Searching for Music, Finding Ratios:
The Brethren of Purity's Epistles *On Music* and *On Proportions* in the Judeo-Arabic Medical Tradition*

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Abstract

This study examines the inclusion of the Ikhwān al-Ṣafāʾ's epistles *On Music* and *On Proportions* (*Epistles 5* and *6*) under a single title, *Kitāb al-mūsīqā* (*Book of Music*), in the Berlin composite manuscript Or. Oct. 350, a fifteenth-century Judeo-Arabic compilation from the Iberian Peninsula devoted to medicine. The *Kitāb al-mūsīqā* (fol. 28v–30v) also contains a short passage on the musical nature of the pulse that explicitly refers to Ibn Sīnā (Avicenna) – a section absent from the known Arabic corpus of the *Epistles*. Through an examination of the codicological and textual structure of the manuscript, the study investigates how the transmission of *ʿilm al-mūsīqī* (the science of music) within a Judeo-Arabic medical framework reflects a broader understanding of ratios and proportions as principles connecting musical, mathematical, and physiological knowledge. It suggests that such an understanding preserves the original theoretical sense of *mūsīqī*, later echoed in its European reception under the aegis of al-Fārābī.

Key Words

Judeo-Arabic tradition; Ikhwān al-Ṣafāʾ; Ibn Sīnā; al-Fārābī; Arabic music theory; medicine; mathematics; examination of pulse

I. *Introduction*

> Contepletur numeros secundum se Arithmeticus, numeros certe sub ratione ad aliud cognoscent Musicus, et Algebræus.
> Gulielmi Gosselini, *De arte magna, seu de occulta parte numerorum*[1]

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1 (« Let the arithmetician contemplate numbers in themselves while the musician and the algebraist know them in relation to one another »). Gulielmus Gosselinus, *De arte magna, seu de*

The folios 28v–30v of the Berlin composite manuscript Or. Oct. 350[2] contain several notable features that contribute to their significance. First, they are written in Arabic in Hebrew characters – here referred to as Judeo-Arabic in this graphic and codicological sense – and contain a compendium of two *Epistles* of the Ikhwān al-Ṣafāʾ (Brethren of Purity, tenth century), providing compelling evidence that these texts were known and studied within Jewish intellectual circles. Secondly, since the manuscript has been identified as copied in various Sephardic scripts and dated mainly to the fifteenth–sixteenth century in Iberian Peninsula, these folios further support the idea that the Ikhwanian tradition was known and transmitted in that milieu.

Additionally, the two epistles correspond to *Epistle 5*[3] (*Epistle on Music*) and *Epistle 6*[4] (*Epistle on Proportions*), both presented under the shared title *Kitāb al-mūsīqā* (*Book of Music*). Amnon Shiloah had already identified the presence of both epistles in the Berlin manuscript. The present analysis builds on this observation by reconsidering the significance of their joint transmission: the two treatises are not merely copied side by side, but appear as complementary parts of a single study on musical science. This fusion, grounded in the concept of ratios and proportions, nuances interpretations that treat the two epistles as separate works and risk overlooking the mathematical dimension of the theoretical science of

occulta parte numerorum, quae et algebra et almucabala vulgo dicitur, libri quatuor, Aegidius Beys, Paris 1577, p. 2. As in Peter Pesic's study of the relations between music and mathematics, I begin with this same passage from Gosselinus which – though composed in the late Renaissance – encapsulates the enduring conception of *musica est scientia proportionum*: while arithmetic contemplates *numeros secundum se*, music considers *numeros sub ratione ad aliud* – numbers in relation to one another. Could there be a more fitting expression of what Arabic and Judeo-Arabic scholars called *ʿilm al-mūsīqī*, the mathematical science of ratios and proportions? See, Peter Pesic, *Music and the Making of Modern Science*, MIT Press, Cambridge (Mass.) 2014.

2 Moritz Steinschneider, *Verzeichniss der hebräischen Handschriften der Königlichen Bibliothek zu Berlin*, vol. II, A. Asher, Berlin 1897, p. 98–100 (Oct. 350). This manuscript, catalogued as *Medizinische Sammelhandschrift: Arabisch in hebräischer Schrift* (Medical Compendium Manuscript: Arabic in Hebrew Script) and held by the Staatsbibliothek zu Berlin – Preußischer Kulturbesitz, Germany, is accessible as a digital resource at https://digital.staatsbibliothek-berlin.de/werkansicht/?PPN=PPN1042512213; and at https://www.qalamos.net/receive/DE1Book_manuscript_00004163 (Accessed Oct. 2025). See also Amnon Shiloah *The Theory of Music in Arabic Writings (c. 900–1900): Descriptive Catalogue of Manuscripts in Libraries of Europe and the U.S.A.*, G. Henle Verlag, München 1979, p. 383–384, cat. no. 286.

3 Ikhwān al-Ṣafāʾ, *Risāla fīʾl-mūsīqī* (*Epistle on Music*; *Epistle 5*, hereafter). Please refer to the critical edition, Id., *On Music: An Arabic Critical Edition and English Translation of Epistle 5*, ed. and transl. Owen Wright, Oxford University Press – The Institute of Ismaili Studies, Oxford 2010.

4 Ikhwān al-Ṣafāʾ, *Risāla fīʾl-nisab al-ʿadadiyya wa al-handasiyya wa al-taʾlīfiyya.* (*Epistle On Arithmetical, Geometrical and Harmonic Proportions*; *Epistle 6*, hereafter). See Id., *On Composition and the Arts: Arabic Edition and English Translation of Epistles 6–8*, ed. and transl. Nader El-Bizri, Godefroid de Callataÿ, Oxford University Press – The Institute of Ismaili Studies, Oxford 2018.

music – a discipline through which, as the Brethren state, « dexterity in every art and craft » (*al-ḥidhq fī al-ṣanāʾiʿ kullihā*) is attained.[5]

Within this framework, the *Kitāb al-mūsīqā* appears in a composite manuscript (Berlin, Or. Oct. 350) comprising several well-known Arabic treatises primarily devoted to medicine. At first glance, the inclusion of a musical treatise among medical texts may seem accidental – perhaps the result of the compiler's choices or the constraints of available space. Yet there are strong reasons to think otherwise. First, the index preceding the collation confirms the actual structural organization of the extant manuscript, listing the science of *mūsīqī*[6] among the medical works, even though the individual treatises do not occupy exactly the same place in the order. Second, the inclusion is further justified by the final section of the treatise itself, which explicitly applies musical ratios to the perception of the pulse, thus connecting musical and medical knowledge. Third, if we reconsider how the science of music was understood in the Arabic and Judeo-Arabic traditions up to the fifteenth century, its presence within a medical compilation appears entirely consistent.

Understanding *mūsīqī* [7] as a mathematical science of number, ratio, and proportion clarifies its practical role within a medical framework.

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[5] I have addressed this problem in two related studies, where I argued that previous scholarship has often treated *Epistles 5* and *6* separately, without sufficiently considering their conceptual affinity and their shared grounding in the science of ratios and proportions. See Laura Tribuzio, « Restoring Harmony through the Propaedeutic Science of Music: A Reconsideration of the Brethren of Purity's *Epistle on Music* and Its Relation with the *Epistle on Proportions* », in Godefroid de Callataÿ, Sébastien Moureau (eds.), *Power, Religion, and Wisdom. Orthodoxy and Heterodoxy in al-Andalus and Beyond = Micrologus. Nature, Sciences and Medieval Societies*, 33 (2025), p. 335–367; and Ead., « The Exception is Music. From Harmony to the Occult Arts in the Reordering of the Brethren of Purity's *Epistles 5* and *6* », in Godefroid de Callataÿ, Sébastien Moureau (eds.), *Science and Craft: The Relations Between the Theoretical and Practical Sides of the Occult and Esoteric Sciences in the Islamic World*, SISMEL–Edizioni del Galluzzo, Firenze (forthcoming 2026). The present article builds on these studies by showing that the Judaeo-Arabic *Kitāb al-mūsīqā* offers manuscript evidence for the close relationship between the two epistles.

[6] In Arabic and Judeo-Arabic sources, the term for music appears in both forms, *mūsīqī* and *mūsīqā*. For reasons of consistency, I have adopted *mūsīqī* as the normalized analytical form, since it is more frequently attested in the manuscript. Where the form *mūsīqā* occurs, I indicate it explicitly, as in the title *Kitāb al-mūsīqā*. In this case, I retain the manuscript form rather than following Shiloah's normalization as *Kitāb al-mūsīqī*.

[7] It would be prudent to refrain from translating the term *mūsīqī* as 'music' in this specific context, as it appears to have been employed primarily as a transliteration of the Greek word *mousikē* (μουσική), generally used to refer to *harmonia* (ἁρμονία). Since the eighth–ninth centuries, this transliterated Greek term has been utilized in scientific and philosophical Arabic contexts to designate the discipline primarily concerned with ratios and proportions. This particular discipline is technically referred to as *ʿilm al-taʾlīf* (the science of harmony), as exemplified by the excerpt from the Brethren of Purity provided here: « In this Epistle, which is commonly known as the 'Epistle on Music' (*al-risāla al-mulaqqaba biʾl-mūsīqī*), we want to recall the art that is composed by bodily and spiritual [matter] which is the art of harmony (*ṣināʿa al-taʾlīf*) and the

In this tradition, *mūsīqī* was a mathematical discipline concerned with ratios and proportions – the science of harmony (*ʿilm al-taʾlīf*) – which could also be brought into relation with physiological observation. For a physician, musical science could therefore offer a conceptual framework for understanding measured relations in the body, especially in the analysis of the pulse, a central component of medical assessment and prognosis in classical medicine. With this additional section – absent from the original Epistles – the *Kitāb al-mūsīqā* echoes *Avicenna's Kitāb al-Qānūn fī l-ṭibb* (*The Book of the Canon of Medicine*) by showing how musical ratios could be brought into relation with the proportional and rhythmic structure of the pulse. The final section of the treatise should therefore not be understood as a simple appendix or as a mere justification for the presence of musical material in a medical manuscript. It does not offer a full commentary on Avicenna's passage in the *Qānūn*, but rather a selective and highly compressed reworking of it. The compiler explicitly recalls Ibn Sīnā's discussion of musical ratios in relation to the pulse, yet reshapes this material in light of the proportional theory developed earlier in the treatise. In this sense, the Judaeo-Arabic *Kitāb al-mūsīqā* adds something significant to Avicenna's observations: it re-situates the medical discussion of the pulse within an Ikhwānian mathematical framework, where musical consonance, proportion, and the rhythm of the living body are brought into relation.

II. *The Brethren of Purity's* Epistles 5 *and* 6 *in the Judeo-Arabic Tradition*

A substantial body of literature has explored the transmission and reception of the Brethren of Purity's ideas in al-Andalus and, more broadly, in the medieval Iberian Peninsula, both through direct and indirect references. Several studies have traced their influence across different intellectual circles, with particular attention to Jewish authors and readers.[8]

Within the Judeo-Arabic transmission of the *Epistles*,[9] notable translations include, to the best of my knowledge, the *Risāla al-jāmiʿa* (*The Comprehensive*

knowledge of proportions (*al-nisab*) », Ikhwān al-Ṣafā', *Epistle 5*, p. 6. For further evidence and detailed explanations, see Tribuzio, « Restoring Harmony », p. 346–355.

[8] While likewise it is not within the scope of this paper to present a comprehensive survey of this vast field, it is worth noting the sustained scholarly interest in the influence of the *Rasāʾil Ikhwān al-Ṣafāʾ* on both Kabbalistic and Neoplatonic Jewish thought, as well as in the exploration of their possible Ismāʿīlī background – an approach exemplified by Sarah Stroumsa, « Wondrous Paths: The Ismāʿīlī Context of Saadya's 'Commentary on *Sefer Yeṣira*' », *Bochumer Philosophisches Jahrbuch für Antike und Mittelalter*, 18/1 (2015), p. 74–90; Ehud Krinis, « Cyclical Time in the Ismāʿīlī Circle of Ikhwān al-Ṣafāʾ (Tenth Century) and in Early Jewish Kabbalists Circles (Thirteenth and Fourteenth Centuries) », *Studia Islamica*, 111/1 (2016), p. 20–108.

[9] Apart from the preliminary list of approximately one hundred manuscripts scattered across Europe, Iran, and Turkey, as reported by Nader El-Bizri, a comprehensive inventory of the *Rasāʾil*

Epistle),[10] *Risāla fī'l-mūsīqī* (*Epistle on Music*; *Epistle 5*), and the *Risāla fī l-nisab al-ʿadadiyya wa-l-handasiyya wa-l-taʾlīfiyya* (*Epistle on Arithmetical, Geometrical, and Harmonic Proportions*; *Epistle 6*). Let us now consider the last two epistles and examine both their direct and indirect forms of transmission in the Iberian Peninsula and North Africa.

Indirect evidence, such as echoes or references found in other works, provides valuable insights into the dissemination and reception of the Brethren's ideas.

a. An instance of indirect evidence appears in Shem-Tov ben Yosef ibn Falaquera's *Sefer Ha-mavaqqesh* (*Book of the Seeker*), composed in the seventh/thirteenth century. In this text, three out of six questions are devoted to the science of music and reflect the content of *Epistle 5*.[11]

b. Another indirect example is found in Moses ibn Ezra's *Maqāla al-Ḥadīqa* (*Treatise of the Garden*), an Arabic text written in Hebrew characters. Here, Ibn Ezra discusses nine philosophical anecdotes (*nawādir*) concerning music and the acoustics of sound, which closely parallel *Epistle 5*.[12]

Direct evidence consists of Arabic excerpts of the Epistles written in Hebrew script:

Ikhwān al-Ṣafāʾ manuscripts has long been lacking. This gap is now being addressed by G. Van Den Bossche's ongoing digital catalogue, *Manuscripts of the Ikhwān al-Ṣafāʾ Textual Tradition*, which currently lists 466 entries. The project adopts a deliberately broad definition of the corpus, encompassing the core *Rasāʾil Ikhwān al-Ṣafāʾ* and its sister texts (*Risālat al-jāmiʿa* and *Risālat jāmiʿat al-jāmiʿa*), as well as the Persian abridged translation *Mujmal al-ḥikma* and several personal selections or abridgements. See *The Ikhwān al-Ṣafāʾ Manuscript Project*, https://ikhwansafamss.github.io/catalogue/ (Accessed Oct. 2025). See also Nader El-Bizri, *The Ikhwān al-Ṣafāʾ and Their Rasāʾil. An Introduction*, Oxford University Press – The Institute of Ismaili Studies, Oxford 2008, note 41, p. 22–23.

[10] Ehud Krinis, « *Al-Risāla al-jāmiʿa* and its Judeo-Arabic Manuscript », in Mohammad Ali Amir-Moezzi (ed.), *Islam: identité et altérité. Hommage à Guy Monnot*, Brepols, Turnhout 2013, p. 313–331.

[11] Amnon Shiloah, *Jewish Musical Tradition*, Wayne State University Press, Detroit 1992, p. 56-58. See also Id., « The Chapter on Music in Ibn Falaqera's *Book of the Seeker* », in Judith Cohen (ed.), *Proceedings of the World Congress on Jewish Music, Held in Jerusalem, July 31–August 4, 1978*, Institute for the Translation of Hebrew Literature Ltd., Tel Aviv 1982, p. 373–377.

[12] Amnon Shiloah, « The Musical Passage in Ibn Ezra's *Book of the Garden* », in Id., *The Dimension of Music in Islamic and Jewish Culture*, Variorum, Aldershot 1993, p. 211–224. Shiloah shows a close resemblance only with the *nawādir*, but I would like to underline that also the parts on the acoustic of the sound seems to be closely connected to *Epistle 5*. See also Israel Adler, *Hebrew Writings Concerning Music, in Manuscripts and Printed Books from Geonic Times up to 1800*, The Jewish Music Research Centre – Hebrew University, Jerusalem 1975, p. 160.

a. One fragment from Cairo Genizah[13] deals with tuning of the lute (*al-ʿūd*) and appear to draw analogies between playing its notes and writing words.[14]

b. A second example occurs in the manuscript Berlin Or. Oct. 350 (fol. 28v–30v), which contains a compilation of *Epistles 5* and *6* under the shared title *Kitāb al-mūsīqā*.[15]

The first direct witness, however, remains elusive. Our only source of information is Henry George Farmer's brief study *Two Genizah Fragments on Music*, which reports a communication from Richard Gottheil of Columbia University. In February 1933, Gottheil sent Farmer transcriptions of two fragments from an unspecified set of Genizah manuscripts said to have been discovered « in Paris ». The older fragment reportedly contained a page from the Ikhwān al-Ṣafāʾ's *Risāla fi'l-mūsīqī*, transcribed into Hebrew characters. Beyond Farmer's brief half-page summary,[16] little additional information is available. The present location of the fragment once owned by Gottheil is unknown, and despite repeated searches – including

[13] Henry G. Farmer, « Two Genizah Fragments on Music », *Transactions of the Glasgow University Oriental Society*, 19 (1961–1962), p. 52–62. This paper was reprinted twice: (1) As a booklet, under a revised title « Jewish Genizah Fragments on Music » and together with a second paper: Id., *The Oriental Musical Influence and Jewish Genizah Fragments on Music*, London – New York 1964 (edition consulted). (2) As an article in a collection of reprinted works by Farmer: « The Oriental Musical Influence and Jewish Genizah Fragments on Music », in Eckhard Neubauer (ed.), *Studies in Oriental Music. History and Theory. Reprint of Writings Published in the Years 1925–1966*, vol. I, :Institute for the History of Arabic-Islamic Science at the Johann Wolfgang Goethe University, Frankfurt am Main 1997, p. 328–358.

[14] For a compilation of musical fragments from the Cairo Genizah that demonstrate the Jewish community's engagement with music theory, see Hanoch Avenary, « Paradigms of Arabic Musical Modes in the Genizah Fragment Cambridge, T-S N.S. 90.4 », *Yuval: Studies of the Jewish Music Research Centre*, 4 (1982), p. 11–28. Although not a Judeo-Arabic transcription, the Genizah fragment *T-S Ar. 41.23* is worth mentioning here, since – as G. Ferrario has shown – it belongs to the same environment of transmission in which Jewish scholars engaged with the *Rasāʾil Ikhwān al-Ṣafāʾ* through Arabic-script copies. Cambridge (UK), Cambridge University Library, *T-S Ar. 41.23* (Cairo Genizah fragment, Arabic script, 1 f., ʿAbbāsid book-hand); cf. Ferrario Gabriele, « In a Hidden Place: Traces of Bāṭinism in the Fragments of the Cairo Genizah », in de Callataÿ, Moureau (eds.), *Power, Religion, and Wisdom*, p. 313–315.

[15] For the reference to the manuscript, see note 2, *supra*. For the editions see Adler, *Hebrew Writings Concerning Music*, p. 50–54; Shiloah Amnon, « Deux textes arabes inédits sur la musique », *Yuval: Studies of the Jewish Music Research Centre*, 1 (1968), p. 221–248. In this paper, I will refer to Shiloah's Judeo-Arabic edition for comparison. It includes a French translation, which shows some degree of looseness or imprecision in certain passages.

[16] This is why I refer to *Jewish Genizah Fragments on Music* as a brief printed study rather than a scholarly article. I must admit that locating this publication was challenging. Initially, I held hope of finding Professor Gottheil's transcript. Yet, upon receiving the text, my disappointment was notable as the reference to the Ikhwān's fragment proved quite brief (p. 23–24). See Farmer, « Jewish Genizah Fragments on Music », p. 23–24.

inquiries to the National Library of Israel,[17] its whereabouts remain uncertain. It may still be traceable in the private papers of Gottheil or Farmer, although this remains purely speculative.

This account is significant for two reasons. First, it illustrates the remarkable scholarly energy devoted to the study of Arabic music theory in Hebrew sources during the 1930s, reflected in the discoveries drawn also from the Genizah material. Second, it reflects the conditions under which early researchers worked, when the main effort was devoted to identifying, cataloguing, and transcribing fragments, often before a fuller critical analysis could take shape.

In contrast to this lost fragment, the second piece of direct evidence survives in the Berlin manuscript Or. Oct. 350, edited separately by Amnon Shiloah (1968) and Israel Adler (1975).[18] The task of editing was hindered by the poor legibility of the manuscript and its rough handwriting. Even so, the work of both editors remains noteworthy, particularly in view of the textual and geographical variations typical of the Judeo-Arabic language.

III. *The Berlin Composite Manuscript (Or. Oct. 350): Structure, Dating, and the Place of* Kitāb al-mūsīqā

The Berlin manuscript Or. Oct. 350 is a composite collection of eight treatises, copied in several distinct hands and displaying both linguistic and paleographical variations. The only dated portion occurs at the end of the seventh treatise – Abū Bakr ibn Zakariyyā al-Rāzī's *Kitāb al-aqrādhibīn*[19] (*Book of Compound Drugs / Pharmacopeia*) – on fol. 165r, where the explicit, written in a Western Sephardi semi-cursive Hebrew hand, records the completion of the work in Seville, 5226 AM / 1466 CE. The same hand also appears in the preceding treatise – no. 6, *Kitāb al-taqsīm wa-al-tashjīr* (*Treatise on Division and Ramification*) – and in the following no. 8, the anonymous *Theoretical and Practical Instructions for the Doctor*; together they form a continuous sequence extending from fol. 107r to 168v.

The manuscript, catalogued in the Staatsbibliothek zu Berlin as a *Medizinische Sammelhandschrift: Arabisch in hebräischer Schrift* (*Medical Compendium Manuscript: Arabic in Hebrew Script*), was described by M. Steinschneider[20] as a composite volume of 168 folios in various Spanish scripts, mostly from the fifteenth century, with the portion comprising fol. 91r–165v completed on 15 Shebaṭ 5226 (1466 CE)

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[17] I would like to express my gratitude to Ehud Krinis (Ben-Gurion University of the Negev) and Friederike Schmidt (Martin Luther University Halle-Wittenberg) for their generous help and insightful comments on the Judeo-Arabic transcriptions in Hebrew characters. The final version and any remaining inaccuracies are entirely my own.

[18] See note 15, *supra*.

[19] The normalized Arabic form of the title is *Kitāb al-aqrābādhīn*.

[20] See note 2, *supra*.

in Seville and followed by later additions.[21] In his description, Steinschneider seems to extend this date to all texts within that range, including treatise 5 (Ibn Sīnā, *Qānūn II, 1*). A closer codicological examination, however, indicates that only treatises 6–8, copied by the same Western Sephardi semi-cursive hand, belong to the dated section, whereas treatise 5 is written in a distinct script. Moreover, Steinschneider did not take into account the index on fol. 1r, written in a different hand and listing twelve treatises, whereas the extant manuscript preserves only eight.[22] Notably, in this index *Kitāb al-mūsīqā* occupies the third position, recorded as *al-thālith fī ʿilm al-mūsīqā* (אלתלת פי עלם אלמוסיקא). The explicit reference suggests that the presence of the musical treatise was not accidental, but that it was understood, at least by the compiler of the index, as belonging to a broader medical and scientific compilation.

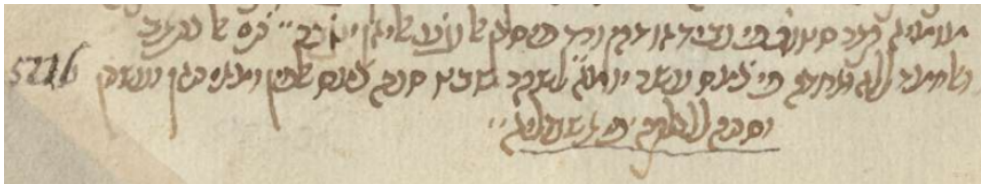

Fig. 1: Berlin, Staatsbibliothek zu Berlin, Or. Oct. 350, fol. 165r: explicit of *Kitāb al-Aqrāḍhibīn (Pharmacopeia*, Judaeo-Arabic). The closing lines refer to the completion of the treatise, praising God and dating the copy to the fifteenth day of the month of Shevat, in the year five thousand two hundred and twenty-six from the Creation, in Seville. (Manuscript property of: Staatsbibliothek zu Berlin – Preussischer Kulturbesitz, Orientabteilung).

The dated explicit, found on fol. 165r, reads as follows:

> תם אלכתאב ואלחמד ללה ו[...]דח פי כמס עשר יומה ולשחר שבט סנת כמס אלפין ומאיתאן ועשרין וסתה ללכליקה פי אשבילייה.[23]
>
> *Tamma al-kitāb wa-l-ḥamdu li-llāh wa-[...]dihi fī khams ʿashar yūma wa-li-shahr Shubaṭ sanat khams alfīn wa-māʾitani wa-ʿishrīn wa-sitta li-l-ḫalīqa fī Ishbiliya.*

[21] The use of Arabic in Hebrew script in this late Sephardi context is noteworthy and should not be taken as evidence for a fifteenth-century composition of the text itself. Rather, it points to the continued copying or reworking of earlier Arabic scientific material within a Judeo-Arabic written tradition.

[22] Steinschneider also included a ninth part, which, however, does not correspond to a distinct treatise but rather to a collection of notes scattered throughout the manuscript. See STEINSCHNEIDER, *Verzeichniss der hebräischen Handschriften*, p. 99–100.

[23] The Hebrew-script transcription is given in normalized modern type; the Latin transliteration is diplomatic and preserves the manuscript reading without correction.

تمّ الكتاب، والحمدُ للهِ وحمدِهِ،[24] في اليوم الخامسَ عشرَ من شهر شِباط، سنةَ خمسِةِ آلافٍ ومائتَيْن وستٍّ وعشرينَ للخلقةِ في إشبيلية.[25]

> The book is completed, and praise be to God and His praise, on the fifteenth day of the month of Shevat, in the year five thousand two hundred and twenty-six from the Creation, in Seville.[26]

A visual comparison between the folios containing *Kitāb al-mūsīqā* (fol. 28r–30v) and those of the following medical section (fol. 107r–168v) shows two closely related but not identical hands. Both are written in a Western Sephardi semi-cursive typical of fifteenth-century Andalusi manuscripts, sharing comparable overall proportions and several similar letterforms – most notably in *mīm* (מ / م) and *tāʾ / tav* (ת / ت). However, the *alef* (א / ا) differs clearly in shape and execution. Yet the musical section displays lighter ink, a less even line, and more variable pressure, whereas the medical section is more regular and deliberate. These traits suggest a related Sephardi scribal milieu, broadly compatible with the fifteenth-century Andalusi context of the dated medical section, though they do not prove that the two parts were copied by the same individual or formed a single codicological unit. The Seville colophon should therefore not be directly extended to the musical section, but it provides a useful point of comparison for situating the manuscript within a late Sephardi written tradition.

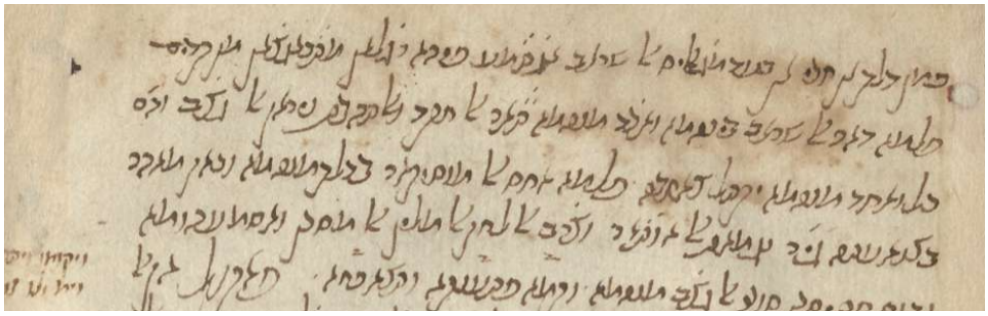

Fig. 2: Berlin, Staatsbibliothek zu Berlin, Or. Oct. 350, fol. 29v. (Manuscript property of: Staatsbibliothek zu Berlin – Preussischer Kulturbesitz, Orientabteilung).

[24] Normalized Arabic. The sequence דה[…]ו, following *al-ḥamdu li-llāh*, is interpreted here as *wa-ḥamdihi* (وَحَمْدِهِ, ‘and His praise’). The reading, though not certain owing to the fusion and partial obscurity of the middle letters—possibly representing a *ḥet/mem* ligature—accords with Iberian–Sephardi devotional usage.

[25] Normalized Arabic.

[26] Berlin, Staatsbibliothek zu Berlin, Or. Oct. 350, fol. 165r.

The internal arrangement of *Or. Oct. 350* reveals a coherent compilation of eight Judeo-Arabic treatises, whose contents are listed below in manuscript order.

1. Ḥunayn ibn Isḥāq, *Madkhal al-ṭibb ʿalā sabīl al-masʾalati wa-l-jawāb* (*Medical Introduction to the Writings of Galen in Questions and Answers*).[27]
2. Ikhwān al-Ṣafāʾ, *al-Qawl al-thāmin min Kitāb al-mūsīqā* (*The Eighth Discourse from the Book on Music*).[28]
3. Anonymous, *Risāla fī ḥifẓ al-ṣiḥḥa* (*Epistle on the Preservation of Health*).[29]
4. Anonymous, *Dustūr* (*Medical instruction*).[30]
5. Ibn Sīnā, *al-Kitāb al-thānī min al-Qānūn fī l-ṭibb fī l-adwiya al-mufrada* (*The Second Book of the Canon of Medicine, on Simple Drugs*, also known as *Materia Medica*).[31]
6. Abū Bakr ibn Zakariyyā al-Rāzī, *Kitāb al-taqsīm wa-l-tashjīr* (*Treatise on Division and Ramification*).[32]
7. al-Rāzī, *Kitāb al-aqrādhibīn* (*Pharmacopeia*).[33]
8. Untitled anonymous text, described by Steinschneider as « Theoretical and Practical Instructions for the Doctor ».[34]

Both the manuscript's material sequence and the index on fol. 1r confirm that the *Kitāb al-mūsīqā* was positioned among medical and pharmacological works. Its inclusion therefore appears deliberate rather than incidental, reflecting the compiler's perception of mūsīqī as relevant to a broader medical-scientific framework.

[27] מדכל אלטב אלפה הנין אבן אסהק אלכתב גאלינוס עלי סביל אלמסאלה ואלגואב, fol. 4r–22r; followed by notes before the next treatise.
[28] אלקול אלתאמן מן כתאב אלמוסיקא, fol. 28v–30v; followed by notes before the next treatise.
[29] רסאלה פי הפט אלצחה, fol. 32v–59v.
[30] דסתור, fol. 59v–90v, in the same hand as the preceding text.
[31] אלכתאב אלתאני מן אלקאנון מן אלאדויה אלמפרדה, fol. 91r–106v.
[32] כתאב אלתקסים ואלתשגיר, fol. 107r–150v.
[33] כתאב אלאקראבין, fol. 151r–165r.
[34] Fol. 166v–168v.

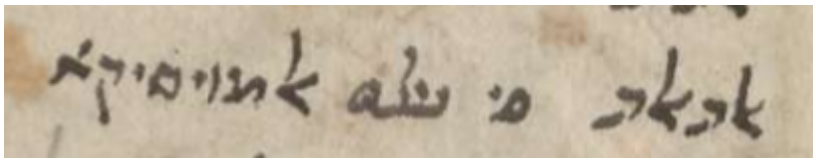

Fig. 3: Berlin, Staatsbibliothek zu Berlin, Or. Oct. 350, fol. 1r: excerpt from the index listing *Kitāb al-mūsīqā*, recorded in Judeo-Arabic script as אלתלת פי עלם אלמוסיקא (*al-thālith fī ʿilm al-mūsīqā*), indicating its position as the third treatise in the compilation. (Manuscript property of: Staatsbibliothek zu Berlin – Preussischer Kulturbesitz, Orientabteilung).

The position of *Kitāb al-mūsīqā* in a corpus devoted to the body and its functions gains further significance in light of its closing section, which discusses the rhythm of the pulse, a domain where musical proportions and medical observation intersect. As will be examined in the following pages, this passage reveals a conception of *mūsīqī* not merely as an art of sound, but as a mathematical science grounded in numerical ratios and harmonic proportions, capable of being brought into relation with medical observation.

IV. *The* Kitāb al-mūsīqā*: Berlin Or. Oct. 385, fol. 28v–30v*

The following passage reproduces the incipit of the Judaeo-Arabic compilation of the *Kitāb al-mūsīqā*:

> אלקול אלתאמן מן כתאב אלמוסיקא מא חו לאיק באלאנסאן הפטח לאנה מן מלאד אלנפס קאל גרצנא פי הדא אלכתאב מערפה אלנסב וכיפיה אלתאליף אללתאן במערפתהא יכון אלחדק פי אלצנאיע כלהא.[35]
>
> The eighth discourse from the Book of Music,[36] on what is fitting for a human being to retain, for it is among the delights of the soul. He said: our purpose in this book is the knowledge of proportions (*al-nisab*) and the modality by which harmony (*kayfiyyat al-taʾlīf*) manifests; through the knowledge of them both, dexterity in all the arts is achieved.

[35] Hebrew script (as in the manuscript, normalized modern type). Following is the normalized Arabic version.
القول الثامن من كتاب الموسيقى ما هو لائق بالإنسان حفظُه، لأنه من ملاذّ النفس. قال: غرضُنا في هذا الكتاب معرفةُ النِّسَب وكيفيّةُ التأليف، اللتان بمعرفتهما يكون الحِذقُ في الصنائع كلِّها.

[36] Shiloah supplies here the verb *yuʿlim* ('instructs') in his edition, but the phrase can also be read coherently without it. With *yuʿlim*, the passage would read: « The eighth discourse from the Book of Music instructs what is fitting for a human being to retain, for it is among the delights of the soul ». See, SHILOAH, « Deux textes arabes inédits sur la musique », p. 224.

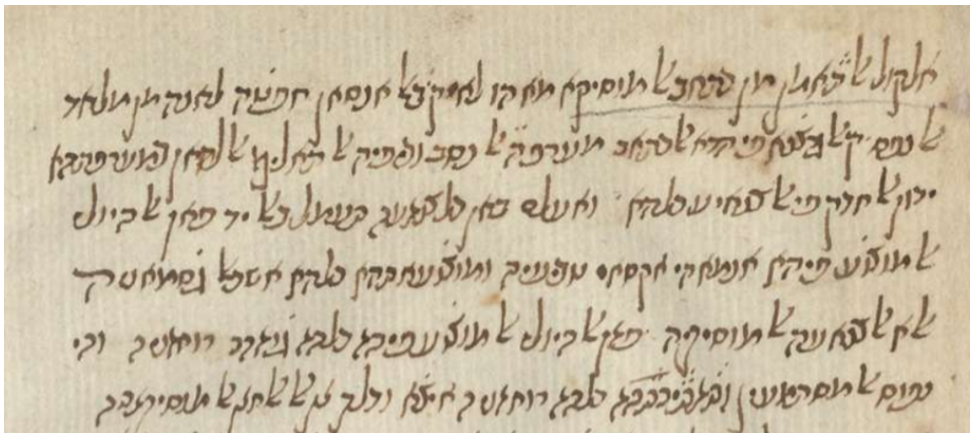

Fig. 4: Berlin, Staatsbibliothek zu Berlin, Or. Oct. 350, fol. 28v: beginning of *Kitāb al-mūsīqā* (Judaeo-Arabic). The opening lines introduce the eighth discourse (*al-qawl al-thāmin*) « on what delights the soul », corresponding to the *Epistle on Music* of the *Ikhwān al-Ṣafāʾ*. (Manuscript property of: Staatsbibliothek zu Berlin – Preussischer Kulturbesitz, Orientabteilung).

Shiloah raised the question of whether the mention of the « eighth discourse » at the beginning of the manuscript (fol. 28v) might indicate the original placement of the *Epistle on Music*, possibly situated after the two epistles *On the Theoretical Speculative Arts* (*Epistle 7*) and *On the Practical Arts* (*Epistle 8*). Although my own reading follows a different line of evidence, I consider his hypothesis plausible.[37]

However, it is clear that the « eighth discourse » cannot refer to the position of the manuscript within the collection to which it belongs, as it is in fact the second manuscript following Ḥunayn ibn Isḥāq's *Medical Introduction to the Writings of Galen in Questions and Answers*,[38] nor can it refer to its place in the index, where it appears as the third entry.

What can therefore be reasonably asserted is that the copyist was reproducing – or perhaps rewriting – a pre-existing compilation rather than copying directly

[37] Shiloah's supposition is not without basis, since *Epistle 7* itself classifies music among the propaedeutical sciences, yet places it after the theoretical (*al-ṣanāʿiʿ al-ʿilmiyya*) and practical arts (*al-ṣanāʿiʿ al-ʿamaliyya*), and therefore after *Epistles 7* and *8* in the actual systematization. What Shiloah did not take into account, however, is that in the Judaeo-Arabic tradition, the two treatises *On Music* (*Epistle 5*) and *On Proportions* (*Epistle 6*) are transmitted together, since *Proportions* represents the mathematical treatise on music. This arrangement suggests that the compiler of the Judaeo-Arabic collection regarded *Music* and *Proportions* as a single composite treatise, positioned beyond the theoretical sciences as a synthesis linking the mathematical foundations (*Epistles 1–4*) to the philosophical arts. See Shiloah, « Deux textes arabes inédits sur la musique », p. 224; Tribuzio, « The Exception is Music », p. 64.

[38] מדכל אלטב אלפה הנין אבן אסהק אלכתב גאלינוס עלי סביל אלמסאלה ואלגואב
مدخل الطب ألفه حنين ابن اسحق الكتب جالينوس على سبيل المسالة والجواب

from an original Arabic exemplar.[39] Whether the text of reference was in Arabic or Judeo-Arabic cannot be definitively determined.

At the level of manuscript analysis, the evidence suggests that the copyist had access to a model in which the epistles *On Music* and *On Proportions* had already been arranged together, with *On Music* preceding *On Proportions*. This points to a manuscript tradition – or at least to a scribal practice – in which coupling the two epistles served to emphasize the mathematical dimension of *mūsīqī*, a feature absent from the epistle *On Music* itself, which was not, as I have argued elsewhere and will briefly recall in section VII (see *infra*), intended to represent the Brethren's theoretical treatise on music.

The subsequent statement by the copyist further supports the thesis that the epistle *On Proportions* was traditionally regarded as the mathematical section of the musical subject.

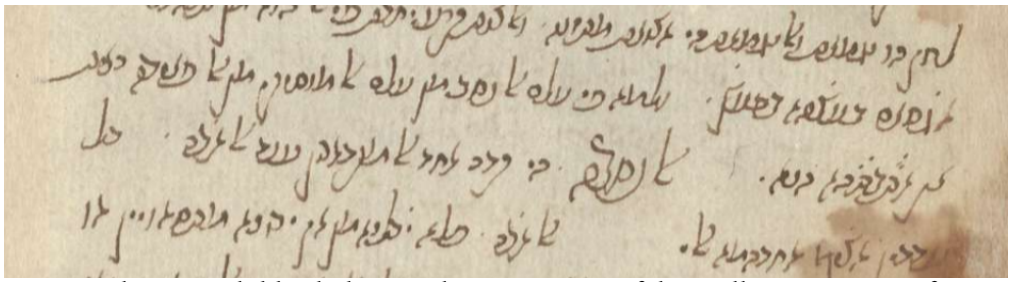

Fig. 5: Berlin, Staatsbibliothek zu Berlin, Or. Oct. 350, fol. 29v, ll. 7–10: passage from the *Kitāb al-mūsīqā* contains, on line 8, what appears to be a compiler's insertion, noting that the discussion of proportions was considered useful for the science of music and therefore suitable to be recorded at this point in the text. This suggests a conscious intervention in the arrangement of the material. (Manuscript property of: Staatsbibliothek zu Berlin – Preussischer Kulturbesitz, Orientabteilung).

[39] One could infer this based on the use of the term 'qawl' discourse, which suggests that each epistle (*risāla*) is mentioned as a distinct section within a larger treatise or compilation. Additionally, the use of another term, 'kitab' (treatise, book), to refer to a single epistle implies a potential reorganization or revision of the original content and structure. These two terminological choices suggest that the epistles may have undergone alterations or refinements in their presentation.

ולמא פי עלם אלנסב מן עלם אלמוסיקי מן אלפאידה ראית אן אתבתהא חנא ...[40]

ولما في علم النسب من علم الموسيقي من الفائدة، رأيت أن أثبتها هنا ...

> And since there is benefit in the science of proportions within the science of music, I deemed it appropriate to record it here.

This remark provides valuable insight into the reasoning behind the arrangement. By observing the usefulness of the science of proportions (*ʿilm al-nisab*) for the science of music (*ʿilm al-mūsīqī*), the copyist acknowledges the close relationship between the two disciplines. The statement does not necessarily imply that the science of proportions is entirely subsumed under music; rather, it shows that musical science draws upon proportional theory as one of its mathematical foundations. It is therefore likely that, influenced by a textual tradition in which proportions were treated as essential to the understanding of music and harmony, he decided to copy the two epistles together.

This evidence confirms that music was conceived as a mathematical science in Arabic writings from the third/ninth century onwards. The inclusion of the Brethren's *Epistle on Proportions* within this framework indicates that the mathematical interpretation of *mūsīqī* was already firmly established and remained influential throughout the Middle Ages. Its presence in the Judaeo-Arabic *Kitāb al-Mūsīqā* further demonstrates the continuity of this conception across linguistic and cultural boundaries. The enduring legacy of this approach is reflected in later Arabic and Jewish texts and finds a significant parallel in Latin scholastic thought, where the mathematical study of harmony – already firmly established through Boethius' *De institutione musica* – continued to define music as a rational and speculative science, as we have already seen in Gosselinus.

V. *Music, Medicine, and the Pulse: Ibn-Sīnā's Ratios in the Judeo-Arabic* Kitāb al-mūsīqā

As previously noted, fol. 28v–30v of *Or. Oct. 350* transmit a Judeo-Arabic reworking of the Ikhwān al-Ṣafāʾ's *Epistle on Music* and *Epistle on Proportions*, unified under the title *Kitāb al-mūsīqā*. This section offers a closer examination of how the compiler

[40] Berlin Or. Oct. 385, fol. 29v (Hebrew script as in the ms.). The Judeo-Arabic rewriting of *Epistle 6* commences from this point. Adhering to the original text's structure, it starts by exploring the concept of ratios (*al-nisab* / אלנסב), classifying them into two categories: those where the two terms are equal and those where the first term is greater than the second. These are then further subcategorized into five distinct species (*al-nisab al-khamsa* / אלנסב אלכמסה). Subsequently, the discourse delves into the comprehensive analysis of the threefold distinction of proportions (*al-nisab* / אלנסב): namely arithmetic (*al-nisba al-ʿadadiyya* / אלנסבה אלעדדיה), geometric (*al-nisba al-[h]andasiyya* / אלנסבה אלאנדסיה) and harmonic (*al-nisba al-taʾlīfiyya* / אלנסבה אלתאלפיה).

reshaped the two treatises into a single reflection on proportions as the theoretical basis of music.

The first part (fol. 28v–29v), broadly corresponding to *Epistle on Music*, defines *mūsīqī* as the knowledge of numerical ratios and measured motions that underlie harmony in both the cosmos and the soul, and explains the principle of *munāsabāt* (correspondences or proportional affinities). It focuses on the ethical and therapeutic effects of melody and on the role of human need in placing music among the theoretical and practical arts, particularly with respect to medicine, hospitals, and astrological prognostications.

The second part (beginning on fol. 29v, line 8, and continuing through fol. 29r, 30r, and 30v)[41] opens with the compiler's intervention already mentioned: « And since there is benefit in the science of proportions within the science of music, I deemed it appropriate to record it here ».

With this explicit statement, the compiler introduces material from *Epistle on Proportions*, presenting a concise exposition of *nisab* (*ratios*)[42] – its species, degrees, and examples. The text distinguishes between equality and inequality, simple and multiple ratios, and the three canonical forms of proportion: arithmetic, geometric, and harmonic. The discussion culminates in a concise reference to Ibn Sīnā, whose analysis of the pulse in the *Qānūn fī l-ṭibb* exemplifies the same numerical harmony in the living body – derived from the harmonic proportion 3 : 4 : 6, which generates the intervals of the fourth, the fifth, and the octave, each expressed through its corresponding ratio: 4 : 3, 3 : 2, and 2 : 1. The text explains that every 'sound' (*ṣawt*) begins from a fixed reference point, the fundamental or starting note (*wāḥid*), the lowest pitch serving as the standard for comparison, and rises in accordance with these ratios – the fourth spanning four degrees from the starting note, the fifth five, and the octave eight. [43] It concludes that these are the

[41] Fol. 29r and 29v are misbound in the manuscript and appear in reversed order.

[42] In the main Arabic tradition, both 'ratio' (λόγος) and 'proportion' (ἀναλογία) were usually translated by the same term, نسبة (*nisba*, pl. *nisab*), with no consistent attempt to distinguish between the two. This reflected a tendency to view the relation between quantities and the equality of such relations as belonging to a single conceptual field. In the later Latin translations, the same overlap persisted: *ratio* and *proportio* were often used almost interchangeably. This linguistic convergence made it even harder to describe the science of music, which, by its nature, should have been defined as the science of harmony. Yet, because harmony itself was expressed through musical practice, the two domains became indistinguishable. The confusion introduced by translation and transmission – from Greek into Arabic and later into Latin – thus reinforced the tendency to merge *harmonia* and *musica* into one and the same discipline. See section VII for further discussion and Tribuzio, « Restoring Harmony », p. 353 and passim.

[43] Shiloah regarded the passage as problematic, interpreting *wāḥid* (واحد) as the numeral 'one', given the surrounding discussion of ratios. In Arabic and Persian practical theory, however, *wāḥid* designates the first open string – the heaviest and lowest tone – which, together with the remaining strings, is commonly referred to as 'one', 'two', 'three', and 'four', rather than by the older names *bamm*, *mathnā*, *mathlāth*, and *zīr*. Recognizing this meaning clarifies the text and

very ratios mentioned by Ibn Sīnā in connection with the pulse, required for its proper understanding, before closing with the invocation: « And God is the All-Knowing, Lord of the Worlds ».

ומן הדה אלנסבה אסתכראג תאליף אלאלחאן. פאלדי באלארבעה הי ארבעה אצואת והי
אלזאיד תלת ואלדי באלכמסה אלזאיד נצף והי כמסה אצואת ואלדי באלכל [והי] אלצעפא
והי תמאניה אצואת ואעני הנא בקולי אצואת [אן] יבדא אלצות כאנה מנכפץ וירפע
רפאעתה אלי מקדאר זיאדה אלתלת והו [ארב]עה [בו]אחד ממא אבתדי בה אלדי הו
אלזאיד תלת או כמסה בואחד [והו] אלזאיד נצף או תמאניה בואחד והו אלזאיד[44] אלצעפא
וקד דכר ך סינא פי אלנבץ הדא אלנסב לחאגתה כאנת פי דלך ללנבץ פאן לם תתבין לה
מן כלאמה (...) [45] פיתחצל פיתחצל לה צורה אלנבץ עלי אלכמאל. ואללה הו אלעאלם ודב אלעאלמין.[46]

من هذه النِّسبة يُستخرَج تأليف الألحان. فالتي بالأربعة هي أربعةُ أصوات، وهي الزائدةُ ثُلثًا، والتي بالخَمسة هي الزائدةُ نِصفًا، وهي خمسةُ أصوات، والتي بالكلّ، وهي الضِّعف، هي ثمانيةُ أصوات. وأعني هنا بقولي "أصوات" أن يبدأ الصوتُ كأنّه منخفضٌ ثم يُرفَع رفعته على مقدار زيادة الثُّلث، وهي أربعةٌ بواحدٍ مما ابتدأ به، وهي الزائدةُ ثُلثًا؛ أو خمسةٌ بواحد، وهي الزائدةُ نِصفًا؛ أو ثمانيةٌ بواحد، وهي الزائدةُ الضِّعف. وقد ذكر ابن سينا في النبض هذه النِّسَب لحاجةٍ كانت في ذلك للنبض، فإن لم تتبيَّن له من كلامه، فيتحصّل له صورةُ النبض على الكمال. والله هو العالم ربُّ العالمين.

From this proportion[47] is derived the composition (*taʾlīf*) of melodies. The fourth consists of four sounds and corresponds to an increase by a third (4:3); the fifth consists of five sounds and corresponds to an increase by a half (3:2); and the octave, that is, the double, consists of eight sounds (2:1). By “sounds” I mean that a tone begins as if low, then rises in pitch according to the measure of its proportional increase – four to one from the fundamental or starting note (*wāḥid*), when the excess is a third; five to one [from the starting note], when the excess is a half; and

shows that the compiler retained the technical lexicon of instrumental theory within a mathematical framework. See SHILOAH, « Deux textes arabes inédits sur la musique », p. 221–248, in part. note 88; p. 233–234.

[44] The word אלזאיד (*al-zāʾid*, ‘the exceeding’ or ‘added’) is omitted in Shiloah’s Judeo-Arabic transcription, most likely by oversight. SHILOAH, « Deux textes arabes inédits sur la musique », p. 228.

[45] Shiloah notes that, at this point, the copyist attempted to erase a word by scraping the parchment; see SHILOAH, « Deux textes arabes inédits sur la musique », p. 228.

[46] Or. Oct. 350, fol. 30v. In Shiloah’s Judeo-Arabic transcription, several forms appear normalized and at times over-corrected – for example, the feminine *hiya* referring to *aṣwāt* (‘sounds’) is rendered as the masculine *huwa*. Similar fluctuations occur elsewhere. In the normalized Arabic transcription presented here, these forms have been regularized according to grammatical context, whereas in the unnormalized version diacritics and graphic signs (e.g., three points for *th* [ث], one dot for *kh* [خ] or *dh* [ذ]) are reproduced as they appear in the manuscript.

[47] Just before citing Avicenna, the *Kitāb al-mūsīqī* discusses the threefold classification of proportions – arithmetic, geometric, and harmonic – and concludes with the definition of the harmonic proportion, expressed as 3:4:6. Here, the ratio between the middle term (4) and the first term (3) is 4:3, corresponding to the fourth; the ratio between the greater term (6) and the middle term (4) is 6:4, reduced to 3:2, corresponding to the fifth; and the ratio between the greater term (6) and the first term (3) is 6:3, reduced to 2:1, corresponding to the octave. Algebraically, this relation may be expressed as a : c = (b – a) : (c – b).

> eight to one [from the starting note], when the excess is the double. Ibn Sīnā mentioned these same ratios with regard to the pulse, since they were required for that purpose. Even if they are not explicitly evident from his words, one may nevertheless derive from them a complete understanding of the pulse. And God is the All-Knowing, Lord of the Worlds.

In the *Qānūn fī l-ṭibb*, the extensive chapter on the pulse appears in Book I, *al-fann al-thānī* (Second Section), within the third teaching (*taʿlīm*) devoted to symptoms and indications (*al-aʿrāḍ wa-l-dalāʾil*).[48] In its opening chapter, Avicenna, following Galen,[49] explains that the measurement of metrical correspondences (*munāsabāt al-wazn*) perceived in the pulse are not merely comparable to musical intervals in a loose sense, but can be described through precise numerical ratios. Alongside the multiple ratios (in which one term is an exact multiple of another, such as 2 : 1 or 3 : 1, representing the octave and the twelfth), he lists the epimoric ratios (where the greater term exceeds the lesser by one of its parts, such as 3 : 2, 4 : 3, and 5 : 4), corresponding respectively to the fifth, the fourth, and the major third. These proportional relations express the rhythmic alternation of expansion and contraction in the artery, so that bodily harmony is defined by numerical commensurability.[50]

The relationship, however, must be carefully qualified. The pulse is measured through ratios that are mathematically precise; yet these ratios are borrowed from *ʿilm al-taʾlīf*, where they properly define relations of pitch, sharpness, and heaviness.

Their application to the pulse is therefore not a simple identification between music and physiology, but an analogical transfer of a mathematical model from musical consonance to bodily rhythm.

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[48] For Ibn Sīnā's passage on musical ratios in the pulse, see Ibn Sīnā, *Kitāb al-Qānūn fī l-ṭibb*, ed. Muḥammad A. al-Ḍannāwī, 3 vols., Dār al-kutub al-ʿilmiyya, Beirut 1999, vol. I, p. 168–182. In Greek and Arabic medicine, the study of symptoms related to the *animal faculty* (*al-quwwa al-ḥayawāniyya*) – the vital power residing in the heart and circulating through the arteries to preserve innate heat – was conducted by observing the movements of the radial artery. This discipline, known as the *science of the pulse* (*ʿilm al-nabḍ*), served to diagnose both the strength or weakness of the animal faculty and the equilibrium of innate heat within the heart.

[49] وَجَالِينُوس يَرَى أَنَّ الْقَدْرَ الْمَحْسُوسَ مِنْ مُنَاسَبَاتِ الْوَزْنِ مَا يَكُونُ عَلَى إِحْدَى حُذُو النِّسَبِ الْمُوسِيقَارِيَّةِ الْمَذْكُورَةِ
Galen holds that the perceptible measure of rhythmic correspondence is that which follows one of the musical ratios mentioned above. (Ibn Sīnā, *Kitāb al-Qānūn fī l-ṭibb,* vol. I, p. 171). For Galen's ambiguous position on the validity of rhythmic examination in pulse evaluation, as well as his listing of musical ratios for pulse diagnosis, see Laura Tribuzio, « The Science of Pulse between Logical and Musical Speculations, from Galen to Ibn Sīnā's Arabic Commentaries », *Eurasian Studies*, 10 (2012), p. 235–259, in part. p. 256.

[50] We can also observe that, in Ibn Sīnā's tradition, these ratios are identified differently. For example, in a writing attributed to him – but of doubtful authenticity – titled *Rag shināsī yā risāla-yi nabḍ*, the reported ratios are 6:1, 2:1, and 4:1; see Ibn Sīnā, *Rag shināsī yā risāla-yi nabḍ*, ed. Muḥammad Mishkwāt, Anjuman-i Āthār-i Millī, Teheran 1951, p. 32.

Comparing Avicenna's adaptation of the Galenic[51] discussion of pulse ratios in the *Qānūn* with the passage in the *Kitāb al-mūsīqā* shows that the Judeo-Arabic compiler reproduces only three of them – 4 : 3, 3 : 2, and 2 : 1 – the intervals derived directly from the harmonic proportion 3 : 4 : 6 and regarded as the most consonant in music. They correspond, respectively, to the fourth [four degrees from the *wāḥid*], the fifth (five degrees, 3 : 2 = 6 : 4), and the octave (eight degrees, 2 : 1 = 6 : 3). These relations arise naturally from the experiment of the string: by doubling, halving, and dividing it in these simple ratios, one generates the same consonances that define musical harmony – and, by extension, the rhythmic balance of the pulse.

The *Kitāb al-mūsīqā* does not merely reproduce Avicenna's example but reinterprets it within its own structure. The ratios described in the final lines are the direct and practical outcome of the theoretical model of harmonic proportion developed earlier in the text. In Avicenna, the transfer from *ta'līf* to pulse remains analogical, since *ta'līf* strictly concerns pitch relations. In the Judeo-Arabic compilation, however, the same ratios are integrated into a broader Ikhwānian conception of *mūsīqī* as a science of proportion and measured motion. The vibration of the string and the pulsation of the artery are not identical phenomena, but both become intelligible through the same numerical language of commensurable ratios.

Mūsīqī thus emerges not simply as the science of audible sound, but as a discipline capable of quantifying measured motion, whether in pitch or in pulse. Avicenna's employment of these ratios in the *Qānūn* explains why the compiler could naturally situate this musical treatise among medical writings: both disciplines depend on the same logic of proportion and measure. The convergence between musical and physiological reasoning does not erase the analogy between them; rather, it reveals a shared mathematical foundation through which harmony expresses the measured correspondence of movements in nature.

VI. *Notating Ratios: Numerical and Letter Numerical Notation in the* Kitāb al-mūsīqā

Although Amnon Shiloah correctly identified the *Kitāb al-mūsīqā* as comprising material from both the *Epistle on Music* and the *Epistle on Proportions*, the significance of their joint transmission has not been fully explored. A closer examination of the Judeo-Arabic compilation suggests that the two treatises are not merely juxtaposed, but deliberately fused and arranged as a progression from

[51] On Ibn Sīnā's selective reworking of Galen's pulse ratios and on the analogical, rather than identical, relation between musical ratios and pulse perception, see Tribuzio, « The Science of Pulse between Logical and Musical Speculations », p. 247–260.

the general to the particular. The central focus thus falls on the concept of *nisba* (ratio/proportion), which is marked throughout the manuscript by the parallel use of Hindu-Arabic numerals and Hebrew letter-numerals following *abjad* values to indicate a series of ratios drawn from the *Epistle on Proportions* (fol. 29r; see figures 6–8).

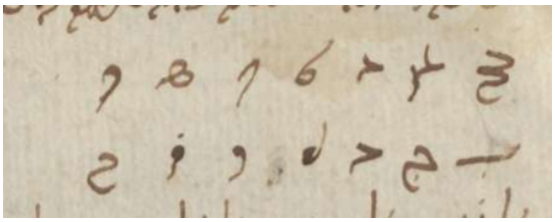

Fig. 6: Berlin, Staatsbibliothek zu Berlin, Or. Oct. 350, fol. 29r, ll. 5–6, *Kitāb al-mūsīqā*. The upper line gives the numerical ratios (in Arabic numerals), and the lower line gives the corresponding values written in Hebrew letters used in the abjad system (following the Judeo-Arabic practice): 3:2; 4:3: 5:4; 6:5; 7:6; 8:7; 9:8 (epimoric ratios). (Manuscript property of: Staatsbibliothek zu Berlin – Preussischer Kulturbesitz, Orientabteilung).

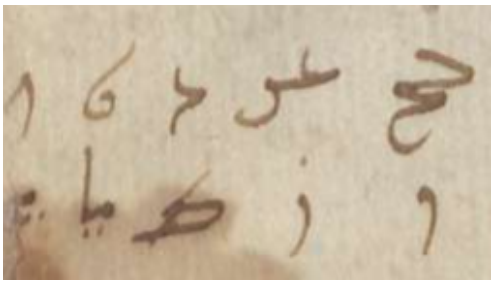

Fig. 7: Berlin, Staatsbibliothek zu Berlin, Or. Oct. 350, fol. 29r, ll. 8–9: 5:3, 7:4, 9:5, 11:6, 13:7 (superpartient ratios). Manuscript property of: Staatsbibliothek zu Berlin – Preussischer Kulturbesitz, Orientabteilung).

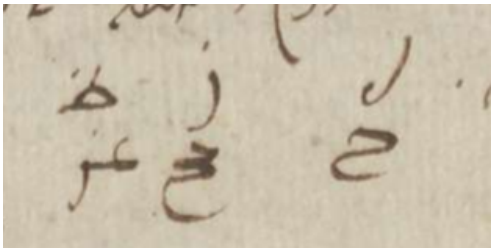

Fig. 8: Berlin, Staatsbibliothek zu Berlin, Or. Oct. 350, fol. 29r, ll. 11–12: 5:2, 7:3, 9:4 (multiple-superparticular ratios). Manuscript property of: Staatsbibliothek zu Berlin – Preussischer Kulturbesitz, Orientabteilung).

This notational arrangement reinforces the mathematical basis of *mūsīqī* by making the sequence of ratios immediately legible within the page layout. It should not be understood as a fully diagrammatic visualization of proportions, but rather as a graphic-numerical mode of notation. In this respect, it differs from other Judeo-Arabic and Hebrew musical or medical commentaries, where string ratios could be represented more literally through proportional lines or diagrams.

The compiler's connecting remark signals the shift from the general exposition of the science of music to the specific analysis of ratios and proportions, thus shaping a single, continuous argument in which *nisba* emerges as the mathematical principle linking music and the natural order.[52]

VII. *The Enduring Mathematical Tradition of* mūsīqī *in the Judeo-Arabic Transmission of the Brethren: On the Status of* mūsīqī

A clear understanding of the Judeo-Arabic transmission of the Brethren's conception of music requires a more precise account of the semantic and disciplinary status of *mūsīqī* within the Arabic philosophical tradition and its Judeo-Arabic reception. Rather than treating *mūsīqī* as a self-evident equivalent of modern 'music', this section examines how the term could designate both practical musical activity and a theoretical-mathematical science concerned with proportion, harmony, and motion.

فقد يُظَنُّ بهذه الصِّناعةِ [الموسيقية] أنّها نظريّةٌ وعَمَليّةٌ، بسببِ مُشاركتِها صِناعةَ عِلمِ الموسيقى العمليّةِ في الاسم، وليس كذلك ...

One may mistakenly think of this craft [music] as both theoretical and practical, due to its sharing a name with the practical science of music; yet this is not the case ...[53]

Al-Fārābī's caution regarding the shared name of practical and theoretical music is particularly useful for the present discussion. It does not imply that *mūsīqī* was simply reduced to audible performance but rather shows that authors themselves were aware of the need to distinguish between practical music-making and the theoretical science of music. In the Arabic philosophical context relevant to the Brethren, and in the Judeo-Arabic manuscript examined here, *mūsīqī* is therefore approached primarily as a theoretical mathematical discipline, grounded in proportion and motion.

The Brethren themselves express a similar awareness in several passages of the *Epistles*, introducing the lexeme *mūsīqī* with phrases such as *mulaqqaba bi-* ('commonly known as'), *yuʿrafu bi-* ('known as'), or *khuṣṣa bi-* ('designated by') when

[52] On more explicitly diagrammatic representations of musical ratios in Hebrew and Judeo-Arabic materials, including proportional lines, see Adler, *Hebrew Writings Concerning Music*. The present manuscript does not employ such diagrams; its interest lies rather in the juxtaposition of numerical and letter-numerical notation. Given the Sevillian provenance of the manuscript in a Christianate milieu after 1248, this notational practice should also be situated within a broader Mediterranean context in which Arabic, Hebrew, and Latin mathematical cultures interacted. The evidence considered here, however, does not allow us to posit any direct dependence on a specific textual source.

[53] al-Fārābī, *Kitāb al-mūsīqī al-kabīr*, ed. Ġaṭṭās ʿAbd al-Malik al-Khashaba, Maḥmūd Aḥmad al-Ḥifnī, al-Majlis al-aʿlā li-l-funūn wa-l-ādāb wa-l-ʿulūm al-ijtimāʿiyya, Cairo 1967, p. 89.

referring to the science of harmony (*ṣināʿat al-taʾlīf*). These expressions suggest that *mūsīqī* could function as a conventional label rather than as an exact technical definition – for instance, when they write of « the science of harmony which is commonly known as *mūsīqī*. »

In doing so, they acknowledged that this discipline was generally called *mūsīqī* without being identical to it in meaning.[54]

The terminological tension already present in the Arabic reception of Greek materials formed the focus of my earlier studies on *Epistles 5* and *6*,[55] where I situated both texts within their third/ninth-century philosophical and scientific context. The present section builds on that argument by examining how the Judeo-Arabic *Kitāb al-mūsīqā* preserves and reorganizes this understanding of *mūsīqī* as a theoretical mathematical science, without reducing it to practical music-making.

VII.1. Is *mūsīqī* Synonymous with 'Music'?
Mūsīqī and the Order of *Epistle 5* and *Epistle 6*

Based on the analysis of the sources, it appears that during the third/ninth century, the term *mūsīqī* was adopted in Arabic literature as a transliterated generic term referring to the mathematical science of ratios and proportions. This science was more properly denoted by the Arabic term *taʾlīf*, corresponding to the Greek lexeme *harmonía* (ἁρμονία, 'harmony').

The foundations of harmony as a field of mathematical inquiry were established by the Pythagoreans, who conducted empirical investigations into the relationship between quantities and numbers within the domain of *mousikē* (μουσική). This close connection between music and mathematic was continuously reinforced throughout the Greek tradition and its subsequent transmission.[56] Consequently, by the third/ninth century, *mūsīqī* in Arabic usage had come to denote a distinct branch of mathematics devoted to the study of ratios and proportions.

This historical perspective suggests that the characterization of *mūsīqī* as a propaedeutic science in medieval Arabic sources requires further qualification.[57]

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[54] I have provided a detailed examination of how *mūsīqī* is mentioned by the Brethren, including an appendix on the use of the term *mulaqqaba* throughout the *Epistles* in Tribuzio, « Restoring Harmony », p. 341–342; p. 362–364.

[55] Tribuzio, « Restoring Harmony » and Tribuzio, « The Exception is Music », p. 69–74.

[56] For the history of harmony in Greek literature – which remains difficult to reconstruct and often uncertain – see, among others, Andrew Barker, *The Science of Harmonics in Classical Greece*, Cambridge University Press, Cambridge 2007 and Árpád Szabó, *The Beginnings of Greek Mathematics*, transl. A. M. Ungar, D. Reidel Publishing Company, Dordrecht – Boston 1978.

[57] Indeed, it is evident that there have been two distinct research fronts in the study of mathematics and music. The mathematical front has critically examined the mathematical nature of music within Greek and Latin literature. However, the musical front, which focuses on music as a part of the *quadrivium*, has not sufficiently clarified the relationship between music and mathematics.

In the context examined here, *mūsīqī* denotes not only a preparatory discipline, but also the science of harmony itself, that is, the study of ratios and proportions forming the mathematical foundation of consonance, balance, and order.

Re-examining this point compels a new reading of *Epistles 5* and *6*. The traditional interpretation, which treats *Epistle 5* as an introduction to *mūsīqī* and *Epistle 6* as an arithmetic appendix, obscures the original structure.[58] Evidence suggests that the two epistles form a single intellectual unit.[59] *Epistle 6* represents the theoretical core: it develops the mathematical basis of *mūsīqī,* called *ʻilm al-taʾlīf* (ʻscience of harmony') *Epistle 5,* originally following *Epistles 7* and *8*,[60] appears as a practical adaptation of that theory. The Judeo-Arabic transmission confirms this reading, since both epistles are transmitted together under the single title *Kitāb al-mūsīqā.*

VII.2. *Mūsīqī* between Mathematics and Perception: The Case of al-Fārābī

Arabic writings from the third/ninth century onward consistently associated *mūsīqī* with mathematics, defining it as a science grounded in ratios (*nisab*) and

The current conceptual boundaries between these two fields have influenced investigations for a considerable period, underscoring the need for a comprehensive examination of Arabic literature sources to gain a deeper understanding of the subject matter.

58 For the broader redactional and codicological context that invites a reconsideration of the traditional separation between *Epistles 5* and *6*, see Janne Mattila, *The Formation of the Ikhwānian Corpus: A Philological Study of the Epistles and Two Summaries Attributed to the Brethren of Purity*, Brill, Leiden – Boston 2025, esp. chapters 1–3. Mattila's discussion of the gradual redaction of the *Epistles*, their curricular order, manuscript variation, titles, transitions, and internal cross-references is particularly relevant to the unstable position and relationship of *Epistles 5* and *6* in the transmission. My reading is compatible with this broader framework, while focusing specifically on their musical and mathematical unity.

59 See note 5, *supra.*

60 A re-evaluation of the order of the *Rasāʾil* suggests that the epistle *On Music*, which does not place strong emphasis on mathematical aspects, was subsequently relocated and positioned alongside *On Proportions*. See Tribuzio, « The Exception is Music », p. 74–81. Abbas Hamdani, in his study « The Arrangement of the *Rasāʾil Ikhwān al-Ṣafāʾ* and the Problem of Interpolations », in El-Bizri (ed.),*The Ikhwān al-Ṣafāʾ and Their Rasāʾil*, p. 83–100, challenges the traditional view of the *Rasāʾil* as a gradual and collaborative corpus. He proposes instead that the *Epistles* were not composed sequentially but rather simultaneously, following a coherent plan of content and arrangement between 260/873 and 297/909. While my own research focuses on selected thematic areas within the *Rasāʾil*, rather than the corpus as a whole, my findings resonate with the conclusions of Godefroid de Callataÿ, who argues that the composition was a lengthy, multi-author process, possibly initiated as early as the 10th century or before. It therefore seems plausible that the writing of the fifty-two epistles was a gradual and cumulative enterprise, with multiple contributors working at different stages. Revisions and rearrangements likely occurred over time, accounting for the textual variations and the shifting positions of *On Music* and *On Proportions*. As Hamdani and other scholars have suggested, further manuscript-based study is needed to clarify the complex evolution of the *Rasāʾil* and the interplay of different authorial voices; cf. de Callataÿ, « From Ibn Masarra to Ibn ʿArabī », p. 232.

harmony (*taʾlīf*). This conception, which we encounter in the Brethren's *Epistles*, derives from an older Pythagorean framework[61] transmitted through the works of al-Kindī and his circle, often referred to in modern scholarship as *la tradition kindienne*, where music functions as a mathematical discipline concerned with proportions rather than with sound itself. Within this tradition, represented by al-Kindī, Qusṭā ibn Lūqā, al-ʿĀmirī, and the Ikhwān al-Ṣafāʾ, the four mathematical sciences were understood to comprise arithmetic, geometry, astronomy, and music – the last dealing with relations among numbers rather than with numbers taken *per se*.[62]

Al-Fārābī's contribution, while often read as a departure from this tradition, should rather be seen as its complement. In the *Kitāb al-mūsīqī al-kabīr* [63](*Great Book of Music*, fourth/tenth centuries) he distinguishes between two approaches to the science of music. One is empirical, deriving its principles from practical experience (*tajriba*) and the sensory study of melodies and rhythms. The other is theoretical, treating music through mathematical categories that express its fundamental proportions. For al-Fārābī, both aspects are necessary: music is a practical art whose theoretical study nonetheless belongs among the speculative sciences. He thus maintains the same conceptual boundary found in al-Kindī's tradition between arithmetic – concerned with number considered in itself (*ʿadad ʿalā iṭlāq*) – and music, which deals with numbers in relation to one another (*al-nisab*). In the *Iḥṣāʾ al-ʿulūm* (*Enumeration of the Sciences*),[64] widely known among Jewish and Latin

[61] The term 'Pythagorean framework' refers to the mathematical conception of *mūsīqī* as a science of ratios and harmony. In Arabic sources, this framework is not presented in opposition to Aristoxenus's perceptual approach but rather integrated with it; both rational and sensory criteria coexist. See Laura Tribuzio, « La scienza acustica tra *philosophia* e medicina nella tradizione avicenniana (XI–XIII s.) », PhD diss. Università degli Studi di Bari 2006, p. 23–30.

[62] On this intellectual lineage, which modern scholarship has called *la tradition kindienne*, see Daniel De Smet, « Une classification ismaélienne des sciences. L'apport d'Abū Yaqūb al-Sijistānī à la 'tradition d'al-Kindī' et ses liens avec Abū 'l-Ḥasan al-ʿĀmirī », in Anna Aksoy, Wim Raven (eds.), *Islamic Thought in the Middle Ages. Studies in Text, Transmission and Translation in Honour of Hans Daiber*, Brill, Leiden 2008, p. 79 note 13. See also Tribuzio, « The Exception Is Music », p. 69–74, on the classification of *mūsīqī* within this tradition.

[63] Al-Fārābī, *Kitāb al-mūsīqī al-kabīr*, p. 47–105; see also Rodolphe d'Erlanger, *La Musique arabe.* t. I : *Grand traité de la musique* (*Kitābu l-Mūsīqī al-Kabīr*), Geuthner, Paris 1930, p. 5–36. In this treatise al-Fārābī distinguishes between *al-ṣināʿa al-naẓariyya* (the theoretical art) and *al-ṣināʿa al-ʿamaliyya* (the practical art), showing that music, though rooted in sensory experience, belongs to the theoretical/speculative sciences, more specifically to the mathematical sciences. This articulation complements, rather than departs from, the earlier Kindian conception of *mūsīqī* as a mathematical discipline.

[64] Al-Fārābī, *Iḥṣāʾ al-ʿulūm*, ed. ʿUthmān Āmīn, 2nd ed., Dār al-Fikr al-ʿArabī, Cairo 1949, p. 76; p. 86–88. al-Fārābī maintains a clear distinction between arithmetic (*ʿadad ʿalā iṭlāq*), which studies numbers in themselves, and music (*al-nisab*), which investigates numbers as relational magnitudes. For an analysis of how this distinction is echoed and reinterpreted in later Arabic sources, see Tribuzio, « Restoring Harmony », esp. note 44.

readers,[65] al-Fārābī reiterates this classification.[66] There, *mūsīqī* occupies an intermediate position: it belongs to mathematics by virtue of its subject matter (*ratios*), yet also touches upon physics because of its concern with sound and perception. This double affiliation of music with both mathematics and physics helps explain the semantic and disciplinary flexibility surrounding *mūsīqī*, as well as the terminological caution already observed in the Brethren's *Epistles*. It also provides a useful framework for understanding how later readers and compilers could associate the science of proportions with music without necessarily collapsing the two disciplines into one. It is in this broader intellectual horizon that the Judaeo-Arabic arrangement of *Epistles 5* and *6* may be reconsidered.

VIII. *Conclusion:* Epistles 5 *and* 6 *between Manuscript Evidence and al-Fārābī's Legacy?*

The joint transmission of *Epistles 5* and *6* in the Judaeo-Arabic *Kitāb al-mūsīqā* is supported by both manuscript evidence and the internal content of the two texts. Their arrangement under a single title, together with the compiler's remark on the usefulness of the science of proportions for music, suggests that the association was not accidental. *Epistle 6* provides the theoretical-mathematical

[65] For the Hebrew transmission of this work, in addition to other direct and indirect references, it may be noted that around 1250 Shem Tov Ibn Falaquera incorporated several passages from al-Fārābī's *Iḥṣāʾ al-ʿulūm* into his own 'Enumeration of the Sciences' (*Rēshit ḥokhmāh*); subsequently, Qalonymos ben Qalonymos completed the full Hebrew translation of the treatise in 1314 (*Be-mispar ha-ḥokhmōt*), thereby broadening access to al-Fārābī's theories. See Mauro Zonta, « Influence of Arabic and Islamic Philosophy on Judaic Thought », in Edward N. Zalta, Uri Nodelman (eds.), *The Stanford Encyclopedia of Philosophy*, Metaphysics Research Lab, Stanford University (first published 10 Dec 2007; substantive revision 21 Feb 2024): https://plato.stanford.edu/entries/arabic-islamic-judaic/ (Accessed Oct. 2025). For the inclusion of musical passages in *Tibb al-nufūs* by Joseph ben Judah Ibn ʿAqnin and in *Shem Tov Ibn Falaquera's Rēshit ḥokhmāh*, see Adler, *Hebrew Writings Concerning Music*, p. 155–158 (290); p. 166–168 (330); for Qalonymos ben Qalonymos's translation see Ibid., p. 201–202 (470). In the Latin tradition of the *Iḥṣāʾ al-ʿulūm*, two translations entitled *De Scientiis* were produced in twelfth-century Toledo – one literal by Gerard of Cremona and another paraphrastic by Dominicus Gundissalinus – which were later incorporated into thirteenth-century Latin encyclopaedism (Vincent of Beauvais, Roger Bacon, Jerome of Moravia). See Andrea Pozzobon, « La tradizione latina dell'*Iḥṣāʾ al-ʿulūm* di al-Fārābī », Ph.D. Diss., Università di Padova 2012.; Id., *La classificazione delle scienze (De Scientiis)*, Il Poligrafo, Padova 2013; Charles Burnett, *Arabic into Latin in the Middle Ages: The Translators and Their Intellectual and Social Context*, Ashgate, Aldershot 2009.

[66] The *Iḥṣāʾ al-ʿulūm* (translated into Latin as *De Scientiis*) divides theoretical music (*ʿilm al-mūsīqī al-naẓarī*) into five discourses (*aqwāl*); the second (*qawl fī uṣūl hādhihi l-ṣināʿa*) concerns « the derivation (*istikhrāj*) of the notes ... and the clarification (*tabyīn*) of their ratios to one another ». The sequence *istikhrāj al-naghm / tabyīn al-nisab* shows that musical pitches are conceptually derived from mathematical relations, not merely described by them – a nuance later flattened in the Latin *De Scientiis*, where *tabyīn* is rendered *declaratio* and *nisab* simply *proportiones* rather than *ratios*. See also note 42, *supra*.

discussion of ratios and proportions, while *Epistle 5* explores their qualitative and practical manifestations in music, the arts, and the natural order. The two epistles are therefore presented not as independent treatises, but as complementary parts of a single musical-mathematical inquiry.

Al-Fārābī's legacy [67] may help to contextualize this arrangement within a broader intellectual tradition in which *mūsīqī* was understood not merely as practical music-making, but as a theoretical science grounded in mathematical reasoning and informed by sensory experience. This does not require assuming a direct dependence on al-Fārābī by the Judaeo-Arabic compiler. Rather, his formulation offers a useful horizon for understanding how later readers could view ratios, proportions, and harmony as belonging to the wider domain of musical science. In this sense, the Berlin manuscript does more than preserve a textual variant: it shows how the relation between music and proportion could be reorganized within a medical and scientific compilation, where *mūsīqī* emerges as a science of harmony capable of connecting mathematical abstraction, perceptual experience, and the order of the living body.

This study has taken its starting point from Gulielmus Gosselinus, who opened his *De arte magna, seu de occulta parte numerorum* (Paris, 1577) with the observation: « Contempletur numeros secundum se Arithmeticus, numeros certe sub ratione ad aliud cognoscet Musicus et Algebræus » – « Let the arithmetician contemplate numbers in themselves, while the musician and the algebraist know them in relation to another ».[68] By associating music and algebra as disciplines concerned with number in relation, Gosselinus places both within the domain of what he calls *de occulta parte numerorum* – the hidden part of numbers. Music and algebra, in this perspective, do not contemplate number in itself, but investigate the relations that govern it.

The folios 28v–30v of Berlin Or. Oct. 350 reflect a comparable concern within a much earlier Judaeo-Arabic and Ikhwānian framework. Through the joint transmission of the *Epistle on Music* and the *Epistle on Proportions*, the manuscript preserves a conception of *mūsīqī* as a science of ratios and proportions: an inquiry into the mathematical order underlying sound, harmony, and, in its final section, the measured rhythm of the living body. The comparison with Gosselinus is not meant to suggest direct continuity, but to illuminate a shared intellectual problem:

[67] For the Hebrew reception and translations, see note 65, *supra*. On the Latin tradition of De Scientiis and its influence on medieval European writers on music, see Henry G. Farmer, « The Influence of al-Fārābī's 'Iḥṣāʾ al-ʿulūm' (De Scientiis) on the Writers on Music in Western Europe », *The Journal of the Royal Asiatic Society of Great Britain and Ireland*, 3 (July 1932), p. 561–592, esp. 573; and Don M. Randel, « al-Fārābī and the Role of Arabic Music Theory in the Latin Middle Ages », *Journal of the American Musicological Society*, 29/2 (Summer 1976), p. 173–188, esp. 176.

[68] See note 1, supra.

how number, when considered relationally, becomes capable of explaining domains that are not immediately reducible to arithmetic alone.

In this sense, the Berlin manuscript and Gosselinus's treatise, though distant in time, language, and context, both point to the same broader question: the search for what remains hidden yet intelligible within numerical relations.

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