

# SYSTEMATIST BUZURG AND ITS RELATIVES: NOTES ON A ZALZALIAN MODAL GENUS

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## INTRODUCTION

Rather as light may be viewed as either a particle or a wave in modern physics, so Zalzalian modality may be approached from the perspectives of systematics or structure, and of dynamics or process. The traditional materials of modal systematics are *qjnās* or genera (the Arabian singular form being *jīns*, “genus”), here termed polychords, with the tetrachords and pentachords of classic 9<sup>th</sup>-15<sup>th</sup> century Near Eastern theory<sup>1</sup> supplemented in modern theory by trichords<sup>2</sup>, and scales, often spanning an octave but sometimes a lesser or greater compass, joining together two or more polychords<sup>3</sup>.

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<sup>1</sup> For helpful summaries of 9<sup>th</sup>-15<sup>th</sup> century Near Eastern theory, see for example [Ghrab, 2009] and [Forster, 2010, p. 610-787]. The early Systematist era around 1250-1300 is the focus of [Wright, 1978]. Some of the main writings are available in French translation in [Erlanger, 2001, Vol. I-IV]. Please note that all terms referring to particularities common to Arabian and Turkish music, such as *maqām* and *qjnās* (genera) names (as well as interval names such as *baqīyya* etc.), and wherever these terms are close one to another in pronunciation and writing, have been unified for the sake of coherency in this article.

<sup>2</sup> For a summary of modern Arabian *jīns* theory, see [Marcus, 1989, p. 280-322], where the term “tetrachord” is used in a generic sense for trichords and pentachords also. Addressing the practice and theory of modern Turkish musicians, [Ederer, 2011, p. 79-80, 201-210] finds, for example that *maqām* (as a reminder of the previous note, this term is used in the article for both Arabian *maqām* and Turkish *makam*) *Huzām* is understood to have a lower *ūd* (or *segah*) trichord “*sikā*-3,” although standard 20<sup>th</sup>-century Turkish theory recognizes only tetrachords and pentachords.

<sup>3</sup> Šafīyī-a-d-Dīn al-Urmawī (c. 1216-1294) in his *Kitāb al-Adwār* or *Book of cycles* (for Arabian sources or manuscripts, see [Urmawī (d. 1294), 1980; 1984; 1986; 2001]) is a germinal source, defining seven lower tetrachords and 12 upper pentachords, and combining these *qjnās* to form 84 “cycles” or octave scales. Two commentaries of

From a dynamic or process-oriented view, however, to perform in the *maqām* tradition with its various Arabian, Kurdish, Turkish, Hebrew and other manifestations, or in the related Persian *dastgāh* tradition, is to journey through an often fluid series of *qjnās* or modal constellations, with a range of inflections, intonational shifts or nuances<sup>4</sup>, and modulations. From this perspective, describing a given *maqām* or *dastgāh* in terms of an octave scale might be like attempting to convey the essence of a motion picture or video by the image of a single frame<sup>5</sup>.

Like a *maqām* or *dastgāh*, an individual *jīns* or *genus* is in practice a fluid reality with various shades of intonation possible. Theory may describe interval sizes in terms of classic integer ratios, divisions of the octave into a given number of “parts” or positions (not necessarily equal)<sup>6</sup>, or

→ special interest as catalogued in [Shiloah, 1979, pp. 418-419] are Anonymous LXII, translated in [Urmawī (d. 1294) et Jurjānī (al-), 2001], and Anonymous LXI, Arabic text and French translation in [Ghrab, 2009, p. 139-239 (translation); p. 241-377 (text)]. Beyhom [2010, p. 204, note n. 25] gives some proposed attributions for Anonymous LXII. For a modern approach to modal systematics, see Beyhom [2003a; 2010].

<sup>4</sup> For an overview of some intonational nuances in Arabian music as described by the Syrian theorist Tawfiq a-š-Šabbāgh, see [Racy, 2004, p. 106-113]; for a survey of different modern Arabian intonational understandings, see [Marcus, 1989, p. 201-240] and [Marcus, 1993]; for comparisons between *maqāmāt*, see [Beyhom, 2010, p. 153-154, 179 Fig. 7]. In Turkish music, both [Signell, 2008, p. 41-42, 157-159] and [Ederer, 2011, p. 66-73] document the use of intonations not recognized in standard 20<sup>th</sup>-century Turkish theory; Ederer [p. 69] notes the complaint of Can Akkoç, at a congress held at Istanbul Technical University in 2008, that the Western ideals “inherent” in this standard Turkish theory also “impose a ‘particle’ idea on ‘wave’ phenomenon.” For flexible concepts of Persian intonation in theory and practice, see [Farhat, 2004, p. 15-19] and [During, 1985]. For measurements of performances, see, e.g., [Beyhom, 2007] and [Bozkurt et al., 2009].

<sup>5</sup> For different Arabian views on whether any *jīns* constellation brought about by a momentary inflection should be recognized as a distinct *maqām*, see [Marcus, 1989, p. 354-358] and [Marcus, 2001, p. 40-41]. [Shumays (Abu), 2013] proposes the *jīns* rather than the *maqām* as the primary unit for modulations. [Farhat, 2004, p. 16] holds that “[m]ost Persian modes, in their elemental forms, can be expressed within a tetrachord or pentachord,” but that in some cases “as many as seven or more tones are needed to convey the mode adequately.” He adds that “[t]he octave is not significant,” and that some modes have notes in the higher octave differing from those in the lower octave.

<sup>6</sup> The flexibility of a systematic scheme dividing the octave into 17 or 24 steps or positions, for example, is illustrated by Beyhom [Beyhom, 2003b, p. 115-118], with *maqām Bayātī* as an example of how intonation may vary between styles within a single country such as Lebanon (with *sikā* at around 355 cents above *rāst* in a classic style, but 330 cents in a folk style); between different countries such as Lebanon and Turkey; and indeed for a given musician during the same performance, for example with *sikā* lower when ascending and higher when descending. Yet all these manifestations of *Bayātī* would fit the 24-step systematic category of 3 3 4 steps (or, in a 17-step system, 2 2 3 steps). See also [Beyhom, 2010a, p. 152-154] and accompanying notes and figures.

tonometric units such as cents (1200 to an octave) or savarts (301 to an octave), etc.<sup>7</sup> In practice, however, the tuning of a given *jins* may vary expressively and desirably vary within a single performance, as well as between different performers or regional practices.<sup>8</sup>

It is with this awareness of fluidity, and of the tendency of art to blur or transcend neat theoretical categories, that I approach the systematic concept here termed “*Buzurg*,” or more specifically “Systematist *Buzurg*,” to distinguish the category of 13<sup>th</sup>-15<sup>th</sup> century Systematist theory on which I focus from other, more recent, uses of the term “*Buzurg*” and related terms such as *Buzruk* (Arabic) or *Bozorg* (Persian).<sup>9</sup>

A yet more important caution focuses on the diachronic dimension: Near Eastern music is not a static or unchanging art, but rather a dynamic and evolving one, whether in the Systematist Era or today! Given the Western “Orientalist” misconception of a mysterious and somehow miraculously frozen Near Eastern musical art, the reality of diachronic change and indeed at times of deliberate innovation cannot be overstressed in a survey like this of “*Buzurg*-like” polychords as they occur in a wide range of modal forms and contexts.<sup>10</sup>

Above all, no claim is made or implied that a modern “*Buzurg*-like” polychord in some Near Eastern usage is genetically related to Systematist *Buzurg*, and even less that it represents a modal form coming down to us unchanged over a time depth of seven centuries! Rather, the purpose of this brief survey is to show how the same general variety of polychord may arise in quite different modal contexts which illustrate both the dynamic nature of Near Eastern modality and the great diversity of local traditions to be found within it.

## 1. THE “SYSTEMATIST *BUZURG*” CONCEPT

Strictly speaking, *Buzurg* in Systematist usage is the name for either a pentachord or an octave scale (see Section 3 below). The nucleus of the *Buzurg* concept, as meant here, is the lower tetrachord of these larger structures as presented by Ṣafīyy-a-d-Dīn al-Urmawī (c. 1216-1294) with a specification of its ratios by his

commentator, Shiloah’s Anonymous LXII<sup>11</sup>, and also by Qutb a-d-Dīn a-sh-Shirāzī (1236-1311).<sup>12</sup> As detailed by Owen Wright<sup>13</sup>, this tetrachord features steps of 14:13, 8:7, and 13:12 (139, 231, and 128 cents), and appears in two permutations, both with the larger 8:7 interval as the middle step. The numbers at the top of each example show monochord string lengths:

112 1/1 0	104 14/13 128.3	81 16/13 359.5	84 4/3 498.0
	14:13 128.3	8:7 231.2	13:12 128.6

52 1/1 0	48 13/12 138.6	42 26/21 369.7	39 4/3 498.0
	13:12 138.6	8:7 231.2	14:13 128.3

A flexible and pragmatic sense of a “*Buzurg*” type of tetrachord might focus on lower and upper steps somewhere in the range from around 14:13 to 13:12, or about 125-140 cents; and a middle step not too far from 8:7, or around 225-240 cents. The third note of the tetrachord, at 16/13 (359 cents) or 26/21 (370 cents) in these classic forms, will more generally be somewhere around 355-370 cents.

Two modern modal systematic schemes may be especially apt for expressing this flexible concept of a *Buzurg* tetrachord at about the right level of resolution. One option, going back to Cleonides of the Aristoxenian school (2<sup>nd</sup> century CE?), is the division of the octave into 72 parts (16.67 cents each), with each of these parts in turn divisible into halves (at 8.33 cents), or 144 parts in all. This option, standard in Byzantine music theory since 1881<sup>14</sup>, is used to define the Soft Chromatic *genus* according to the 72-division as 8-14-8 parts, or 133.3-233.3-133.3 cents, nicely describing the same general type of tetrachord as Systematist *Buzurg*.

Another option, especially favored in modern Turkish and Syrian theory<sup>15</sup>, is a division of the octave into 53 Holderian commas (HC) of 22.642 cents each. Here a generalized notation of 6-10-6 commas, or 136-226-136 cents, also gives a sense of the *Buzurg* region.

<sup>7</sup> While cents are now used widely in Near Eastern and other sources, the savart seems common in certain studies of Iranian music such as [Caron et Savate, 1966] and [During, 1985]. A savart is very close to 4 cents, but more accurately 3.987 cents.

<sup>8</sup> Thus see note n. 6 above, and studies such as [During, 1985] and [Bozkurt et al., 2009].

<sup>9</sup> An example is *buzurk*, *buzrak*, or *buzruk* [Marcus, 1989, p. 815; Beyhom, 2003b, p. 21 - Tab. 1] as the name in the Arabian scale for the note an octave higher than *Sikā*, i.e. *ṣawfīḥā*. In modern Iranian music, *Bozorg* is a *gushe* or melodic theme within the *dastgah* or modal family of *Shur* [Farhat, 2004, p. 30, 123-124 Ex. 18].

<sup>10</sup> See, e.g., [Marcus, 1989] on changes in the Arabian *maqām* system both in practice and in theory over the last two centuries or so.

<sup>11</sup> See [Ghrab, 2009, p. 75-76 and n. 67, along with Table V.11]; and for cataloguing of Anonymous LXII, [Shiloah, 1979, v. 10, p. 418-419].

<sup>12</sup> Wright [Wright, 1978, v. 28, p. 54-55] notes that Qutb a-d-Dīn also gives a variant of *Buzurg* identical to his version of *Hijāz*, with steps of 12:11-7:6-22:21 or 151-267-81 cents (see Section 4.3 below).

<sup>13</sup> [Wright, 1978, v. 28, p. 54-55].

<sup>14</sup> On the use of the 72-division in Byzantine theory, and the definition of the Soft Chromatic (or “Mild Chromatic”) as 8-14-8 steps, see [Skoulios, 2012, p. 18-21].

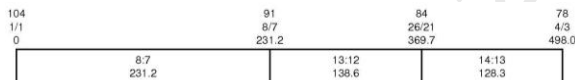
<sup>15</sup> For studies of Turkish music with a prominent role for the Holderian comma, see [Signell, 2008; Bozkurt et al., 2009; Ederer, 2011]. The Syrian theorist Tawfiq a-ṣ-Ṣabbāgh makes use of this unit in defining his ideal gamut [Marcus, 1989, p. 828-832] and in describing good intonation for different *maqāmāt* [Racy, 2004, p. 106-113]. For the use of HC in a Byzantine context see [Skoulios, 2012].

With the original Systematist *Buzurg* or the Byzantine Soft Chromatic as a close modern counterpart, the intonational category we are here seeking is expressly defined. Often, however, a “*Buzurg* style” of intonation may arise as one possible choice within a wider continuum for a given *jins*, as with the distinctive tetrachord below the final of the Iranian *Avaz-e Bayat-e Esfahan* (see Section 4.2 below), or with some varieties of Arabian or Turkish *Hijāz* (Sections 4.3 and 4.4).

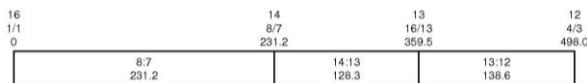
The remainder of this paper takes the “very noble” *jins* described by Ibn Sīnā (980-1037), with a lower step of 8:7 and upper steps of 13:12 and 14:13 arranged in either order<sup>16</sup>, and the octave modes which can be formed from this *genus*, as one starting point that can lead to the Systematist *Buzurg* pentachord of the 13<sup>th</sup>-15<sup>th</sup> centuries as well as its distinctive lower tetrachord (Sections 2-3). Section 4 then samples some manifestations of a “*Buzurg*-like” tetrachord intonation in the more recent settings of the Byzantine Soft Chromatic; Iranian *Esfahan*; the Arabian *Maqām* type or subtype of *Hijāz Gharīb*; and one Turkish understanding of the *Hijāz* tetrachord as may arise in *Maqām Hijāz*, and possibly also *Maqām Huzām*.

## 2. IBN SĪNĀ’S “MOST NOBLE” GENUS: AN ARCHYTAN-ZALZALIAN SYNTHESIS

In his survey of *ajnās* or *genera*, Ibn Sīnā expresses his special admiration for a “very noble” *jins* in which the lower two intervals are 8:7 (231 cents) and 13:12 (139 cents), leaving 14:13 (128 cents) as the upper interval completing the 4/3 fourth at 498 cents. In this first form, the genus is as follows<sup>17</sup>:



He then notes that alternatively the lower two steps may be 8:7 and 14:13, with 13:12 as the complement or upper step completing the fourth, thus producing another manifestation of the same basic *genus*<sup>18</sup>:



What these two permutations share in common is the property that all steps are superparticular, that is, of the form  $([n+1]:n)$ , a property exhibited by many

<sup>16</sup> See [Fārābī (al-) et al., 2001, v. 2, p. 148], and [Forster, 2010, p. 674-675].

<sup>17</sup> [Fārābī (al-) et al., 2001, v. 2, p. 148], and [Forster, 2010, p. 674].

<sup>18</sup> [Fārābī (al-) et al., 2001, v. 2, p. 148]. [Forster, 2010, p. 675] notes that Erlanger gives a diagram showing the string lengths only for the second division of 16:14:13:12.

(although not all) of the tetrachords of the influential Greek theorist Ptolemy (c. 90-c. 168 CE).

The second form is especially remarkable for its very simple monochord division of 16:14:13:12. Ibn Sīnā offers an engaging mathematical demonstration which, from one perspective, recapitulates some Greek developments upon which he then sets his own stamp of Zalzalīan genius.<sup>19</sup> Although offered in connection with the first permutation (8:7-13:12-14:13), this demonstration on the monochord would best fit the second form (8:7-14:13-13:12).

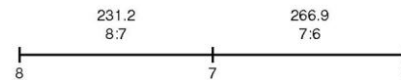
In this process of the arithmetic division or “halving” of intervals on the monochord, Ibn Sīnā starts by dividing a double octave (4:1) into a lower and upper octave (4:2:1):



Next, we divide the 4:2 octave into two equal lengths, producing the 4:3 fourth and 3:2 fifth at 498 cents and 702 cents (two of the principal concords of the Pythagoreans):



Ibn Sīnā’s next step is to divide the 4:3 fourth into a large 8:7 tone (231 cents) and a small minor third at 7:6 (267 cents). This is the division of the fourth into 8:7:6 favored by Archytas (428-347 BCE)<sup>20</sup>:



The final and innovative step of Ibn Sīnā is likewise to divide the interval of 7:6 or 14:12 into equal lengths of 14:13 and 13:12, producing one of the permutations of his “very noble” *jins*:



From this perspective, Ibn Sīnā’s divisions unite two elements. The first is the Archytan division of the fourth into a large 8:7 tone and small minor third at 7:6. In Greek theory, this 8:7:6 division appears in such tetrachords as the Diatonic of Archytas or Tonic Diatonic of Ptolemy, for example 32:28:27:24 (8:7-28:27-9:8 or 231-63-204 cents), where a lower and undivided 8:7 step is followed by a division of the upper 7:6 into

<sup>19</sup> [Fārābī (al-) et al., 2001, v. 2, p. 148].

<sup>20</sup> See [Erickson, 1993; Chalmers, 1993, p. 7-9].

a very effective melodic thirdtone at 28:27 (63 cents) plus a usual tone at 9:8 (204 cents).<sup>21</sup>

To the Archytan division of 8:7:6, Ibn Sīnā unites the Zalzalīan approach of dividing a minor third (here 7:6) into two subtly unequal middle seconds, here the superparticular Zalzalīan steps at 14:13 and 13:12, thus 16:14:13:12. Ibn Sīnā seems generally to prefer that tetrachords with Zalzalīan seconds use these smaller superparticular steps at 14:13 and 13:12, although he also addresses the tetrachords of al-Fārābī (c. 870-950) with lower intervals of a 9:8 tone plus a larger Zalzalīan second at 12:11 (151 cents) or 11:10 (165 cents).<sup>22</sup>

In the *ūd* tuning of Mansur Zalzal of Baghdad (?-791), as interpreted by al-Fārābī and later writers, a tetrachord of a variety called *Mustaqīm* by Ibn Sīnā (Arabic for “right, correct, standard”) <sup>23</sup>, and *Rāst* in 13<sup>th</sup>-century and later theory (a Persian word with synonymous meanings) has a lower 9:8 tone; plus an upper 32:27 Pythagorean minor third (at 294 cents) divided into two Zalzalīan or middle seconds.

Some interpretations of this Zalzalīan division include al-Fārābī’s 9:8-12:11-88:81 (204-151-143 cents), with the *wusṭā* Zalzal or middle third finger fret at 27/22 (355 cents); Ibn Sīnā’s 9:8-13:12-128:117 (204-139-156 cents), with the third step at 39/32 (342 cents); and Ṣafīyy-a-d-Dīn’s adoption of a variation mentioned by Ibn Sīnā where the fret for Zalzal’s third is placed midway between the 9/8 and 4/3 frets, producing a division of 72:64:59:54 or 9:8-64:59-59:54 (204-141-153 cents).<sup>24</sup>

As these divisions and others addressed by Ibn Sīnā illustrate, with a lower step of a usual 9:8 tone, it is impossible to divide the upper minor third at 32:27 or 294 cents into Zalzalīan seconds which are both superparticular (i.e. 14:13, 13:12, 12:11, or 11:10).<sup>25</sup>

Using a lower step of 8:7 however – which along with 7:6 is a characteristic interval of Archytas – it is possible to divide the upper 7:6 minor third neatly into superparticular steps of 13:12 and 14:13, or vice versa, thus arriving at a “very noble” *genus* indeed. We might describe this as a brilliant Archytan-Zalzalīan synthesis.

Ibn Sīnā’s presentation represents one side of Near Eastern modality: an intellectually elegant division leading to an aurally beautiful result, confirmed by reason and sense alike. However, about a millennium later, Barış Bozkurt and colleagues<sup>26</sup> have suggested how the 16:14:13:12 division might routinely arise in an “Arabi[an] rendition of the cadence region of *Maqām Sīkā*” if we think of the final step *sīkā* as the third step of a *Rāst* tetrachord at around 16/13 above *Rāst*. What follows is my interpretation of what Bozkurt et al. are likely describing.

If we think of the step *Sīkā* as the third step of a *Rāst* tetrachord, then a usual tuning might be somewhat as follows<sup>27</sup>:

raṣṭ	duka	sīkā	jāharka
1/1	9/8	16/13	4/3
0	203.9	359.5	498.0
	9:8 203.9	128:117 155.6	13:12 138.6

Here, if the step *sīkā* is a cadential goal, whether as the final of *Maqām Sīkā* or as a momentary focus

<sup>21</sup> The thirdtone step at 28:27 is a common element of all three genera of Archytas: the diatonic, chromatic, and enharmonic. See [Erickson, 1993]; [Chalmers, 1993, p. 104] gives a very useful table of classic Greek modes for all three of these genera.

<sup>22</sup> For Ibn Sīnā’s discussions of diatonic tetrachords with a 9:8 tone joined to a superparticular Zalzalīan step of 11:10, 12:11, 13:12, or 14:13, see [Fārābī (al-) et al., 2001, v. 2, p. 148-150].

<sup>23</sup> See [Fārābī (al-), 2001, v. 2, p. 241-242 and Fig. 9]; [Erlanger, v. V, 1949, p. 7]; [Manik, 1969, p. 52]; and [Forster, 2010, p. 682, 685 Tab. 11.32 (Mode 8)].

<sup>24</sup> For al-Fārābī’s interpretation of Zalzal’s middle finger fret at 27/22, see, e.g., [Forster, 2010, p. 632-646; Abou Mrad, 2004, p. 7, 20; Pohlit, 2011, p. 36-38]. For Ibn Sīnā’s preference in tuning the *ūd* for the tetrachord 9:8-13:12-128:117, see [Fārābī (al-) et al., 2001, v. 2, p. 235], and [Forster, 2010, p. 666-673] (discussing Ibn Sīnā’s tuning in detail). On Ṣafīyy-a-d-Dīn’s description of a fret at 72/59 or 344.7 cents, which he notes as a more common practice, see [Forster, 2010, p. 714-717], and [Pohlit, 2011, p. 44-48]; for a tetrachord with steps of 9:8, 64:59, and 59:54 as one of his principal *ajnās*, see [Ghrab, 2009, p. 67, Tab. V.4]. While Ṣafīyy-a-d-Dīn himself uses a theoretical reinterpretation of the Zalzal fret as 8192/6561 (a Pythagorean diminished fourth at 384.4 cents, very close to 5/4 at 386.3 cents, represented in modern Turkish theory by an interval of around 17 HC), he calls the more popular 72/59 fret the “Persian middle finger,” a name (*wusṭā-l-furs*) originally applied by al-Fārābī to a fret slightly higher than 32/27 (294.1 cents), at 81/68 (302.9 cents).

<sup>25</sup> See [Fārābī (al-) et al., 2001, v. 2, p. 148-150]. Ibn Sīnā also notes that certain divisions of a 32:27 minor third involve a superparticular Zalzalīan interval plus an interval not itself “consonant” (i.e. superparticular), but which is very close to or “resembles” a superparticular ratio. Thus in al-Fārābī’s jins of 9:8-11:10-320:297, the interval of 320:297 (129.1 cents) is “very close” to 14:13 (128.3 cents); here the difference (not specified by Ibn Sīnā) is only 2080:2079 or 0.833 cents. Likewise, Ibn Sīnā notes in his own tetrachord of 13:12-9:8-128:117 that 128:117 (155.6 cents) “much resembles” 12:11 (150.6 cents); here the difference is 352:351 or 4.925 cents. In [Fārābī (al-), 2001, v. 1, p. 235], Ibn Sīnā likewise notes in his *ūd* division of 9:8-13:12-128:117, the upper interval is “approximately” 12:11, but more precisely 128:117.

<sup>26</sup> See [Bozkurt et al., 2009, p. 46]. Curiously, the allusion to a *jins* of 16:14:13:12 as “resemblant” of a “quotidian Arabi[an] rendition of the cadence region of *Maqām Sīkā*...” occurs in a discussion where the main point is that this *jins* is an unlikely reading of Ṣafīyy-a-d-Dīn’s *Rahāwī*, for which they reasonably suggest 12:13:14:15, an interpretation which may also be found in [Ghrab, 2009, p. 75 and Tab. V.11].

<sup>27</sup> This might be described as a moderately high or bright Arabian *Rāst*, taking the theoretical form of a permutation of Ibn Sīnā’s 9:8-13:12-128:117 with the upper intervals reversed so that the larger Zalzalīan step precedes the smaller, with the third at 16/13 or 359 cents. More generally, a *Rāst* third somewhere around 360 cents might be typical for various Syrian styles, for example.



of interest in some other *maqām*, then the note or leading tone below it, *dūkā*, should as Ali Jihad Racy describes based on the writings of Tawfiq a-ṣ-Ṣabbāgh be “slightly raised”<sup>28</sup>, thus reducing the rather large Zalzalian step at *dūkā-sikā*, here around 155 cents, to facilitate a more incisive cadence. Raising *dūkā* quite subtly, by about a comma, can be musically very effective, and produces a momentary placement of *dūkā* at around 8/7, like this, approximating Ibn Sīnā’s division:

rast	dūka	sika	jaharka
1/1	8/7	16/13	4/3
0	231.2	359.5	498.0
	8:7 231.2	14:13 128.3	13:12 138.6

As explained by Scott Marcus<sup>29</sup>, the raising of a cadential leading tone (generally by a semitone) is known in Arabian theory as a *dint*. Thus this type of subtle inflection might be described as a “comma *dint*.”

Before moving from Ibn Sīnā’s *genus* with 8:7 as the lowest step to Systematist *Buzurg* where this ratio becomes the middle step, we should note a possible ambiguity that the Archytan intervals of 8:7 and 7:6 raise from a viewpoint of modal systematics.

From one viewpoint, which might be traced back to classic Greek times, 8:7 at 231 cents is a large tone or diatonic step, being slightly less than half of a 4:3 fourth at 498 cents (or around 249 cents), while 7:6 at 267 cents is slightly larger than half a fourth, and thus a small minor third or chromatic step. From this perspective, Ibn Sīnā’s divisions of 8:7-13:12-14:13 (with a third at 26/21 or 370 cents) and 8:7-14:13-13:12 (with a third at 16/13 or 359 cents) could be regarded as Archytan variations on *Rāst*, fitting the pattern of a tone followed by two Zalzalian seconds.

From another perspective, however, both 8:7 and 7:6 could be seen as inhabiting an intermediate territory between the regular 9:8 tone at 204 cents and the regular minor third at 32:27 or 294 cents in classic theory, and not too far from this in much current Near Eastern theory and practice. Thus both these Archytan intervals of the 8:7:6 division of the fourth might fit Hormoz Farhat’s category of a “plus-tone”<sup>30</sup>, or Amine Beyhom’s concept of a “slightly augmented second” at around 230-270 cents.<sup>31</sup>

<sup>28</sup> [Racy, 2004, p. 109-110].

<sup>29</sup> [Marcus, 1989, p. 612-617].

<sup>30</sup> [Farhat, 2004, p. 16, 26]. Farhat defines a plus-tone as around 270 cents.

<sup>31</sup> Beyhom [Beyhom, 2003b, p. 118] describes a category which in the 24-step modal concept often used for Arabian music would be described as a 5/4-tone, with a size of around 230-270 cents; in [Beyhom, 2007, p. 9], he quotes the Turkish musician Kudsî Ergüner on a preference for a “lightly (or slightly) augmented” (“*légèrement augmentée*”) second, illustrated by steps measured at 242, 237, and 232 cents. See [2007, p. 5, and 8 n. 45] on steps at around 7/6 (267

The Systematist tradition of Ṣafīyy-a-d-Dīn, and also the earlier writings of al-Fārābī and Ibn Sīnā, support the classic Greek distinction, treating *genera* with 8:7 as the largest step as diatonic, but *genera* with an undivided step of 7:6 as chromatic.<sup>32</sup>

However, a concept such as Beyhom’s of the territory from around 8:7 to 7:6 as an intermediate category might well apply if performers had an understanding, for example, that in a given variety of *Hijāz*, a middle step of 9:8 were uncharacteristically small, either 8:7 or 7:6 within the idiomatic range, and 32:27 or the like unstylishly wide.

The system of 53 Holderian commas, taken not as a precise tonometric gauge but as an evocative set of categories, can help in envisioning a rough map of this region. Thus 9 HC suggests a usual tone around 9:8; 10 HC, an Archytan step around 8:7; 11 HC, a hemifourth close to a ratio such as 15:13 (248 cents), on the border between the Greek diatonic and chromatic; 12 HC, an Archytan step near 7:6; and 13 HC, a usual minor third near 32:27.

Ibn Sīnā’s fruitful *genus*, and its *Buzurg* offshoots, focus our attention on the charms of the 8:7 or 10 HC region, however it may be conceptualized in a given theoretical approach or performance tradition.

### 3. SYSTEMATIST *BUZURG*: A POSSIBLE DERIVATION

As briefly mentioned at the opening of this paper, while the term “*Buzurg*” often applies here to a variety of tetrachords, the Systematist tradition often defines *Buzurg* as a pentachord or octave scale. We can arrive at two of these pentachordal *ajnās* by starting with Ibn Sīnā’s *genus* in either of his two permutations, and forming an octave mode from two conjunct tetrachords.

Let us begin, for example, with his first permutation of 8:7-13:12-14:13 or 104:91:84:78 (231-139-128 cents). In order to arrive at string lengths for an octave scale based on two conjunct tetrachords plus an upper 9:8 *ṭanīnī* or tone, we must choose a length for the lowest note great enough so that the string length for each note of the scale can be expressed as an integer. Here, for example, the 4/3 step completing the fourth of the lower tetrachord will be followed by the interval of 8:7 that begins the second tetrachord, producing a note at 32/21 or 729 cents (larger

cents), near the higher end of this range of approximately 230-270 cents.

<sup>32</sup> Ghrab [Ghrab, 2009, p. 63-67] provides a convenient overview of the *ajnās* of al-Fārābī, Ibn Sīnā, and Ṣafīyy-a-d-Dīn; for a fuller discussion of al-Fārābī and Ibn Sīnā, see also [Forster, 2010, p. 658-663, 673-677]. On the *ajnās* of Ṣafīyy-a-d-Dīn, see [Arslan, 2007, p. 9-11].

than a pure 3/2 fifth by a *comma* of 64:63 or 27.3 cents). In order for the string length for this note to be expressed as an integer, the string length of the lowest note must be divisible by 32. Thus the length for this note of 104 in our original 104:91:84:78 tetrachord must be quadrupled to 416, the smallest multiple which is divisible by 32 :

lower tetrachord				upper tetrachord				9:8
416	364	336	312	273	252	234	208	
1/1	8/7	26/21	4/3	32/21	104/63	16/9	2/1	
0	231.2	369.7	498.0	729.2	867.8	996.1	1200	
	8:7	13:12	14:13	8:7	13:12	14:13	9:8	
	231.2	138.6	128.3	231.2	138.6	128.3	203.9	

If we now start on the third step of this beautiful scale at 26/21, taking this step as our new final or point of reference, and moving through the same notes until we reach the original seventh step at 16/9 (now 56/39 or 626 cents) and then adding a step to complete a 3/2 pentachord, we arrive at this pentachord:

336	312	273	252	234	(224)
1/1	14:13	4:3	4:3	56/39	3/2
0	128.3	359.5	498.0	626.3	702.0
	14:13	8:7	13:12	14:13	117:112
	128.3	231.2	138.6	128.3	75.6

This may be the most often cited form of the Systematist *Buzurg* pentachord, attributed by Wright to Ṣafīyy-a-d-Dīn and Qutb a-d-Dīn, and by Ghrab to the former's commentator Anonymous LXII.<sup>33</sup> To arrive at a closely related form of *Buzurg* cited by Wright<sup>34</sup>, we begin with Ibn Sīnā's second permutation of 8:7-14:13-13:12 or 16:14:13:12, also one of the main *ajnās* of Ṣafīyy-a-d-Dīn<sup>35</sup>, use it as the basis for a mode based on two conjunct tetrachord, and then form a *genus* starting on the third step of this mode (here 16/13), again adding a step to form a complete 3/2 pentachord<sup>36</sup>:

lower tetrachord				upper tetrachord				9:8
192	168	156	144	126	117	108	96	
1/1	8/7	16/13	4/3	32/21	64/39	16/9	2/1	
0	231.2	359.5	498.0	729.2	857.5	996.1	1200	
	8:7	14:13	13:12	8:7	14:13	13:12	9:8	
	231.2	128.3	138.6	231.2	128.3	138.6	203.9	
	156	144	126	117	108	(104)		
	1/1	13/12	26/21	4/3	13/9	3/2		
	0	138.6	369.7	498.0	636.6	702.0		
		13:12	8:7	14:13	13:12	27:26		
		138.6	231.2	128.3	138.6	65.3		

These *Buzurg* pentachords consist of a lower tetrachord featuring a permutation of Ibn Sīnā's *jins* with the 8:7 interval as the middle step, thus 14:13-8:7-13:12 for the first form, and 13:12-8:7-14:13 for the second. Then there follows an upper 9:8 tone divided into what we might term a 2/3-tone followed by a thirddtone, thus 14:13-117:112 (128-76 cents) for the first form; and 13:12-27:16 (139-65 cents) for the second. Thus the second and fifth steps of the *genus* form a perfect

fourth at 4/3, 14/13-56/39 (128-626 cents) or 13/12-13/9 (139-637 cents).<sup>37</sup> While this derivation of the *Buzurg* pentachord is only one possibility, it does at least reflect two related Systematist themes. The first is the advice ascribed to Ṣafīyy-a-d-Dīn to consider all six permutations of a given tetrachord, with Ibn Sīnā's 8:7-13:12-14:13 and 8:7-14:13-13:12 divisions certainly fertile ground for the application of this advice.<sup>38</sup>

The second is the Systematist interest, for example as expressed by Shiloah's Anonymous LXI, in modes sharing "common notes," or which in modern terms are in whole or part modal rotations of each other. That is, the two modes use many or all of the same notes, but with a different note as the final.<sup>39</sup> Here, *Buzurg* would share many of the same notes as what we might term the "Archytan *Rāst*" of Ibn Sīnā or Ṣafīyy-a-d-Dīn, but starting on the third note – somewhat like the relationship of modern Arabian *Rāst-Sikā*.

An interesting feature which the *Buzurg* pentachord shares with some other Systematist pentachords and octave scales is the division of the tone between the 4/3 fourth and 3/2 fifth into a larger and smaller step, here specified as 14:13-117:112 or 13:12-27:26, the latter division of the 9:8 *ṭanīnī* or tone being found at some locations in the *ūd* tuning presented by Ibn Sīnā.<sup>40</sup> This results in steps above the final of *Buzurg*

<sup>37</sup> Wright [1978, p. 55] also gives forms for the *Buzurg* division of the fifth at 14:13-8:7-13:12-13:12-27:26 (128-231-139-139-65 cents) and 13:12-8:7-14:13-14:13-117:112 (139-231-128-128-76 cents).

<sup>38</sup> In addition to Ibn Sīnā's Archytan *Rāst*, as I have styled it, at 8:7-13:12-14:13 or 8:7-14:13-13:12; and *Buzurg* at 14:13-8:7-13:12 or 13:12-8:7-14:13, we have two permutations with 8:7 as the upper step, and the two lower steps at 14:13 and 13:12 forming a 7/6 third, thus 14:13-13:12-8:7 (28:26:24:21) at 128-139-231 cents, or 13:12-14:13-8:7 (364:336:312:273) at 139-128-231 cents. An approximate 14:13-13:12-8:7 division is reported by [Yarman, 2008a, p. 26-29] in a performance of *Maqām 'Ushshāq* (corresponding to an Arabian *Bayātī* or Persian *Shūr*) by "a venerable Turkish Neyzen – Niyazi Sayin," a *neyzen* being a ney player. As shown, *ibid.*, p. 29, Tab. 3.2, the steps are 123.5-137.1-227.9 cents, with the third at 260.6 cents and a fourth at 488.5 cents, by comparison to 7/6 and 4/3 at 266.9 and 498.0 cents, so that the tuning might be described as a "compressed" variation on 14:13-13:12-8:7.

<sup>39</sup> See [Ghrab, 2009, p. 85-87, 206]; with Anonymous LXI catalogued in [Shiloah, 1979, p. 418-419]. Marcus [1989, 398-400] reports a similar concept in the modern Arabian theorist Ṣalāh a-d-Dīn, who recognizes "derived *maqāmāt*" resulting, for example, from taking *Maqām Rāst* and making a step other than *C* or *Rāst* the new final. Thus starting on "the second degree" *D* or *dikā* produces *Maqām Huseynī*; starting on "the third degree" *E'* or *Sikā* produces *Maqām Sikā*, and so on. Derived *maqāmāt* in this scheme may also involve accidental inflections, with or without the element of modal rotation.

<sup>40</sup> Thus in the system of Ṣafīyy-a-d-Dīn building an octave scale from a lower tetrachord plus an upper pentachord, the tenth *jins* in the latter category is JBTJJ, where T is a *ṭanīnī* or whole tone at 9:8 or sometimes 8:7; B is a *baqīyya*, the smallest type of step in Systematist theory, often a 256:243 or 90 cents; and J is a *mujānnab* interval, somewhere between a semitone and a tone. If the fourth or *Rāst* tetrachord TJJ is joined to this pentachord, then we have one version

<sup>33</sup> See [Ghrab, 2009, p. 75, Tab. V.11 and n. 67].

<sup>34</sup> See [Wright, 1978, p. 54-55].

<sup>35</sup> See [Ghrab, 2009, p. 67 and Tab. V.4, and 72 and Tab. V.8].

<sup>36</sup> For a beautiful diagram of a conjunct octave scale based on the *jins* 8:7-14:13-13:12, see [Arslan, 2007, p. 14].

at 4/3-56/39-3/2 (498-626-702 cents) or 4/3-13/9-3/2 (498-637-702 cents).

From a 21<sup>st</sup>-century viewpoint, such an arrangement might suggest Persian *Shur*, for example, where the fifth step is a *moteqayyer* or variable step, has one version at around 3/2, cited in the “textbook” version of this *dastgah*; and a lowered or *koron*<sup>41</sup> version at about a thirddtone below this, with 56/39 and 13/9 both close to Farhat’s tuning (based on an averaging of some tar and setar frets) at around 630 cents.<sup>42</sup>

This feature of the *Buzurg* pentachord raises the question of whether, as in modern *Shur*, the thirddtone step at 56/39-3/2 or 13/9-3/2 was rarely used as a direct melodic interval, although these two versions of the fifth might fluidly alternate depending on the modal context, with the lowered form often preferred, for example, in descending toward the final.<sup>43</sup>

Or might the thirddtone step have been relished as a routine feature of melody, as happens in the Archytan Diatonic tetrachord (Ptolemy’s Tonic Diatonic) common to al-Fārābī, Ibn Sīnā, and Ṣafīyy-a-d-Dīn, with its 28:27 step at 63 cents, e.g. in 36:32:28:27 or 9:8-8:7-28:27 or 204-231-63 cents?<sup>44</sup>

→ of *Kirdāniyya*, TJJ-JBTJJ, e.g. [Ghrab, 2009, p. 74, Tab. V.9], which resembles a modern or disjunct *Maqām Rāst* TJJ-T-TJJ, with the middle tone divided into a Zalzalian step plus a small semitone. Ṣafīyy-a-d-Dīn’s eighth pentachord likewise has a divided tone, here TJJJB, so that when a lower *Rāst* tetrachord is joined to this *jins*, the mode Isfahan results, TJJ-TJJJB, like the usual Systematist or conjunct *Rāst* TJJ-TJJT with the upper T divided into JB, see *ibid.*, p. 74, Tab. V.9. For an account of Ibn Sīnā’s *ūd* fretting, see [Forster, 2010, p. 666-673]. The 13:12-27:26 division (139-65 cents) of the 9:8 tone occurs, for example, at 1/1-13/12-9/8 (0-139-204 cents), and again at 9/8-39/32-81/64 (204-342-408 cents).

<sup>41</sup> Here the term *koron* refers to the modern Persian notational symbol, represented by ASCII “p”, serving to lower a step by a variable amount often equal to approximately a third of a *ṭarīnī* or tone around 9:8, or around 70 cents. As originally devised by Ali Naqī Vaziri (1886-1981) – see for example [Farhat, 2004, p. 8-10, 26] – the *koron* would lower a note by a quartertone in an equal 24-step division, or 50 cents, and the *sori* (ASCII “>”) would raise a note by this same amount. However, Persian musicians read both signs flexibly as variable inflections, often c. 45-70 cents [Farhat, p. 17, Fig. 8].

<sup>42</sup> See [Farhat, 2004, p. 17, Fig. 8] for this tuning, with one correction needed: the step B<sup>p</sup>-B should be 70 cents, not 90 cents. With Farhat’s placement of the final of *Shur* at D, the *koron* fifth at A<sup>p</sup> will be 630 cents. Using a tuning like that of Ibn Sīnā, it would be slightly larger, at 13:9 or 636.6 cents.

<sup>43</sup> See [Farhat, 2004, 27] on the variable fifth degree of *Shur*: “When the melodic line is descending, it is usually lowered by a microtone from a to a<sup>p</sup>.” On the rule that a *koron* (or *sori*) interval such as A<sup>p</sup>-A is not used as a direct melodic step, except in certain ornamental contexts, see *ibid.* at 18; and [Talā’i, 2000, p. 13].

<sup>44</sup> Abou Mrad [2005, 8, 21] proposes interpretations of certain Systematist *ajnas* featuring such thirddtone or even quartertone steps, based on the *ūd* tunings of al-Fārābī: for example, a *Buzruk* (or *Buzurg*) at 12:11-9:8-88:81-12:11-33:32 or 151-204-143-151-53 cents, with 33:32 at 53.3 cents as the “minimal *diesis*” of al-Fārābī.

Whatever the answer may be, this *Buzurg* pentachord serves as the basis for a Systematist octave scale, with a usual upper tetrachord of *Rāst*, or in Systematist notation TJJ, showing a *ṭarīnī* or tone followed by two *mujannab* or Zalzalian second steps (with a B or *baqiyya*, representing a *limma* or semitone, used to show the thirddtone step of the *Buzurg* pentachord). The following versions assume that the first interval of the upper *Rāst* tetrachord is a usual 9:8 tone, and that the Systematist “consonance” of the scale, as measured by the number of perfect fourths and fifths present within its notes<sup>45</sup>, is maximized by placing the seventh step of the scale at a 3:2 fifth above the third step of the *Buzurg* jins. Thus for the form of *Buzurg* with a 16/13 third, the seventh step is at 24/13 (1061 cents); for the form with 26/21, it is at 13/7 (1072 cents):

Buzurg fifth						Rast tetrachord					
3024	2808	2457	2268	2106	2016	1792	1638	1512			
1/1	14/13	16/13	4/3	56/39	3/2	27/16	24/13	2/1			
0	128.3	359.5	498.0	626.3	702.0	905.9	1061.4	1200			
J	T	J	J	B	T	J	J				
14:13	8:7	13:12	14:13	117:112	9:8	128:117	13:12				
128.3	231.2	138.6	128.3	75.6	203.9	155.6	138.6				

Buzurg fifth						Rast tetrachord					
1404	1296	1134	1053	972	936	832	756	702			
1/1	13/12	26/21	4/3	13/9	3/2	27/16	13/7	2/1			
0	138.6	369.7	498.0	636.6	702.0	905.9	1071.7	1200			
J	T	J	J	B	T	J	J				
13:12	8:7	14:13	13:12	27:26	9:8	208:189	14:13				
138.6	231.2	128.3	138.6	65.3	203.9	165.8	128.3				

As Ghrab observes<sup>46</sup>, the 8:7 step in *Buzurg* receives the same category of T or tone as the 9:8 step. In these possible tunings of the *Buzurg* octave mode, the upper *Rāst* tetrachords are permutations of *genera* described by Ibn Sīnā with a lower 9:8 step, but with the order of the two upper steps reversed. The original arrangements are 9:8-13:12-128:117 (204-139-156 cents), which Ibn Sīnā uses in his *ūd* tuning with its fret of Zalzal at 39/32 or 342 cents; and 9:8-14:13-208:189 (204-128-166 cents), with a low Zalzalian third at 63/52 or 332 cents.<sup>47</sup> Reversing the order of the upper steps results in higher thirds (here in relation to the 3/2 step of *Buzurg*) at 16/13 and 26/21, interestingly producing the same third sizes as in his two divisions with 8:7, 13:12, and 14:13.<sup>48</sup>

<sup>45</sup> On the “consonance” concept, see Wright [1978, p. 95-123]. As Wright explains, consonance involves both the number of perfect fourths, fifths, and octaves present within a scale; and the avoidance of certain melodically “dissonant” successions of steps such as BJ.

<sup>46</sup> [Ghrab, 2009, p. 76]. For Qutb a-d-Dīn’s use of 8:7 in *Buzurg* see [Wright, 1978, p. 54-55].

<sup>47</sup> [Fārābī (al-) et al., 2001, v. 2, p. 150, 235].

<sup>48</sup> Ibn Sīnā’s favored diatonic *ajnas* with a tone plus two Zalzalian second steps follow the general pattern that the two lower steps are superparticular, with a tone at 8:7 or 9:8 joined to a smallish Zalzalian second at 13:12 or 14:13. Larger Zalzalian seconds occur as more complex “remainder” intervals in the forms with the 9:8 tone, e.g. 13:12-9:8-128:117 (139-204-156 cents) or 9:8-14:13-208:189 (204-128-166 cents). In contrast, he addresses but does not so favor al-Fārābī’s *ajnas* with a 9:8 tone joined to a large Zalzalian step: 9:8-



Although there is no evidence that it was used historically, another possible variation on a *Buzurg* mode would have the lower interval of the *Rāst* tetrachord at 8:7, resulting from a theoretical viewpoint in simpler monochord divisions:

Buzurg fifth					Rāst tetrachord				
336	312	273	252	234	224	196	182	168	
1/1	14/13	16/13	4/3	56/39	3/2	12/7	24/13	2/1	
0	128.3	359.5	498.0	626.3	702.0	933.1	1061.4	1200	
J	T	J	J	B	T	J	J		
14:13	8:7	13:12	14:13	117:112	8:7	14:13	13:12		
128.3	231.2	138.6	128.3	75.6	231.2	128.3	138.6		

Buzurg fifth					Rāst tetrachord				
156	144	126	117	108	104	91	84	78	
1/1	13/12	26/21	4/3	13/9	3/2	12/7	13/7	2/1	
0	138.6	369.7	498.0	636.6	702.0	933.1	1071.7	1200	
J	T	J	J	B	T	J	J		
13:12	8:7	14:13	13:12	27:26	8:7	13:12	14:13		
138.6	231.2	128.3	138.6	65.3	231.2	138.6	128.3		

In this variation, the lower tetrachord of *Buzurg* and the upper *Rāst* tetrachord are permutations of each other, sharing the steps of 8:7, 13:12, and 14:13.

Although Systematist *Buzurg* is often presented in its pentachord forms<sup>49</sup>, and Ghrab notes Safi al-Din's use of the name (transliterated as “*bozorg*”) in this sense (i.e. JTJJB), it is also possible to view *Buzurg* as a scale in terms of a lower tetrachord JTJ plus either a complex upper pentachord of JBJTT, or a divided middle tone plus an upper *Rāst* tetrachord, thus JB-JTT, with Ghrab's tables illustrating these alternative perspectives.<sup>50</sup>

Thus to speak of 14:13-8:7-13:12, or 13:12-8:7-14:13, or more broadly a tetrachord realized in a similar pattern as a “*Buzurg*-like tetrachord” may be not too great a poetic liberty. However, the division of the added 9:8 *tanīnī* or tone (4/3-3/2) in the Systematist pentachord into

→ 12:11-88:81 (204-151-143 cents) and 9:8-11:10-320:297 (204-165-129 cents). See [Fārābī (al-) et al., 2001, v. 2, p. 148-150, 235].

<sup>49</sup> Thus see [Ghrab, 2009, p. 68-69, Tab. V.5 and n. 31], for Anonymous LXII's naming of JTJ-JB as *zīrafkand* “*Buzruk*”; and JTJJB as *bozorg* according to al-Lādhīqī, *ibid.*, p. 69, Tab. V.6; as well as *bozorg* as JTJJB in Šafīyy-a-d-Dīn, *ibid.*, p. 75, Tab. V.10. Arslan [2007, p. 19] likewise gives Šafīyy-a-d-Dīn's *Buzurg jīns* as JTJJB (or, in the modern Turkish alphabet where “C” is the equivalent of Arabic J, “C-T-C-C-B”).

<sup>50</sup> See [Ghrab, 2009, p. 68-69, Tables V.5 and V.6], where Anonymous LXII treats *Buzurg* as having a disjunction dividing the *jīns* into a tetrachord plus a tone, JTJ-JB, whereas al-Lādhīqī gives simply JTJJB, and likewise Šafīyy-a-d-Dīn (*ibid.*, p. 75, Tab. V.10). For the octave cycle or mode of *Buzurg* as having a lower tetrachord of JTJ, see Ghrab [2009, p. 74 and Tab. V.9], showing Šafīyy-a-d-Dīn's concept of the sixth lower tetrachord of his system (JTJ) plus the tenth upper pentachord (JBTTJJ). Since each of his seven lower tetrachords is used to form a family of 12 modes (one with each of the 12 upper pentachords), the modes with the sixth tetrachord are numbered 61-72, with *Buzurg* as the tenth of these, or mode 70. The upper JBTTJJ may also be analyzed as a divided lower tone plus a *Rāst* tetrachord, as shown by Ghrab's notation in this table of JB-TJJ. Likewise see p. 89-90 and Tab. V.16-V.17, showing a division of JTJ-JB-TJJ, and noting the views of Šafīyy-a-d-Dīn and Ibn Ghaybī associating *Buzurg* respectively with a modal ethos of “sadness and languor” or “sadness.”

JB, a lower Zalzalīan second at 14:13 or 13:12 (128 or 139 cents, and upper thirdtone at 117:112 or 27:26 (76 or 65 cents), resulting in octave scales with notes at 56/39-3/2 or 13/9-3/2, adds a special air of intrigue to this scalar form and the various avenues of exploration it opens for 21st-century musicians.<sup>51</sup>

This air of mystery results in good part from the absence, as far as I know, of any information or examples from Systematist sources showing the *saṣr* (Arabic) or *seyir* (Turkish) of *Buzurg*, that is, the “road” or path to be followed when journeying through the *ajnās* of this octave scale so as to make it a mode of some kind. Thus an interpretation of Systematist *Maqām Buzurg* becomes in practice a reconstruction, or indeed a re-creation.

Finally, to place the focus of this paper on the 8:7 step of *Buzurg* in a more balanced perspective, I should emphasize that the flexible Systematist notation permitted a variety of intonational readings. Thus Wright gives Šafīyy-a-d-Dīn's version of *Buzurg* as having a lower pentachord of 14:13-8:7-13:12-14:13-117:112 as above, but with an upper *Rāst* tetrachord of the kind favored also in much modern Turkish theory, with steps at 9:8-10:9-16:15 or 204-182-112 cents as in the Intense Diatonic of Ptolemy (or, in terms of the final of *Buzurg*, notes at 3/2-27/16-15/8-2/1).<sup>52</sup>

Further, Nidaa Abou Mrad offers an interesting interpretation of *Buzurg* (for which he uses the Arabic transliteration “*Buzruk*”) as it might be performed by musicians around 1300 favoring the tunings of al-Fārābī, based for example on *Rāst* as 9:8-12:11-88:81 (204-151-143 cents). Although in the special case of *Buzurg* two theorists specify the Systematist T or *tanīnī* step as 8:7 (see note n. 46), Abou Mrad follows the usual interpretation of T as a 9:8 tone (here the monochord lengths are mine)<sup>53</sup>:

432	396	352	324	297	288
1/1	12/11	27/22	4/3	16/11	3/2
0	150.6	354.5	498.0	648.7	702.0
J	T	J	J	J	B
12:11	9:8	88:81	12:11	12:11	33:32
150.6	203.9	143.5	150.6	150.6	53.3

As Abou Mrad notes, this version of *Buzurg* features al-Fārābī's step of 33:32 or 53 cents, described in Mrad's table as a quartertone or “minimal *diesis*.”<sup>54</sup> This is approximately the size of quartertone (around 3/68 octave or 53 cents) that Chrysanthos of Madytos (c. 1770-1846) associates with the classic Greek

<sup>51</sup> For example, one possible 21<sup>st</sup>-century strategy for *Buzurg* is to begin by emphasizing the *ajnās* JTJ-T-TJJ, with a mostly undivided middle tone, and then to make the steps 4/3-56/39 or 4/3-13/9 the focus for a modulation to an “Archytan *Rāst*” à la Ibn Sīnā where these steps are reinterpreted as 26/21-4/3 or 16/13-4/3 in a tetrachord of 8:7-13:12-14:13 or 8:7-14:13-13:12 on the second note of the original *Buzurg*.

<sup>52</sup> See [Wright, 1978, p. 70, “54 *Buzurg*”].

<sup>53</sup> See [Abou Mrad, 2005, p. 8, 21].

<sup>54</sup> [Abou Mrad, 2005, p. 8, 21].



Enharmonic and seeks out in his interpretation of Byzantine music.<sup>55</sup>

Having duly noted the likely intonational variety prevailing during the Systematist era of the 13<sup>th</sup>-15<sup>th</sup> centuries, we now return to *Buzurg* in the sense of a tetrachord resembling 13:12-8:7-14:13 or 14:13-8:7-13:12.

#### 4. BUZURG-LIKE AJNĀS IN MORE RECENT NEAR EASTERN MUSIC

In seeking out *Buzurg*-like *genera* in recent Near Eastern music, we may draw on materials ranging from theoretical documents and explanations by musicians of their intonational understandings<sup>56</sup> to fret measurements and tonometric data for performances. In the following brief sampling of different traditions, all of these lines of evidence play a part.

The categorization of intervals based on their approximate size in Holderian commas (equal to 1/53 octave or 22.6 cents each) provides one intuitive model for a generic concept of a “*Buzurg*-like tetrachord”: a pattern of approximately 6-10-6 HC (around 136-226-136 cents). This suggests upper and lower intervals around 6 HC, or in the category of smallish Zalzalian seconds (like the classic 14:13 and 13:12 at 128 and 139 cents), and a middle step somewhere around the classic 8:7 or 231 cents.

The 6-10-6 HC concept also implies a third note at around 16 HC, generically a large Zalzalian third. The literal value of 362 cents evokes the general region including the classic ratios of 16/13 or 359 cents, and 26/21 or 370 cents.

From this perspective, we consider first the Byzantine Mild Chromatic as it has been historically defined, and as it might be expressed in some shadings based on the 68-step concept introduced by Chrysanthos of Madytos; then the Persian or more broadly Iranian *Avaz-e Bayat-e Esfahan* with its wide continuum of intonational interpretations; an Arabian (or more specifically Syrian) understanding of *Ḥijāz Gharīb*; and Turkish understandings, in practice and theory, of certain

shadings of *Ḥijāz* and possibly also the *Ḥijāz* tetrachord used in *Maqām Huzām*.

##### 4.1. The Byzantine Mild Chromatic

Chrysanthos of Madytos, in his *Great Theory of Music* (1832) as translated by Katy G. Romanou<sup>57</sup>, uses a 68-step system for conceptualizing interval sizes which will be discussed below. However, in addressing what he terms the diphonic genus, built from consecutive trichords rather than tetrachords, Chrysanthos gives as one of its realizations this octave mode which seems to imply a division of the octave into 64 steps: an octave scale of 7 12, 7 12, 7 12, 7 steps.<sup>58</sup> Here is a literal interpretation in cents under the 64-step system, following the solmization syllables of Chrysanthos with *νη* (*ne*) mapped to C or *Rāst*, as in the recent article by Markos Skoulios<sup>59</sup>. Here the accidental “d” shows an Arabian half-flat:

first trichord			second trichord			third trichord		
C	Dd	E	F	G	Ad	Bd	C	
ne	pa	bou	ga	di	ke	zo	ne	
0	7	19	26	38	45	57	64	
0	131.25	356.25	487.5	712.5	843.75	1068.75	1200	
	[7, 131.25	12] 225.0		[7, 131.25	12] 225.0		[7,... 131.25	

If the 64-step system is indeed intended, then this diphonic or trichordal tuning, when viewed from a Systematist or later Byzantine perspective with a focus on tetrachords, shows two symmetrical and disjunct tetrachords of 7 12 7 steps at a literal 131-225-131 cents, which would fit the general category of *Buzurg*, with the upper and lower steps a bit larger than 14:13 (128 cents), and the middle step a bit smaller than 8:7 (231 cents). The third at 356 cents is near the lower end for *Buzurg*, slightly below the smaller classic ratio of 16/13 (359 cents). One consideration favoring this reading of Chrysanthos is that the Patriarchal Committee on Music in 1881 reinterpreted his diphonic as a Mild Chromatic with tetrachords rather than trichords at 133-233-133 cents, based on a division of the octave into 36 parts, as will be detailed below. From a theoretical standard, this apparent use of the 64-step system might seem curious for a few reasons. First, both in the other examples of chromatic *genera* and modes accompanying this octave species, and his

<sup>55</sup> See [Chrysanthos (of Madytos) & Rōmanou, 1973: p. 105-108] for Chrysanthos on the Byzantine Enharmonic genus as 13-3-12 steps of the 68-division, or 229-53-212 cents; and [Skoulios 2012, p. 21] on interpretations of 14-4-12 steps in the 72-division or 233-67-200 cents, and 10-3-9 HC or 226-68-204 cents, both essentially equivalent to the Diatonic of Archytas at 8:7-28:27-9:8 or 231-63-204 cents.

<sup>56</sup> Both [Beyhom, 2007] and [Ederer, 2011] are very interesting in seeking out and quoting the analyses by Turkish musicians of their own performances and intonational nuances; likewise, Marcus [e.g. 2002] enriches his theoretical perspective with the understandings of many Arabian musicians.

<sup>57</sup> For explanations by Chrysanthos of the Byzantine Diatonic in a *Rāst* like permutation as approximately 12-9-7 steps, thus leading to the 68-step system, see Chrysanthos (of Madytos) & Rōmanou [1973, p. 17-18, 21-24, and 88-91]. Here I generally agree with and follow the interpretation in [Michalakis, p. 26-27].

<sup>58</sup> [Chrysanthos (of Madytos) and Rōmanou, 1973, p. 99] (see diagram “A”).

<sup>59</sup> The mapping of *νη* to *Rāst*, or C in modern Arabian notation, used by Skoulios seems to me also quite felicitous. In practice, the Mild Chromatic forms of the Second and Fourth Byzantine Modes tend to center on the tones of *di* or *nawā* (G), and *βou* or *Sikā* (E<sup>b</sup>), the respective finals of these two modes – see also [Skoulios, 2012, p. 25-26].

exposition generally, Chrysanthos favors a 68-step concept, and also uses the 72/144-step concept of Cleonides (which he treats as involving 60 integral steps to the fourth, or 144 in all, rather than 72 steps each divisible in half) to illustrate some classic Greek tetrachords or “shades” of intonation “known to Eucleides.”<sup>60</sup>

Thus this use of the 64-step system seems a bit isolated.

Another point is that, unlike either the 68-division or the 72/144-division, the 64-division has fourths and fifths at 487.5 and 712.5 cents, as compared to 4/3 and 3/2 at 498.0 and 702.0 cents, an “impurity” of more than 10 cents. Narrow fourths around 485 cents, for example, have been documented by Nelly Caron and Dariouche Safvate as characteristic of the older Iranian interpretation of *Avaz-e Bayat-e Tork* or “the Old Tork”<sup>61</sup>, and by Beyhom in a contemporary performance of *Maqām Hijāz*<sup>62</sup>.

However, fourths and fifths this far from the acoustic « pure » value seem more unusual as regular values in a division of the octave to be used as a standard system.

These possible doubts aside, we find that the Committee of 1881 used the 36-step system (a subset of the 72/144-step system of Cleonides) to codify a very *Buzurg*-like tuning of the Mild Chromatic<sup>63</sup>, here shown in the 72-step notation common in 20<sup>th</sup>-21<sup>st</sup> century sources:

0	8	22	30	42	50	64	72
0	133.3	366.7	500.0	700.0	833.3	1066.7	1200
8	14	8	12	8	14	8	
133.3	233.3	133.3	200.0	133.3	233.3	133.3	

As Skoulios explains, the Committee of 1881 based its 36-step values on ratios such as 27:25 (133.2 cents) for the 4-step interval of 133.3 cents, and 100:81 (364.8

cents) for the 11-step Zalzalian third at 366.7 cents – respectively 8 and 22 steps in the 72-division found in much 20<sup>th</sup>-21<sup>st</sup> century Byzantine theory. These ratios were derived as complex ratios of 5, with the 27:25 step, for example, equal to 16:15 (111.7 cents) plus an 81:80 *comma* (21.5 cents). Likewise, the third at 100/81 is equal to two 10:9 steps (each at 182.4 cents), or to a 5/4 major third (386.3 cents) as found in some tunings of Archytas, Didymus, and Ptolemy, less an 81:80 *comma*.<sup>64</sup>

There is another strategy for explaining these ratios which might be more intuitive from a classic Zalzalian perspective. If we take the steps of 13:12 and 14:13, or 139 and 128 cents, found in Ibn Sinā and in Systematist *Buzurg*, then dividing the sum of the two numerators by the sum of the two denominators results in a mediant at 27:25 or 133 cents, roughly midway between these two sizes:

$$\frac{(13+14)}{(12+13)} = \frac{27}{25}$$

Indeed either 27/25 at 133.238 cents, or the 8-step interval of 133.333 cents in the 72-division, is very close to the average or mean of 14:13 and 13:12, which together add up to 7/6 (266.871 cents). Two 27/25 steps are equal to 729/625 or 266.476 cents, and two 8-step intervals to 266.667 cents. Thus, a step around 133 cents would nicely represent an “average” size for the Zalzalian seconds at 14:13 (128 cents) and 13:12 (139 cents) in Systematist *Buzurg*. Likewise, if we place an “average” *Buzurg* third at a 27:25 step down from a 4:3 fourth, this yields the ratio of 100/81 or 364.8 cents, about midway between the classic thirds at 16/13 (359.5 cents) or 26/21 (369.7 cents).

From a larger modal perspective, this *Buzurg* third at around 22 steps in the 72-division, or 367 cents, is the same as the Zalzalian third occurring, for example, in the Byzantine Fourth Mode Plagal, generally much like an Arabian or Turkish *Rāst*.<sup>65</sup> Here the Committee of 1881 specified a tetrachord, as expressed in the 72-division, of 12 10 8 steps, or 200-167-133 cents, compared with the Mild Chromatic in the following diagram:

Byzantine Diatonic			
0	12	22	30
0	200.0	366.7	500.0
12	10	8	
200.0	166.7	133.3	

Byzantine Mild Chromatic			
0	8	22	30
0	133.3	366.7	500.0
8	14	8	
133.3	233.3	133.3	

<sup>60</sup> [Chrysanthos (of Madytos) & Rōmanou, 1973, p. 100-101].

<sup>61</sup> See [Caron and Safvate, 1966, p. 70-72], where it is explained that the “Old Tork” commences on *fa* or *F*, in this context the note a tone below the final of *Shur* at *sol* or *G*, notes which from the perspective of *Maqām* may be equivalent to *rāst* and *dūkā*. In the traditional tuning, *ibid.* at 72, the fourth *fa-sī* or *F-B<sup>b</sup>* is narrow at around 121 savarts or 484 cents, by comparison to a just 4/3 at a rounded 125 savarts. A table of measured intervals in Iranian music, *ibid.*, p. 36-37, Tab. B, might fit such a tuning. The steps forming the lower tetrachord of Old Tork, *fa-sol-hā<sup>2</sup>-sī* or *F-G-A<sup>b</sup>-B<sup>b</sup>*, would be 51-34-35 savarts or 204-136-140 cents, yielding a fourth of about 120 savarts or 480 cents. Note that the upper steps of this narrow tetrachord, *G-A<sup>b</sup>-B<sup>b</sup>* at 136-140 cents, represent the notes above the final of *Shur*, with a small minor third at 276 cents, not far from 7/6 (267 cents) and quite close to 12 HC (272 cents).

<sup>62</sup> See [Beyhom, 2003, v. I, p. 319], measuring a *Hijāz* tetrachord in a performance of a Sufic chant by Cinuçen Tanrikorur at 130-265-90 cents, with a fourth “slightly (*légèrement*) ‘diminished’ to 485 cents.” From a Systematist (or neo-Systematist) perspective, this tuning closely approximates a lower interval of 14:13 and a middle interval of 7:6 (128-267 cents), with the upper interval as a usual semitone at 256:243 or 90 cents.

<sup>63</sup> See [Skoulios, 2012, p. 21].

<sup>64</sup> [Skoulios, 2012, p. 19.].

<sup>65</sup> See [Skoulios, 2012, p. 21 and Tab. 6a (Byzantine Diatonic, termed “Mild Diatonic”) and Tab. 6c (Mild Chromatic); 2012, p. 27, on Fourth Mode Plagal or “Plagal 4<sup>th</sup> Echos” being “directly equivalent to *Rāst Makam*”].

Just as the Mild Chromatic resembles *Buzurg*, the Diatonic in this *Rāst* permutation closely resembles the “Medium (or Moderate) Noncontinuous” of al-Fārābī and Ṣafīyya-d-Dīn<sup>66</sup>:

396 1/1 0	352 9/8 203.9	320 99/80 368.9	297 4/3 498.0
	9:8 203.9	11:10 165.0	320:297 129.1

Here the 99/80 third at 368.9 cents is almost identical to the larger classic *Buzurg* third at 26/21 or 369.7 cents. In a Byzantine context, the *Buzurg*-like Mild Chromatic could be described from one view as identical to the *Rāst*-like Diatonic, except that the second note of the Diatonic at a usual tone of around 9:8 is lowered by about a third of a tone, placing it at a smallish Zalzalīan second or 2/3-tone above the the lowest note.<sup>67</sup>

Very briefly it may be useful to address how we might describe this variety of Mild Chromatic using the 68-step system of Chrysanthos or a possible extension of it, by analogy to the 72/144-step system of Cleonides, where each of the 68 steps is divisible into two equal parts, thus a 68/136-step system.

From a strictly mathematical perspective, as Skoulios asserts, the 68-step system is not very successful as an approximation in logarithmic terms of al-Fārābī’s Zalzalīan *jīns* used in his *ūd* tuning, 9:8-12:11-88:81 (204-151-143 cents), or in string ratios 108:96:88:81.<sup>68</sup> However, the Syrian musician and theorist Mikhā’il Mashāqa found it in practice an accurate guide to Arabian music, better than the 24-step division he used in his own exposition of the *maqāmāt*.<sup>69</sup>

In this sense, the 68-step system of Chrysanthos might be described as an imprecise logarithmic approximation of al-Fārābī’s tetrachord which yet has the advantage of capturing certain musical features quite attractive to some musicians in the Arabian and Byzantine traditions.

One method for deriving this 68-division, which may more or less summarize the explanations of Chrysanthos himself, is to begin with al-Fārābī’s *jīns* of 108:96:88:81. The difference in the lengths of the steps at 108 and 96, a 9:8 tone apart, is (108 - 96) or 12, so that

<sup>66</sup> For al-Fārābī, see [Forster, 2010, p. 610-787] 2010, p. 663, Tab. 11.28]; for Ṣafīyya-d-Dīn, see [Arslan, 2007, p. 10]. The Arabic term *mumfaṣīl*, which could be translated as either “noncontinuous” or “disjunct,” refers to a *jīns* where the first two ratios are superparticular, as here in 9:8-11:10-320:297, but are not contiguous in the series of such ratios, moving from 9:8 to 11:10 and skipping over 10:9 – as compared to a “continuous” or “conjunct” *jīns* such as 8:7-9:8-28:27 (a permutation of the Diatonic of Archytas).

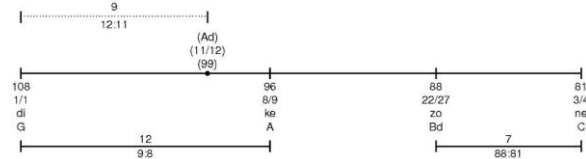
<sup>67</sup> See [Savas, 1965, p. 61] for a diagram using the 72-step system and placing side by side tetrachords in the Byzantine Diatonic at 12-10-8 steps (200-167-133 cents) and the Mild Chromatic at 8-14-8 steps, with the third of either tetrachord at 22 steps or 367 cents.

<sup>68</sup> [Skoulios, 2012, p. 19].

<sup>69</sup> See [Mashāqa et Smith, 1849, p. 180-182, 216-217].

the tone may be conceptualized as “12 parts.” If we start again at the full length of 108, and find a note at 12:11 above it, we arrive at a length of 99 parts, a difference of (108 - 99) or 9 parts. Finally, if we compare the two highest steps of the tetrachord at 27/22 and 4/3, with lengths of 88 and 81, the difference is (88 - 81) or “7 parts”<sup>70</sup>.

The following explanation is given by Chrysanthos in his *Great Theory of Music*, to which I add a diagram showing his solmization syllables  $\delta\iota\kappa\epsilon\zeta\omega\upsilon\eta$  (*di ke zo ne*) for his tetrachord of 108:96:88:81.



“Here below is proved that the intervals  $\delta\iota\kappa\epsilon$ ,  $\kappa\epsilon\zeta\omega$  and  $\zeta\omega\upsilon\eta$  have to each other the ratios such as 12, 9, 7:  $\delta\iota\kappa\epsilon : \kappa\epsilon\zeta\omega :: \frac{1}{9} : \frac{1}{12}$ , this is  $\frac{4}{36} : \frac{3}{36}$ . Consequently,  $\frac{4}{36} : 12 :: \frac{3}{36} : X$  and  $4 : 12.36 :: 3 : 36X$ . Therefore,  $4.36X = 12.36.3$  and  $X = 9$ .”<sup>71</sup>

This comparison of 12 units for 9/8 and 9 units for 12/11 fits the monochord of Chrysanthos (with his ratios 1/1, 8/9, etc., showing fractions of the total string length for the four notes) if and only if we measure both 9/8 at (108 - 96) or 12 units, and 12/11 at (108 - 99) or 9 units, starting from the full length of 108 units.

Indeed the respective differences of 12 and 9 so obtained closely approximate the logarithmic sizes of 9:8 and 12:11 (203.9 and 150.6 cents), with the latter interval very close to an exact “3/4-tone.”

Chrysanthos then approximates the size of  $\zeta\omega\upsilon\eta$ , the upper 88:81 interval of the tetrachord, by taking the difference in lengths between these two notes at 22/27 and 3/4 of the whole:

“If it is assumed that the entire string equals 27, the fraction  $\frac{27}{27}$ , which is 1, will correspond to the  $\Delta\epsilon$ , the  $\frac{24}{27}$ , which is  $\frac{8}{9}$ , will correspond to the  $\kappa\epsilon$ , the  $\frac{22}{27}$  to the  $\zeta\omega$  and the  $\frac{3}{4}$  to the  $\upsilon\eta$ . Therefore, the  $\frac{7}{108}$  will correspond to the interval  $\zeta\omega\upsilon\eta$ , because  $\frac{1}{4} - \frac{5}{27} = \frac{27}{108} - \frac{20}{108} = \frac{7}{108}$ . Whence, since  $\delta\iota\kappa\epsilon : \zeta\omega\upsilon\eta :: \frac{1}{9} : \frac{7}{108}$ , then  $\frac{1}{9} : 12 :: \frac{7}{12.9} : X$ . Therefore  $\frac{1}{9}X = \frac{12.7}{12.9} = \frac{7}{9}$  and  $X = \frac{7.9}{9.1} = \frac{63}{9} = 7$ ”<sup>72</sup>.

<sup>70</sup> See note n. 57 above for Chrysanthos on the *jīns* of 9:8-12:11-88:81.

<sup>71</sup> [Chrysanthos (of Madytos) & Rōmanou, 1973, p. 23, n. 2]: Rōmanou ends with « $x + 9$ », which is an error corrected in the 2010 edition, [Chrysanthos (of Madytos), 2010].

<sup>72</sup> [Chrysanthos (of Madytos) & Rōmanou, 1973, p. 23-24, n. 2].



In other words, using an entire length of 108 units, the note  $\nu\eta$  at the fourth, or a length of  $3/4$ , must be shorter by  $1/4$  of 108 units, or 27 units; while  $\zeta\omega$  at  $27/22$ , or a length of  $22/27$ , is shorter by  $5/27$  of 108 units, or 20 units. Thus the difference ( $27 - 20$ ) is 7, which we can also obtain simply by comparing the string lengths for  $27/22$  and  $4/3$  at 88 and 81 units, again a difference of 7 units.

As Michalakakis observes, citing the proposal of “Ch. Symmeonides,” the “Chrysanthian” values of 12 units for 9:8 and 9 units for 12:11 would “correspond to the number of centimetres when starting, for each individual interval alike, from the outer extremity of a 108 cm chord.”<sup>73</sup> However, the small Zalzalian second of the tetrachord at 88:81 has its difference measured from the  $27/22$  note to the upper  $4/3$  fourth, giving us (88 - 81) or 7 units.

Thus we arrive at a division of the fourth, for the Byzantine Diatonic (which Chrysanthos bases in theory upon al-Fārābī’s tetrachord) with steps of 12-9-7 parts, a fourth equal to 28 parts, and octave of 68 parts. While this does not very well approximate the tetrachord of al-Fārābī at 108:96:88:81 or 204-151-143 cents, it gives an interesting variation on al-Fārābī’s alternative tuning of 9:8-11:10-320:297 (204-165-129 cents) noted above:



Here the bright *Rāst* third at 370.6 cents is almost identical to the 26/21 third of Ibn Sīnā and *Buzurg*, and also typical of 20<sup>th</sup>-21<sup>st</sup> century practice in some Syrian traditions, as reported for example by Julien Jalal Ed-Dine Weiss and Stefan Pohlit<sup>74</sup>, as well as evidently in some of the historical Ottoman traditions that Mashāqa found influential.<sup>75</sup> One facet of the 68-step system, at least if taken as a literal measure, is that the small Zalzalian second at 7 steps or 123.5 cents is quite minimal, being rather smaller than 14:13 (128.3 cents),

and equal in theory to precisely a quarter of a tempered fourth at 494.1 cents.

The 68-step system has its regular tone – formed from two fifths of 705.9 cents (or 40 steps each) less a 2:1 octave – at 12 steps or 211.8 cents, rather wider than 9:8 at 203.9 cents, with a tendency toward these larger tones documented in some varieties of Iranian music<sup>76</sup> and also favored by some Byzantine musicians<sup>77</sup>. However, while Chrysanthos uses this 12-step tone in most of his polychords and scales, he does not focus on a cycle of fourths or fifths as the basis of Byzantine or *Maqām* intonation. Nor does Chrysanthos focus on the compact regular semitone formed from a chain of five fourths at 28 steps or 494.1 cents each (e.g. E-A-D-G-C-F), a literal thirdtone at 4 steps of 70.6 cents. Thirdtones of around this size, or not too much larger, are favored in some Iranian practices, for example.<sup>78</sup>

The 68-step system of Chrysanthos can very nicely express one classic form of *Buzurg*, the 13:12-8:7-14:13 variety (139-231-128 cents) with a 26/21 third, by a tetrachord of 8 13 7 steps:



Here the 26/21 (369.7 cents) is virtually just. A “mirrored” permutation reversing the position of the lower and upper steps results in a very low *Buzurg* third, at 352.9 cents or precisely half of the perfect fifth at 40/68 octave (or 10/17 octave) or 705.9 cents, by comparison to the smaller third of classic *Buzurg* at 16/13 or 359.5 cents.



If we admit a Cleonides-like division of each of the 68 steps into halves, however, then more *Buzurg* variants become possible. The following rather closely

<sup>73</sup> [Michalakakis, 2009, p. 26, and n. 22], citing Dimitrios Makrakis as also favoring this view.

<sup>74</sup> See, e.g., Pohlit [2011, p. 57-58, 117; 2012, p. 59-62] on the placement by the Aleppian *mevlevi Sheikh* ‘Ali a-d-Darwish of the step *Sikā* at the very complex theoretical ratio of 315657/256000 or 362.7 cents, almost identical to 16 HC (362.3 cents), and a practical range of around 355-365 cents in Damascus, and 365-375 cents in Aleppo [Pohlit, 2012, p. 61, Fig. 6].

<sup>75</sup> For example, Mashāqa (see [Mashāqa et Smith, 1849, p. 187]), having given a melodic pattern for *Maqām Hijāz-Kār*, adds, “Thus the Constantinople masters have arranged it.” Pohlit [2011, p. 117, and Fig. 4.7, Fig. 4.8] suggests a third at around 370 cents as possibly typical of “an older Turkish version of that genre” (*Rāst*), as well as of current Aleppian usage. [Yarman, 2010] likewise suggests an historical tuning of the Turkish *Sikā* at “370 cents or so.”

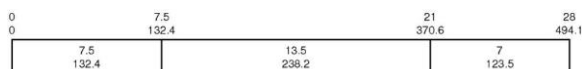
<sup>76</sup> Thus [Pertout, 2007, v. I, 53, Tab. 21] finds an average “major second” in the *sanjūr* tunings of Qmars Piraglu at 208.6 cents; During [1985, p. 113; 2006, p. 332] reports an *Esfahan* tuning (Section 4.2 below) by Ahmad Ebadi of 35.3-52.6-35.3 savarts or 140.7-209.7-140.7 cents, thus implying a fourth of 491.2 cents, as compared to a just  $4/3$  at 498.0 cents, or 28 steps of the 68-division at 494.1 cents.

<sup>77</sup> Michalakakis [2009, p. 33, 47], in favoring the 68-division of Chrysanthos with its tone at 12 steps or 211.8 cents and fifth at 40 steps or 705.9 cents, points to “vocal tradition, especially psaltiki, where fifths are LARGER than natural” (i.e. than  $3/2$  at 702.0 cents), noting that “Marika Franzekopoulou from Constantinople, who was of Hellenic descent, also used extended fifths and > 210 cent tones, as did lyra player Lambros Leontarides.”

<sup>78</sup> See [Caron and Safvate, 1966, p. 36-37, Tab. B] and [During, 1985, p. 113] for Safvate’s *Esfahan* with steps above the final of 204-72 cents (discussed in Section 4.2); and [During, 185, p. 214; 2006, p. 332] for Ebadi’s *Homayun* with an upper semitone at 74.2 cents (discussed in Section 4.3).

0	7.5	20.5	28
0	132.4	361.8	494.
7.5	13	7.5	
132.4	229.4	132.4	

Another variation which may model certain performance practices is the following:



#### 4.2. Iranian Avaz-e Bayyat-e Esfahan

Much of the *dastgah* system centers around the premier modal family, *Dastgah-e Shur*, somewhat analogous in its features to Arabian *Bayātī* or Turkish *Ushshāq*, and in its central role to Arabian or Turkish *Rāst*.<sup>80</sup> A *dastgah* or *avaz* consists of a number of *gushe-ha* or melodic themes, some of which could be viewed as independent modes, organized into a suite as a performance unit based on a sequence of transitions and contrasts between *gushe-ha* rather like the transitions of *Maqām* modulation. One of the five satellite families is *Avaz-e Bayat-e Esfahan*, the “Avaz of the Song (or Verses) of *Esfahan*,” *Esfahan* or *Isfahan* being one of the historical capitals of Persia.<sup>81</sup>

In this example, the final of *Esfahan* is on *Do* or *C*, with the characteristic tetrachord of special interest thus starting a fourth lower, at *Sol* or *G*, which in Safvate's examples is the final of *Shur*. Here I quote the Caron-Safvate notation, with a *koron* (p) lowering a note by around a third of tone, where this sign is not applied to the step *si* or *B* below the final<sup>82</sup>.



A notable feature of this upper *jins*, whatever we choose to call it, is the diatonic thirdtone step of 72 cents at  $D-E^b$ , with the third  $C-E^b$  at 276 cents, not too far from the Archytan ratio of 7:6 at 267 cents. The 72-cent step, likewise, is somewhat but not dramatically wider than the 28:27 thirdtone at 63 cents much favored by Archytas. Returning to the *Buzurg*-like *Esfahan* genus, the 132-cent step leading up to the final  $C$  is notated simply  $B-C$ , although a *koron* sign for the lower step,  $B^b-C$ , might seem better to express the idea of a small 2/3-tone at around 14:13 than an unaltered  $B-C$ . However, as Caron and Safvate explain, this notational choice may reflect the wide range of intonational variation for *Esfahan*, with this tuning as a kind of intermediate case as regards both the size of the middle interval and the height of the third step.

<sup>79</sup> See, e.g. [Farhat, 2004, p. 19-21].

<sup>80</sup> Ederer [2011, p. 375, n. 14] observes that the Ottoman theorist Dimitri Cantemir (1673-1723) took *Maqām Ḥusaynī*, using “the same tones” as *Rāst*, but starting on the final *dūkā*, as “the main mode of the basic scale.” Chrysanthos (see [Chrysanthos (of Madytos) & Rōmanou, 1973, p. 6-7]) likewise introduces neophytes to the basic “diatonic scale” in the form of *πα-βου-γα-δι-κε-ζο-νι-πα* (or *pa-bou-ga-di-ke-zo-ne-pa*) with two disjunct tetrachords of 9-7-12 steps, with *πα* corresponding to *dūkā* and the mode to *Ḥusaynī*. While Arabian and Turkish *Maqām* musicians often regard *Rāst* as the premier *maqām*, Racy [2004, p. 99] reports one Arabian opinion that *Maqām Bayātī*, also on *dūkā*, especially exemplifies the features of Eastern music.

<sup>81</sup> See [Caron and Safvate, 1966, p. 88-91]; and [Farhat, 2004, 76-80].

<sup>82</sup> See Caron and Safvate [1966, p. 36-37 (Tab. B) and 88-90].

<sup>83</sup> For Systematist Nawā as TBT, see [Ghrab, 2009, p. 75, Tab. V.10] (Ṣafiyya-a-d-Din), and *ibid.*, p. 69, Tab. V.6 (al-Ladiqi). On *Dasgāhe Nawā*, see [Caron and Salvate, 1966, p. 74-78], and Farhat [2004, p. 81-88].

<sup>84</sup> See [Talâi, 2000, p. 12, Chart 4], who suggests a tuning for *Dashti* of 200-80-220 cents; and notes, *ibid.*, p. 13-14 and Chart 6, that on fretted instruments the desire for freer transposition may lead to a “tempered” (i.e. less ideal) version at 200-100-200 cents.

A wonderful example of what both these authors and Hormoz Farhat term “the Old *Esfahan*” is provided by Ibn Sinā’s classic *jins* of 13:12-9:8-128:117 (139-204-156 cents), a permutation of the tetrachord used for his *ūd* tuning with the two lower steps reversed, with both forms sharing a Zalzalian third at 39/32 or 342 cents:

468	432	384	351			
1/1	13/12	39/32	4/3			
0	138.6	342.5	498.0			
<table><tr><td>13:12 138.6</td><td>9:8 203.9</td><td>128:117 155.6</td></tr></table>				13:12 138.6	9:8 203.9	128:117 155.6
13:12 138.6	9:8 203.9	128:117 155.6				

Using the 53-step concept, this type of *Esfahan* would be aptly expressed as 6-9-7 commas, with 6 and 7 commas representing respectively a smaller and larger Zalzalian second step, and the sum of the lower two steps at around 15 commas, or a smaller Zalzalian third. As Caron and Safvate observe, the upper step of the Old *Esfahan* is a “3/4-tone,”<sup>85</sup> a good description for Ibn Sinā’s 128:117 at 156 cents, as well as for al-Fārābī’s 12:11 step at 151 cents, two ratios between which Ibn Sinā notes a resemblance.<sup>86</sup>

Hormoz Farhat describes and recommends such a tuning for *Esfahan*, using symbols for interval sizes which generally would fit nicely the scheme of Holderian commas. He uses “M” for a major second around 9:8 or 204 cents (9 HC), “m” for a minor second or limma around 256:243 or 90 cents (4 HC), “N” for a larger neutral or Zalzalian second at around 160 cents (7 HC), and “n” for a smaller neutral second at around 135 cents (6 HC), emphasizing that all of these steps are somewhat variable (e.g. smaller and larger neutral seconds at around 125-145 cents and 150-170 cents).<sup>87</sup>

Farhat’s model for *Esfahan*, based on two conjunct tetrachords below and above the final, would neatly fit his indicated interval categories if the note at a fourth below the final were placed at G on his suggested tar or sitar tuning (based on averaging some frettings), also one popular choice for the final of *Shur*, so that the final of *Esfahan*, as in the Safvate tuning, would be on C:

G	Ap	Bp	C	D	Eb	F						
0	135	340	500	705	795	1000						
<table><tr><td>n 135</td><td>M 205</td><td>N 160</td><td>M 205</td><td>m 90</td><td>M 205</td></tr></table>							n 135	M 205	N 160	M 205	m 90	M 205
n 135	M 205	N 160	M 205	m 90	M 205							

This tuning of the *Esfahan jins* at 135-205-160 cents is very close either to Ibn Sinā’s 139-204-156 cents or to a literal 6-9-7 HC at 136-204-158 cents. The upper tetrachord at 205-90-205 cents is very close to a Pythagorean 9:8-256:243-9:8 or 204-90-204 cents, as

compared to Safvate’s 204-72-220 cents with its narrower semitone or thirddone step.

Comparing this “Old *Esfahan*” tetrachord or Ibn Sinā’s classical model with Safvate’s 128-240-132 cents may suggest why the latter and his colleague Caron used a *G-A<sup>b</sup>-B-C* notation rather than *B<sup>b</sup>*: the *koron* sign might suggest a step at *B<sup>b</sup>-C* at around 7 HC or 150-160 cents, when in fact the intended step at 132 cents is about a comma smaller, a small 2/3-tone as opposed to an ample 3/4-tone.

As they explain in a footnote, since the introduction in Iran of the European orchestra, the step of a 3/4-tone in the Old *Esfahan* has been reduced to a semitone, a description nicely fitting a tuning of Mohammad Musavi as recorded by Jean During at 33.3-65.5-27.2 savarts (with 301 savarts to a 2/1 octave), or 132.8-261.1-108.4 cents, with a major third at 393.9 cents (a bit wider than 5/4 at 386.3 cents).<sup>88</sup>

0	132.8	393.9	502.3
132.8	261.1	108.4	

From this perspective, the *Buzurg*-like tuning of Safvate represents a kind of intermediate region on the *Esfahan* spectrum, with an upper tetrachordal step of a 2/3-tone at around 130 cents, notably smaller than in the Old *Esfahan* with its 3/4-tone at 155-160 cents or so (*B<sup>b</sup>-C*); but also notably wider than in a thoroughly “Modern” *Esfahan* with a semitone step on the order of 110-120 cents (*B-C*). Thus the remark which he and Caron offer that in reality this step should be played somewhere between *B<sup>b</sup>* and *B* might especially fit a tuning like theirs.<sup>89</sup> Likewise, the third of Safvate’s tuning at 368 cents is somewhere between a traditional *G-B<sup>b</sup>* (around 340 cents) and the fully “modern” *G-B* (around 5/4 or 386 cents, or even somewhat higher).

While Farhat’s intended example of the Old *Esfahan* quoted above can be found in his 17-note *tar* or *setar* tuning at one popular location for this modal family, his indicated notes on the instrument (as opposed to his notation for the interval sizes) would result, following his tuning scheme, in a *Buzurg*-like shading a bit different from Safvate’s. Farhat in his book places the final of *Shur* on *D*, another likely location, and also the the lowest note of the tetrachord leading up to the final of *Esfahan*. Here a *sori* accidental (>) raises a step by a small amount often equal to around a quarter to a third of a tone<sup>90</sup>:

<sup>85</sup> [Caron and Safvate, 1966, p. 89].

<sup>86</sup> [Fārābī (al-) et al., 2001, v. 2, p. 150, 235].

<sup>87</sup> See Farhat [2004, p. 76-77 and Ex. 184] for the tuning of *Esfahan*, and [p. 15-16, 25-26], on the variable tuning of Zalzalian or neutral intervals.

<sup>88</sup> See During [1985, p. 113; 2006, p. 332]. There is a small and inconsequential discrepancy between During’s measurement of the middle interval as 65.8 savarts (262.7 cents) in the 1985 article, and 65.5 savarts (261.1 cents) in his book of 2006.

<sup>89</sup> [Caron and Safvate, 1966, p. 89, n. 1].

<sup>90</sup> See [Farhat, 2004, p. 76, Ex. 184], and the tuning scheme, [*ibid.*, p. 17, Fig. 8].



D	Ep	F>	G	A	Bb	C
0	135	360	495	700	790	995
	135	225	135	205	90	205

The lower tetrachord is 135-225-135 cents, with the upper and lower steps close to 13:12 or 139 cents and the middle step a bit smaller than 8:7 or 231 cents. Here 6-10-6 HC is close to a literal measurement. The upper tetrachord at 205-90-205 cents is again very close to Pythagorean, or 9-4-9 HC.

Interestingly, while Farhat offers a very useful “theory of flexible intervals” in Persian music<sup>91</sup>, his scheme jumps from the usual tone at around 9:8 or 204 cents to a “plus tone” at around 270 cents used as a chromatic step in modes such as *Chahargah* and *Homayun* (comparable to Arabian *Hijāz* or Turkish *Hicaz*), and from our perspective often synonymous with the Archytan 7:6 at 267 cents, or a step around 12 HC or three times a 90-cent *limma* (271 or 272 cents).

However, the 225-cent interval of his *Buzurg*-like example, although evidently unintended, does along with tunings like Safvate’s suggest another category or subcategory: a “small plus tone” somewhere around 8:7 (231 cents), or 10 HC (226 cents), and sometimes a bit larger, up to 240 cents or so.

The wide intonational spectrum for *Esfahan* may hint at a diversity of understandings and interpretations that may have prevailed in Systematist times also. This observation applies likewise to Arabian or Turkish *Hijāz* and related *genera*.

#### 4.3. Arabian *Hijāz* Gharīb and related forms

One of the most clear descriptions of what is here termed a *Buzurg*-like tetrachord in Arabian music occurs in the Syrian theorist Tawfiq Tawfiq a-ṣ-Ṣabbāgh, in passages helpfully summarized by Ali Jihad Racy<sup>92</sup>. A-ṣ-Ṣabbāgh’s perspective is especially interesting as that of an Arabian musician who expressed a great admiration for Turkish music, and who used the 53 commas system common to modern Turkish and Syrian theory in order to describe various nuances and refinements of intonation.

In order to place a-ṣ-Ṣabbāgh’s discussion of the *genus* known as *Hijāz Gharīb* in perspective, we must note the vast intonational spectrum covered by different forms of *Hijāz* and related Near Eastern modal categories such as the Iranian *Dastgah-e Chahargah*. As Beyhom<sup>93</sup> observes, Qutb a-d-Din provided a description of a *Hijāz* tetrachord using a chromatic step of 7:6 as the middle interval (to my knowledge the first

known documentation of what John Chalmers terms this “neo-chromatic” structure with the large step “in the central position”<sup>94</sup>):

84	77	66	63
1/1	12/11	14/11	4/3
0	150.6	417.5	498.0
	12:11	7:6	22:21
	150.6	266.9	80.5

More generally, this variety of *Hijāz* features a lower Zalzalian second step somewhere in the neighborhood of 13:12 (139 cents) or 12:11 (151 cents); a middle step of around 7:6 or 12 HC (the “plus tone” of Farhat, Section 4.2 above), and an incisive semitone sometimes at around Pythagorean 256:243 or 4 HC at 90 cents, or, as here, somewhat smaller, at 22:21 or 81 cents. The third note of the tetrachord will be at a large major third, with a size at around the Pythagorean 81/64 (408 cents) or, as here, somewhat larger at 14/11 (418 cents).

Qutb a-d-Din’s tuning is especially elegant from a theoretical perspective because all three steps are superparticular (12:11-7:6-22:21), and in fact represents a permutation of Ptolemy’s Intense Chromatic (22:21-12:11-7:6), a *jins* noted by al-Fārābī, Ibn Sīnā, and Ṣafiyy-a-d-Din.<sup>95</sup> In practice, two modern tunings by Ahmad Ebadi of the Persian *Dastgah-e Homayun* with its *Hijāz*-like tetrachord leading up to the final, as measured by Jean During, show how Qutb a-d-Din’s ratios may have been subject around 1300 also to many fine intonational variations. During’s measurements in savarts are shown along with values in cents<sup>96</sup>:

0	38.4	105.3	123.3
0	153.1	419.8	494.0
	38.4	66.9	18.6
	153.1	266.7	74.2

0	37.7	105.7	126.8
0	150.3	421.4	504.3
	37.7	68.0	20.8
	150.3	271.1	82.9

Beyhom, taking note of Qutb a-d-Din’s *Hijāz* and similar modern Iranian tunings, then illustrates a very different color of *Hijāz* with his *Zirkulā jins* associated with the Arabian *Maqām Hijāz-Kār*, a *Maqām* sharing the same final as *Rāst*. As he explains, a *Zirkulā genus* may be derived from *Rāst* simply by lowering the second note from the usual tone around 9:8 to a

<sup>94</sup> [Chalmers 1993, p. 15] cites Gevaert [Gevaert, 1875, p. 292-293] for this usage of “neo-chromatic.”

<sup>95</sup> Wright [1978, p. 51, n. 5] notes that Qutb a-d-Din describes this *Hijāz jins* as “the fifth of the six possible arrangements of intervals in the second species of the chromatic genus.” Ghrab [2009, p. 63-65] gives 22:21-12:11-7:6 for al-Fārābī, and for Ibn Sīnā 7:6-12:11-22:21 or 28:24:22:21; and Arslan [2007, p. 10] for Ṣafiyy-a-d-Din gives the latter form, 7:6-12:11-22:21.

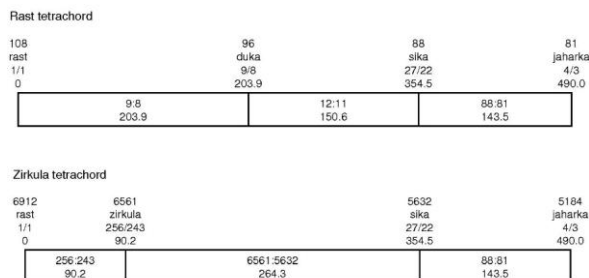
<sup>96</sup> See [During, 1985, p. 114] and [During, 2006, p. 332].

<sup>91</sup> [Farhat, 2004., p. 15-16].

<sup>92</sup> [Racy, 2004, p. 106-113].

<sup>93</sup> [Beyhom, 2007, p. 5].

semitone.<sup>97</sup> Here is an example of this process as it might have obtained on an ‘ūd fretted according to the method of al-Fārābī, with the *Rāst* third at 27/22 or 354.5 cents. (It may be well to add that while the theoretical monochord lengths for the *Zirkulā* tuning can appear daunting, an udist hypothetically hitting on this *jins* around 1000 or 1300 would need only to make the experiment of playing the *baqiyya* or regular diatonic semitone fret at 256/243 or 90 cents in place of the usual 9/8 *ṭanīnī* or tone, and then the *wuṣṭā* or middle finger fret Zalzal for the 27/22 third at 355 cents, and then the 4/3 fourth.)



Here the name *Zirkulā* may refer to the step *Zirkulā* in the Arabian naming of the *Maqām* scale, located at a semitone above *Rāst*. Given that Beyhom reports a possible placement of the third in a classical Lebanese *Rāst* at around 355 cents<sup>98</sup>, and assuming that in this practice the step *Zirkulā* might be placed at around 256/243 or 90 cents (4 HC), then the intonation he describes might be quite close to this theoretical model.

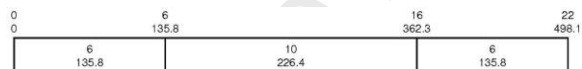
By comparison to the form of *Ḥijāz* described by Qutb a-d-Din and often favored in modern Iranian practice, for example with steps at a rounded 150-270-80 cents, here the middle step is likewise in the neighborhood of 7:6 or 267 cents, but with the lower and upper steps reversed in mirrorlike fashion, say a rounded 90-265-145 cents. Thus the third of the tetrachord, at around 14/11 or 418 cents in the first interpretation, is here around 27/22 or 355 cents – a difference of a full 60 cents, or a third of a tone!

Having gotten some sense of the breadth of the *Ḥijāz* intonational spectrum, we now consider the standard Turkish *Ḥijāz* tuning that a-ṣ-Ṣabbāgh evidently takes as a base for the Arabian practice he favors, expressed as a division of 5-12-5 HC<sup>99</sup>. Literally this would be 113.2-271.7-113.2 cents, with a third at 17 HC or 384.9 cents, very close to the small major third at 5/4

(386 cents). The following diagram shows this tuning in Holderian commas and cents:



In *Ḥijāz Gharīb* – with *Gharīb*, as Racy explains, meaning “foreign” or “strange” or “estranged”<sup>100</sup> – the characteristic tuning “results from lowering the third step... by one comma, and moving the... second step upward by one comma.”<sup>101</sup> Thus we would have something like:



This is a fine example of the *Buzurg* type of tetrachord, with the third at around 362 cents, likely close to many Syrian shadings of the *Rāst* third, for example. Racy notes both the “profound ecstatic character” of *Gharīb* as widely recognized by Syrian musicians, and the fact that this is a “modal structure” which, “apart from a-ṣ-Ṣabbāgh’s allusions, is seldom conceptualized or analyzed as such in the more formal theoretical sources.”<sup>102</sup> In the area around Aleppo, *Ḥijāz Gharīb* is known also as *Ḥijāz Nawarī*, the *Ḥijāz* of the *Roma* or Gypsies.<sup>103</sup>

Another modal description by a-ṣ-Ṣabbāgh, of *Maqām Sīkā* ‘*Arabi*’ or “Arabian *Sīkā*” (Racy prefers the transliteration *Sīkāh*), has a variation which might involve a similar *Buzurg*-like pattern. Here the base form is as follows, with the literal translation of Holderian commas into cents meant only as a general guide:



As Racy notes, a-ṣ-Ṣabbāgh equates this *Maqām* with Turkish *Huzām*, and indeed the *ajnās* fit the general scheme of Arabian *Huzām* also: a lower *Sīkā* trichord (6-9 HC), a middle *Ḥijāz* tetrachord (here with a Turkish interpretation of 5-12-5 HC), and then the beginning of a *Rāst jins* that crosses the boundary of the octave – i.e. 9-7-(6) HC. Among the possible variations for this *Maqām* which he addresses, one of them involves a construction “similar to *Ḥijāz Gharīb*” on the third step here at around 15 commas or 340 cents above the final, with an eventual cadence on the final, “as typically happens when Turks play [*maqām*] *Huzām*.”<sup>104</sup>

<sup>97</sup> [Beyhom, 2007, p. 7-8 and Fig. 1].

<sup>98</sup> Beyhom [2003, v. I, p. 52] suggests as a possibility a classic Lebanese *Rāst* with steps at around 200-155-145 cents, as inferred from the placement by two very good musicians, as Beyhom himself writes, of the step *Dūkā-Sīkā* in a classical *Maqām Bayātī* at 155 cents, see [*ibid.*, v. I, p. 115-116].

<sup>99</sup> [Racy, 2004, p. 108].

<sup>100</sup> [Racy, 2004, p. 110-111, n. 50].

<sup>101</sup> [Racy, 2004, p. 108].

<sup>102</sup> [Racy, 2004, p. 110].

<sup>103</sup> [Racy, 2004, p. 110-111, n. 50].

<sup>104</sup> [Racy, 2004, p. 110].

Racy's account of a-ṣ-Ṣabbāgh could be read to call for a *Gharīb*-like form of the middle *Hijāz jins* at around 6-10-6 commas. The following is one possible interpretation in a neo-Systematist fashion, with the approximate Holderian commas shown along with ratios and cents, and with the *ajnās* shown in the manner of Eric Ederer<sup>105</sup>, with the name of a *jins* followed by its size (e.g. *Sikā*-3 for a *Sikā* trichord):

sika-3			hijaz-4 (gharib)			Rast tetrachord		
0	6	15	21	31	37	46	53	59
756	702	624	576	504	468	416	378	351
1/1	14/13	63/52	21/16	3/2	21/13	189/104	2/1	28/13
0	128.3	332.2	470.7	702.0	830.3	1034.2	1200	1328.3
6	9	6	10	6	9	7	6	
14:13	9:8	13:12	8:7	14:13	9:8	208:189	14:13	
128.3	203.9	138.6	231.2	128.3	203.9	165.8	128.3	

Here the central *Hijāz Gharīb jins* is realized as a classic *Buzurg* at 13:12-8:7-14:13 or 139-231-128 cents, with a third of 26/21 or 370 cents, also featured in the upper *Rāst* tetrachord.

Whether an interpretation of *Huzām* like that just described might in fact occur in the area around Aleppo, for example, remains an open question. But a-ṣ-Ṣabbāgh and Racy's writings have raised some fascinating questions about modern counterparts in Syrian or other Arabian practices of Systematist *Buzurg*.

#### 4.4. Turkish Hicaz tetrachord in some interpretations

In approaching Turkish versions of *Hijāz* that exhibit *Buzurg*-like patterns, there is no better place to start than a demonstration of some idioms in this *Maqām* by musician and musicologist Kudsi Erguner, as measured by Beyhom. To place the passages in proper context, I give his values in cents for the steps and intervals in each group of pitches or segments he analyzes, and also approximate Holderian commas, which seem generally to express well the interval types<sup>106</sup>:

seg1	seg2	seg3
0	6	16+
0	129	371
6	10+	
129	242	

Fig. 1 Group 1 (ascending), segments 1-3.

seg4	seg5	seg6
0	6	20
0	129	452
6	14	
129	323	

Fig. 2 Group 2 (ascending), segments 4-6 (not idiomatic).

<sup>105</sup> For Ederer's *jins* notation, see, e.g., [2011, p. 393-401, 402-472], where he diagrams which *ajnās* may acceptably be joined in Turkish *Maqām* practice, and gives descriptions of different *maqāmāt*. For example, at p. 409, Fig. 9, *Rāst* is diagrammed as *Rāst*-5 plus a conjunct *Rāst*-4.

<sup>106</sup> See [Beyhom, 2007, p. 9-10 and Tab. 1].

seg7	seg8	seg9	seg10
0	6	16	22
0	131	368	501
6	10	6	
131	237	133	

Fig. 3 Group 3a (ascending), segments 7-10.

seg13	seg12	seg11	seg10
0	5	15	22
5	116	348	501
5	10	7	
111	232	153	

Fig. 4 Group 3b (descending), segments 10-13

Erguner's first grouping of pitches, as analyzed by Beyhom, show an ascending melody of 129-242 cents, which might be described as a *Buzurg*-like trichord with the large step rather wider than 8:7 at 231 cents, and comparable to Safvate's Esfahan at 128-240-132 cents. Erguner and Beyhom term this a second "slightly (*légèrement*) augmented,"<sup>107</sup>. This is a demonstration of what Erguner regards as idiomatic intonation.

The second grouping has steps of 129-323 cents, demonstrating the kind of "exaggerated augmented second" which should be avoided in in Erguner's view.<sup>108</sup> This step is a bit larger than the precise Pythagorean augmented second (e.g.  $E^b-F^{\#}$ ) at 19683:16384 or 317.6 cents, or a literal 14 HC at 317.0 cents. Such a large middle interval for a *Hijāz*-type tetrachord, or indeed usually larger, is by contrast the norm for the Byzantine Tense Chromatic, where Chrysanthos specifies a tuning in the 68-step system of 7-18-3 parts (124-318-53 cents).<sup>109</sup> Indeed the tuning adopted by the Committee of 1881 is 100-333-67 cents, which could be expressed as 4-15-3 HC, with an undivided smallish Zalzalian third as the central interval.<sup>110</sup>

It is also noteworthy that<sup>111</sup> the *Hijāz* and other tetrachords are more or less modified in the process of transposition, or simply in performance. The *Hijāz* tetrachord acquires for example a larger middle interval, e.g. around 13 commas or 32/27 (294 cents) when transposed to *Irāq*<sup>112</sup>. Thus Erguner's preference for a small interval around 8:7 or slightly larger may point to the diversity of Turkish tastes.

<sup>107</sup> [Beyhom, 2007, p. 9].

<sup>108</sup> [Beyhom, 2007, p. 9].

<sup>109</sup> See [Chrysanthos (of Madytos) & Rōmanou, 1973, p. 99, diagrams B, C, and D]. Diagram B shows two disjunct and symmetrical tetrachords, 7-18-3-12-7-18-3, while C and D combine a lower or higher 7-18-3 with a disjunct diatonic tetrachord of 9-7-12 steps, as in the Byzantine First Mode or *Maqām Huzaynī*.

<sup>110</sup> See, e.g. [Savas, 1965, p. 63-64], and [Skoulios, 2012, p. 21, Tab. 6c].

<sup>111</sup> [Signell, 2008, p. 32 sq.].

<sup>112</sup> Or even 14 commas or 6/5 (316 cents), in some of its transpositions as I was informed by an evaluator of this article.



For example, the theorist M. Ekrem Karadeniz (1904-1981) specifies a *Hijāz* tetrachord of 5.5-13-3.5 HC or 125-294-79 cents, with a full 13-comma middle interval, and a 419-cent high major third and narrow upper semitone at 79 cents very close to Qutb a-d-Din's 14/11 (418 cents) and 22:21 (81 cents – see Section 4.3). Thus comparing Systematist *Buzurg* with Qutb a-d-Din's *Hijāz* around 1300, or Erguner's modern Turkish *Hijāz* with that of Karadeniz, may suggest how a wide range of tetrachord tunings representing the same basic *genus* may shade and blur into each other.<sup>113</sup>

Returning to Erguner's demonstration, we find that he then performs a melody with ascending and descending motion (Groups 3a and 3b in the diagrams above). Group 3a, with ascending steps of 131-237-133 cents, gives a tetrachord very similar to Safvate's *Esfahan*, with a third at 368 cents. In Group 3b, we have a demonstration of the Turkish nuance known as *cazibe*<sup>114</sup> or "attraction,"<sup>115</sup> in which, for example, descending steps tend to be slightly lowered (and ascending steps somewhat raised) in certain contexts. Thus the ascending pitches are 0-131-368-501 cents, but descending 501-348-116-5 cents (ending very slightly higher than the first pitch).

This *cazibe* phenomenon applies more generally in Turkish music, with Eric Ederer quoting a description of *Maqām Rāst* given by Agnès Agopian, in which she tells how her teacher Aram Kerovpian "taught me that *Rāst* is like an old man... And when he sits down – when you make the cadence – you lower the third degree, *Sikā*, very gently – not like in *Ushshāq* – like it's the end of the day for this tired old fellow."<sup>116</sup>

Thus Erguner's demonstration is a fine example of what might be termed a "10-comma *Hijāz*" or *Buzurg*-like intonation with lower and upper Zalzalian steps somewhere around 130 cents, a middle step around 8:7 or often somewhat larger, and a third around 360-370 cents.

Ederer, like a-ṣ-Ṣabbāgh and Racy, also provides some hints that this general type of *Hijāz* may be common for the tetrachord in *Maqām Huzām* which follows the *Sikā* (or *Segah*) trichord above the final. For many Turkish performers, as for a-ṣ-Ṣabbāgh, one standard form of the *Hijāz* tetrachord is 5-12-5 commas, or around 113-272-113 cents, with a small major third of around 17 commas or 5/4 (386 cents).

<sup>113</sup> See [Pohlit, 2011, p. 68, and Fig. 2.30]. The Karadeniz system refines the 53-comma scheme by dividing each HC in half, for a 106-division, with each step divided in turn into 100 Turkish *sentî*, or 10600 per octave. Karadeniz *Hicaz* (*Hijāz*) is thus 1100-2600-700 *sentî* or 5.5-13-3.5 HC (125-294-79 cents). A reasonably close monochord division is 14:13-13:11-22:21 or 28:26:22:21 (128-289-81 cents).

<sup>114</sup> Equivalent to the Arabic « *jāzibīya* ».

<sup>115</sup> See [Ederer, 2011, p. 107].

<sup>116</sup> [Ederer, 2011, p. 143].

Surveying the views of Turkish performers, Ederer reports three different approaches as described by musicians who agree that this tetrachord in *Huzām* calls for a modification of the standard *Hijāz*: raising the second note, with the other notes unaltered; likewise simply lowering the third note, here with an adjustment of "two commas" specified; or, of special interest here, raising the second note and lowering the third.<sup>117</sup> If the modifications are assumed to be on the order of a comma (as with a-ṣ-Ṣabbāgh and Racy) unless otherwise specified, then results like these might obtain.

Original standard Turkish Hicaz

0	5	17	22
0	113.2	384.9	498.1
5	12	5	
113.2	271.7	113.2	

Second step raised

0	6	17	22
1/1	13/12	5/4	4/3
0	138.6	386.3	498.0
6	11	5	
13:12	15:13	16:15	
138.6	247.7	111.7	

Third step lowered by two commas

0	5	15	22
1/1	16/15	11/9	4/3
0	111.7	347.4	498.0
5	10	7	
16:15	55:48	12:11	
111.7	235.7	150.6	

Second step raised, third step lowered

0	6	16	22
1/1	13/12	26/21	4/3
0	138.6	369.7	498.0
6	10	6	
13:12	8:7	14:13	
138.6	231.2	128.3	

The version with the second step raised at around 6-11-5 HC, whatever the precise intonation in a given performance situation, might somewhat resemble the kind of intonation favored for Iranian *Esfahan* and also *Homayun* or *Chahargah* by Tala'i, with steps of about 140-240-120 cents.<sup>118</sup> This and the standard form share in common a third of around 5/4.

The version with the second step unchanged, but the third step lowered by about two commas, has a large semitone at around 5 HC or 16:15, but a smallish Zalzalian third maybe somewhere around 39/32 (342 cents) or, as in the diagram, 11/9 (347 cents).

As in a-ṣ-Ṣabbāgh and Racy, raising the second step and lowering the third step, if each is adjusted by about a comma, results in a 6-10-6 HC or *Buzurg*-like *jins*. With the third step placed near the upper end of the *Buzurg* range, around 370 cents, this would be a distinction of around 15 cents or 2/3-HC from the standard third at or near 5/4.

<sup>117</sup> [Ederer, 2011, p. 202-203].

<sup>118</sup> See [Talā'i, 2000, p. 12, Chart 4], where this *jins* is called "Chahargah."

The last scenario would produce the same kind of intonation in *Huzām* that Erguner demonstrates in *Hijāz* itself. Thus we may be looking at a range of intonational preferences which can apply to this tetrachord in the context of either *maqām*.

Both in his dissertation and in a personal communication (e-mail of 24 May 2014), Ederer notes that a *Hijāz* tetrachord with a narrower middle interval – in the above examples, often around 10 commas as opposed to the standard 12 commas or so – is known as “*garip Hicaz*”. The word *garip* can mean “foreign/strange/nostalgic,”<sup>119</sup>; “I take it here partly as ‘strange’ and partly as ‘nostalgic’...”<sup>120</sup>.

As in Syria, so in Turkey, this is an intonational style “associated with *Romany* (Gypsy) performance,” and also associated by at least one Turkish musician with “Istanbul *Hijāz*,” or as Ederer puts it “*Hicaz* with an Istanbul accent.”<sup>121</sup>

These examples may suggest how, in Turkish music, *Buzurg*-like interpretation of *Hicaz* at around 6-10-6 commas represents one option in an intonational milieu where a “slightly augmented second” or plus-tone somewhere in the range of around 10-12 HC may be optimal for many performers. As in the different understandings expressed by performers as to the tuning of the *Hijāz jins* in *Huzām*, this framework leaves great scope for variation and diversity.

#### 4.5. Some boundary cases

In the fluid practice of Near Eastern intonation, there are no clear lines between one type or subtype of *genus* and another, and some boundary or borderline cases may illustrate how this is also true for the concept of *Buzurg* here advocated, with 6-10-6 HC as one flexible shorthand.

One such case occurs in a version of Iranian *Esfahan* as tuned on *setar* by Haji Aqa Mohammad Irani

and measured by During, with steps and intervals shown in savarts and cents<sup>122</sup>:

0	33.5	89.1	121.3
0	133.6	355.2	483.6
33.5	55.6	32.2	
133.6	221.7	128.4	

Here the lower and upper small Zalzalian steps neatly fit the *Buzurg* concept, and the question is whether the middle step at 222 cents is quite wide enough to fit our pattern: it is not quite 10 cents narrow of 8:7, while the third at 355 cents or around 27/22 is a bit lower than the smaller classic *Buzurg* third at 16/13. Is this example right at the threshold of *Buzurg*, or should it be deemed to have crossed that threshold? Incidentally, this tetrachord also illustrates the use of a narrow fourth around 485 cents in Iranian music noted by Caron and Safvate.<sup>123</sup>

Another type of tuning, exemplified by a tuning of the *Hijāz jins* on the fourth step of *Maqām Kārjighār* as proposed by Ozan Yarman in one of the versions of his Yarman24 system, seems to me distinct from a usual *Buzurg*, but with some common qualities. Here I give his ratios for the notes of *Kārjighār* along with values in cents and an indication of the *ajnās*, viewed in Turkish theory as a lower *Ushshāq* tetrachord (here around 7-6-9 commas) and an upper *Hicaz* pentachord<sup>124</sup>:

ushshak-4				hicaz-5			
1/1	128/117	32/27	4/3	16/11	104/63	16/9	2/1
0	155.6	294.1	486.0	648.7	867.8	996.1	1200
128:117	13:12	9:8	12:11	143:126	14:13	9:8	
155.6	138.6	203.9	150.6	219.1	128.3	203.9	

Here the *Hijāz* division at 151-219-128 cents differs from *Buzurg* proper by reason of the larger size of its lower Zalzalian step at 12:11, in contrast to the usual *Buzurg* range around 14:13 or 13:12, as well as its narrower middle step at about 12 cents short of 8:7. The affinity with *Buzurg*, however, is conveyed by the third at 26/21 or 370 cents. This tuning, and the *Buzurg* type proper, may be different shadings of the more general *Hijāz Gharīb* (or “*garip Hicaz*”) category.

Finally, Dariush Talā'i's *Esfahan* tuning illustrates a situation where the two lower steps might each participate in a typical *Buzurg*-like *genus*, but the two taken together raise the third above the the “larger Zalzalian” range of *Buzurg*, with 16/13 and 26/21

<sup>119</sup> [Ederer, 2011, p. 457, n. 84]; <<http://en.wikipedia.org/wiki/Garip>> has “strange, peculiar / poor, forlorn.” The Saja Turkish English Dictionary, as quoted at <<http://translation.babylon.com/turkish/to-english/garip/>>, has:

1. strange, unusual, peculiar, odd, queer, curious, bizarre, weird, eccentric, outlandish, unfamiliar.
2. one living in a foreign land or far from home, stranger.
3. poor, wretched, forlorn.
4. moving, touching, pathetic.
5. How strange!/How curious!/That's odd!”

<sup>120</sup> [Ederer, Personal Communication, 24 May 2014].

<sup>121</sup> [Ederer, Personal Communication, 24 May 2014]. See also Ederer [2011, p. 144, 457 n. 84], where he draws the connection with an “Istanbul *Hijāz*,” notes that in this type of interpretation the second degree is higher and the third degree lower, and associates this genre with “*Romany* musicians of Western Turkey.”

<sup>122</sup> See During [1985, p. 113; 2006, p. 332]. Here there is a very small discrepancy between the published values for the middle interval at 55.8 savarts (222.5 cents, with a third at 356.0 cents) in 1985, and 55.6 savarts or 221.7 cents (as shown in the diagram) in 2006.

<sup>123</sup> [Caron and Safvate, 1966, p. 72]; see also note n. 61 above.

<sup>124</sup> [Yarman, 2008b] gives ratios for one version of his Yarman24 tuning, and specifies the steps for *Maqām Kārjighār*, resulting in the tuning shown in my diagram.

as emblematic, and into the “small major third range” near  $5/4$ <sup>125</sup>:



Here the lower 140-cent step in a *jins* of 140-230-130 cents, or the middle 240-cent step in 130-240-130 cents, would form a fine *Buzurg* with a third at 370 cents; the first model approximates the classic 13:12-8:7-14:13, while the second is close to Safvate's *Esfahan* or Erguner's demonstration of *Hijāz*. However, when combined, 140-240 cents yields a third of 380 cents, near 17 HC and just short of  $5/4$ , thus moving beyond the realm of large Zalzalian or middle thirds, and into that of small major thirds. The fuzzy boundary between these realms might be found somewhere in the region of 372-378 cents, another open and perhaps mostly academic question, given the flexibility of intonation in practice and the importance of context.

## CONCLUSION

In this survey I have sought mostly to focus on Systematist *Buzurg* as a fascinating and beautiful *genus*, and to search for this variety of tetrachord in more recent Near Eastern modal practice. Identifying a few of these manifestations is only a starting point for delving more deeply both into current practice, and possibly also into comparisons of different practices and traditions that, rather like the comparative method in

linguistics, might reveal more about the evolution of these practices and lead to better reconstructions of earlier styles.<sup>126</sup>

For example, Skoulios suggests an affinity between the Byzantine Mild Chromatic as realized in the Second Mode and Turkish *Huzām*<sup>127</sup>, while Julien Jalal Ed-Dine Weiss sees a similarity between Systematist *Buzurg* and the “rare” Arabian *Maqām Sīkā Baladī*<sup>128</sup>, described by Racy as related to *Hijāz Gharīb*<sup>129</sup>.

Iranian *Esfahan* may have affinities with Arabian *Hijāz* (and Turkish *Hicaz*), given its lower *Esfahan jins* (JTJ) followed by a conjunct *jins* of TBT (like Arabian and Turkish *Nahawand* or *Būsālīk*), in a pattern analogous to Turkish *Maqām Humāyūn* (with conjunct *ajnās* of *Hijāz* and *Būsālīk*); and with a later shift of focus upward to a *jins* of *Shur* or *JJT* (like Arabian *Bayātī* or Turkish *Ushshāq*) at the fifth above the lowest step of the *Esfahan jins* (analogous to Turkish *Maqām Uzzāl*, with disjunct *ajnās* of *Hijāz* and *Ushshāq*).<sup>130</sup> Here the obvious difference is that in *Esfahan*, the final is the fourth note of the lower *jins*, while in *Hijāz* it is the first note.

Exploring such proposed similarities should lead to a better appreciation of these modal forms, whatever it may reveal about similarities or differences.

One lesson of both the Systematist literature around 1300 and of recent studies on contemporary practice is that the intonational spectrum for a category such as *Hijāz* has been and remains very broad and diverse. That lesson of variety, in theory and yet more in the practice which theory seeks very imperfectly to record and codify, is as important as any of the particulars here described.

<sup>126</sup> I am indebted to Ozan Yarman for dialogues in which we discussed the possibilities for this kind of “comparative method” for Near Eastern modal traditions.

<sup>127</sup> Skoulios [2012, p. 25] terms this the “mild chromatic.”

<sup>128</sup> [Pohlit, 2011, p. 121]; the comparison to *Sīkā Baladī* accompanies a diagram of a *Buzurg* pentachord at 14:13-8:7-13:12-14:13-117:112 (Fig. 4.17). *Ibid.* at p. 119 and Fig. 4.12, the *jins* 13:12-8:7-14:13 (in our terms, a “*Buzurg* tetrachord”) is associated with a “(hypothetical) form” of *Hijāz Gharīb*; at p. 150 and Fig. 4.50, the same *jins* is associated with “Iranian *Esfahan*.”

<sup>129</sup> Racy [2004, p. 110-111, and n. 49-50] provides some information on *Sīkā Gharīb* or *Sīkā Baladī*, the latter name meaning a “local,” “country,” or “folk” *Sīkā*, and explains that *Sīkā Gharīb* or *Baladī* may resemble *Hijāz Gharīb* while subtly differing in placing more emphasis on the third note of the tetrachord, “as would happen” in *Sīkā*, “rather than on the fourth” as in *Hijāz*.

<sup>130</sup> On the opening structure of *Esfahan* as conjunct *ajnās* of JTJ-TBT centered on the final, with a subsequent shift of focus to *Shur* or *JJT* at a tone above the final (and an eventual return to the lower focus of the opening *ajnās*), see [Farhat, 2004, p. 76-80]. On Turkish *Humayūn* as a conjunct *Hijāz* tetrachord and *Būsālīk* pentachord, and Turkish *Uzzāl* as a disjunct *Hijāz* pentachord and *Ushshāq* tetrachord, see [Ederer, 2011, p. 459-460, and Fig. 116-117].

<sup>125</sup> [Tala'i, 2000, p. 12, Chart 4, “Chahargah”].



## PLATES

## Table of Buzurg, Hijaz, and related tetrachords

HC = Holderian commas or 53-division; CU = Chrysanthos units or 68-division

Mo = Byzantine *moræ* or 72-division; Sa = Savarts or 301-division

Ibn Sina (c. 980-1037), tetrachord fitting later Systematist JTJ category

1:1	13:12	39:32	4:3
0	138.6	342.5	498.0
13:12	9:8	128:117	
138.6	203.9	155.6	

Buzurg c. 1300, lower version, e.g. Shiloah's Anonymous LXII

1:1	14:13	16:13	4:3
0	128.3	359.5	498.0
14:13	8:7	13:12	
128.3	231.2	138.6	

Buzurg c. 1300, higher version, e.g. Qutb al-Din al-Shirazi

1:1	13:12	26:21	4:3
0	138.6	369.7	498.0
13:12	8:7	14:13	
138.6	231.2	128.3	

Hijaz c. 1300, Qutb al-Din al-Shirazi

1:1	12:11	14:11	4:3
0	150.6	417.5	498.0
12:11	7:6	22:21	
150.6	266.9	80.5	

Nidaa Abou Mrad's Buzurg variation, for era of c. 1300, based on tuning of al-Farabi

1:1	12:11	27:22	4:3
0	150.6	354.5	498.0
12:11	9:8	88:81	
150.6	203.9	143.5	

Nidaa Abou Mrad's deduced chromatic variation on Buzurg or Hijaz, for era of c. 1300, based on tuning of al-Farabi

1:1	12:11	81:64	4:3
0	150.6	407.8	498.0
12:11	297:256	256:243	
150.6	257.2	90.2	

HC = Holderian commas or 53-division; CU = Chrysanthos units or 68-division  
 Mo = Byzantine *morīæ* or 72-division; Sa = Savarts or 301-division

Iranian Homyun, Ahmad Ebadi as measured by Jean During

0 Sa	38.4 Sa	105.3 Sa	123.3 Sa			
0	153.1	419.8	494.0			
<table><tr><td>38.4 Sa 153.8</td><td>66.9 Sa 266.7</td><td>18.6 Sa 74.2</td></tr></table>				38.4 Sa 153.8	66.9 Sa 266.7	18.6 Sa 74.2
38.4 Sa 153.8	66.9 Sa 266.7	18.6 Sa 74.2				

Iranian Homyun, Ahmad Ebadi as measured by Jean During, second version

0 Sa	37.7 Sa	105.7 Sa	126.8 Sa						
0	150.3	421.4	504.3						
<table><tr><td>37.7 Sa</td><td>68.0 Sa</td><td>20.8 Sa</td></tr><tr><td>150.3</td><td>271.1</td><td>82.9</td></tr></table>				37.7 Sa	68.0 Sa	20.8 Sa	150.3	271.1	82.9
37.7 Sa	68.0 Sa	20.8 Sa							
150.3	271.1	82.9							

Turkish Hicaz, Ekrem Karadeniz tuning

0 HC	5.5 HC	18.5 HC	22 HC						
0	124.5	418.9	498.1						
<table><tr><td>5.5 HC</td><td>13 HC</td><td>3.5 HC</td></tr><tr><td>124.5</td><td>294.3</td><td>79.2</td></tr></table>				5.5 HC	13 HC	3.5 HC	124.5	294.3	79.2
5.5 HC	13 HC	3.5 HC							
124.5	294.3	79.2							

Syrian Hijaz Gharib according to Tawfiq al-Sabbagh and Ali Jihad Racy

0 HC	6 HC	16 HC	22 HC						
0	135.8	362.3	498.1						
<table><tr><td>6 HC</td><td>10 HC</td><td>6 HC</td></tr><tr><td>135.8</td><td>226.4</td><td>135.8</td></tr></table>				6 HC	10 HC	6 HC	135.8	226.4	135.8
6 HC	10 HC	6 HC							
135.8	226.4	135.8							

Turkish Hicaz, Kudsi Erguner as measured by Amine Beyhom

0 HC	6 HC	16 HC	22 HC						
0	131	368	501						
<table><tr><td>6 HC</td><td>10 HC</td><td>6 HC</td></tr><tr><td>131</td><td>237</td><td>133</td></tr></table>				6 HC	10 HC	6 HC	131	237	133
6 HC	10 HC	6 HC							
131	237	133							

Turkish Karcighar, Ozan Yarman's Hicaz genre in one version of Yarman24 tuning

1/1	12/11	26/21	4/3			
0	150.6	369.7	498.0			
<table><tr><td>12:11 150.6</td><td>143:126 219.1</td><td>14:13 128.3</td></tr></table>				12:11 150.6	143:126 219.1	14:13 128.3
12:11 150.6	143:126 219.1	14:13 128.3				

HC = Holderian commas or 53-division; CU = Chrysanthos units or 68-division  
 Mo = Byzantine *moræ* or 72-division; Sa = Savarts or 301-division

Chrysanthos of Madytos 1832, Byzantine Diphonic, trichordal, 64-division(?)

0	7	19	26
0	131.25	356.25	487.5
[7, 131.25	12] 225.0	[7,... 131.25	

Chrysanthos of Madytos 1832, Byzantine Tetrachordal Chromatic, 68-division

0 CU	7 CU	25 CU	28 CU
0	123.5	441.2	494.1
7 CU 123.5	18 CU 317.6	3 CU 52.9	

Byzantine Mild Chromatic, Patriarchal Commission on Music, 1881

0 Mo	8 Mo	22 Mo	30 Mo
0	133.3	366.7	500.0
8 Mo 133.3	14 Mo 233.3	8 Mo 133.3	

Byzantine Tense Chromatic, Patriarchal Commission on Music, 1881

0 Mo	6 Mo	26 Mo	30 Mo
0	100.0	433.3	500.0
6 Mo 100.0	20 Mo 333.3	4 Mo 66.7	

Iranian Esfahan, Nelly Caron and Dariuche Safvate

0 Sa	32 Sa	92 Sa	125 Sa
0	128	368	500
32 Sa 128	60 Sa 240	33 Sa 132	

Iranian Esfahan, Hormoz Farhat's "Old Esfahan" as found in his tar or setar tuning

G	Ap	Bp	C
0	135	340	500
135	205	160	

Iranian Esfahan, Hormoz Farhat's possibly unintended Buzurg-like version on D or re

D	Ep	F>	G
0	135	360	495
135	225	135	



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