Safī al-Dīn al-Urmawī and the Theory of Music:

Al-Risāla al-sharafiyya fī al-nisab al-taʿlīfiyya

Content, Analysis, and Influences

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SAFĪ AL-DĪN AL-URMAWĪ AND THE THEORY OF MUSIC:
AL-RISĀLA AL-SHARAFIYYA FI AL-NISAB AL-TAʾLĪFIYYA
CONTENT, ANALYSIS, AND INFLUENCES

Dr. Fazli Arslan*

Introduction

One of the most important figures of the history of Middle Eastern music is Safī al-Dīn 'Abd al-Mumin al-Urmawī (d. 1294). One meets his name in the introductions to most of the books written in the field of the theory of Eastern music. Al-Urmawī analyzed thoroughly the Greek sources and the works of Muslim scholars such as al-Kindī, al-Fārābī and Ibn Sinā. He studied the practical music of his time scientifically and systematized it. The theory and practice of this systematization can be found in his main treatise al-Risāla al-sharafiyya fi al-nisab al-taʿlīfiyya (The Sharafian Treatise on Musical Proportions).

It is acknowledged that the contribution of Safī al-Dīn al-Urmawī is of tremendous importance in the chain of theoretical works in the history of Arabic music starting with al-Kindī. He studied the sciences in al-Mustansiriyya school in Baghdad and was well known as a celebrated calligrapher and writer of literature. Safī al-Dīn was also a good physicist and a performer of the 'ūd (oriental lute). Being famous with his compositions abroad, Safī al-Dīn invented two musical instruments and trained students in the fields of calligraphy and music. "Old Orient Sound System with 17 Notes" which was systematized by Safī al-Dīn was considered as one of the best sound systems by some writers. It is thanks to this system and other achievements that he was claimed as Zarlino of the Orient.

The works of Safī al-Dīn in the field of music theory, Kitāb al-adwār (The Book of Musical Modes) and al-Risāla al-sharafiyya fi al-nisab al-taʿlīfiyya were the sources for many authors who wrote about the theory of music for several centuries after his time. Qutb al-Dīn Mahmud al-Shirāzī (d. 1310), Abd al-Qadr b. Ghasībī al-Marāghī (d. 1435), Fath Allāh Mūmin al-Shirwānī (d. 1486), Muḥammad b. 'Abd al-Hamīd al-Lādhīqī (d. 1494) and Alishah b. Haci Buke (d. 1500) are some of the writers who relied on Safī al-Dīn in their works.

The treatise al-Risāla al-sharafiyya consists of five discourses under different headings. Its content is analysed in this article. A special focus is laid on the mathematical fundamentals of music in the second, third and fourth discourses of the book. The parts of the works of al-Kindī al-Fārābī and Ibn Sinā that benefited to Safī al-Dīn are also indicated. Finally, the traces of al-Sharafiyya are tracked by showing references to it in some works written in later centuries, in order to emphasize the impact of the book on the subsequent studies and the innovations it brought.

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1 The study is based on the Arabic text that I have extracted from the three oldest manuscript copies of al-Sharafiyya in Turkey (The Language and History-Geography Faculty, Saib Sencer MS I/4810; Topkapı Palace Museum Library, Ahmad III, MS 3460; Nuruosmani Library, MS 3647) and the copy in Paris Bibliotheque Nationale, MS 2479.
First Discourse of *al-Sharafiyya*

In the first discourse of *al-Sharafiyya*, composed of five subheadings, Safi al-Dîn examined the theory of sound and approached the subject by narrating ideas mostly from al-Fârâbî and partly from Ibn Sinâ. In this discourse, Safi al-Dîn explains the ideas of al-Fârâbî on the formation of sound and points out what he considers as the defective aspects of the Second Master's analysis. He defines the note and explains the reasons of the acuity and gravity. In this context, he examines some ideas of al-Fârâbî and Ibn Sinâ on this subject and indicates that he disagrees with them and states the falsity of their opinions. Then he explains the reasons of the acuity and gravity in the stringed and wind instruments, before he writes on the features of the note.²

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Figure 1. Cover of the CD-Rom issued in February 2007 "Music of the Abbasid Era: The Legacy of Safiyya a-d-Dîn al-Urmawi" by the violonist and musicologist Nidaa Abou Mrad and the Arab classical music ensemble of Antonine University (Lebanon).

Second Discourse

This chapter is about ratios of numbers to each other, making up of intervals, the ratio of the intervals made up, the levels and names of consonance and dissonance.

The Ratio between the Numbers:

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According to Safi al-Din there is always a ratio between two numbers. He arranged them as 12 parts. Firstly, two numbers are equal to each other (the position of equality) if there is no equality between the numbers, there is one of the ratios below:

**Mithl and guz**: First level 1+1/2 (3/2), then continuing to infinity 1+1/3 (4/3), 1+1/4 (5/4). This super particular is the ratio of (1+1/N).

**Mithl and agzā**: the first level of this goes on like 1+2/3 (5/3), 1+3/4 (7/4), 1+4/5 (9/5)...

**Di’f and guz**: starts with 2+1/2 (5/2) and goes on like 2+1/3 (7/3), 2+1/4 (9/4) ...

**Di’f and agzā**: starts with 2+2/3 (8/3) and goes on like 2+3/4 (11/4), 2+4/5 (14/5) ...

**Amthal**: First level is 3 and then goes on like 5, 6, 7, 9 ...

**Amthal and guz**: First level goes on like 3+1/2 (7/2), 3+1/3 (10/3), 3+1/4 (13/4) ...

**Amthal and agzā**: First level goes on like 3+2/3 (11/3), 3+3/4 (15/4) ...

**Ada’f**: First level is 4, then goes on like 8, 16. In order to keep the word short Safi al-Din says "guz’ and agzā are added like this and goes on forever". That is to say, *ada’f and guz’* starts with 4+1/2 (9/2), 4+1/3 (13/3), and *ada’f and agzā* with 4+2/3 (14/3) then goes on like 4+3/4 (19/4) ....

Then he showed all the ratios between the two numbers on a thread divided into 12 equal parts in order to make us see all the ratios practically.

Let us have a look at the ratios between numbers on this figure.

<table>
<thead>
<tr>
<th>M</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>h</th>
<th>V</th>
<th>Z</th>
<th>H</th>
<th>T</th>
<th>Y</th>
<th>YA</th>
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</tr>
</thead>
</table>

The Names of the Intervals:
Safi al-Din names the intervals which he calls "usable". He points out that the rest is recognized with their ratios. The intervals are:

1. **Zu’l-kul merrateyn** (two octaves): The first of the intervals Safi al-Din names. The interval positioned between YB/C, H/B, D/A is the first level of *ada’f* level. Its ratio is 2/1x2/1=4/1.
3. **Zu’l-kul vel erba’** (octave and tetra chord): H/C interval is an example for this. 2/1x4/3=8/3.
4. **Zu’l-kul** (octave): It is positioned between the intervals of YB/V, Y/h, H/D, V/C, D/B, B/A. Its value is 2/1.
5. **Zu’hams** (penta chord): The first of *mithl and guz’* levels. It is positioned between YB/H, T/V, V/D. Its ratio is 3/2.

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3 These 11 ratios which are out of the numbers of equality are mentioned in *Mukaddimāt al-usūl* as it was mentioned in *al-Sharafīyya*, Alishah b. Haci Buke, *Mukaddimāt al-usūl*, University of Istanbul, The Library of Ancient Works, The Department of Persian Manuscripts, MS 1097, fol. 5a. For more details on the intervals and ratios in al-Shirwānī, see al-Shirwānī, *Majalla fī al-mūsāq*, fol. 39.
6. Zu’l-erba (tetra chord): The intervals of YB/T, H/V, D/C. The second level of *mithl* and *guz* at tetra chord. Its ratio is 4/3.

In spite of the fact that Safi al-Din says the intervals mentioned above is recognized with their names and the rest is recognized with their ratios, he also points out that the interval of 9/8 is known as "tan’înî" (whole-tone) and the one with 256/243 is called *bakiyye* (remnant/limma). Among the ones he named there is also an interval called *irkha* and he indicates that this is the quarter of "tan’înî (9/8)".

![Figure 2. First page of "Kitab al-adwar" by Safi al-Din.](image)

In the treatises of al-Kindî, the terms octave, penta chord, tetra chord and tan’înî (9/8) are frequently encountered⁴. In the *Risāla fi al-mūsîqi* of Ikhwân al-Safâ, there is no information on the ratios of the numbers with each other in the way Safî al-Dîn put forward. However, the sentences in Ikhwân al-Safâ about this subject are important. "The best compositions are the ones produced with the most consonant ratios"⁵. Then, it is pointed out that these consonant ratios are 2/1, 3/2, 4/3, 5/4, 9/8⁶. In the *Sixth Risâla* of Ikhwân al-Safâ where "numbers, the effect of numerical ratios on the people and the ratios related to music" mostly take place, these subjects are examined: "The ratio is a measure between two amounts. When the two numbers are compared to each other, both are either equal or not. If there is no equality between the two numbers, one is either smaller or larger than the other. When the smaller one is compared to the larger one, there are nine positions. These are: 3/2, 4/3, 5/4, 6/5, 7/6, 8/7, 9/8, 10/9, 11/10... Besides, the ratios of *di’f* (two fold), *mithl* and *guz*, *mithl* and *agza*, *di’f* and *guz*, *di’f* and *agza* and *ada’f* are also indicated"⁷.

After naming nine harmonious intervals as octave, penta chord, tetra chord, tan’înî, mujannab, bakiyye, two octaves, octave and penta chord, octave and tetra chord, Shirwâni points out that the consonant intervals

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⁶ Ibid, i, 164.
are 12 in practice and he adds three octaves, two octaves and penta chord, two octaves and tetra chord to the ones mentioned above.8

**The Parts of Intervals:**

Safi al-Dīn divides the intervals he explains into three parts; large, middle and small.

1. Large Intervals: Two octaves, octave and penta chord, octave and tetra chord and octave intervals.

2. Middle Intervals: Penta chord and tetra chord intervals.

3. Small Intervals: The intervals such as 5/4, 6/5 and 7/6... He calls the small intervals as "lahnī" (melodic) and further subdivides them into three:
   a. Large lahnī intervals; 5/4, 6/5, 7/6 ratio intervals.
   b. Middle lahnī intervals; 8/7, 9/8, 10/9 ratio intervals.
   c. Small lahnī interval; the intervals starting with 11/10 and continuing.

![Figure 3. Extract from the colophon page of "Kitab al-adwar" by Safi al-Dīn.](image)

Compared to the performers of his period, Safi al-Dīn points out that lahnī intervals are divided into three. These are the extra intervals the biggest of which is 9/8, middle one is 14/13 and the smallest one is 256/243. He claims that all consonant melodies are made up of these three because the other lahnī intervals look and sound like each other. Therefore, he explains that 9/8 is used instead of 8/7 and 10/9, and that instead of all middle intervals 14/13, and instead of all small lahnī intervals 256/243 is used.

**Consonant and Dissonant Intervals**

Later on, Safi al-Dīn divides the intervals he described into consonants and dissonants.9 He divides the consonants into two as first level consonants and second level consonants:

1. Octave intervals; the major consonant and the most natural one of the intervals.

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8 Al-Shirwānī, Majalla fi al-mūsīqī, fols. 59-66.
9 For an identical definition, see al-Shirwānī, ibid, fol. 59.
2. Second level consonant intervals; two octave, octave and pent chord, octave and tetra chord intervals.

Then there is the pent chord and tetra chord. The intervals of 5/4, 6/5 and 7/6 out of these are the weak consonant intervals. As for the small lahnī, the most consonant of them are 8/7 and 9/8. He points out that as the intervals get smaller, so does the weakness.

![Figure 4. Extract from a scene of music (Hadith Bayād wa Riyādh), 13th century](http://expositions.bnf.fr/livraranab/grands/099.htm).

Ibn Sinā divides the intervals into three as large, middle and small intervals. Octave intervals were classified by Ibn Sinā as large interval, tetra chord and pent chord intervals as middle, and the others coming after tetra chord are classified as lahnī. To Ibn Sinā also, the large lahnī intervals are the ones with 5/4, 6/5, 7/6, 8/7, 9/8, 10/9, 11/10, 12/11, 13/12 and 14/13 ratios. Middle lahnī intervals are the ones from 15/14 to 29/28. The others starting with 30/29 are the small lahnī intervals.

Al-Lādhīqi classified intervals as large, middle and small in the same way as Safī al-Dīn and pointed out that this classification belongs to Safī al-Dīn. This classification also exists in Al-Shirwānī. The large and middle intervals Rauf Yekta pointed out with a heading of "consonant intervals" are the same as those recorded by Safī al-Dīn. Yekta pointed out all the other intervals except these as "small intervals" and showed them to the staff.

**The Third Discourse of al-Sharafiyya**

The main topic of this third part of the treatise is about the addition, division, subtraction of the intervals and the formation of these kinds.

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13 Yekta, *Türk Musikisi Nazariyâti*, p. 94; Also see *Traité anonyme*, pp. 34-41.
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The Addition of the Intervals:
Safi al-Dīn starts the third discourse with the processes of the addition, division and subtraction of the intervals. If two intervals are equal to each other the numerator and the denominator are multiplied by each other while being added. The biggest (uzmā) and the smallest (suğrā) number of the interval are obtained. Then in order to find the medium (wasat) number, the numerator of the one is multiplied by the denominator of the other as these two are of equal ratios. If we add the two tetra chords, it is 4x4=16 which is uzmā side. 3x3=9 gives the number which is suğrā, while 4x3=12 is the medium number. So, three numbers are formed, which are 16, 12, and 9. It is obvious that 16/12=4/3.

If we want to add a third tetra chord to these, we should do the arithmetic of 16/9x4/3. Calculating this we get 64, 48, 36, and 27 – which are numbers whose ratios to each other subsequently are 4/3.

If one of the two intervals is big and the other is small, we multiply the numerator and the denominator by each other. Let us add 4/3 and 9/8. The result is 4/3 x9/8=36/24 and these are the big and small sides. Later on, if we want to leave the tetra chord at the beginning side or in Safi al-Dīn’s words "if we want to do the addition on the high in pitch (tiẓ) side", we multiply the denominator of the tetra chord by the numerator of the other ratio. That is to say, it is 3x9=27 which is one of the wasat numbers. In other words, in the ratios between the three numbers 36, 27, 24, pent chord comes at the beginning side and taninī comes after that: 36/27=4/3 and 27/24=9/8.

If we want to do the addition at the low in pitch (pest) side, that is, if we want to leave the taninī at the beginning, then we multiply the denominator of the taninī by the numerator of the tetra chord. In this case the medium number is 32. In other words, as it is seen between the numbers of 36, 32, 24, 36/32=9/8 is at the beginning side, 32/24=4/3 is at the end.

The Division of the Intervals:
If we divide any interval into two equal parts, the process to be done is to multiply the numerator and the denominator of the interval by 2 and to find the medium (wasat) number by adding half of the difference between the big number we get and the small number. For example: we divide 4/3 into two; we get 4x2=8 and 3x2=6 and these are the big and the small sides. For the medium number, we add 1 which is half of 2, the difference of 8 and 6 into the small side. This number is 7. We get the numbers of 6, 7 and 8. In this case a tetra chord is divided into two intervals as 8/7 and 7/6.

The intervals can also be divided into more than two parts. If so, the number intended to be divided into how ever many numbers is multiplied by the numerator and the denominator.

The Subtraction of the Intervals from Each Other:
As we want to subtract a small interval from a big interval, if the ratio to be subtracted is intended to leave at the high in pitch side, firstly the numerator of the big side and the denominator of the small side are multiplied and then the denominators are multiplied by each other. Let us subtract 3/2 from 4/3. It is 3x3=9, 3x2=6. We multiply 2 by 4 for the wasat number. We get the numbers of 9, 8, and 6 which is a process when we want 9/8 to leave at the high in pitch side. Here, 9/8 is at the high in pitch and 4/3 ratio which exists between 8 and 6 is left at the low in pitch side. If we want to leave the ratio to be obtained at the low in pitch side, in this case we multiply the denominators by each other. The result is 12. As it is seen, the ratio of 9/8 which is between the numbers of 12, 9, 8 is at the low in pitch side.
The subjects of the addition, the division and the subtraction of the intervals do not take place in Treatises of al-Kindī, and Rasāʿīl of Ikhwān al-Safā. Al-Fārābī studied this subject in detail as "simple numerical relations between the intervals". Ibn Sinā allocated the second discourse of his work to this subject. The first part of the second discourse, which he divided into two, is about the addition of the intervals with each other and their subtraction from each other, while the second part is about redoubling the intervals and their division.

Later on, the addition, subtraction and division of the intervals were dealt with by subsequent authors. Al-Lādhīqī dedicated the second part of his treatise to this topic, and Rauf Yekta dealt with it in detail in the chapter Müzikînin Mebâdi-i Riyâziyesi (The Preliminary Mathematics of Music).

The Arrangement of the Intervals within Tetra chord and Constituting the Kinds:
Safi al-Dīn arranged tetra chords, from 5/4 to 256/243, with lahnī intervals. And this is no more than three intervals and four notes called jins (kind). If the ratio of the biggest of the intervals in tetra chords is bigger than the total sum of the other two, it is called layyîn (weak) kind. The rest is called qawî (strong) kind.

In a tetra chord there are three ratios bigger than the other two. These are 5/4, 6/5, 7/6. Layyîn is divided into three. The one whose biggest interval is 5/4 is called râsim (enharmonic), the one with 6/5 is lawnî (chromatic) and the one with 7/6 is named nâzîm (chromatic). The following one will be 8/7, which is not bigger than the other two ratios; it is classified in the qawî (diatonic) kinds.

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14 Al-Fārābī, Kitâb al-mûsiqî al-kabîr, pp. 188-204.
15 Ibn Sinâ, Gawâmî’ ilm al-mûsiqî, pp. 33-41.
16 Al-Lâdhîqî, al-Risâla al-fathîyya, fols. 46a-52a; see also al-Shirwâni, Majalla fi al-mûsiqî, fols. 83-89; Traité anonyme, pp. 47-50.
17 See Türk Musikisi Nazariyati, pp. 35-45.
Layyin classes are arranged as follows:

\[ \begin{align*}
\text{Rāsim (daif/feeble)} & : \quad \frac{5}{4}\times\frac{32}{31}\times\frac{31}{30} = \frac{4}{3}. \\
\text{Rāsim (eşed/firm)} & : \quad \frac{5}{4}\times\frac{24}{23}\times\frac{46}{45} = \frac{4}{3}. \\
\text{Lawni (feeble)} & : \quad \frac{6}{5}\times\frac{19}{18}\times\frac{20}{19} = \frac{4}{3}. \\
\text{Lawni (firm)} & : \quad \frac{6}{5}\times\frac{15}{14}\times\frac{28}{27} = \frac{4}{3}. \\
\text{Nāzim (feeble)} & : \quad \frac{7}{6}\times\frac{16}{15}\times\frac{14}{13} = \frac{4}{3}. \\
\text{Nāzim (firm)} & : \quad \frac{7}{6}\times\frac{12}{11}\times\frac{21}{20} = \frac{4}{3}. \\
\end{align*} \]

Next come qawī (strong) kinds:

\[ \begin{align*}
\text{First non-conjunct (feeble)} & : \quad \frac{8}{7}\times\frac{14}{13}\times\frac{12}{11} = \frac{4}{3}.
\text{First non-conjunct (firm)} & : \quad \frac{8}{7}\times\frac{21}{19}\times\frac{18}{17} = \frac{4}{3}.
\text{Second non-conjunct (feeble)} & : \quad \frac{9}{8}\times\frac{64}{59}\times\frac{59}{54} = \frac{4}{3}.
\text{Second non-conjunct (firm)} & : \quad \frac{9}{8}\times\frac{48}{43}\times\frac{86}{81} = \frac{4}{3}.
\text{Third non-conjunct (feeble)} & : \quad \frac{10}{9}\times\frac{12}{11}\times\frac{11}{10} = \frac{4}{3}.
\text{Third non-conjunct (firm)} & : \quad \frac{10}{9}\times\frac{9}{8}\times\frac{16}{15} = \frac{4}{3}.
\end{align*} \]

The following ones are the kinds formed by putting the two equal ratios together. These are zü't-tadi'f (doubling) kinds. They are arranged in three classes:

\[ \begin{align*}
\text{First doubling} & : \quad \frac{8}{7}\times\frac{8}{7}\times\frac{49}{48} = \frac{4}{3}.
\text{Second doubling} & : \quad \frac{9}{8}\times\frac{9}{8}\times\frac{256}{243} = \frac{4}{3}.
\text{Third doubling} & : \quad \frac{10}{9}\times\frac{10}{9}\times\frac{27}{25} = \frac{4}{3}.
\end{align*} \]

Safi al-Dīn reminds us that bakiyye interval is named for 256/243 in "second doubling kind" and points out that this is the most often used; it is called zü'l-müddeteyn.

Then three intervals are arranged with the two ratios following each other in a tetra chord; this kind is called muttasil (conjunct /continuous).

\[ \begin{align*}
\text{First conjunct} & : \quad \frac{8}{7}\times\frac{9}{8}\times\frac{28}{27} = \frac{4}{3}.
\text{Second conjunct} & : \quad \frac{9}{8}\times\frac{10}{9}\times\frac{16}{15} = \frac{4}{3}.
\text{Third conjunct} & : \quad \frac{10}{9}\times\frac{11}{10}\times\frac{12}{11} = \frac{4}{3}.
\end{align*} \]

Thereafter, the kinds formed as not following each other but formed as skipping one ratio are arranged. These kinds, called munfasil (disjunct), are three parts:

\[ \begin{align*}
\text{Feeble disjunct} & : \quad \frac{8}{7}\times\frac{10}{9}\times\frac{21}{20} = \frac{4}{3}.
\text{Medium disjunct} & : \quad \frac{8}{7}\times\frac{11}{10}\times\frac{320}{297} = \frac{4}{3}.
\text{Firm disjunct} & : \quad \frac{9}{8}\times\frac{12}{11}\times\frac{11}{10} = \frac{4}{3}.
\end{align*} \]

After finishing the kinds he arranged under the consideration of the tetra chord as composed of three intervals, Safi al-Dīn points out that it is possible to divide the tetra chord into four intervals opposite to the
general rule of "a tetra chord is composed of three intervals". This is most conveniently classified in two ways.

First: 13/12x14/13x13/12x96/91=4/3.
Second: 13/12x14/13x15/14x16/15=4/3.

The second one is arranged as 24 classes and the most convenient one is the first class (13/12, 14/13, 15/14, 16/15); it is called as the first single kind (Isfehān). Safi al-Dīn subtracts 16/15 from the tetra chord and names the rest the second single kind (Rāhewī).

The Consonant and Dissonant of the Kinds:
Safi al-Dīn divides these kinds into three classes: major consonant, mid consonant and weak consonant. The first one of the qawī kinds is the most consonant, the most well known and the most used one with its six classes.

36 classes of layyin (rāsim, lawnī, nāzim classes) are weak harmonious. They are not used. Safi al-Dīn points out that the tetra chord with 9/8x9/8x256/243 (diatonic) ratio is mostly used. He also explains that it is also possible for the person studying into this letter to arrange many kinds out of the ones he himself arranged.

Thus, Safi al-Dīn emphasizes on these kinds hugely in his work. This subject was dealt with in detail in al-Fārābī. Before him, al-Kindī also had explained three kinds: taninī (including every diatonic kinds), lawnī (including every chromatic kinds) and te'liftī (composed kind –including every enharmonic kinds). Taninī is composed of "taninī-taninī-fadla" (ton-ton-limma) intervals. Lawnī is arranged as fadla-fadla-three halves taninī; (1 ½ tone). Te'liftī kind is arranged as irkha-irkha-two taninī (tones). 18

Al-Fārābī examined layyin and qawī kinds under the heading of "the arrangement and classes of the kinds" in detail. Although it has a great similarity with al-Fārābī's, Safi al-Dīn's approach never refers to al-Fārābī in the third discourse dedicated to the arrangement of the kinds. 19

Ibn Sinā allocated the third discourse of his Gawāmi' ilm al-mūsīkā of Kitāb al-Sifā to the kinds. Defining these kinds, as they are composed of three intervals and four notes, he calls them "lahnī". Qawi kinds are explained in the third discourse and lawnī ones are in the fourth part. 20 Two other authors hit upon the kinds issue. While al-Lādhīqi devoted a large place in his work to the topic, 21 al-Shirwānī never mentioned it, arguing that "it would exceed the capacity of his brief work.". 22

Rauf Yekta takes this subject into his work and explains it completely in parallel with Safi al-Dīn. 23 After examining all the kinds Safi al-Dīn did, Rauf Yekta explains: "After this tiring work, maybe it will be asked how many tetra chords consonants with each other were obtained. As a response, we would say with shyness that only four consonants were decided and a tetra chord was obtained. The others were confined into the theoretical books. Additionally, these obscured the ideas of the European artists who attempted to

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18 For detailed information, see Risāla fi khubr sinā'at al-ta'li'f (Turabi, p. 124).
19 Al-Fārābī, Kitāb al-mūsīqā al-kabīr, pp. 276, 317.
20 For details see: Ibn Sinā, Gawāmi', pp. 45-46.
21 See al-Lādhīqi, al-Risāla al-fathiyya, fol. 53a; Traité anonyme, pp. 51-76.
22 See al-Shirwānī, Majalla fi al-mūsīqā, fol. 99.
do unfruitful works to realize them while they were unveiling the mystery of the kinds in Greek music so many centuries later”.

![Figure 6. Extract from Abû Ma'şhar al-Balkhi's Kitâb al-mawâlid.](image)

**The Fourth Discourse of al-Sharâfiyya: The Arrangement of the Kinds in Big Layers**

**The Formation of Two Octaves with Tetra chords and Tanînî Intervals:**

In this part, Safî al-Dîn firstly arranges two octave scales with tetra chords. He calls the tetra chords in two octaves *tabaka* (layer) and mentions the first, second, third, fourth layers subsequently. He calls *tanînî fâsila* in this arrangement. In this case, an octave composed of two tetra chords (*tabaka*) and a tone (*fâsila/tanînî*) and two octaves consist of four tetra chords and two tones.

He arranges the tetra chords and *tanînî* intervals mentioned above within two octaves as nine classes. In the first three classes *fâsila* is at the low in pitch side, tetra chords are at the high in pitch side, in the second three classes *fâsila* is at the high in pitch side and tetra chords are at the low in pitch side, in the third three classes ”*fâsila* intervals” are in the medium and tetra chords are at the low in pitch and high in pitch sides. Also, there are two tetra chords and a *tanînî* in the second octave. In the second octave *tanînî* intervals change their position in each class and they are at the low in pitch, the high in pitch and the medium. Safî al-Dîn marked the tetra chords as "C", and the *tanînî* intervals as "B" and he arranged the sequences like this:

- If the two *fâsila* (*tanînî*) are both at the low in pitch side; *munfasil al-athql*.
- If the two *fâsila* are at the high in pitch side; *munfasil al-ahad*.
- If the first *fâsila* is at the low in pitch and the other is at the high in pitch, then a tetra chord is at the medium; *muttasil*.
- If the two *fâsila* are between the tetra chords; *munfasil al-awsat* or *fâsila al-wustā*.

---

The symbols, ratios and names of these nine classes which he arranged in two octaves with tetra chords and tanin intervals are as follows:

I. C-C-B C-C-B: 4/3x4/3x9/8x4/3x9/8=4/1=4: Munfasil al-ahad
II. C-C-B B-C-C: 4/3x4/3x9/8x4/3x9/8=4: Munfasil al-ahad al-athqal
III. C-C-B C-B-C: 4/3x4/3x9/8x4/3x9/8=4: Munfasil al-ahad al-awsat
IV. B-C-C B-C-C: 9/8x4/3x4/3x4/3=4: Munfasil al-athqal
V. B-C-C C-C-B: 9/8x4/3x4/3x9/8x4/3x9/8=4: Munfasil al-athqal al-ahad
VI. B-C-C C-B-C: 9/8x4/3x4/3x9/8x4/3x9/8=4: Munfasil al-athqal al-awsat
VII. C-B-C C-B-C: 4/3x9/8x4/3x9/8x4/3x9/8=4: Munfasil al-awsat
VIII. C-B-C C-C-B: 4/3x9/8x4/3x4/3x9/8x4/3x9/8=4: Munfasil al-awsat al-ahad
IX. C-B-C B-C-C: 4/3x9/8x4/3x9/8x4/3x9/8=4: Munfasil al-awsat al-athqal

The two octaves are arranged by combining the tetra chords as shown above.

Al-Fārābī called "tanin-tetra chord-tetra chord" arrangement "munfasil al-athqal", "tetra chord-tetra chord-tanin" arrangement munfasil al-ahad, "tetra chord-tanin-tetra chord as munfasil al-awsat. He made this two arrangements in two octaves and he called the arrangement of tanin-tetra chord-tetra chord tanin-tetra chord-tetra chord munfasil cem-i tām, "tetra chord-tetra chord-tanin-tetra chord-tetra chord" was called munfasil cem-i tām, "tetra chord-tanin-tetra chord tetra chord-tanin-tetra chord" was called cem’ al-ictima. Al-Fārābī did not use such symbols as "C" for tetra chords and "B" for taninis intervals like Safī al-Dīn.25

The Arrangement of Tetra chords in One Octave with the Intervals at Kinds:

Safī al-Dīn arranges munfasil al-ahad with some of the kinds he made up in his third discourse. Munfasil al-ahad (C-C-B) is composed of the intervals of 4/3x4/3x9/3=2/1. He arranges the tetra chords in munfasil al-ahad firstly with the intervals of "first non-conjunct kind" (gayr-i muttasil). First non-conjunct kind’s intervals are 8/7x14/13x13/12=4/3. He arranges the first and the second tetra chord from these intervals and puts 9/8 at the end in order to complete the circle. Safī al-Dīn points out that he doesn’t use "layyin kinds" as they are dissonant and some of the qawi kinds as they are very near in value.

25 See. Al-Fārābī, Kitāb al-mūṣiqī al-kabīr, p. 329-332; This subject was taken place in al-Lādhiqi and Traité anonyme just like the one in al-Sharafiyya. See al-Risālah al-fathiyya, fols. 38a-41a and Traité anonyme, pp. 78-91.
I. Munfasil al-ahad in lower octave is composed of these intervals as it is used with the intervals of "first non-conjunct kind" (ghayr-i muttasil):

Octave

II. Munfasil al-ahad, with the intervals of "second non-conjunct".
9/8x64/59x59/49x9/8x64/59x59/54x9/8=2/1.

III. With the intervals of "third non-conjunct ";
10/9x12/11x10/9x12/11x10/9x12=2/1.

IV. With the intervals of "first conjunct" (muttasil);
8/7x9/8x64/59x59/49x9/8x64/59x59/54x9/8=2/1.

V. With the intervals of "second conjunct ";
9/8x10/9x16/15x9/8x10/9x16=2/1.

VI. With the intervals of "third conjunct ";
10/9x11/10x12/11x10/9x12=2/1.

VII. With the intervals of "first doubling" (zūl-tadīfī);
8/7x8/7x9/8x64/59x59/49x9/8x64/59x59/54x9/8=2/1.

VIII. With the intervals of "second doubling";
9/8x9/8x256/243x9/8x9/8x256/243x9/8=2/1.

IX. With the intervals of "third doubling";
10/9x10/9x27/25x10/9x10/9x27=2/1.

X. With the intervals of "first disjunct (feeble)" (munfasil);
8/7x10/9x21/20x8/7x10/9x21=2/1.

XI. With the intervals of "second (medium) disjunct";
9/8x11/10x320/297x9/8x11/10x320/297x9/8=2/1.

XII. With the intervals of "third (firm) disjunct";
10/9x12/11x11/10x10/9x12=2/1.
arrangement of munfasil al-ahad and with the types of qawī kinds mentioned above. These are 12. Reflecting on the first table, the others will go on at the same order, he does the same arrangement of munfasil al-ahad in the lower octave in two octaves. The ratios are:

I. With the intervals of "first non-conjunct kind" (ghayr-i muttasil).

II. With the intervals of "second non-conjunct";
\[
\frac{9}{8} \times 64 / 59 \times 59 / 54 \times 9 / 8 \times 64 / 59 \times 59 / 54 \times 9 / 8 = 4 / 1 = 4.
\]

III. With the intervals of "third non-conjunct";
\[
10 / 9 \times 12 / 11 \times \frac{320}{297} = 4.
\]

IV. With the intervals of "first conjunct/muttasil";
\[
\frac{8}{7} \times 9 / 8 \times \frac{256}{243} = 4.
\]

V. With the intervals of "second conjunct";
\[
\frac{9}{8} \times \frac{27}{25} = 4.
\]

VI. With the intervals of "first disjunct" (munfasil);
\[
\frac{10}{9} \times 10 / 9 \times 10 / 9 = 4.
\]

VII. With the intervals of "second disjunct";
\[
\frac{8}{7} \times \frac{9}{8} \times 10 / 9 \times \frac{27}{25} = 4.
\]

VIII. With the intervals of "third disjunct";
\[
\frac{9}{8} \times 10 / 9 \times 10 / 9 = 4.
\]
Safi al-Dīn indicates that when examined the most consonant one and the best one to the human nature of these scales are two scales of "second doubling kind" (zu’t-tad’il al-thanī) (9/8x9/8x256/243=4/3 and 10/9x10/9x27/25=4/3) "second conjunct kind" (muttasīh; (9/8x10/9x16/15=4/3).

Common Notes in the Scales:
Safi al-Dīn explains with an example how other kinds in octave can be arranged. Such as the scale arranged with the intervals of "the second conjunct kind" in the bass octave:

```
A  B  C  D  h  V  Z  H
9/8 10/9 16/15 9/8 10/9 16/15 9/8
```

The order of 9/8x10/9x16/15=4/3 here is the ratios of "the second conjunct kind" with those of the first class. The third class of the same kind is like 10/9x16/15x9/8=4/3. This third class here exists between B and h. As it is mentioned here it is possible to see several more tetra chords in this way in these scales. Safi al-Dīn calls them "bahr".

The tetra chord between B and h here is accepted as "second bahr". Also, C-V tetra chord is the ratios of "the second conjunct kind" with its sixth class and it is called the "third bahr" in the scale. D-Z tetra chord is the "fourth bahr" and the ratios are the same as those of the first one. h-H tetra chord has the same values as those of the second tetra chord. Safi al-Dīn calls the total of these bahr (tetra chordal species) in one octave as "şadd".

Safi al-Dīn gave the bahrs (tetra chords) mentioned above in his Kitāb al-adwār in one octave with the keys of Rāst scale.26 In al-Sharafiyya he showed the eight different octaves which are in two octaves that he presented with a table.27

The Accordatura of Stringed Instruments and Ūd:
Safi al-Dīn says that all the sounds exist in one string but one string is not enough to compose and perform it and that two, three, four or more stringed instruments were invented for this purpose. Two stringed instruments can be accorded in different ways. The most common one is the tetra chordal accord. The 'ūd, which is considered to be the most perfect and well known of the instruments, is a five string instrument. The one at the top is the bamm and then comes mathlath, mathnā, zīr and hādd strings.

The 'ūd instrument is named as the most excellent instrument of all in Ikhwān al-Safā28 and the most famous one in al-Fārābī.29 The same idea is expressed in the following books. The reason why the instrument is called "ūd kāmil" (the perfect lute) is because it includes all the notes.30

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26 Safi al-Dīn, Kitāb al-adwār, Yale University, The Beineke Rare Book and Manuscript Library, MS S 73, fol. 30.
27 Alishah presented seven scales of one octave which he showed in an Ushshūl scale of two octaves with their names. He pointed out these full scales are called "all sorts of kinds". Alishah b. Haci Buğa, Mukaddimati al-Uṣūl, fol. 29b; also see for bahr Al-Lādhiqī, al-Risāla al-fathya, fol. 76a; for common notes see Traité anonyme, p. 103.
28 Ikhwān al-Safā, al-Risāla fi al-mūsīqī, i, 148.
29 Al-Fārābī, Kitāb al-mūsīqī al-kabīr, p. 498.
30 Al-Lādhiqī, al-Risāla al-fathyya, fol. 88a.
The names of bamm, mathlath, mathnā, zīr are the same in each music manuscript.\textsuperscript{31} Besides, al-Kindī mentioned about the ones tying one more string named hādd below zīr string in his age, and he adds that they take five things, five senses, five fingers and planets and five prosody circles into consideration while doing this.\textsuperscript{32} Al-Fārābī allocated a great part for the ūd while he was explaining the subject of producing notes and instruments and talked about the tunes of four strings of the ūd instrument mentioned above and about the accord orders in many ways. At the end, he pointed out that one of the three ways is to add a fifth string to the ūd instrument in order to achieve the two octaves/ haddetu’l-hāddāt. Two octaves will be completed with the note when the ring finger touched on the fifth string.\textsuperscript{33}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{example}
\caption{Some instruments.}
\end{figure}

In the following works the instrument of ūd has five strings with hādd.\textsuperscript{34} The accord of ūd is a tetra chordal accord. In this case there are two octaves between the open position of the bass (A) at the top and the key where the ring finger touches at the lowest string. A-Lh. In all music manuscripts (Adwār) the accord orders between the strings of ūd is the same. According to al-Fārābī well-known accord is the one where the sound of ring finger tune of each string and the sound of open position of the lower string is equal.\textsuperscript{35} This expression is the same as the one Safī al-Dīn presented above.\textsuperscript{36}

**Determining 17 Notes on the Ūd: The Division of the Frets:**

Safī al-Dīn points out that firstly he determines seven tones in the first tetra chord on the bamm string of the ūd with ratios of "the second doubling kind" (9/8x9/8x256/243=4/3 tone-tone-limma), which he calls "zū "l-mūddeteyn", then as limma-limma-tone 9/8x9/8x256/243=4/3. He does not perform the duty to find the others, just points out the names of tones. The tones he determined is shown on a table of the ūd with their high in pitch octaves in Kitāb al-adwār and al-Sharafiyya as follows\textsuperscript{37}:

\textsuperscript{31} Al-Kindī talks about the strings of this instrument in detail both in the book Kitāb al-musawwitāt al-wataniyya (see Turabi, pp. 149-153) and in Risālah fi azqā’ khubriyya (Turabi, pp. 163-167) and he connects celestial bodies, natural events, and human morality with emotions and behaviours. Also see; Ikhwān al-Safā, i, 149, al-Fārābī, Kitāb al-mūsīqī al-kabīr, p. 502; Ibn Sinā, Gawāmi', p. 148.
\textsuperscript{32} Kitāb al-musawwitāt al-wataniyya (Turabi, p. 142).
\textsuperscript{33} Al-Fārābī, Kitāb al-mūsīqī al-kabīr, pp. 588-592.
\textsuperscript{34} Ibn Sinā, Gawāmi', p. 148; Alishah, Mukaddimat al-usūl, fol. 89a-89b.
\textsuperscript{35} Al-Fārābī, Kitāb al-Mūsīqī al-kabīr, p. 597. Here al-Fārābī tells about various accord orders of ūd.
\textsuperscript{36} Al-Kindī, al-Risāla al-kubrā fi al-ta'līf(Turabi, p. 176); Ikhwān al-Safā, i, 149, Ibn Sinā, Gawāmi', p. 148.
\textsuperscript{37} Safī al-Dīn, Kitāb al-adwār, fol. 33.
Safī al-Dīn shows the tunes on the strings after the *bamm* by giving the names. However, he tells in his *Kitāb al-adwār* the division of an octave into 17 intervals in detail and this manner is carried on in the works of following *adwār* and new works. These 17 tones (18 with its octave) are shown depending on their distance to the starting sound like this:

<table>
<thead>
<tr>
<th>N°</th>
<th>Names of the notes</th>
<th>Ratios</th>
<th>Sent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A (أ)</td>
<td>1/1</td>
<td>0,00</td>
</tr>
<tr>
<td>2</td>
<td>B (ب)</td>
<td>256/243</td>
<td>90,22</td>
</tr>
<tr>
<td>3</td>
<td>C (ج)</td>
<td>65536/59049</td>
<td>180,45</td>
</tr>
<tr>
<td>4</td>
<td>D (د)</td>
<td>9/8</td>
<td>203,91</td>
</tr>
<tr>
<td>5</td>
<td>H (ه)</td>
<td>32/27</td>
<td>294,13</td>
</tr>
<tr>
<td>6</td>
<td>V (ي)</td>
<td>8192/6561</td>
<td>384,36</td>
</tr>
<tr>
<td>7</td>
<td>Z (ز)</td>
<td>81/64</td>
<td>407,82</td>
</tr>
<tr>
<td>8</td>
<td>H (ه)</td>
<td>4/3</td>
<td>498,04</td>
</tr>
<tr>
<td>9</td>
<td>T (ث)</td>
<td>1024/729</td>
<td>588,27</td>
</tr>
<tr>
<td>10</td>
<td>Y (ى)</td>
<td>262144/177147</td>
<td>678,49</td>
</tr>
<tr>
<td>11</td>
<td>YA (ياء)</td>
<td>3/2</td>
<td>701,96</td>
</tr>
<tr>
<td>12</td>
<td>YB (ىب)</td>
<td>128/81</td>
<td>792,18</td>
</tr>
<tr>
<td>13</td>
<td>YC (ىع)</td>
<td>32768/19683</td>
<td>882,40</td>
</tr>
</tbody>
</table>

These tones are shown on a porte:

The Scales of Maqāms

After telling the harmonious arrangements of tanīnī, mujannab, and bakiyya intervals Safi al-Dīn starts to form maqām scales with these intervals. He indicates that the performers of his age have given the following names to the ranges he mentioned above and he gives the intervals:

1. Ushshāq  
   2. Nawā  
   3. Abūsalik  
   4. Rāst  
   5. Nawrūz  
   6. Irāq  
   7. Isfehān  
   8. Buzurg  
   9. Zipākand  
  10. Rāhawī

Safi al-Dīn points out that seven out of ten kinds are of 4/3 value, one is 3/2, one is 5/4 and another one is 6/5.

We can count the intervals given in the table as follows. In this case we will remember which ratios Safi al-Dīn used for tanīnī, mujannab and bakiyya intervals:
Safi al-Dīn arranges the first seven of the kinds above having the value of full tetra chord with their equals and one tanīnī, that is to say, he does it by adding the pentha chords of the same ranges into these tetra chords. While doing this he arranges them by leaving interval (tanīnī-9/8) at the high pitch side (munfasil al-ahad), at the low pitch side (munfasil al-athqal) and at the middle (munfasil al-awsat) and he points out the most used ones of the ranges.

The first kind (Ushshāq) is arranged with the first and second tetra chords with the arrangement of munfasil al-ahad, munfasil al-athqal and munfasil al-awsat as follows:

- **Munfasil al-ahad**: A-D-Z-H-YA-YD-Yh-YH: \( \frac{4}{3} \times \frac{4}{3} \times \frac{9}{8} = \frac{2}{1} \)
- **Munfasil al-athqal**: A-D-Z-H-YA-YD-YZ-YH: \( \frac{9}{8} \times \frac{4}{3} \times \frac{4}{3} = \frac{2}{1} \)
- **Munfasil al-awsat**: A-D-Z-H-YA-YD-YZ-YH: \( \frac{4}{3} \times \frac{9}{8} \times \frac{4}{3} = \frac{2}{1} \)

He says that of the three, the range arranged as munfasil al-ahad is the most used. To note, this is the range of Ushshāq arranged as tetra chord-tetra chord-tanīnī, its tetra chords are also arranged as T-T-B: \( \frac{9}{8} \times \frac{9}{8} \times \frac{256}{243} \times \frac{9}{8} = \frac{4}{3} \).

As the interval ratios of the ranges above were mentioned before, we will not mention them again here. So, a range of Ushshāq is composed of ratio values of 9/8x9/8x256/243x 9/8x9/8x256/243x9/8 = 2/1 in one octave. This is the following topic and maqām ranges are composed of the ranges arranged here. As same as above Nawā, Abūsalik, Rāst, Nawrūz, Irāq, Isfehān kinds are arranged, there occurs totally 63 scales.

Safi al-Dīn determined the ones well known among the musical artists and mostly used in these ranges. He demonstrated them in a table such as below:

<table>
<thead>
<tr>
<th>Kind</th>
<th>Arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ushshāq</td>
<td>A-D-Z-H-YA-YD-Yh-YH</td>
</tr>
<tr>
<td>Nawā</td>
<td>A-D-h-H-YA-YB-Yh-YH</td>
</tr>
</tbody>
</table>

39 This is the kind as Safi al-Dīn indicates, having a value of 5/4. The ratio is the average value of the major third with a value of 8192/6561 used in practice.

40 Safi al-Dīn gives the ratio of 6/5 for Rāhewī. But the ratio of 6/5 is the ratio used instead of the minor third with the ratio of 32/27.
Safi al-Dīn showed the one (rast) he chose among these scales with its 17 tones and indicated that the ones knowing the arrangements of the intervals would be able to show each period with the same method. Safi al-Dīn did not show all the maqāms he named and gave the intervals in the table. The ones he showed in the table are: Ushshāq, Abusalik, Nawārūz, Rāst, Husaynī, Rāhawī, Zanqūla, Irākī, Isfehān, Zirāfkand, Hijazi/Hijaz, Buzurg. He showed these maqām scales by adapting on each tone as 17 layers. However, he started from the starting sound of the second tetra chord of the former layer at each layer.

In the Treatises of al-Kindī, although the maqāms which Safi al-Dīn mentioned with the names above are not taken place, together with tanīnī, lawnī and telliī names consisting the maqāms, three more kinds and seven maqām ranges are presented. These are shown with the notes of modern time by the editors studying al-Kindī. These maqāms do not have a special name in al-Kindī but they are shown with their equal maqāms in Greek music 41. The subject of maqām is in the important topics of subsequent music manuscripts.42

Safi al-Dīn completes his work by mentioning several accords of the ād, the subject of transforming tones (nagme), in the fifth discourse the subject of īkār and composing.

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41 Turabi, pp. 83-84.
42 The source of these adwārs is Safi al-Dīn. However, there have been substantial differentiations in defining maqāms and their numbers and existed important varieties about this subject between these manuscripts. See Alishah, fols. 14b-24b; al-Lādhiqī, al-Risāla al-fathiyya, fols. 74a-74b; al-Shirwānī, Majalla fi al-mūsīqī, fol. 100; Hizir b. Abd Allah, Kitāb al-adwār, Topkapi Rewan no: 1728, fol. 63b; Traité anonyme, pp, 107-120.
Conclusion

Safi al-Dīn is a scholar who occupies an important place in the history of Eastern music in the XIIIth century. His fame relies on the influential works he wrote in the field of theoretical music. Besides being a theoretician, he was a professional music performer, a composer and an inventor of musical instruments. As in the Eastern sources, Safi al-Dīn is also one of the theoreticians that took a valuable place in the works of Western modern writers who studied Eastern music. His works had been a source for almost all the musical writings composed in subsequent centuries. These writings, are as if they were, mere annotations on the original discoveries of Safi al-Dīn. The authors of these works name Safi al-Dīn the master of this field and praise him.

The main treatise of Safi al-Dīn al-Sharafiyya is perfect in terms of both arrangement and style. This feature of the work is, as we mentioned before, due to the fact that the author knew Arabic previous literature and built upon it.

Safi al-Dīn studied the ratios between the numbers very systematically, named the intervals established with these ratios, classified them, and explained the consonance and dissonance ones in detail.

After al-Fārābī, the tetra chord divisions had never been examined in such a detailed way in any adwār. Safi al-Dīn showed all possible divisions and pointed out the most consonant of these. He mentioned the tetra chords with four intervals and penta chordal kinds and explained the consonant ones. Some writers following him avoided this topic as it is complicated and full of details, and did no more than following the same route as Safi al-Dīn.

Safi al-Dīn al-Urmawi benefited from several sequencing forms of tetra chord, penta chord and taninī intervals while he was arranging two octave ranges. While forming one and two octave ranges, he arranged the intervals of tetra chord and penta chord in several ways and formed the maqāms with the consonant ranges appearing after this work. In addition, he mentioned some topics such as the determination of 17 sound ranges, common tones of scales, transposition, performing of an instrument, the order of accords, and the performance with several accords and compositions.

The examination and naming of the maqāms in Kitāb al-Adwār and al-Sharafiyya of Safi al-Dīn were achieved for the first time. In al-Sharafiyya Safi al-Dīn arranged 63 ranges with tetra chords and penta chords, and he produced 18 maqāms out of them and showed the scales of 12 ones in the tables by adapting them into 17 tones/notes. Up until the end of the fifteenth century, there seems no great change in the classification and naming of the maqāms that Safi al-Dīn accomplished.

Having a great knowledge over the terminology of music in his age, Safi al-Dīn surveyed almost all the topics in al-Sharafiyya with a clear and understandable language and style. With the purpose of being a light for the incoming studies in the future, we believe that al-Sharafiyya's valuable work supplied some substantial contributions which should be noticed by everybody writing over theoretical music in the Islamic heritage of the past.
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