

Some Notes on Woodwind Instruments in al-Fārābī's *Kitāb al-Mūsīqī al-kabīr*

Yasemin Gökpınar ORCID: 0000-0003-1021-5657
Austrian Academy of Sciences / Ruhr-University Bochum
yasemin.goekpinar@oeaw.ac.at

Abstract

Al-Fārābī (d. 950 CE), the so-called ‘Second Master’ (Aristotle being the First Master), is known for his influential works on philosophy, especially his commentaries on Aristotle, as well as for his works on logic, physics and metaphysics, ethics, and politics. It was on behalf of al-Karḥī, Caliph ar-Rāḍī's (r. 934–940 CE) *wazīr*, that al-Fārābī wrote his *Grand Book on Music*, explaining musical concepts such as rhythm and melody to the *wazīr*. As a logician and practicing musician, he combined and improved upon different sources, such as Greek musical theory, as well as on the Arabic authors and musicians al-Kindī (d. after 870 CE) and Iṣḥāq al-Mawṣilī (d. 850 CE).

In this paper, I discuss several issues related to woodwind instruments mentioned in al-Fārābī's *Grand Book on Music*. Al-Fārābī expounds on their interconnections with the tonal production of other instruments, specifying their tone system in terms of finger positions on the fret-board of the *ūd*.

Further questions address the relation between theory and practice, as well as some considerations about the modes that seem to be common on woodwinds.

Keywords

Arabic music theory – Al-Fārābī – Woodwinds – Mediaeval music

Al-Fārābī, the exceptional Muslim scholar known to the Latin Middle Ages as Alfarabius or Avennasser, used to be referred to in the Islamic world simply as the ‘Second Master’, the first being Aristotle, whose writings are the primary basis of al-Fārābī's vast work.

Born around 257 AH/870 CE, Abū Naṣr Muḥammad b. Muḥammad b. Ṭarḥān al-Fārābī died in Damascus in the year 339 AH/950 CE. According to his *nisba*, or attribution, he or at least his family originated from Khurasan or Transoxania – both regions included settlements called by the name

of al-Fārāb. Little is known about his life. In his youth, he moved to Baghdad, and then in 331 AH/943 CE on to Syria, a keystone region for the transmission of Greek literature to the Arabic-writing community.¹ His supremely influential philosophical works comprise original writings and commentaries on Aristotle's books on logic, physics and metaphysics, ethics, and politics. Introduced to philosophy primarily by the Christian Yuḥannā b. Ḥaylān, al-Fārābī also seems to have had contact with the school of Christian Aristotelians in Baghdad, especially with the famous translator Abū Biṣr Mattā b. Yūnus (d. 329 AH/940 CE).² Since music was an integral part of the canon of knowledge known as the quadrivium, it was natural that al-Fārābī would write about music theory as well, all the more so because he may have been a practising musician himself.³

His *Grand Book on Music* (*Kitāb al-Mūsīqī al-kabīr*) was composed on behalf of al-Karḥī, Caliph ar-Rāḍī's (r. 297–322 AH/934–940 CE) *wazīr*, to whom he explains musical concepts ranging from the basics of harmonic theory up to questions of rhythm and melodic composition.⁴ The only existing full translation of the book into a European language was published in French by Rodolphe d'Erlanger between 1930 and 1935, notably before the Arabic text had even been edited for the first time. More recently, George Dimitri Sawa translated the two chapters about rhythm, while Alison Laywine is currently preparing an English translation of the entire work.⁵

Apart from the *Grand Book*, seven other works by al-Fārābī are known to have dealt with music. Only three of these, however, seem to have survived, including a short chapter in the *Iḥsā' al-ʿulūm* ("Classification of the sciences"), which was known in Latin translation in Europe, the *Kitāb al-Īqā'āt* ("Book on rhythms") and the *Kitāb Iḥsā' al-Īqā'āt* ("Book for the basic comprehension of rhythms"). The latter have both been translated into English by Sawa and into German by Eckhard Neubauer, together with editions of the texts.⁶ None of these texts comes anywhere close to the comprehensiveness of the *Kitāb al-Mūsīqī al-kabīr* and its richness of sources regarding harmonic theory and melody. In contrast, al-Fārābī's two other works on rhythm are crucial for understanding his conception of rhythm, being revisions of the comparatively opaque explanations in the corresponding chapters of the *Grand Book*.⁷

Al-Kindī (d. after 870) had already used Greek sources to some extent, but it was not until al-Fārābī's times that a greater number of Greek works bearing on music – such as Aristotle's *De anima*, works by Aristoxenus, Euclid, Nicomachus and Ptolemy – had been translated into Arabic.

¹ Janos 2015; Druart 2016.

² Janos 2015 mentions Abū Biṣr as "possibly" one who "shaped" al-Fārābī's philosophical thought. For al-Fārābī's connection to the Greek Philosophical School of Alexandria, cf. Vallat 2004; Watt 2008; cf. also Lameer 1997; Endreš 2003; D'Ancona 2017.

³ Sawa 2015a.

⁴ Sawa 2015a.

⁵ Druart 2016.

⁶ Sawa 2015a.

⁷ Cf. Sawa 2009.

Al-Fārābī combined different sources and improved on them. For example, he drew on Greek musical theory as well as on the Arabic authors and musicians al-Kindī, Iṣḥāq al-Mawṣilī⁸ (d. 850) and Ibn al-Munağğim⁹ (d. 913). Al-Fārābī's double approach of scientific description and evaluation, as well as of considerations concerning musical practice, make his book a veritable treasure trove of Arabic music theory.

An important part of this treasure is formed by the chapter on musical instruments. Although its section on the ʿūd is naturally the biggest, due to the importance of this instrument as the model for displaying harmonic structures, al-Fārābī also pays considerable attention to woodwinds.

Here this investigation will concern itself with the scales and tonal range of these instruments. How does he describe the notes they play? Does he refer to different sizes of instruments with different ranges? Does he differentiate between notes in different octaves? Between modes? Pursuing these questions will also put us in a better position to assess al-Fārābī's understanding of the relationship between theory and practice. Neubauer's¹⁰ and especially Sawa's¹¹ works on rhythm have opened an important field of music theory. With this article on tonal material of musical instruments and al-Fārābī's attempts to transfer the lute-based pitches to the fingerholes of the woodwind instruments, I hope to further our understanding of the *Kitāb al-Mūsīqī al-kabīr* in its entire musicological context, filling in another lacuna in the development of Arabic music theory.

After reflecting on theoretical issues and various ratios, al-Fārābī starts his chapter on woodwinds by detailing the general conditions that would affect the pitches of these instruments. Subsequently, he presents four different woodwind instruments of his time, specifying their respective pitch ranges: these instruments are the *mizmār muzdawiğ murakkab* (Arabic: "composite double *mizmār*"), the "most common *mizmār*", the *surnāy* (Persian: "festive flute"), and the *mizmār muzāwağ* (Arabic: "paired *mizmār*"), which is also known as *mizmār muṭannā* (Arabic: "doubled *mizmār*") or *dūnāy* (Persian: "two flutes").

The first of these instruments, the *mizmār muzdawiğ murakkab*, consists of two pipes that are connected to a third, into which the player blows. From the central pipe two or more connections lead to the left and right pipes. Al-Fārābī states that it is difficult to predict the precise pitches because it would be impossible to determine the proportions of air going into the different pipes. Therefore, he says, the ratios of the notes at the bridges do not always correspond to the ratios that one might predict on the basis of the fingerhole positions. Consequently, these instruments were built according to the makers' experience and the model of existing pipes. From al-Fārābī's description of the *surnāy*, where he stresses the pipes' conical nature, we may guess that the pipes of this instrument were mostly cylindrical, although he does not expressly state this.

⁸ Cf. al-Fārābī, *K. al-Mūsīqī al-kabīr*, 58 Ḥašāba.

⁹ Cf. al-Fārābī, *K. al-Mūsīqī al-kabīr*, 102 Ḥašāba.

¹⁰ Neubauer 1968–9; Neubauer 1994.

¹¹ Sawa 2009; Sawa 1989: 35–70.

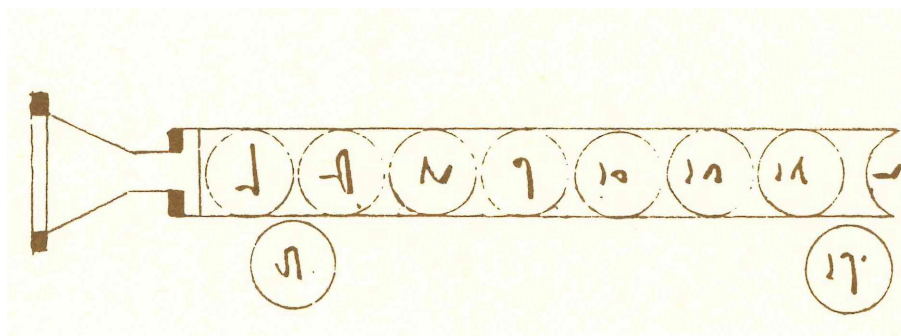


Figure 1: Sketch of the “most common *mizmār*”, including its mouthpiece, Ms. Istanbul, Köprülü, 953, facs. ed., 296 (courtesy of Eckhard Neubauer).

Al-Fārābī does not detail the nature of the mouthpieces of any woodwind instrument. However, all six extant manuscripts¹² include drawings of the *mizmār muzdawīğ murakkab*, the “most common *mizmār*” and the *mizmār muzāwāğ* (but not the *surnāy*), which show trapezoid mouthpieces. The drawings of Ms. 953, Köprülü (Istanbul) pp. 294, 296, 303, which represent these with protecting caps on their ends, especially suggest a double-reed. On the other hand, these drawings, although doubtless deriving from a common archetype, may not go back to the author’s autograph. There is therefore a chance that they derive from some copyist’s contemporary understanding that does not necessarily reflect what al-Fārābī had in mind. Similarly, the trapezoidal shape might also have spread from one illustration to others by mistaken generalisation. Other ‘wrong’ details, such as hugely oversized fingerholes, shed further doubt on the accuracy of the extant copies, not to mention serious problems with the representation of a double reed on the *mizmār muzdawīğ murakkab* – a topic we cannot further pursue here.

The second instrument is what al-Fārābī calls the “most common *mizmār*”, whose notes correspond to the ones on the *‘ūd*. Its single pipe must also have been cylindrical, both externally and internally. It has seven finger holes of similar diameter aligned on the upside, one thumbhole on the back, and one additional lateral hole close to the lower end. In his discussion, al-Fārābī identifies the individual holes by assigning letters of the traditional *abğad* alphabet to them. In this way, the finger holes are labelled with ascending pitch as Ğ, D, H, Z, Ḥ, Ṭ, Y, the alphabetical series being continued with K for the thumb hole. The initial A is reserved for the end of the bore at the bottom of the pipe; accordingly, B is assigned to the hole between A and Ğ.

The next instrument is the *surnāy*, variants of which appear still to be played in Turkey (*zurna*), in the Balkans, in Iran, India and elsewhere, all equipped with double reeds. Al-Fārābī describes this instrument as having a conical corpus, which confirms the assumption of not only linguistic, but genuine organological continuity with modern *zurna*-type instruments. Its side holes are once more associated with letters. Eight are aligned on the upside (from the highest hole downwards: A, B, Ğ, D, H, Z, Ḥ, Ṭ), supplemented by one on the left (N) and one on the right hand (M) close to

¹² Ms. 953, Köprülü (Istanbul): 294, 296, 303; Ms. 876, Rağıp Paşa (Istanbul): ff. 118v, 120r, 122r; Ms. or. 651 (Leiden): ff. 77v, 78r, 81r; Ms. res. 241 (Madrid): 116, 117, 122; Ms. C 40 inf. (Ambrosiana): ff. 126r, 127v, 130v.; Ms. 220b, Garrett (Princeton): ff. 65r, 66r, no image of the *mizmār muzāwāğ*.

the exit. Once more, the thumbhole (**K**) comes last in the alphabetic series, preceded by the exit of the main bore at the bottom of the instrument (**Y**). As for the pitch of this instrument, al-Fārābī states that it is an octave above that of the others.

Finally, another double instrument is presented: the *mizmār muzāwağ*, for which the author also gives the alternative names of *mizmār muṭannā* and *dūnāy*. The illustration in the manuscript Ms. 953, Köprülü (Istanbul) 303, suggests that it consisted of two double-reed pipes, like the *aulos* of antiquity. However, we should probably not rule out the possibility that they may in fact have rather been single-reed instruments, similar to reedpipes still found in Egypt, North Africa, and the Levant under the names such as *miğwiz* or *zummāra*. On the other hand, in contrast to the tubes of the *mizmār muzāwağ*, those of the modern instruments either play in unison, pairs of matching holes being operated by a single finger positioned across the entire instrument, or, in the case of the modern *arğūl*, consist of one drone pipe and one melody pipe. In any case, al-Fārābī does not clarify the nature of this instrument's mouthpiece in the text any more than those of the other instruments.

In contrast to the first of the four woodwinds, its two tubes are only tied together in parallel or at an acute angle, meaning that there are no internal connections between them, and the player must blow into both at the same time. When naming the holes by means of the *abğad* alphabet, al-Fārābī remains once more reticent about the absolute or relative placing of the holes, so the drawings of the Köprülü manuscript with their huge holes do not reflect anything that is said in the text. The *mizmār muzāwağ* has no thumbholes, but four and five holes respectively on the upper side. Al-Fārābī describes them as follows: the bores at the end of the tubes are called **A** and **B**, tube **A** has five holes, labelled, from **A** upwards, as **Ğ**, **D**, **H**, **Z**, and **Ḥ**, and tube **B** has only four holes, from **B** upwards, **L**, **K**, **Y** and **Ṭ**.

Considering the labelling of the holes on the three instruments, to the holes of which labels are attached at all, the variety is striking. The *abğad* starts like this: **A**, **B**, **Ğ**, **D**, **H**, **W** (which al-Fārābī always omits), **Z**, **Ḥ**, **Ṭ**, **Y**, **K**, **L**, **M**, **N**... For the “most common *mizmār*”, this series starts from the lowest pitch. The opposite is true for the *surnāy*, where a descending series starts from the letter **A** for the finger hole next to the mouthpiece, while the last letters **K**, **M** and **N** are assigned to the additional holes. The labelling of the *mizmār muzāwağ* is more complex: the tubes are named **A** and **B**, but otherwise, the tube of **A** is labelled upwards, that of **B** downwards. Evidently, the letters merely follow his line of reasoning in the text.

But how does al-Fārābī refer to available notes? Given his intimacy with ancient Greek music theory, one might expect to find the Greek terms of the Greater Perfect System, or a loan translation, perhaps including a description of the intervals between the individual notes. Indeed, he equates the Greek designations with the Arabic *abğad* earlier in his book, when regarding the theoretical basis of music theory.¹³

¹³ Al-Fārābī, *K. al-Mūsīqī al-kabīr*, 506 Ḥašaba.

أ	A	lowest-pitched open string: <i>bamm</i>
ب	B	(two <i>leimmata</i> (<i>baḡiyyatān</i>) or half a tone (<i>niṣf ṭanīnī</i>) lower than the index finger on the <i>bamm</i>), omitted in Figure 2 for reasons explained in the text
ج	Ĝ	index finger on the <i>bamm</i>
د	D	Zalzalian middle finger on the <i>bamm</i>
هـ	H	third highest open string (<i>maṭlat</i>)
ز	Z	index finger on the <i>maṭlat</i>
ح	Ḥ	Zalzalian middle finger on the <i>maṭlat</i>
ط	Ṭ	second highest open string (<i>maṭnā</i>) or little finger on the <i>maṭlat</i>
ك	K	above (<i>muḡannab</i>) the index finger of the <i>maṭnā</i>
ي	Y	index finger on the <i>maṭnā</i>

Table 1: Pitches played on the “most common *mizmār*”

However, in describing existing musical instruments, al-Fārābī chooses a different method. Further exploring a path that had been laid out by earlier theorists, he uses finger positions on the fretboard of the *ūd* to specify both relative pitches and range of the woodwinds. Like many modern lutes, the Early Islamic lute was tuned in fourths,¹⁴ as we already know from al-Kindī’s description, which predates al-Fārābī. The same author also details fret positions, all derived from a framework of pure fifths and fourths. So the index finger fret plays a note a whole tone above the open string (9/8), the middle finger fret a minor third (32/27), the ring finger fret a major third (81/64), and the small finger fret a fourth (4/3), coinciding in pitch with the next higher open string.¹⁵ In the passage under scrutiny, al-Fārābī also stresses several times that the position of the small finger is equal to the next open string, which offers further evidence that his strings are still tuned in fourths. For the instrument called *mizmār muzdawiḡ murakkab*, al-Fārābī cannot give any note equivalents in terms of finger positions, but he does do so for the other three.

Here the focus will be on only two of these instruments : the “most common *mizmār*” and the *mizmār muzāwaḡ*, the first giving an example of how al-Fārābī specifies pitches, and the second illustrating al-Fārābī’s use of elements of Greek music theory.

1 The “most common *mizmār*”

Al-Fārābī warns the reader that one cannot predict the pitches of the “most common *mizmār*” on the basis of its physical properties, in the ways he had described in the opening paragraphs of his section on woodwinds. While the instruments would thus not play the desired scales straightforwardly, because of unavoidable imprecisions of construction, the required notes are nevertheless elicited by the players by careful manipulation (e.g., by means of embouchure?). Being interested in the musical uses of the instruments, al-Fārābī details the pitches actually played, providing their equivalents on the *ūd*, as indicated in Table 1, Figure 2, and Figure 3. Instead of the diatonic middle-finger fret described above, al-Fārābī here refers to an alternative fret position, the “Zalzalian

¹⁴ Söhne 1994: 366; cf. Neubauer 1993.

¹⁵ Söhne 1994: 365.

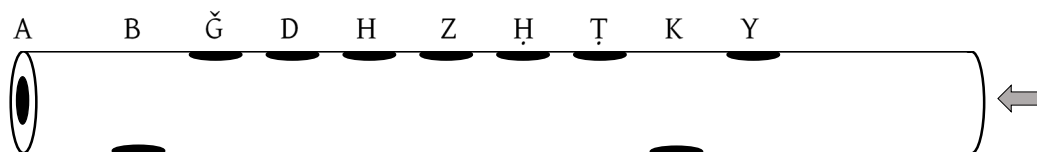


Figure 2: The “most common *mizmār*”. The exit end of the pipe, sounding the bass note, is on the left.

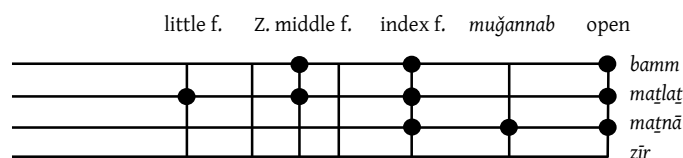
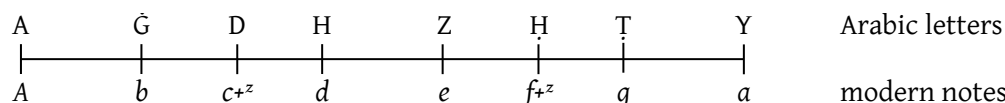


Figure 3: The equivalents of the notes of the “most common *mizmār*” as fret positions on the ‘ūd

middle finger”. Earlier, he had defined this position as lying halfway between the ring-finger fret and the “Persian middle-finger fret”. The latter in turn sits halfway between the index and ring finger frets.¹⁶ As a result, the Zalzalian fret creates a neutral third with its open string (and with the index fret on the next higher string).¹⁷ In terms of intervals, al-Fārābī therefore describes a scale of tone, three-quartertone interval, another three-quartertone interval, tone, three-quarter-tone interval, another three-quartertone interval, tone – if we omit the somewhat strange pitches of **B** and **K** for the moment:



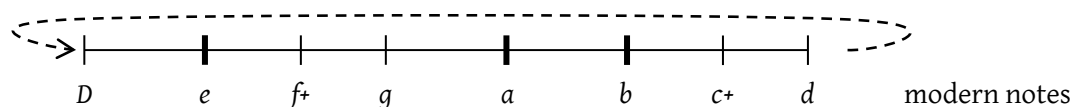
The scale thus includes what later theory describes as tetrachords of the *rāst* type. Currently, a *rāst* octave scale is usually conceptualised as comprising, in rising direction, two disjunct ‘tetrachords’ (*ağnās*, Sg. *ğins*), each consisting of a tone, a three-quartertone interval, and another three-quartertone interval:



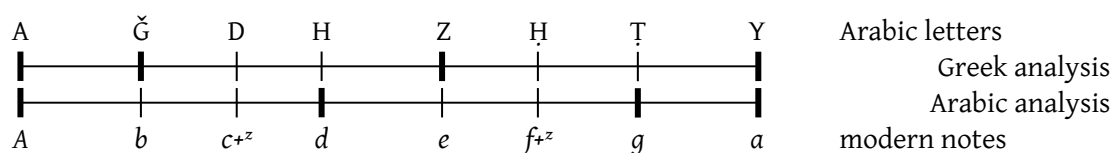
In terms of Greek music theory, in contrast, nominal tetrachords always have their smaller intervals at the lower end. On this basis, the same scale cannot be described as an octave falling nicely within tetrachord boundaries; instead, the highest interval of the higher tetrachord would appear transferred to the lower end of the octave (resulting in a ‘Phrygian’ octave species):

¹⁶ Al-Fārābī, *K. al-Mūsīqī al-kabīr*, 511 Ḥašaba.

¹⁷ Ideally, the third below calculates as 354.5 cents (27:22), slightly more than an equally tempered neutral third of 350 cents. Conversely, the third above would amount to 347.4 cents (11:9).



Al-Fārābī's *rāst*-like octave, however, is of a different composition, so that it happens to fit well within both the Greek and the later Arabic paradigm. In the Greek view, two conjunct tetrachords (such as *hýpaton* and *mésou*), each consisting of two three-quartertone intervals followed by a tone are complemented by a tone beneath (*proslambanómenos*),¹⁸ in the shape of a 'Hypodorian' octave species. The 'Arabic' analysis, in contrast, would posit two conjunct tetrachords that have their whole tones at their lower ends, below the additional tone:



Regarding the second note (**B**) and the seventh note (**K**), at first glance they seem to be what al-Fārābī describes as alteration of the index finger on the *ūd*. As such they might serve as an embellishment called *tabdīl* ('replacement'). Sawa translates al-Fārābī's explanation of *tabdīl*¹⁹ as follows:

"(a) Those [ornamental notes] which replace some of the fundamental notes are, in order of preference, the octave, then the fifth, and the octave + fifth, then sometimes the fourth; (b) then the neighbouring notes which are mixed in a group such as [a note produced] by the anteriors to the index finger to replace the index finger; (c) the most successful replacements are those which occur in the middle of a piece." (Sawa 1989: 97)

Our concern here is the second type of *tabdīl* (b), the replacement of fundamental notes by means of their neighbouring notes. This may be what the scale of the "most common *mizmār*" tells us: Instead of the index finger, one of its *muğannab* (neighbouring) positions is used, but only at the beginning of the scale (**B**) and at the end (**K**). In the middle (**Z**) the fifth stays unaltered. As the linking point between the two tetrachords, it seems that it must not lose its function by means of alteration. But this applies only if the use of eight fingers plus one thumb to grasp all the finger holes is assumed.

But this is exactly the crux of the problem: al-Fārābī describes the position of note **B** as "between [the end of the bore at the bottom of the pipe (**A**)] and the holes on the back of the instrument",²⁰ so – like the thumb hole **K** – opposite of the other finger holes. This means, unless the player uses his knee, **B** cannot be fingered! Al-Fārābī has only temporarily stated that the note sounding from hole **B** is heard either two *leïmmata* (*baqiyyatān*) or half a tone (*nişf ṭanīnī*) lower than the index finger on the *bamm*. Later, however, he writes verbosely about **B** as a kind of overflow hole that regulates the air supply by redirecting the surplus of air not needed for the pitch of

¹⁸ Cf. Hagel 2018: 452–53.

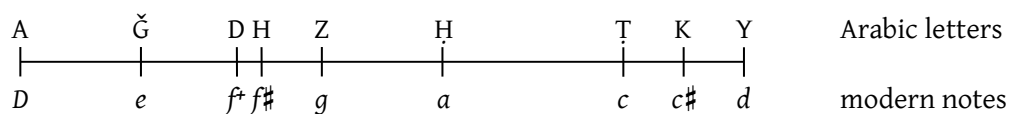
¹⁹ Al-Fārābī, *K. al-Mūsīqī al-kabīr*, 1060–61 Ḥašāba.

²⁰ Al-Fārābī, *K. al-Mūsīqī al-kabīr*, 781 Ḥašāba.

note **A**. Only by reducing the air coming out of hole **A** by means of hole **B**, can note **A** be heard as the fundamental note, namely as the equivalent of the open *bamm*. This means that hole **B** stays open most of the time, “unless in case of exception or *tašbī*”,²¹ the latter being a kind of embellishment of the melody.²² This is a strange claim, however, since the hole is not accessible to any finger. At the end of the corresponding paragraph, al-Fārābī adds that some *mazāmīr* do not need the additional hole **B** because there is no air surplus. This statement can be taken as a hint to the construction of the instrument. If it is well planned, no additional hole **B** will be needed. Otherwise, hole **B** is apparently required for adjusting the tuning, curtailing the air column of the deepest note (and not for any embellishment).

Al-Fārābī also offers two alternative tunings, the first of which utilises both the Zalzalian middle finger and the ring finger (a major third above the respective open string), which is rather unusual, since middle-finger and ring-finger notes of the same string are normally mutually exclusive (Table 2 and Figure 4).

Leaving aside the original positions, the alternative notes by themselves form the intervals of a semi-tone, a tone, a minor third, and a tone. This scale does not make much musical sense in terms of either Arabic or Greek music theory. When we supply the unchanged notes of the original scale, the scale looks like this:



In fact al-Fārābī explains that usually *mizmār* players do not use the note of the middle finger position on the *ūd* together with that of the ring finger on the *ūd*.²³ This restriction to one mode within a composition is known, for example, in Ibn al-Munağğim’s (d. 913) *Kitāb an-Nağam*,²⁴ who,

أ	A	open <i>bamm</i>
ب	B	tuning adjustment, therefore omitted in Figure 4
ج	Ĝ	index finger on the <i>bamm</i>
د	D	Zalzalian middle finger on the <i>bamm</i> ?
هـ	H	ring finger on the <i>bamm</i>
ز	Z	open <i>maṭlaṭ</i>
ح	H	index finger on the <i>maṭlaṭ</i>
ط	T	little finger on the <i>maṭlaṭ</i> or the open <i>maṭnā</i>
ك	K	above (<i>muğannab</i>) the index finger of the <i>maṭnā</i>
ي	Y	index finger on the <i>maṭnā</i>

Table 2: First alternative scale of the “most common *mizmār*”

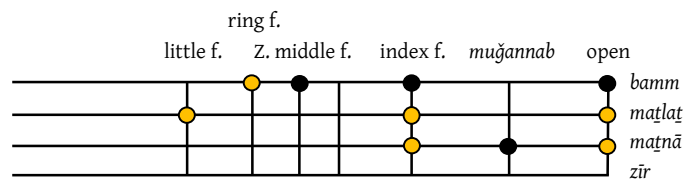


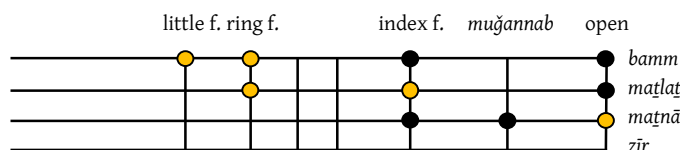
Figure 4: First alternative scale of the “most common *mizmār*” as fret positions on the fretboard of the *ūd*. The changes indicated by al-Fārābī are coloured.

²¹ Al-Fārābī, *K. al-Mūsīqī al-kabīr*, 786–787 Ḥašaba.
²² Sawa 2015b: 225–26.
²³ Al-Fārābī, *K. al-Mūsīqī al-kabīr*, 784 Ḥašaba.
²⁴ Wright 1966: 28–29; Neubauer 1995–6: 266–67; 310–13.

ا	A	open <i>bamm</i>
ب	B	actually for tuning adjustment, therefore omitted in Figure 5
ج	Ĝ	index finger on the <i>bamm</i>
د	D	ring finger on the <i>bamm</i>
ه	H	little finger on the <i>bamm</i>
ز	Z	index finger on the <i>maṭlat</i>
ح	Ḥ	ring finger on the <i>maṭlat</i>
ط	Ṭ	open <i>maṭnā</i>
ك	K	above (<i>muḡannab</i>) the index finger of the <i>maṭnā</i>
ي	Y	index finger on the <i>maṭnā</i>

Table 3: Second alternative scale on the “most common *mizmār*”

however, asserts that there are also songs using eight, nine or ten notes, i.e., obviously transcending a single mode.²⁵ Accordingly, the first tetrachord beginning from the open *bamm* may be diatonic with a Zalzalian middle finger or a ring finger (major third above open string). The second tetrachord is striking in that it features neither. This cannot be a lacuna in the manuscripts, particularly as there is no gap in the assignment of the notes to the letters of the *abḡad* alphabet.²⁶ Rather, there may be a hint as to musical practice here. By means of changes in lip tension the embouchure can be affected, so that the resulting pitch is raised or flattened.²⁷ In this case it would be possible to play a tetrachord of today’s *hiḡāz*, consisting of a semi-tone, a three semi-tone interval (using the *muḡannab*-position of the thumbhole **K**), and a semitone, or a diatonic ‘tetrachord’ with a minor third above the open string.²⁸

Figure 5: Second alternative scale of the “most common *mizmār*” as fret positions on the fretboard of the ‘ūd. The changes indicated by al-Fārābī are coloured.

On the other hand, pitch manipulation by means of embouchure is possible for every note, so there is no need to have two different thirds that are as close to each other as are the Zalzalian middle finger and the ring finger in the first tetrachord. Another problem arises regarding instrument making: Is it possible to drill the two holes for these two notes sufficiently close to each other? Therefore, a textual corruption or perhaps a mistake by al-Fārābī is more probable.

Al-Fārābī’s other alternative scale of the “most common *mizmār*” (Table 3 and Figure 5) features major thirds above the open strings; today one would describe it as comprising two conjunct tetrachords with an additional tone at the top (which is internally divided by the thumb hole,

²⁵ Ibn al-Munaḡḡim, *Kitāb an-Naḡam*, transl. by Neubauer 1995–6: 313–15. In his *Kitāb al-Aḡānī*, 8.373–75 (= 8.25–27 Būlāq 1285), al-İṣfahānī (d. 35 AH/967 CE) gives examples for sophisticated composers who also used eight, nine, or ten notes, either by using the middle and ring finger notes in chromatic succession, allegedly with aesthetically questionable results, or by using these fingers in separate sections of the composition; cf. also 9.43–44; 59–61, 344–45 (= 8.46, 54, 197 Būlāq 1285) “*ḡikru l-aṣwāti llatī taḡma‘u n-naḡama l-‘aṣar*” (“songs containing ten notes”). My thanks go to one of my reviewers for making me aware of this.

²⁶ All six manuscripts I was able to collate are unanimous in this respect: Ms. Istanbul, Köprülü, 953, facs. ed.: 298; Ms. Leiden, or. 651: f. 78b; Ms. Madrid, Res. 241: f. 66a; Ms. Princeton, Garrett, 1984: f. 90a; Ms. Mailand, Ambrosiana, C 40 inf.: ff. 127b–128a; Ms. Istanbul, Raḡıp Paṣa 876: ff. 120a–120b.

²⁷ Ibn Zayla, *al-Kāfi fi l-mūsīqī*, 78 Yūsuf, and al-Ḥasan al-Kātīb, *Kitāb Kamāl adab al-ḡinā*, 135 al-Ḥifnī (transl. in Shiloah 1964: 189), describe two ways of achieving notes falling in between the existing finger holes: by changing the blowing pressure, or by resorting to half opening the next higher finger hole.

²⁸ I do not dare claim that a major third can be achieved by change of lip tension without the possibility of empirical evidence.

which appears to provide a modulating note). These tetrachords consist, in ascending direction, of a tone, a tone, and a semitone; a structure that is nowadays known as *ǧins al-‘aǧam*.²⁹ In terms of ancient Greek theory, this is simply a diatonic octave, though the tetrachord boundaries would once more be analysed quite differently.

A	Ġ	D	H	Z	Ḥ	Ṭ	K	Y		Arabic letters
----- ----- ----- ----- ----- ----- ----- ----- -----										
G	a	b	c	d	e	f	f#	g		modern notes
C	d	e	f	g	a	bb	b	c		

2 The *mizmār muzāwaǧ*

Regarding the *mizmār muzāwaǧ* al-Fārābī again first names the holes of the two tubes, and then discusses the equivalent notes on the ‘ūd. Here the octaves are interesting because al-Fārābī uses two different expressions when describing them.

Both of the notes **B** and **Ḥ** of these *mazāmīr* form an octave (*bi-l-kull*). If we equate (*ǧa‘alnā... musāwīyan*) the *tamdīd* of note **B** (*tamdīd naǧmat B*) with the *tamdīd* of the note of the open *maṭlaṭ*, or if we equate it *bi-l-quwwa* with the note of the open *maṭlaṭ*, then note **Ḥ** is the [note of the] index finger on the *zīr*.

If we let note **B** correspond to (*sāwaqnā... bi...*) the note of the open *bamm*, note **Ḥ** is [the note] of the index finger on the *maṭnā*, and in general (*wa-bi-l-ǧumla*), if we let note **B** correspond to any note of any instrument, either by means of equation of *tamdīd* or *bi-l-quwwa*, then note **Ḥ** becomes equal to the upper octave (*musāwīyatan li-ṣiyāḥ*) of that note of that instrument. (al-Fārābī, *Kitāb al-Mūsīqī al-kabīr*, 796 Ḥaṣāba)

This text passage is striking because al-Fārābī uses a pair of terms here that are not immediately intelligible. The Arabic *tamdīd* is the *nomen verbi* of the verb *maddada* (II form), which means “to extend, to stretch out s. th., to spread, to elongate.”³⁰ Since both the note of the *mizmār muzāwaǧ* and the note on the ‘ūd have a *tamdīd*, from the context *tamdīd* may be thought of as the “position” of the fingers on the instrument. According to this meaning it is suggested that the term *tamdīd* may be derived from the vibration ‘stretch’ of a string, between bridge and fret. Then it might correspond to the

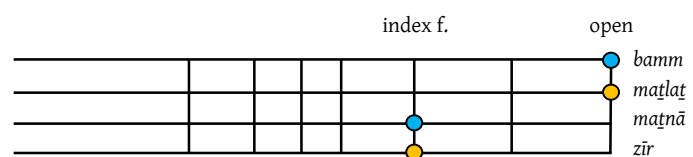


Figure 6: Two octaves on the *mizmār muzāwaǧ* as fret positions on the ‘ūd

Greek *thésis* in the music-theoretical sense of “position”. But there is another possibility. Ancient authors in the Aristoxenian tradition use the same semantic concept for expressing pitch: Their term *tásis*, “tension”, is obviously derived from the experience of tuning the strings of a lyre (or harp). Does *tamdīd* (“stretching, extension”) translate this term, and if so, can this be concluded

²⁹ Cf. ‘Abd-al-‘Azīm 1992: 15.

³⁰ Wehr 1980: 896.

from al-Fārābī's book? Indeed, it can be; for he defines the term in his chapter on *ṭabaqāt* and *tamdīdāt*³¹:

„The condition (*ḥāl*) of any note (*nağma*) in every single system (*ğam'*) of analogous systems (*al-ğumū' al-mutašābiha*) in heaviness or sharpness [=low and high pitch] – I mean the condition that it has in whatever heaviness or sharpness – is named *tamdīd*.”

(al-Fārābī, *K. al-Mūsīqī al-kabīr*, 365 Ḥašaba)

Here, al-Fārābī references the same idea as Cleonides, for example, who says: “A note (*phthóngos*) is the melodic dropping of the voice (*phōnē*) on a *tásis*.”³² This means that the voice can produce a great deal of sound, but if it is melodic (not just a noise) and drops on a *tásis*, (i.e. a certain pitch), then it is called “musical note” (*phthóngos*).

Before finishing the investigation of *tamdīd*, it is necessary to consider the other term used in explaining the octave of the *mizmār muzāwağ*: *bi-l-quwwa*. This is usually translated as “in potency, potentially, virtually”. Therefore in this case, it would mean: If the positions on the *mizmār* are equated with the ones on the *ūd*, either by playing the notes or just in potential, meaning they sound only in the imagination (“potentially”/“virtually”), then the octave is produced. What does this mean? In this case, the translation as ‘in potential’ or ‘potentially’ is imprecise. How should one imagine a note? Unless the listener has absolute pitch, they must imagine notes in relation to others.

In his chapter on registers, al-Fārābī states that a composed melody sounds similar when transposed one octave lower or higher. That is, he says, because the functions of [the notes of] the melody are identical, if they are played one octave lower or higher. They are identical *bi-l-quwwa*, though, they are not in an absolute pitch.³³

In the chapter on similar/analogue intervals (*al-ab'ād al-mutašābiha*), a similar issue occurs. Here, al-Fārābī refers to intervals whose lower note could be half or twice as low and whose higher note could be half or twice as high as the original one. Then, he says, one would call these two intervals “one [and the same] *bi-l-quwwa*” (*wāḥid bi-l-quwwa*), with the lower note of one of the intervals being “*bi-l-quwwa*” the lower note of the other one, and the higher note of one of the intervals being “*bi-l-quwwa*” the higher note of the other one.³⁴

The expression *bi-l-quwwa* here cannot be translated as ‘potentially’ or ‘virtually’, because something more than just imagining another interval is meant. Rather, *bi-l-quwwa* should be translated in terms of function. If one transposes the two notes of an interval or every single note of a melody one or two octave/s higher or lower, the interval or the melody, respectively, will still be

³¹ Al-Fārābī, *K. al-Mūsīqī al-kabīr*, 365 Ḥašaba.

³² Cleonides 1, 179 Jan: φθόγγος μὲν οὖν ἔστι φωνῆς πτωσίς ἐμμελής ἐπὶ μίαν τάσιν. Cf. Aristoxenus, *Harmonics* 1.15, 16 Da Rios.

³³ Cf. al-Fārābī, *K. al-Mūsīqī al-kabīr*, 115 Ḥašaba.

³⁴ Al-Fārābī, *K. al-Mūsīqī al-kabīr*, 357f. Ḥašaba.

heard as musically intact, and its notes will not lose their musical function within the interval or the melody. This conforms precisely to the musical meaning of Greek *dýnamis*.³⁵

So far, al-Fārābī's examples deal only with transposition by octaves. The next paragraph of his chapter on similar/analogous intervals appears to refer to transpositions by less than an octave. There, al-Fārābī says, if one transposes an interval "a small or medium [interval]" higher or lower, then these intervals are called 'similar/analogous, but differing in their *quwwa*' (*al-mutašābihūn al-muhtalifūn fī l-quwwa*). This is a significant meaning of *quwwa*. According to this statement, it seems to refer to transposition in octaves only. This implies that al-Fārābī sees musical function in an absolute sense and not in relation to other notes: Only the octave of a note has the same musical function as the original one, then. Transposition of other intervals than the octave still makes the intervals similar, nevertheless, they no longer have the same quality. They 'differ in function'.



Al-Fārābī's chapter on woodwinds is significant in several ways. It provides us with a more or less rudimentary description of four different woodwinds. Regarding their construction, al-Fārābī keeps us frequently in the dark. We fail to learn about their measurements, materials, the exact place and diameter of their finger holes. Were they arranged equidistantly? And with which kind of mouthpiece, if any, were they equipped? Most of these details would have been evident to al-Fārābī's original audience, while it can only be hoped that it is possible to collect relevant information from other sources, such as the much later Persian *Kanz at-tuḥaf*.³⁶

One major interest of al-Fārābī is to determine and describe the tonality of instruments in terms of pitches and modes. However, though al-Fārābī employs *abġad* letters for labelling finger holes and pipe exits, his labelling remains surprisingly unsystematic, although he uses Greek designations to equal the Arabic *abġad* letters with musical functions (not pitches!) when presenting the theoretical basis of music theory.

Although al-Fārābī is familiar with the Greek Greater Perfect System and otherwise uses it both transcribing the Greek terms and giving Arabic translations, when it comes to describing the various musical pitches of contemporary music, he prefers to demonstrate their equivalents on the frets of the *ūd*, which are unambiguously defined by their association with a particular finger. The use of the *ūd* as model was doubtless prompted by its reputation and popularity; in this way, al-Fārābī's readers could easily assess his assertions, and on top of this, the relation of woodwind notes to lute fingering may well have formed part of the author's everyday musical experience as a performer.

When explaining musical concepts, however, al-Fārābī refers to Greek nomenclature and theory. He differentiates between note (*naġma* = *phthóngos*) and pitch (*tamdīd* = *tásis*), *tamdīd* ("extension", "stretching out", "elongation") apparently being a translation of the Greek term (*tásis* "tension"). Another important expression is *bi-l-quwwa*, which translates Greek *dynámei*, so important

³⁵ Cf. Ptolemy, *Harmonics* 2.4.

³⁶ Cf. Tsuge 2013.

in Aristotelian philosophy, which normally refers to the concept of “potentiality”. In his book on music, however, al-Fārābī has obviously adopted its much more specific musical meaning, which features centrally in Aristoxenus’ musical thinking. Here *bi-l-quwwa* essentially describes the musical “function” (*dýnamis*) of a note (or a combination of notes) within its melodic environment. Following Aristoxenus’ and Ptolemy’s emphasis on the functional equivalence of notes an octave apart, the term becomes crucial for al-Fārābī’s description of octave relationships. Transposition by other intervals is of course possible but will not result in a melody remaining “identical *bi-l-quwwa*”, rather it will be “similar, though different *fī l-quwwa*”.

Al-Fārābī’s method in the chapter on wind instruments is systematic and theoretical insofar as he describes the instruments, discusses their susceptibility to a physical assessment of their relative pitches, labels their holes, and details the pitches resulting from them, referring to more than one way of instrument design where necessary. Notably, he does not endeavour to establish an overarching system of labelling finger holes yet, nor do his labels designate particular notes. He uses concepts of the ancient music theory of the Greeks alongside the Arabic use of the lute as reference for describing pitches.

On the other hand, al-Fārābī also considers practical issues. Although his emphasis is on notes and scales, he points to tuning customs and mentions that woodwind players did not care about theoretical aspects, but rather aimed “at improving the hole positions” without the help of theory.

Most importantly, while emphasising the theoretical relations between physical shape and pitch, al-Fārābī remains acutely aware of the inadequacies of available physical theory for predicting the pitches of many instruments. He does not hesitate to include a discussion of the *mizmār muzdawij*, even though his means are unable to account for its tuning, and though he needs to acknowledge, if indirectly, that makers drilled finger holes that were at odds with theoretical prediction and performers compensated through their blowing technique.

Acknowledgements

My special thanks go to Stefan Hagel for guiding me in concerns of Greek music theory, and to the anonymous reviewers for their valuable advice, as well as Eckhard Neubauer for the kind permission to reprint p. 296 of the facsimile of Ms. Köprülü 953. This publication is based on research funded by the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation programme (grant agreement No 787522). The views presented here, however, reflect only those of the author; the ERCEA is not responsible for any use that may be made of the information contained.

Bibliography

Editions

- Aristoxenus: *Aristoxeni Elementa harmonica*, ed. Rosetta da Rios, Rom: Officinae Polygraphicae, 1954 (Scriptores Graeci et Latini consilio Acad. Lynceorum editi).
- Cleonides: in *Musici scriptores graeci. Aristoteles, Euclides, Nicomachus, Bacchius, Gaudentius, Alypius et melodiarum veterum quidquid exstat*, ed. Carolus Janus, Leipzig: B. G. Teubner, 1895.
- al-Fārābī, Abū Naṣr Muḥammad, *Kitāb al-Mūsīqī al-kabīr*, ed. Ġaṭṭās ‘Abd-al-Malik Ḥašaba, [rev.] Maḥmūd Aḥmad al-Ḥifnī, Kairo: Dār al-Kātīb al-‘Arabī, 1967; Mss.: Ms. Istanbul, Köprülü, 953, facs. ed.: *Kitāb al-Mūsīqī al-kabīr. Grand Book of Music*, ed. Eckhard Neubauer, Frankfurt am Main: Institut für Geschichte der arabisch-islamischen Wissenschaften, 1998; Ms. Leiden, or. 651; Ms. Madrid, Res. 241; Ms. Princeton, Garrett, 1984; Ms. Mailand, Ambrosiana, C 40 inf.; Ms. Istanbul, Rağıp Paşa, 876.
- al-Ḥasan b. Aḥmad b. ‘Alī al-Kātīb, *Kitāb Kamāl adab al-ġinā’*, ed. Maḥmūd Aḥmad al-Ḥifnī and Ġaṭṭās ‘Abd-al-Malik Ḥašaba, Kairo: al-Hay’a al-Miṣriyya al-‘Āmma li-l-Kitāb, 1975.
- Ibn Zayla, Abū Maṣū‘ al-Ḥusayn, *al-Kāfi fī l-mūsīqī*, ed. Zakariyyā Yūsuf, Kairo: Dār al-Qalam, 1964.
- al-İṣfahānī, Abū l-Farağ, *Kitāb al-Ağānī*, vol. viii, Kairo: Maṭba‘at Dār al-Kutub al-Miṣriyya, 1935; vol. ix, Kairo: Maṭba‘at Dār al-Kutub al-Miṣriyya, 1936.
- Ptolemy, *Harmonics*: Ingemar Düring, *Die Harmonielehre des Klaudios Ptolemaios*. Göteborg: Elander, 1930; reprint Hildesheim: Olms, 1982.

Modern works

- ‘Abd-al-‘Azīm, S. (1992). *Ağnidat al-mūsīqā al-‘arabiyya* (2nd edn). Cairo: Dār al-Kutub al-Qawmiyya.
- D’Ancona, C. (2017). Greek sources in Arabic and Islamic philosophy. In: *The Stanford Encyclopedia of Philosophy*. Available at: <https://plato.stanford.edu/archives/win2017/entries/arabic-islamic-greek> [Accessed: 18 January 2020].
- Druart, T.-A. (2016). Al-Farabi. In: *The Stanford Encyclopedia of Philosophy*. Available at: <https://plato.stanford.edu/archives/fall2016/entries/al-farabi> [Accessed: 14 September 2018].
- Endreß, G. (2003). Athen — Alexandria — Bagdad — Samarkand: Übersetzung, Überlieferung und Integration der griechischen Philosophie im Islam. In: P. Bruns (ed.), *Von Athen nach Bagdad: zur Rezeption griechischer Philosophie von der Spätantike bis zum Islam*, Bonn: Borengässer.
- Hagel, S. (2018). Music and Harmonic Theory. In: P.T. Kayser and J. Scarborough (eds), *Oxford Handbook of science and medicine in the Classical World*, Oxford: Oxford University Press, 445–61.
- Janos, D. (2015). al-Fārābī. In: K. Fleet et al. (eds), *Encyclopaedia of Islam, THREE*. https://doi.org/10.1163/1573-3912_ei3_COM_26962.
- Lameer, J. (1997). From Alexandria to Baghdad: Reflections on the genesis of a problematical tradition. In: G. Endreß and R. Kruk (eds), *The Ancient tradition in Christian and Islamic Hellenism: Studies on the transmission of Greek philosophy and sciences dedicated to HJ Drossaart Lulofs on his ninetieth birthday*, Leiden: CNWS Publications, 181–91.
- Neubauer, E. (1968–9). Die Theorie vom iqā‘. I: Übersetzung des Kitāb al-īqā‘āt von Abū Naṣr al-Fārābī. *Oriens* 21–22, 196–232.
- Neubauer, E. (1993). Der Bau der Laute und ihre Besaitung nach arabischen, persischen und türkischen Quellen des 9. bis 15. Jahrhunderts. *Zeitschrift für Geschichte der arabisch-islamischen Wissenschaften* 8, 279–378.
- Neubauer, E. (1994). Die Theorie vom iqā‘. II: Übersetzung des Kitāb Iḥṣā’ al-īqā‘āt von Abū Naṣr al-Fārābī. *Oriens* 34, 103–73.

- Neubauer, E. (1995–6). Al-Ḥalil ibn Aḥmad und die Frühgeschichte der arabischen Lehre von den ‘Tönen’ und den musikalischen Metren, mit einer Übersetzung des *Kitāb an-Naḡam* von Yaḥyā ibn ‘Alī al-Munaḡḡim. *Zeitschrift für Geschichte der arabisch-islamischen Wissenschaften* 10, 255–323.
- Sawa, G.D. (1989). *Music performance practice in the Early ‘Abbāsīd Era 132-320 AH/750-932 AD*. Toronto: Pontifical Institute of Mediaeval Studies.
- Sawa, G.D. (2009). *Rhythmic theories and practices in Arabic writings to 339 AH/950 CE: Annotated translations and commentaries*. Ottawa: Institute of Mediaeval Music.
- Sawa, G.D. (2015a). Al-Fārābī, music. In: K. Fleet et al. (eds), *Encyclopaedia of Islam, THREE*. Available at: https://doi.org/10.1163/1573-3912_ei3_COM_26961.
- Sawa, G.D. (2015b). *An Arabic musical and socio-cultural glossary of Kitāb al-Aghānī*. Leiden/Boston: Brill.
- Shiloah, A. (1964). La perfection des connaissances musicales: Traduction annotée du traité de musique arabe d’al-Ḥasan ibn Aḥmad ibn ‘Alī al-Kātib. *Annales de l’École pratique des hautes études* 97, 451–56. <https://doi.org/10.3406/ephe.1964.4883>.
- Söhne, G. (1994). Zum Versuch der Rekonstruktion einer frühen arabischen Laute. *Zeitschrift für Geschichte der arabisch-islamischen Wissenschaften* 9, 357–72.
- Tsuge, G. (2013). Musical instruments described in a fourteenth-century Persian treatise ‘Kanz al-tuḥaf’. *The Galpin Society Journal* 66, 165–84, 255–59.
- Vallat, P. (2004). *Farabi et l’École d’Alexandrie: des prémisses de la connaissance à la philosophie politique*. Paris: Vrin.
- Watt, J.W. (2008). Al-Fārābī and the history of the Syriac organon. In: G.A. Kiraz (ed.), *Malphono w-Rabo d-Malphone: Studies in honor of Sebastian P. Brock*, Piscataway, NJ: Gorgias Press, 703–31.
- Wehr, H. (1980). *A dictionary of modern written Arabic*. Beirut: Librairie du Liban.
- Wright, O. (1966). Ibn al-Munajjim and the early Arabian modes. *The Galpin Society Journal* 19, 27–48. <https://doi.org/10.2307/841911>.