissen praktischer Musik, sondern vor allem auch din der Musiktheorie belegt, so z.B. bei Regino von Prüm, Guido, Enelbert von Admont, Simon Tunstede u.a. (12).	Microtones in medieval music are not only found in evidence of practical music, but above all also in music theory, e.g. with Regino von Prüm, Guido, Enelbert von Admont, Simon Tunstede and others (12).
In der Musiktheorie lebten die Mikrotöne noch weit über das Mittelalter hinaus fort. Besonders im 16. und 17. Jahrhundert waren Kleinintervalle ein beliebter Gegenstand	In music theory, microtones lived on well beyond the Middle Ages. Small intervals were a popular subject of theoretical research, particularly in the 16th and 17th centuries.

theoretischer Untersuchungen. Dies war eine Folge der Beschäftigung mit der Musiktheorie der Griechen, die im Zuge der Renaissancebewegun außerordentliche Bedeuteung gewann. Zum anderen ist es aber auch auf das zu jener Zeit brennende Problem der reinen Stimmung, besonders der Terzenstimmung, zurückzuführen und, nicht zuletzt, auf ein Bestreben nach Ausdruckssteigerung. P. 20	This was a consequence of the preoccupation with the music theory of the Greeks, which gained extraordinary importance in the course of the Renaissance movement. On the other hand, it is also due to the burning problem of pure mood at the time, especially the mood of thirds, and, last but not least, an attempt to increase expression. P. 20
P. 103 C. Theoretische Abhandlungen über die Musik mit Mikrotönen im 20. Jahrhundert	P. 103 C. Theoretical Treatises on Music with Microtones in the 20th Century
Ein grosser Teil der Theoretiker, die sich in unserem Jahrhundert mit Mikrotönen befassten, waren bzw. sind gleichzeitig auch Komponisten. Ihre Theorien entstanden aus dem Bedürfnis heraus, die ihnen als zu eng erscheinenden Grenzen des Halbtonsystems durch die Einführung kleinerer Tonstufen zu erweitern und der Musik dadurch einen neuen Ausdrucksbereich zu erschliessen. Zwei der in der folgenden Darstellung behandelten Theoretiker haben einige kleinere Kompsitionen geschrieben, die aber nur als Demonstrationsmittle für die vertretenen Theorien angesehen werden können: Jörg Mager und Adriaan Daniel Fokker. Aber auch Magers und Fokkers theoretische Erörterungen zielen auf die Musik selbst hin, die ein Tonmaterial mit mehr als zwölf Stufen in der Oktave zur Grundlage hat.	A large number of the theorists who dealt with microtones in our century were or are also composers. Their theories emerged from the need to expand the limits of the halftone system, which seemed too narrow to them, by introducing smaller tones, thereby opening up a new area of expression for music. Two of the theorists dealt with in the following presentation have written some smaller compositions, which can only be seen as a means of demonstrating the theories represented: Jörg Mager and Adriaan Daniel Fokker. But Magers and Fokker's theoretical discussions also aim at the music itself, which is based on a sound material with more than twelve steps in the octave.
Die im 20. Jahrhundert formulierten Theorien zur Rechtfertigung und Fundierung der Musik mit Mikrotönen lassen sich zeitlich und inhaltlich un drei Epochen einteilen. Bestimmte grundsätzliche Erwägungen finden sich in den Theorien aller Eitabschnitte, aber der Schwerpunkt der Betrachtung liegt jedesmalauf einem anderen Teilaspekt.	The theories formulated in the 20th century to justify and substantiate music with micro tones can be divided into three epochs in terms of time and content. Certain fundamental considerations can be found in the theories of all stages, but the focus of attention is always on a different sub-aspect.

Die erste Epoche erstreckt sich vom Beginn des Jahrhunderts bis etwa 1920/25. Die Theorien dieser Zeit bringen in erster Linie das Unbehagen an den zu engen Grenzen des Halbtonsystems zum Ausdruck und erheben die Forderung nach einer Erweiterung des Tonsystems durch die Hereinnahme kleinerer Stufen als der des Halbtons. Das gültige Tonsystem der zwölfstufigen sogenannten gleichschwebenden Temperatur bleibt als Ausgangspunk weiterer Unterteilung erhalten. In dieser ersten Zeit des Wegbereiterns is einerseits eine mehr allgemeine Rechtfertigung der Aufnahme von Mikrotönen in die Musik vom ästhetischen Gesichtspunkt her vorherrschend. Rein kompositionstechnische Fragen werden nur am Rande erörtert. Andererseits tritt die Frage nach den Möglickeiten instrumentaler Ausführbarkeit in den Vordergrund. Auf dem instrumentalen Sektor wird besondere Bedeutung der Erfindung von Tasteninstrumenten beigemessen, auf denen Mikrotöne darstellbar sind, vor allem deshalb, umdie damals noch völlig neuen Klänge demonstrieren zu können.	The first epoch extends from the beginning of the century to around 1920/25. The theories of the time primarily express the discomfort at the too narrow limits of the halftone system and raise the demand for an expansion of the tone system by taking smaller steps than that of the halftone. The valid sound system of the twelve-step so-called constant temperature remains as the starting point for further subdivision. In this first period of pioneering, there is on the one hand a more general justification for the inclusion of microtones in music from an aesthetic point of view. Purely compositional questions are only discussed in passing. On the other hand, the question of the possibilities of instrumental executability comes to the fore. In the instrumental sector, particular importance is attached to the invention of keyboard instruments on which microtones can be represented, especially in order to be able to demonstrate the sounds that were completely new at the time.
P. 104 Die zweite Epoche theoretischer Fundierung der Musik mit Mikrotönen erstreckt sich etwa von 1920/25 bis zum zweiten Weltkrieg. Hauptanliegen der theoretischen Erörterungen dieser Zeit ist das Aufzeigen klanglicher Kombinationen. Tonfortschreitungen und Zusammenklänge werden ausführlich diskutiert. Zwar werden auch in dieser Zeit speziell zur Darstellung von Mikrotönen geeignete Instrumente erfunden, aber deren Konstruktion wird nicht mehr oder höchstens am Rande zum Gegenstand musiktheoretischer Betrachtungen erhoben. Das Aufzeigen kompositorischer Elemente ist wichtiger gereits eine Festigung in der allgemeinen ästhetischen Beurteilung der	P. 104 The second epoch of the theoretical foundation of music with microtones extends from around 1920/25 to the Second World War. The main concern of the theoretical discussions of this time is to show sound combinations. Sound progressions and coherences are discussed in detail. Even during this period, instruments suitable specifically for the representation of microtones were invented, but their construction is no longer, or at most only marginally, the subject of music theory considerations. The identification of compositional elements is more important than the consolidation of the general aesthetic assessment of microtones. In addition to the

Mikrotöne eingetreten ist. Neben der Erörterung von Klangzusammenstellungen, die unentbehrlich für die Komposition mit Mikrotönen ist, befassen sich die Theoretiker dieser mittleren Epoche teilweise auch mit Fragen der akustischen Fundierung. Aus den Gesetzen der Obertonreihe wird die Existenz von Mikrotönen hergeleitet, in ihrer systematischen Eingliederung werden sie den Ordnungsprinzipien der gleichmässig temperierten Stimmungen unterworfen.	discussion of sound compositions, which is indispensable for the composition with microtones, the theoreticians of this middle period also partly deal with questions of acoustic foundation. The existence of microtones is derived from the laws of the overtone series. In their systematic integration, they are subjected to the ordering principles of uniformly tempered moods.
Eine dritte Epoche theoretischer Durchdringung der Mikrotöne in der Musik ist mit ihrem Beginn nach 1945 anzusetzen. Die Theorien der neueren Zeit behandeln vorwiegend das Tonmaterial vom akustisch-mathematischen Standpunkt aus. Dabei zeigen sich bis heute drei verschiedene Tendenzen, aus denen heraus unterschiedliche Tonsysteme aufgestellt wurden. Zeitlich am frühesten in Erscheinung traten Vertreter jener Richtung, die aus dem Streben nach einer Wiederbelebung der reinen Stimmung eine grössere Unterteilung der Oktave als nur in zwölf Stufen vornehmen. In einer zweiten Richtung wird, wie schon bei Theoretikern der vorhergehenden Epoche, wiederum die Obertonreihe als Ausgangspunkt und Rechtfertigung herangezogen. Ziel ist hier, die unendliche Teilung der Oktave mathematisch zu begründen und ein bis in feinste tonliche Nuancierungen differenziertes Tonmaterial für die Komposition vorzubereiten. Eine dritte Richtung schliesslich geht von der Möglichkeit aus, das gesamte Tonmaterial, das jemals von Menschen musikalisch verwendet wurde, auszunützen. Dabei werden verschiedene historisch fundierte Tonsysteme wie verbunden. Vertreter dieses "kosmopolitisch" anmutenden Denkens ist der Holländer Ton de Leeuw.	A third epoch of theoretical penetration of microtones in music is to begin with after 1945. The theories of modern times mainly deal with the sound material from the acoustic-mathematical point of view. To date, three different trends have emerged, from which different sound systems have been set up. At the earliest time, representatives of the direction appeared who, in pursuit of a revival of the pure mood, subdivided the octave more than only in twelve steps. In a second direction, as with theorists of the previous epoch, the overtone series is again used as a starting point and justification. The aim here is to mathematically justify the infinite division of the octave and to prepare a sound material that is differentiated into the finest tonal nuances for the composition. Finally, a third direction starts from the possibility of using all the sound material that has ever been used musically by people. Various historically sound systems are connected as. The representative of this "cosmopolitan" -looking thinking is the Dutchman Ton de Leeuw.

P.184 Geminsamkeiten und Divergenzen in der theoretischen Zielsetzung Zwei völlig verschiedene Hauptziele, die mit der Einführung von Mikrotönen vergolgt wurden, lassen sich asu den theoretischen Abhandlungen ablesen. Auf der einen Seite stehen die Bestrebungen, denen es in erster Linie auf die größtmögliche Reinheit der Intonation vom Gesichtspunkt der Akustik her ankam. Die Theoretiker dieser Richtung sahen in der 12-stufigen gleichmäßigen Temperatur nur einen Notbehelf, den es zu beseitigen oder mindestens zu verbessern galt. Mit der 12-Ton-Temperatur lehnten sie auch deren weitere Unterteilung ab. Verschiedene Wege wurden von den einzelnen Vertretern beschritten, so z.B. die Einteilung der Oktave in gleichmäßig große Stufen (Avraamov) oder nicht auf der Zahl 12 als Grundlage beruhende mikorintervallische gleichmäßige Temperaturen. Das musikalische Ziel der "Reintöner" war nicht die Schaffung oder Vorbereitung einer eigentlich "neuen" Musik, sondern einerseits die Reinigung der vorhandenen von den Ungenauigkeiten der Intonation, die in der 12-Ton-Temperatur liegen, andererseits auch die Anregung zur Komposition auf der Basis akustisch exakter Relationen. Damit werden grundsätzlich historisierende Absichten verfolgt. Auch die Propagierung der reinen Septime ist nicht neu. Ihre theoretische Beschreibung beginnt schon im 17. Jahrhundert und gelangt zu grösserer Bedeutung im 18. Jahrhundert. (34) P. 185 Die theoretische Begründung und Einführung der Reinintervalle mit Hilfe mikrointervallischer Temperaturen, seien sie gleichmässig oder ungleichmässig, dient dem einen gemmeinsamen Ziel, der Musik den "schönen Klang" zu erschließen. Damit sind die Vertreter dieser Richtung einer mehr	P.184 Similarities and divergences in the theoretical objective Two completely different main goals, which were achieved with the introduction of microtones, can be seen in the theoretical treatises. On the one hand there are the efforts that were primarily concerned with the greatest possible purity of the intonation from the point of view of acoustics. The theorists of this direction saw in the 12-step uniform temperature only a makeshift that had to be eliminated or at least improved. With the 12-ton temperature, they also rejected their further subdivision. The individual representatives took different paths, e.g. the division of the octave into uniformly large steps (Avraamov) or based on the number 12 as a basis micro-interval uniform temperatures. The musical goal of the "Reintöner" was not the creation or preparation of an actually "new" music, but on the one hand the cleaning of the existing inaccuracies in the 12-tone temperature, on the other hand also the suggestion to compose on the Basis of acoustically exact relations. Basically, historicizing intentions are pursued. The propagation of the pure seventh is also not new. Their theoretical description begins in the 17th century and becomes more important in the 18th century. (34) P. 185 The theoretical justification and introduction of the pure intervals with the help of micro-interval temperatures, be they uniform or non-uniform, serves the one common goal of opening up the "beautiful sound" to music. The representatives of this direction are now turning to a more retrospective aesthetic,

retrospektiven Ästhetik zugewandt, die in der gegenwärtigen Zeit auf nur begrenzte Anerkennung stößt.	which is currently only receiving limited recognition.
Die den "Reintönern" entgegengesetzte Strömung bilden die Theoretiker, deren Mikrotonsysteme auf einer weiteren Unterteilung der 12-stufigen gleichmäßig temperierten oder der davon abgeleiteten 6-stufigen Oktave beruhen. Sie sind als die eigentlichen "Modernisten" in der Mikrotonbewegung zu bezeichnen, denn ihnen kam es vor allem auf die Schöpfung "neuer Klänge" an. Bei den Theorien, die dieser Richtung zuzuordnen sind, finden sich verschiedene Abstufungen melodischer und harmonischer Integration der Mikrotöne, von der rein dekorativen bis zur melodisch und harmonisch autonomen Verwendung.	The opposite of the "pure tones" is formed by the theoreticians, whose microtone systems are based on a further subdivision of the 12-stage, evenly tempered or the 6-stage octave derived from it. They can be described as the actual "modernists" in the microtone movement, because what mattered to them most was the creation of "new sounds". In the theories that can be assigned to this direction, there are various levels of melodic and harmonic integration of the microtones, from the purely decorative to the melodic and harmoniously autonomous use.
Eine Zwischenstellung zwischen der ästhetischen Anschauung der "Reintöner" und der mehr revolutionär bestimmten der "Modernisten" nehmen die Theoretiker ein, die zwar für eine weitere glischmâssige Unterteilung der 12-Tone-Temperatur eintraten, die aber auch den "Wohlklang" nicht aufgeben oder ihn sogar durch Mikrotöne retten wollten, wie vor allem Stein oder Möllendorff.	The theoreticians occupy an intermediate position between the aesthetic view of the "pure tones" and the more revolutionary ones of the "modernists" even wanted to save with microtones, like Stein or Möllendorff in particular.
Über die auf einem Vielfachen der 12- (oder 6-) Zahl beruhenden wie auch über die die Reinstimmung fördernden Mikrotonsysteme hinaus weisen diejenigen Theorien, deren Ziel eine - mindestens gedanklich realisierbare - Unendlichkeit der Tonhöhenabstufung ist. In ihr finden beide Richtungeng der Mikrotonbewegung Platz, sowohl die der "Reintöner" als auch die auf der weiteren Unterteilung der 12-stufigen Temperatur beruhende der "Modernisten".	In addition to the microtone systems based on a multiple of the 12 (or 6) number as well as the microtone systems that promote pure tuning, there are theories whose goal is an infinity of the pitch gradation, which is at least feasible in theory. It accommodates both directions of the microtonic movement, that of the "cleaners" as well as that of the "modernists" based on the further subdivision of the 12-stage temperature.
P.187 D. Untersuchungen zur Kompositionstechnik mit Mikrotönen	P.187 D. Studies on composition technique with microtones

Die stilistische und kompositionstechnische Einordnung der Musik mit Mikrotönen kann von zwei Fragestellungen her angegangen werden: was ist einerseits von der Musiktheorie, andrerseits von den parallelen Strömungen der Halbtonmusik her zu erwarten?	The stylistic and compositional classification of music with microtones can be tackled from two questions: what can be expected from music theory on the one hand and from the parallel currents of halftone music on the other?
Wie die Untersuchung der Theorien zeigte, stehen kompositionstechnische und stilistische Fragen nicht immer im Vordergrund der Erörterungen. In der ersten Epoche ist die ästhetische Fundierung und Rechtfertigung Hauptanliegen. Angaben zur praktischen Verwendung der Vierteltöne in der Komposition finden sich bei Stein und Möllendorff. Stein wollte Vierteltöne als Hervorhebung eines Leittonverhälnisses und als Durchgangsnoten zur nahtlosen Verschmelzung zweier benachbarter Halbtöne eingesetzt haben was er selbst in seinen eigenen Kompositionen auch ausführte. Möllendorff sah die Möglichkeiten des Gebrauchs von Vierteltönen in der zeitweiligen Transposition ganzer Partien eines Viertelton höher oder tiefer, wobei die Dur-Moll-Struktur der Harmonik unangetastet blieb.	As the examination of the theories showed, compositional and stylistic questions are not always in the foreground of the discussions. In the first epoch, aesthetic foundation and justification were the main concerns. Information on the practical use of the quarter tones in the composition can be found at Stein and Möllendorff. Stein wanted to use quarter tones to emphasize a key tone ratio and as continuity notes for the seamless merging of two adjacent semitones, which he also performed in his own compositions. Möllendorff saw the possibilities of using quarter tones in the temporary transposition of entire parts of a quarter tone higher or lower, whereby the major-minor structure of the harmonics remained untouched.
Im zweiten Zeitabschnitt richtete sich das theoretische Interesse vor allem auf die Zubereitung kompositorischer Elemente. Die mikrotonale Akkord- und Skalenbildung stand im Mittelpunkt der theoretischen Abhandlungen. Ives beschrieb einige Akkorde, die ihm für vierteltönige Harmonik als geeignet erschienen, und wandte sie in seinen Vierteltonklavierstücken an. Wyschnegradsky wandelte in seinem "Manuel" die Akkorde der traditionellen Harmonielehre mit Vierteltönen ab; allerdings gründete er seine Kompositionen nicht auf diese Art der Harmonik. Im zweiten, kürzeren	In the second period, the theoretical interest was focused mainly on the preparation of compositional elements. Microtonal chord and scale formation was the focus of theoretical papers. Ives described some chords that seemed to vierteltönige harmony as appropriate, and applied them in his quarter-tone piano pieces. In his "Manuel" Wyschnegradsky modified the chords of the traditional harmony with quarter tones; However, he did not base his compositions on this kind of harmony. In the second, shorter part of the "manuel" and in other writings, he showed sounds from two or more quarter

Teil des "manuel" und in anderen Schriften zeigte er Klänge aus zwei oder mehreren nebeneinander liegenden Vierteltönen, die dann auch in seinen Kompositionen auftauchen. Die systematischste und unfangreichste Ordnung des Tonmaterials und der darin enthaltenen Klangkombinationen gab Hába in seiner Harmonielehre. Die fünf Grundsätze, nach denen er siene Klangzusammenstellungen notierte, sind so umfassend, dass damit die gesamte moderne Harmonik erklärt werden könnte, soweit sie auf aus Tönen zusammengesetzten Klängen beruht; die Möglichkeit, auch Geräusche in die Komposition mit einzubeziehen, ist Hába trotz aller klanglichen Kühnheit fremd. Nach den Richtlinien von Hábas Harmonielehre kann jeder Ton mit jedem anderen horizontal und vertikal in Verbindung gebracht werden, und jede Klangkombination kann mit jeder anderen in Beziehung treten. Diese allgemeinen Grundsätze gestatten in ihrer Freiheit sowohl tonale wie atonale Gestaltung. In den umfangreichen Detailausarbeitungen zur Akkordstruktur werden Tonbeziehungen vom Zweiklang bis zu solchen Klanggebilden behandelt, die alle im betreffenden Tonsystem vorkommenden Töne enthalten, d.h. im Halbtonsystem bis zum "Zwölfklang", im Dritteltonsystem bis zum "Achtzehnklang", im Vierteltonsystem bis zum "Vierundzwanzigklang", im Sechteltonsystem bis zum "Sechsunddreissiglang" und im Zwölfteltonsystem bis zum "Zweiundsiebzigklang"; in der Skalenbildung zeigte Hába Ordnungsreihen von fünf bis zu der jeweils größtmöglichen Zahl an Stufen innerhalb eines Tonsystems. Trotz aller Ausf¨hrlichkeit in den Kombinationsmöglichkeiten von Tönen in der Horizaontalen wie in der Vertikalen bleibt Hábas Harmonielehre doch nur eine Sammlung kompositorischer Elemente, über deren Verknüpfung nichts ausgesagt wird.	tones lying next to each other, which then also appear in his compositions. Hába gave the most systematic and extensive order of the sound material and the sound combinations it contains in his harmony theory. The five principles according to which he noted his sound compositions are so comprehensive that they could be used to explain the entire modern harmony, insofar as it is based on sounds composed of tones; the possibility of including noises in the composition is foreign to Hába, despite all the audacious audacity. According to the principles of Hába's theory of harmony, every sound can be connected horizontally and vertically to every other, and every sound combination can relate to every other. These general principles allow both tonal and atonal design in their freedom. The extensive detailed elaborations on the chord structure deal with tonal relationships from the two-tone to such sound structures that contain all the tones occurring in the relevant tonal system, i.e. in the semitone system up to "twelve tone", in the third tone system up to "eighteen tone", in the quarter tone system up to "twenty four tone", in the six tone system up to "thirty six length" and in the twelve tone system up to "seventy two tone"; in the scale formation, Hába showed order series from five up to the greatest possible number of levels within a sound system. Despite all the details of the possible combinations of tones in the horizontal as well as in the vertical, Hába's theory of harmony remains only a collection of compositional elements, about the connection of which nothing is said. But Hába deliberately avoided setting fixed rules; he only wanted to prepare the sound material, whose processing he saw as the individual artistic act. The absolute tonal and harmonic freedom up to which Hába advanced in his theory of harmony had not been realized in his works. His compositions remain bound to tonal centers; The thirds of the chords are not

Aber Hába vermied ganz bewußt das Aufstellen fester Regeln; er wollte nur das Klangmaterial vorbereiten, dessen Verarbeitung sah er als die individuelle künstlerische Tat an. Die absolute tonale und harmonische Freiheit, bis zu der Hába in seiner Harmonielehre vorstieß, hate er in sienen Werken nicht verwirklicht. Seine Kompositionene bleiben an tonale Zentren gebunden; der Terzenaufbau der Akkorde wird zwar nicht ausschließlich beibehalten, herrscht aber noch vor.	exclusively retained, but still prevail.
In der dritten Epoche nach 1945 wurden nur wenige Theorien über Musik mit Mikrotönen veröffentlicht. Ton de Leeuw legte seine Gedanken dazu nicht schriftlich nieder. Björn Fongaards Abhandlungen liegen nur maschinenschriftlich vor und sind deshalb schwer zugänglich. Fongaard behandelte darin das Tonmaterial hauptsächlich vom mathematischen und philosophisch-ästhetischen Gesichtspunkt aus. Sein Ziel für die Komposition ist die Erschließung des gesamten Tonuniversums durch unenlich feine Nuancierungen. Adriaan D. Fokker schließlich strebte weniger eine Theorie zur Begründung eigentlicher Mikrotonmusik als die Verwirklichung der reinen Stimmung an.	In the third epoch after 1945, only a few theories about music with microtones were published. Ton de Leeuw did not put his thoughts down in writing. Björn Fongaard's treatises are only typewritten and are therefore difficult to access. Fongaard mainly dealt with the sound material from a mathematical and philosophical-aesthetic point of view. His aim for the composition is to open up the entire tonal universe through ingeniously subtle nuances. Finally, Adriaan D. Fokker strove less for a theory to justify actual microton music than for the realization of the pure mood.
P. 189 Weiter als die Bezugnahme auf die Theorien führt in der Untersuchung der kompositorischen Techniken der Vergleich mit den Stilrichtungen, die im 20. Jahrhundert die Halbtonmusik beherrschten. Nahezu alle diese Richtungen wurden ebenso für die Mikrotonmusik erschlossen. Wie in der Halbtonmusik gibt es auch hier keine kontinuierlich durchlaufende Entwichlungslinie, sondern verschiedene Strömungen existieren nebeneinander oder überschneiden sich sogar. Im 20. Jahrhundert vollzieht sich der Wechsel der Stilbereiche	P. 189 In the study of compositional techniques, the comparison with the styles that dominated halftone music in the 20th century goes further than the reference to the theories. Almost all of these directions were also opened up for microtone music. As in halftone music, there is no continuous development line here, but different currents exist side by side or even overlap. In the 20th century, the change of style areas took place faster and faster. On the one hand, several generations are creating their works at the same time; on the other hand, there is a

immer rascher. Einerseits schaffen mehrere Generationen glichzeitig ihre Werke; zum anderen macht sich allgemein eine immer größer werdende individuelle Freiheit des Stils geltend, wie sie für fr¨here Epochen nicht beobachtet werden kann. "In der Neuen Musik zehrt das Besondere das Allgemeine auf." (1)	general increase in individual freedom of style that cannot be observed in earlier epochs. "In new music, the special consumes the general." (1)
Die folgende Darstellung einzelner Stilmittle geschieht weitgehend anhand von Musikwerken selbst. Jeder Bereich ist exemplarisch nur an einem oder wnigen Beispielen erläutert. Für die ersten vier Hauptpunkte wurde eine rein stilistische Einordnung in Anlehnung an die Richtungen der Halbtonmusik vergenommen. Gemeinsame Basis aller dort behandelten Kompositionen sind solche Tonsysteme, deren Ursprung die 12- bzw. 6-tönige gleichmäßige Temperatur ist. Der letzte Abschnitt ist der Musik mit nicht auf diese Temperatur zurückführbaren Tonsystemen vorbehalten.	The following depiction of individual stylistic devices is largely based on musical works themselves. Each area is exemplarily explained using only one or a few examples. For the first four main points, a purely stylistic classification based on the directions of halftone music was heard. The common basis of all the compositions discussed there are such sound systems, the origin of which is the 12- or 6-tone uniform temperature [sic]. The last section is reserved for music with sound systems that cannot be traced back to this temperature.

APPENDIX D

YOUTUBE PLAYLISTS FOR DASTGĀH AUDIATION

YouTube playlists of Dastgāh-e Shur and Dastgāh-e Homāyun have been curated by the present author to give readers access to Persian classical music performances whose dastgāhhā contain the neutral second a step above the finalis. The YouTube channel is called “Michael DiBarry.”

Playlist Title: “Dastgāh-e Shur”

Location:

https://www.youtube.com/playlist?list=PL8xxC40USkExBQJ9oLsv7MZC9HHspZKAF

Video Title:	Posted by:
Dastgah Shur	Nima Janmohammadi - Topic
Faramarz Payvar & Ensemble: Dastgah Shur	kittenfood777
Nazar Deli Ra(Shoor Dastgah) | تصنیف ار دلی نازار : قدیمی	Rhythmitica
Pishâhang–e Shur	Hatam Asgari - Topic
sima bina	Feuerrote
تصنیف امان امان - امضرمحم ایرجشن	KheoopsTube
آهنگساز - غریب خانه کنسرت کامل اجرای : ربی‌گل پویان	simorq farhang
Fire of Love	Ziya Tabassian - Topic

Playlist Title: “Dastgāh-e Homāyun”

Location:

https://www.youtube.com/playlist?list=PL8xxC40USkEyTTKjxz36OE2n06wBOqDhq

Video Title	Posted by:
Parisa : Classical Vocal Art of Persia (Dastgah eh homayoun)	Saam Channel
Dastgah of Homayoun	Various Artists - Topic
Dastgah-e Homayoun	Talieh Kamran - Topic
Dastgah Homayoun	Various Artists - Topic
Dastgah Homayoun : Kamel Alipour & Vahdati	Ahmad Azdad
Chakam Ensemble: Live concert in Lausanne, April 2016	Sogol Mirzaei
M.A.Kianinejad & Z.Sabet - Consert 1995 تثاب زویا و نژاد کیانی علی محمد	Ehsan Tavakkol
Mohammad Reza Shajarian - Rendan e mast	DGenome
Ahmad Ebadi - Sooze Eshgh (Homayoun) قعش سوز - عبادی احمد |	Persianmusictube
۱۳۶۴ آلبوم -شور دستگاه -من هلاك تصنیف - شجریان -بیداد	Khonyagaran