

A survey of the history of musical notation

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Abstract

Music has been and still is an essential part of life. Similar to writing text there have been various ideas on how to notate music. This article tries to show, with many images, the solutions found in the course of more than 3000 years of history.

1 Introduction

Over the millennia, humanity has developed many different ways to notate music. The solutions can be roughly categorized visually as follows.

1. action description
2. words
3. letters
4. digits
5. graphics
6. stylized graphics
7. abstract symbols
8. combination of 1–7

This ordering also roughly corresponds to historical development across cultures: The oldest Chinese sources we know of are action descriptions, Mesopotamia seems to have started with letters and digits, while modern Western notation essentially uses all possible combinations.

Interestingly, preserving music itself has been much less important than preserving words – this is true for all ancient cultures throughout the world. We know many texts of hymns and songs, but their music did not survive. Another observation is that most cultures only developed *tablatures*. A tablature basically notates the fingering to play the music on an instrument, not the music itself. An exception to that was a notation system for songs in ancient Greek; however, it was lost with the fall of the Roman empire. Perhaps due to the century-long ban of instruments in the church music of early Christianity, musicians in western Europe developed new ways to notate sung music, which eventually led to the modern notation which is used all over the world today.

The emphasis in this survey is on the graphical representation of music, showing both the inventiveness and the beauty of the solutions discovered, via many images. Using some technical terms related to music for the descriptions is unavoidable; readers without a musical background, however, can simply skip them and enjoy the pictures for themselves.

This article is a greatly revised and extended version of a paper submitted to the MOTYF 2014 confer-



<https://www.youtube.com/watch?v=27opckxcg1c>, with permission

Figure 1: A kinnor-like lyre.

ence proceedings.¹ Most images shown here are high-resolution scans; it is thus recommended that you have a look at the online PDF version so that you can zoom into the document for details!

The music examples were typeset with GNU LilyPond version 2.19.43.²

2 Mesopotamia – Hurrian songs

The oldest notation for music we currently know of was found in the Royal Palace at Ugarit, an ancient port city in northern Syria, today called Ras Shamra (رأس شمرة). These clay tablet shards date to approximately 1400 BCE (figs. 2 and 3); the notation uses words and digits (in Akkadian cuneiform) for a nine-string lyre (fig. 1).

There are several problems making it hard to interpret the data in a meaningful way.

- The text is written in a poorly understood Hurrian dialect.
- Words in the notation represent intervals, not pitches (fig. 4) – is this polyphonic? If not, what is the order of the pitches? Ascending? Descending?
- Should the intervals be filled with scales or something different? In other words, is this a one-to-one representation of what should be played, or is it just a mnemonic aid?
- What do the numbers mean? Repetition? Beats? Something completely different?

3 Greece – The Seikilos Column

The example shown in this section is the famous Seikilos column, found in one of the largest Aegean cities in antiquity, Tralleis (Τραλλεῖς, today Aydın, Anatolia, Turkey), with an approximate age of 2000 years (figs. 7, 5, 6). It is a tombstone depicting an epigram or a skolion (drinking song).

1. MOTYF. International Students' Moving Type Festival 2014: *Type in Music, the Rhythm of Letters*. Polsko-Japońska Akademia Techniki Komputerowych, Warsaw 2015. ISBN 978-83-63103-76-7.

2. <http://www.lilypond.org>

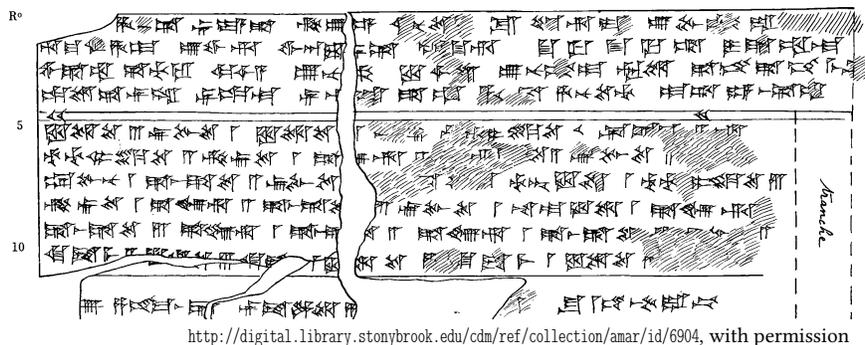


http://www.ramivitale.com/wp-content/uploads/2013/09/H6TabletsFront_lg.jpg



http://www.ramivitale.com/wp-content/uploads/2013/09/H6TabletsBack_lg.jpg

Figure 2: Hymn tablet h. 6 (front and back), consisting of shards RS 15.30, 15.49, 17.387 (Natl. Museum of Damascus).



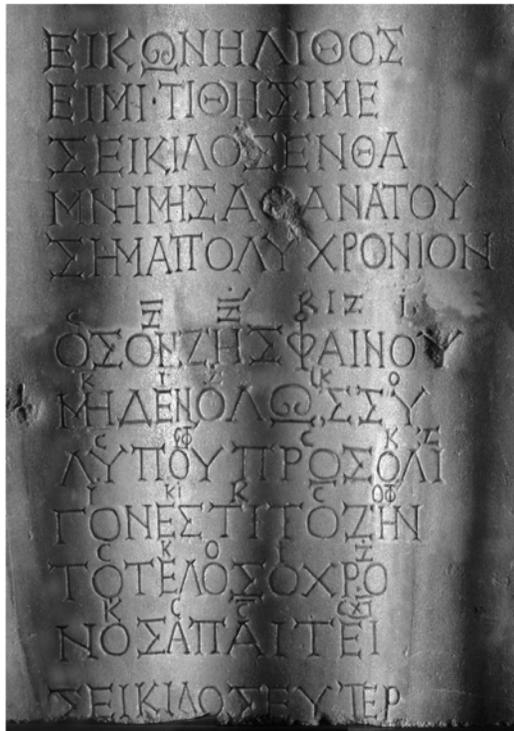
<http://digital.library.stonybrook.edu/cdm/ref/collection/amar/id/6904>, with permission

- R^o 5 qáb-li-te 3 ir-bu-te 1 qáb-li-te 3 ša-aḥ-ri 1 i-šar-te 10 uš-ta-ma-a-ri
- 6 ti-ti-mi-šar-te 2 zi-ir-te 1 ša-aḥ-ri 2 ša-aš-ša-te 2 ir-bu-te 2
- 7 um-bu-be 1 ša-aš-ša-te 2 ir-bu-te 1[+X] na-ad-qáb-li 1 ti-ti-mi-šar-te 4
- 8 zi-ir-te 1 ša-aḥ-ri 2 ša-aš-ša-te 4 ir-bu-te 1 na-ad-qáb-li 1 ša-aḥ-ri 1
- 9 ša-aš-ša-te 4 ša-aḥ-ri 1 ša-aš-ša-te 2 ša-aḥ-ri 1 ša-aš-ša-te 2 ir-bu-te 2
- 10 ki-it-me 2 qáb-li-te 3 ki-it-me 1 qáb-li-te 4 ki-it-me 1 qáb-li-te 2

Figure 3: A transcription of the cuneiform text below the double line that represents musical notation, following Manfred Dietrich and Oswald Loretz (*Kollationen zum Musiktext aus Ugarit*, Ugarit-Forschungen 7, 1975).



Figure 4: The intervals and counters as used in the Hymn tablet. Depending on the order of strings (either ascending or descending), which is unknown, either the first or the second line is the correct one.



<https://commons.wikimedia.org/wiki/File:Seikilos2.tif>

Figure 5: The text of the Seikilos column; left a flattened image, right a version with modernized orthography. Note the final ‘T’ character: To get more symbols for music notation, Greek characters were both mirrored and rotated.

ΕΙΚΩΝΗ ΛΙΘΟΣ
ΕΙΜΙ·ΤΙΘΗΣΙ ΜΕ
ΣΕΙΚΙΛΟΣ ΕΝΘΑ
ΜΝΗΜΗΣ ΑΘΑΝΑΤΟΥ
ΣΗΜΑ ΠΟΛΥ ΧΡΟΝΙΟΝ
ΟΣΟΝ ΖΗΣ ΦΑΙΝΟΥ
ΜΗΔΕΝ ΟΛΩΣ ΣΥ
ΛΥΠΟΥ·ΠΡΟΣ ΟΛΙ-
ΓΟΝ ΕΣΤΙ ΤΟ ΖΗΝ.
ΤΟ ΤΕΛΟΣ Ο ΧΡΟ-
ΝΟΣ ΑΠΑΙΤΕΙ.

Εἰκὼν ἑλίθος εἰμί.
Τίθησί με Σεἰκίλος ἐνθα
μνήμης ἀθανάτου
σήμα πολὺ χρόνιον.

I am a tombstone, an image.
Seikilos placed me here
as an everlasting sign
of deathless remembrance.

Ὅσον ζῆς φαίνου
μηδὲν ὀλῶς σὺ λυποῦ·
πρὸς ὀλίγον ἐστὶ τὸ ζῆν.
τὸ τέλος ὁ χρόνος ἀπαιτεῖ.

While you live, shine
have no grief at all
life exists only for a short while
and time demands its toll.

Hoson zēs, phai - nou mē-den ho-lōs sy ly - pou pros ol-igon es - ti to zēn to te-los ho chronos a-pai - tei
Ὅ-σον ζῆς, φαί - νου μη-δὲν ὀ-λῶς σὺ λυ-ποῦ· πρὸς ὀλ-ί-γον ἐσ - τι τὸ ζῆν τὸ τέλος ὁ χρό-νος ἀπαι-τεῖ

Figure 6: A text version of the Seikilos column using mixed-case Greek, together with an English translation and a representation with modern musical notation. A bar over letters represents two beats, a hooked bar three beats. A dot indicates an unstressed beat, a tie below letters marks a syllable to be sung with more than a single note.

In contrast to the Hurrian songs, this is the earliest known piece of music that can be *almost exactly* transcribed to today’s music notation, thanks to many scientific works of Pythagoras and others who introduced music notation for their theoretical treatises. Sadly, the number of music pieces that actually use the notation is

very small; as mentioned in the introduction, it was not considered important to be written down. Additionally, knowledge of this notation system was lost in the early middle ages; only the text of Greek songs has survived.



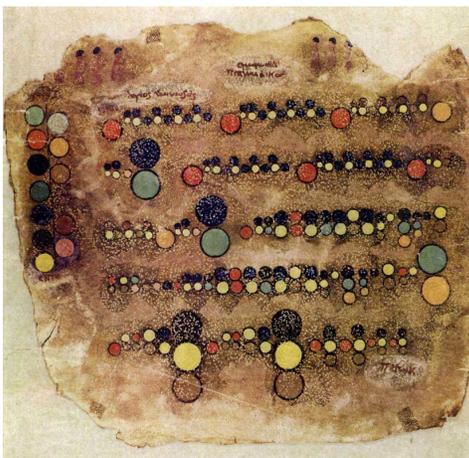
https://commons.wikimedia.org/wiki/File:2_Stèle_portant_l'inscription_de_Seikilos.jpg

Figure 7: The Seikilos column, National Museum of Denmark.

4 Egypt

No musical notation is known from the culture of ancient Egypt; apparently, there was only an oral tradition. Musical instruments are displayed in many images (and some have even survived); it is thus possible to reconstruct at least the range of possible sounds, but nothing more.

A Coptic document with coloured circles, dated to the 5th–7th centuries CE, might be related to notation (fig. 8); however, nobody really knows.



http://musicofthebiblerevealed.files.wordpress.com/2013/07/coptic_musical_notation.jpg

Figure 8: One of six Coptic parchments; colours might indicate pitch, size the duration. Metropolitan Museum, New York (?).

5 Far East

5.1 China

Similar to ancient Greece, music theory was highly developed in ancient China. The most important archaeological site, from a musicological point of view, is the tomb of Marquis Yi of Zeng (曾侯乙墓, *Zēng hóu Yǐ mù*, located in Léigūdūn, 擂鼓墩, Hubei province, China), dated sometime after 433 BCE. Excavated chimestones and bells contain inscriptions related to pitches, scales, and transposition (fig. 9). However, no musical notation was found.

The oldest known notation from China dates from the 7th century, called *wénzìpǔ* (文字譜), a longhand tablature (figs. 10 and 11). It is a plain text description of how to play the *gǔqín* (古琴), a zither.

During the Tang dynasty (8th to 9th centuries) this system of verbal descriptions was greatly simplified, leading to the *jiǎnzìpǔ* (減字譜) tablature (fig. 12). In parallel, another tablature called *gōngchǐpǔ* (工尺譜) was invented (fig. 13); both systems use Chinese characters, digits, and other symbols to notate fingerings.

Modern non-western notation (簡譜 *jiǎnpǔ*), introduced in the early 20th century, is most likely based on the French Galin-Paris-Chevé system, published 1818 (figs. 14 and 15 [after main text]). While not having



<http://herschelian.files.wordpress.com/2013/09/bianzhong-concert-2.jpg>, with permission

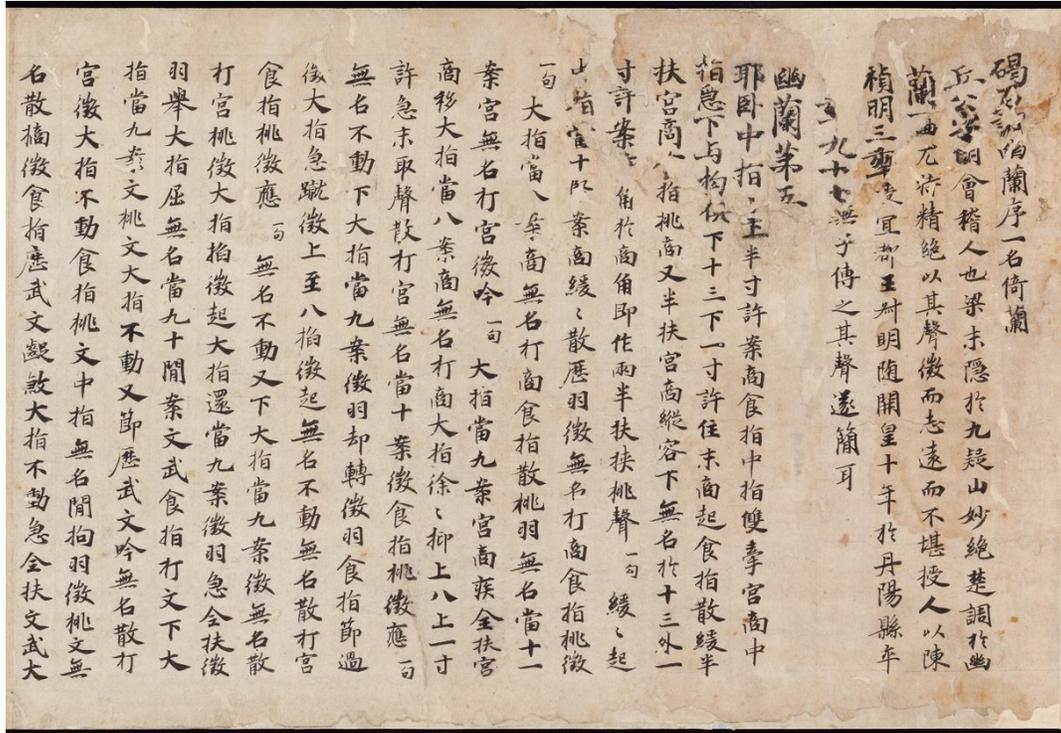
Figure 9: Bells from the tomb of Marquis Yi of Zeng. Hubei Provincial Museum, Wuhan.

耶臥中指 | 卞半寸許案商，
 食指、中指雙牽宮商。
 中指急下与拘俱下十三下一寸許。
 住。末商起。食指散緩半扶宮商。
 食指挑商。又半扶宮商。
 縱容下無名於十三外一寸許案商角，
 於商角即作兩半扶、挾挑聲。



Figure 10: The beginning of *Jiéshí diào yōu lán*, with John Thompson's transcription. While the pitches in the original are given to the quarter tone or better, one can only approximate the rhythm.

A survey of the history of musical notation



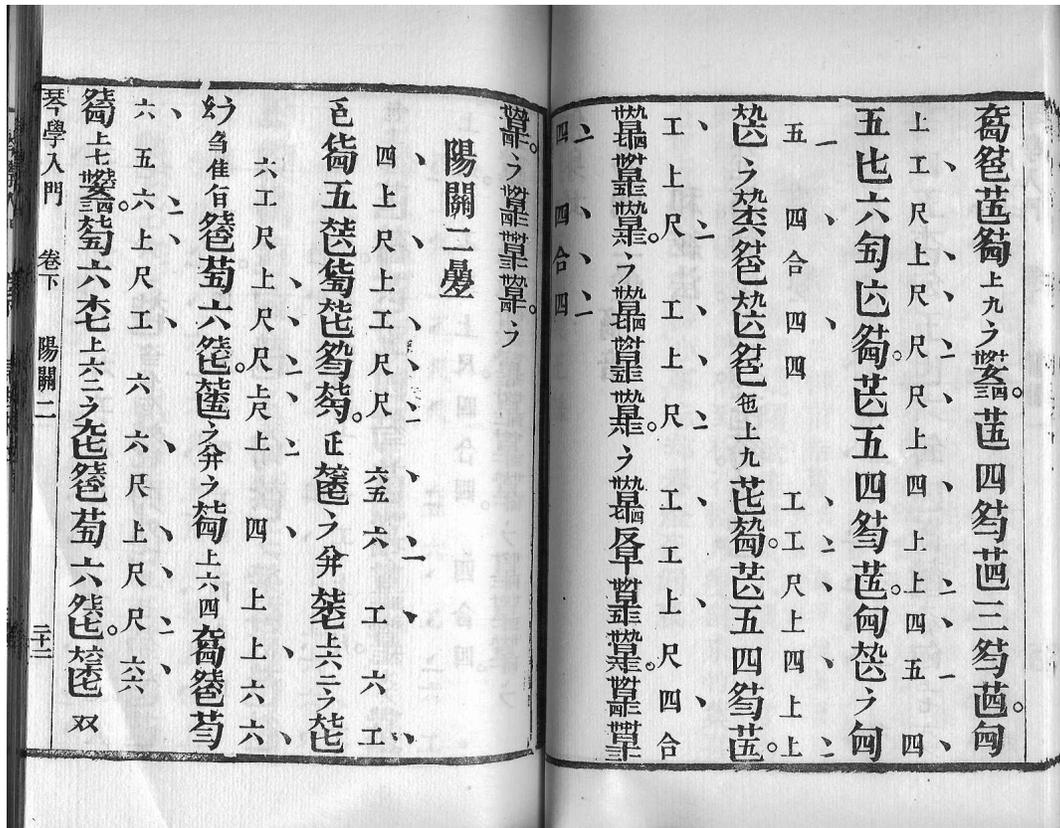
<http://www.emuseum.jp/detail/100229/000/000>

Figure 11: The beginning of the 4 m long scroll with wénzipǔ tablature of the piece *Jiéshí diào yōu lán* (碣石調幽蘭) “Secluded Orchid, in Stone Tablet Mode”, from the 7th century (Tōkyō National Museum, TB-1393).



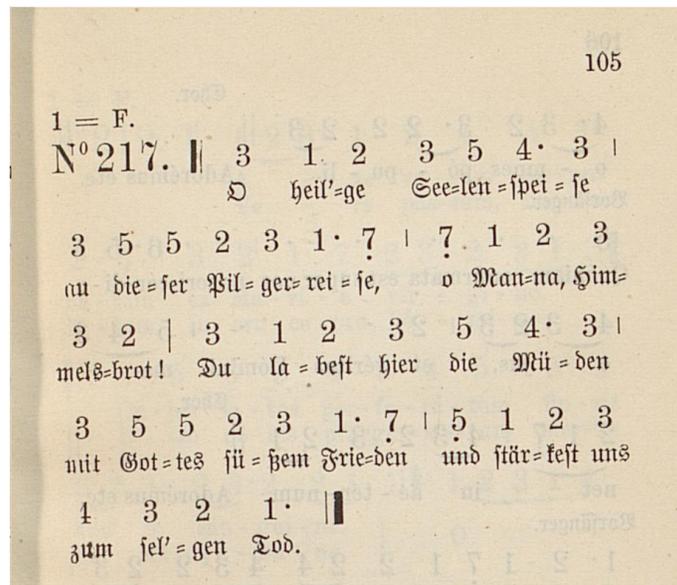
https://en.wikipedia.org/wiki/File:Shenqi_Mipu_vol_3_pg_1.jpg

Figure 12: Two pages from *Shénqí mìpǔ* (神奇秘譜), dated 1425, an example of jiǎnzipǔ tablature for the qín zither.



https://en.wikipedia.org/wiki/File:Kam_Hok_Yap_Mun-Young_Kwan_Sam_Tip.jpg

Figure 13: Two pages from the score book *Qín xué rùmén* (琴學入門), dated 1864, showing gōngchěpǔ tablature for the guqín zither.



<http://sammlungen.ulb.uni-muenster.de/hd/content/pageview/1474276>

Figure 14: Cipher notation for the song *O heil'ge Seelenspeise*, contained in the book *Sursum corda*, a German Catholic hymnal from 1887. The displayed melody is based on *Innsbruck, ich muß dich lassen* (*Innsbruck, I Must Leave You*), a famous song by Heinrich Isaac composed in the second half of the 15th century.

a significant impact on the Western world, it became extremely popular in Asia since it is comparable to the gōngchě tablature. Even today, most traditional music scores and song books use jiǎnpǔ notation.

5.2 Japan

All traditional notation systems in Japan are tablatures, strongly influenced by China and Korea, which in turn was also influenced by China (fig. 16). In the course of time, many different, specialized notations were developed depending on the instrument. This was further specialized by competing music schools, trying hard to provide knowledge of playing the instrument only to members of the clan (fig. 17). In spite of the specialization, all notation systems are just mnemonic devices, making it impossible to interpret it correctly without additional oral tradition.

5.3 Korea

Similar to Japan, both music and music notation was strongly influenced from China.

In the 15th century, the jeongganbo mensural notation (정간보, 井間譜) was developed, providing a means to exactly specify the rhythm by positioning the musical information into a grid. This system, which was the first in Asia able to represent duration of notes, is still in use today (fig. 18); the idea of using a rhythm grid was also exported to Japan in the 18th century.

6 India

Ancient India is another major civilisation that did not develop explicit notation systems. Instead, only hints, usually small strokes above and below the text, were added. As is to be expected, such a system is not reproducible without the oral tradition from guru (गुरु, teacher) to shishya (शिष्य, student).

Modern notations were developed by Vishnu Narayan Bhatkhande (विष्णु नारायण भातखंडे, 1860–1936) and Vishnu Digambar Paluskar (विष्णु दिगंबर पलुस्कर, 1872–1931) in northern India, mainly for teaching music and the preservation of traditional compositions. They are based on Devanagari characters and numbers with a small set of additional symbols (fig. 19).

7 Middle East

No music notation systems were developed in the Middle East after the fall of the Roman empire; there was only oral tradition, as far as we know. Starting around 1830 in Egypt, Western notation was introduced, but only in a very limited way.

Music theoreticians Al-Kindi (أبو يعقوب بن إسحاق الكندي, 9th century) and Al-Farabi (أبو نصر محمد الفارابي, 10th century) used letters to denote strings of the oud (عود, an Arabic lute), together with finger positions. Safi

al-Din al-Urmawi (صفي الدين الأرموي, 13th century) additionally used digits to indicate rhythm in his works. It must be noted, however, that none of these systems gained any practical importance for playing music.

The perhaps most remarkable contributor to middle eastern notation systems was Dimitrie Cantemir, Prince of Moldavia (Turkish: Kantemiroğlu), who published his letter notation around 1710 while in forced exile in Constantinople, collecting and preserving around 340 Ottoman instrumental pieces (figs. 20 and 21).

8 Europe

8.1 Neumes

Isidore of Seville, living in the early 7th century, states in his book *Etymologiae* (also known as *Origines*):

*nisi enim ab homine memoria teneantur soni,
pereunt, quia scribi non possunt*³

*(unless sounds are held by the memory of man,
they perish, because they cannot be written down)*

Music history soon provided counterexamples: Visigothic *neumes* (i.e., inflective marks to notate music) began to develop in northern Spain in the late 7th century (figs. 22 and 23).

Similarly, the first paleofrankish neumes appeared around 850 in Aurelian of Réôme's works (fig. 24).

In the 10th and 11th centuries, development and usage of neumes started to flourish in many places in Europe: St. Gallen (Switzerland), Laon, Brittany (France), to name just a few.

Neumes can be roughly classified as either *adiastematic* or *diastematic*. The older adiaesthetic neumes show the direction of a melody, but no pitches. On the other hand, rhythm and dynamics were quite precise (fig. 25).

Diastematic neumes were rather the opposite: Quite precise pitches, but lack of rhythm and dynamic hints (fig. 26).

It is probable that neumes were originally developed in the Byzantine Empire, based on Greek origins. The orthodox church still uses neumes today (with refined notation).

8.2 Staff lines

Another European invention was the use of staff lines. The first use of horizontal lines to indicate the pitch can be found in the theoretical work *Musica enchiriadis*, written in the 9th century (fig. 27).

Guido of Arezzo further developed the idea of staff lines; he recommended the use of lines in distances of a third in his book *Prologus in Antiphonarium* (around 1030), together with a clef (or coloured lines) to indicate pitches.

3. Isidorus Hispalensis, *Etymologiae*, book III, *De Musica*.

With the introduction of square-note neumes in the 12th century, the development of the notation of Gregorian chant was essentially completed (fig. 28), and is still in use today.

In the same century, polyphony started to develop, mainly in the Notre Dame school in Paris. It also introduced *modes* to control the rhythm (figs. 29 and 30).

8.3 Mensural notation

Perhaps the most important invention in Western musical notation was made by Franco of Cologne (around 1250, as documented in his book *Ars cantus mensurabilis*). He introduced note heads with different shapes to define their own duration.

Previously, rhythm was only implicitly defined by context and learned rules; the new class of note heads allowed the notation of arbitrary durations. This system is still basically the same as what we use today, with only minor changes and additions (figs. 31, 32, 33).

8.4 Tablatures

In the Western music, tablatures spread in the 15th century, mainly for instruments that can produce more than a single note at the same time. Either digits or letters were used to denote keys or fingering (figs. 34, 35, 36).

8.5 Printing

Printing music with movable type started around 1500. In the beginning, the layout was a copy of handwriting (figs. 37 and 38).

Bar lines, ties, slurs, and other marks were gradually introduced in the 16th and 17th centuries (fig. 39).

8.6 Engraving

In the 18th century, polyphonic music became too complicated to be printed with movable types. Instead, engraving techniques were introduced for music, starting with copper plates (chalcography, fig. 40).

Around 1730, the English music publisher John Walsh invented a new engraving technique: Staff lines were drawn with a 5-pronged ‘scoring tool’ onto a pewter plate (an alloy of mainly tin), fixed-size musical symbols were punched with dies, and everything else engraved manually (fig. 41).

In 1799, Johann André from Offenbach am Main, Germany, applied the newly invented lithography technique to music – images on zinc plates being mechanically transferred (fig. 42).

Around 1860, the aesthetics of classical music engraving as used today were completed (fig. 43).

9 The future

The last revolutionary step in the history of music notation to date is the introduction of computers to typeset

music – this is happening right now. Today, the job of a music typesetter working with pewter and dies is now essentially defunct.

However, until very recently, the results produced by computers were hardly adequate compared to manually engraved scores. This difficulty is mainly due to the two-dimensionality of the data, making it hard to automatically achieve visually pleasing scores. At the present time, this is going to change: Computers are steadily becoming more powerful, allowing for the mathematically expensive computations that are necessary for good automatic positioning of the notational elements.

Software is evolving, too: Programmers are learning from the errors and problems affecting the first-generation programs used for typesetting music, and also providing better GUIs with powerful templates for users – who thus need be less aware of the intricate details of correct music layout.

Sources

All images not tagged with a URL were created by the author. Here is a table with additional notes for selected images.

- 1 This image was extracted from a video; it shows Peter Pringle playing an ancient lyre.
- 3 On his website, Casey Goranson collects no less than ten different realizations of the tune that appeared in various scientific papers, see http://individual.utoronto.ca/seadogdriftwood/Hurrian/Website_article_on_Hurrian_Hymn_No._6.html. Most of them, if not all, are highly speculative due to lack of information.
- 6 The English translation of the Greek text was taken from Wikipedia, https://en.wikipedia.org/wiki/Seikilos_epitaph.
- 8 The blog entry <http://musicofthebiblerevealed.wordpress.com/2013/07/25/spiritual-harmony-coptic-musical-notation> gives more details on the possible interpretation of this parchment.
- 9 The photo belongs to Jo Michie’s blog on China, <http://herschelian.wordpress.com/2013/09/25/the-marquis-yi-of-zengs-musical-bells>.
- 10 Thompson’s complete transcription of the piece can be found at <http://www.silkqin.com/02qnpu/01y1/transpdf/jsdy101.pdf>.
- 19 The image was taken from David Courtney’s site *Music of India*, http://chandrakantha.com/articles/indian_music/lippi.html.

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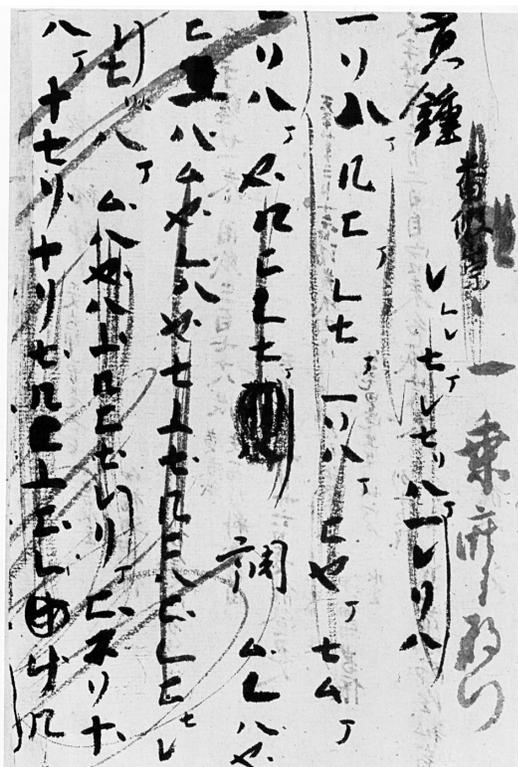
1=G

4/4 0. 6 5643 | 2 - 2. 3 1 12 | 3. 5 6 5 6561 |

5. 3 5 5 3 2 6 5612 | 3. 5 2. 351 6235 | 1 - 1 61 3 32 |

1. 6 1. 233 21. 1 6123 | 5 - 5035 6561 | 5. 3 551 6 6 5655 |

Figure 15: Beginning of the piece *The Moon Mirrored in the Second Spring* (二泉映月, Èrquán yìngyuè) for the *erhú* (二胡, a Chinese fiddle); *jiǎnpǔ* and Western notation.



https://en.wikipedia.org/wiki/File:Tempyo_Biwa_Fu.jpg

Figure 16: The *Tempyō biwa fu* (天平琵琶譜, Tempyō biwa fu), dated ca. 738. This is essentially a Chinese piece using Chinese lute notation, preserved in the Imperial Storehouse (Shōsōin 正倉院) in Nara, Japan.

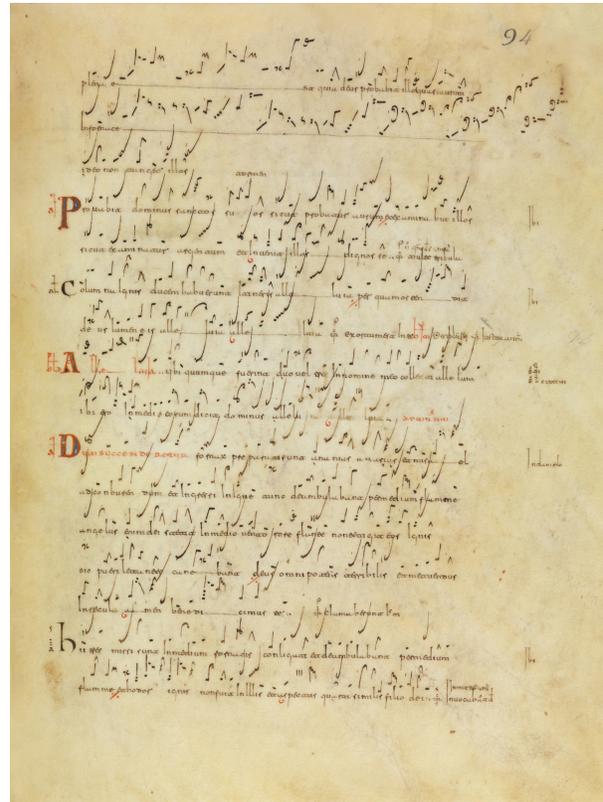


http://www.shaku-rus.com/Scores/Ch_score.jpg

Figure 17: An example of a tablature for the shakuhachi (尺八, an end-blown flute).



http://bvpb.mcu.es/en/catalogo_imagenes/grupo.cmd?posicion=192&path=26408&presentacion=pagina



http://bvpb.mcu.es/en/catalogo_imagenes/grupo.cmd?posicion=193&path=26408&presentacion=pagina

Figure 22: Two pages from the *Visigothic Antiphonal*, most probably an 11th century copy of a 7th century book (Archivo de la Catedral de León, Ms. 8). It depicts Mozarabic chant.

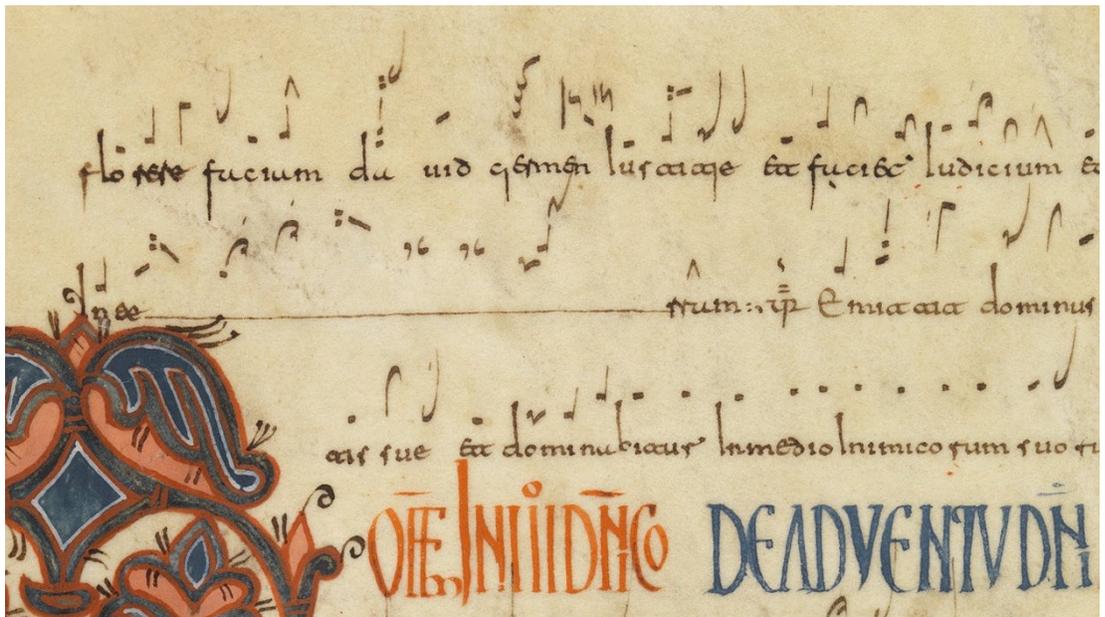
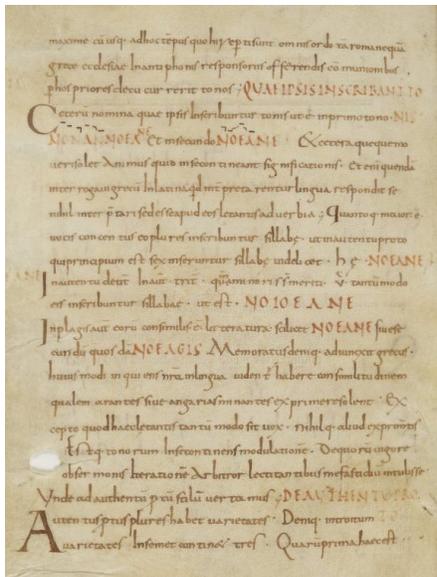


Figure 23: A detailed view of the Antiphonal, also called *Antifonario de León*. Today, these neumes are almost completely undecipherable – the Mozarabic Rite was forbidden in Spain around 1080 by Pope Gregory VII and replaced by the Roman Rite.



<http://gallica.bnf.fr/ark:/12148/btv1b8452635b/f147.item>

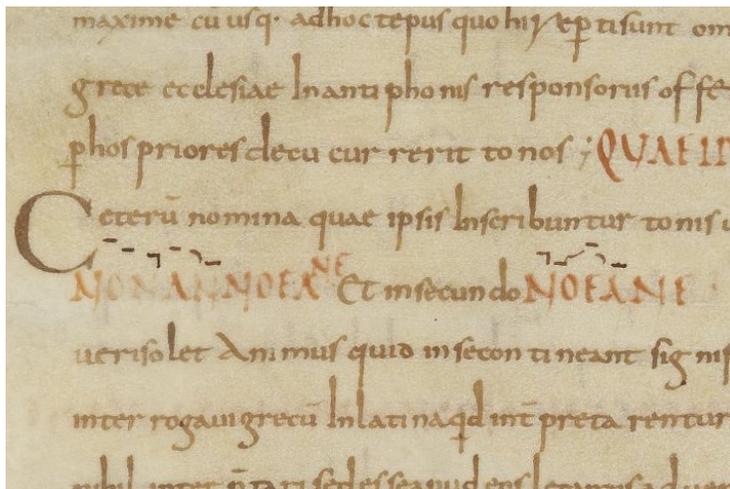
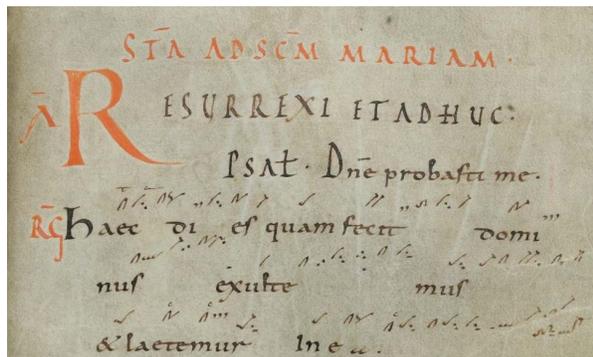
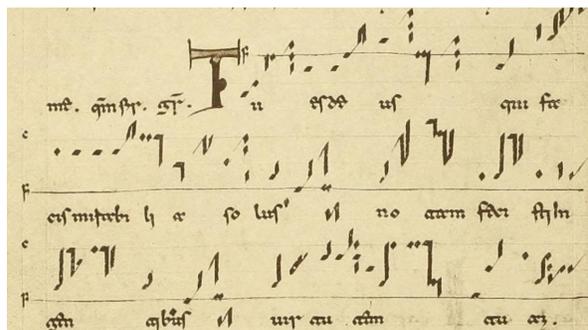


Figure 24: Two views of a page of Aurelian of Rêôme’s book *Musica disciplina*, a Carolingian chant treatise written around 850 — containing only text, no music. The neumes (undecipherable today) in this copy from ~880 were apparently added to this copy by an early reader (Bibliothèque municipale de Valenciennes, Ms. 148).



<http://www.e-codices.unifr.ch/de/csg/0359/107>

Figure 25: A detailed view of p. 107 of the *Codex Sangallensis 359* manuscript from the early 10th century, showing adiaستمatic neumes (St. Gallen, Stiftsbibliothek).



<https://archive.org/stream/palographiemusic15macq#page/60/mode/1up>

Figure 26: The beginning of *Tu es deus* in the *Codex Benevento VI.34* manuscript, f. 59v, written around 1100, showing diastematic neumes (Biblioteca capitolare, Benevento). The thicker line marks the pitch ‘f’, the thinner one pitch ‘c’, a fifth higher, as indicated by the letters at the beginning of the lines. Those letters eventually became the clefs in modern notation.

obstante triu soni inconsonantia. qui tetrardo
est subsecundus. Quae ut lucidiora fiant
exempli descriptione statuatur pro ut pos
sit fieri subaspectum.

Ad hanc descriptionem canendo facile sen
titur quomodo in descriptis duobus membris
sicut subtus tetrardum sonum organalis uox

https://commons.wikimedia.org/wiki/File:Musica_enchiridis_Rex_celi.png

Figure 27: An image from *Musica enchiridis* (Staatsbibliothek Bamberg, Var. 1, fol 57r).
Each line corresponds to a chord of a harp-like instrument.

Is. 45, 8; Ps. 18

L12
E9

IN. I
RBCKS

R O-rá-te * cae- li dé-su- per, et nu- bes plu-
ant iu- stum : ape-ri- á- tur ter- rá, et gé- rmi- net
Sal-va- tó- rem.

<http://www.kalosconcentus.org/images/Musiche/Intr%20Rorate.jpg>, with permission

Figure 28: The *Graduale Triplex* (published by the Abbaye Saint-Pierre de Solesmes in 1979) shows both the diastematic neumes from Metz (above, black) and the adiastratic ones from St. Gallen (below, red), together with square-note neumes taken from the *Graduale Romanum*.



<http://teca.bmlonline.it/ImageViewer/servlet/ImageViewer?idr=TECA0000342136#page/1/mode/tup>

Figure 29: The beginning of Pérotin's *Viderunt Omnes* from the *Magnus liber organi*, composed around 1200, starting with syllable "Vi". This is the first known *Quadruplum*, a piece with four different voices (Biblioteca Medicea Laurenziana, Pluteus 29.1, f. 1, Florence).

Figure 30: Transcription of *Viderunt omnes* from fig. 29, using modern notation.



<http://gallica.bnf.fr/ark:/12148/btv1b8449032x/f575.item>

<http://gallica.bnf.fr/ark:/12148/btv1b8449032x/f576.item>

Figure 31: The beginning of the Gloria of Guillaume de Machaut’s famous *Messe de Notre Dame*, composed around 1360, in black mensural notation (ms. Machaut B, f. 283v–284r, Bibliothèque nationale de France).

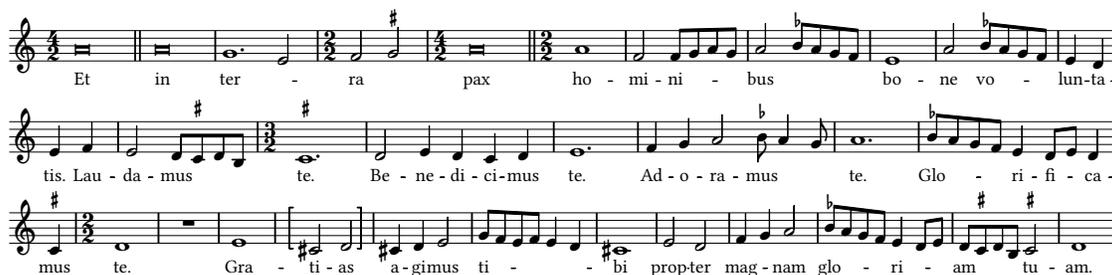


Figure 32: A zoom into the highest voice of the Gloria, together with a transcription to modern notation. Since the original manuscript does not have time signatures, the grouping into bars is rather arbitrary.



http://digi.vatlib.it/view/MSS_Chig.C.VIII.234/0384

Figure 33: The beginning of the *Missa L'homme armé* (Kyrie eleison), written by Josquin des Prez (~1452–1521), in white mensural notation (Biblioteca Apostolica Vaticana, Chig.C.VIII.234, f. 191v). All elements of modern notation except bar lines are present. Using paper instead of parchment made it necessary to use less ink to avoid damage, thus the hollow ('white') note heads.



<http://ricercar.cesr.univ-tours.fr/3-programmes/EMN/luth/sources/consult.asp?numnotice=4&ID=Capirola&index=94>

Figure 34: *Padoana a la francese* from Vincenzo Capirola's lute book, written around 1517 (Newberry Library, Chicago, MS VM C.25, f. 47r).



<http://imslp.org/wiki/Special:ImagefromIndex/111320>

Figure 35: The chorale 'Wir Christen leut', BWV 612, from J. S. Bach's *Orgelbüchlein* manuscript, written around 1715. The last 2½ bars are notated in German organ tablature (Staatsbibliothek zu Berlin Preussischer Kulturbesitz, Mus. ms. autogr. Bach P 283).

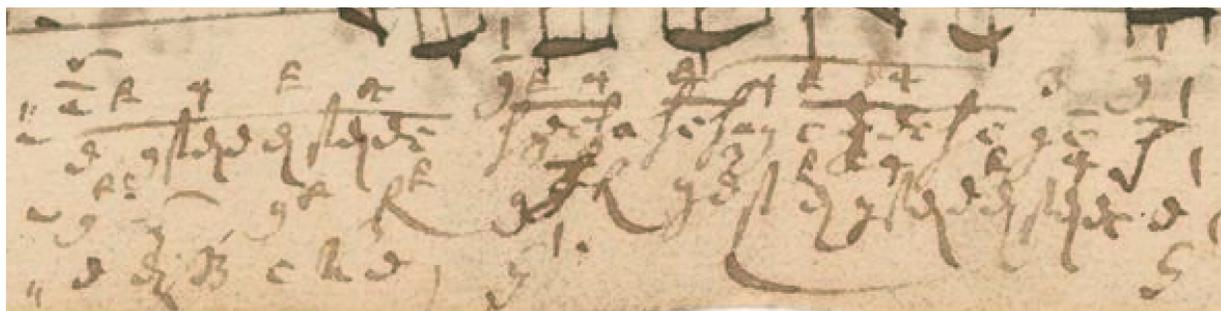
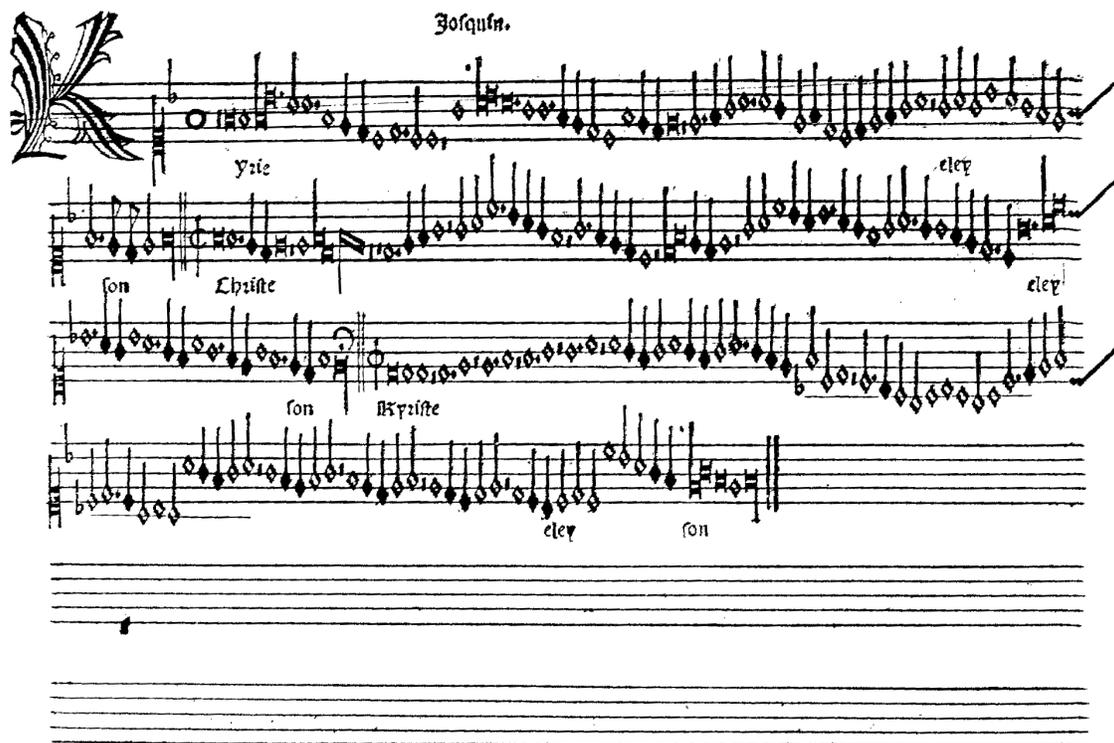


Figure 36: A zoom into BWV 512. In the autograph, each line with German Kurrentschrift letters represents a voice; uppercase letters denote pitches one octave lower, letters with a line above one octave higher. A sharp accidental is indicated by a trailing curved stroke below the baseline. Flats are not used, thus the note sequence 'g-f-e flat-d' is notated as 'g-f-d sharp-d', for example. Superscript digits and other symbols above the letters indicate duration (e.g., '4' for four semiquavers, '1' for a whole note).



[http://imslp.org/wiki/Missarum,_Book_1_\(Josquin_Desprez\)](http://imslp.org/wiki/Missarum,_Book_1_(Josquin_Desprez))

Figure 37: This page of a partbook, printed in Venice by Ottaviano Petrucci in 1502, shows the same mass from Josquin as figure 33.



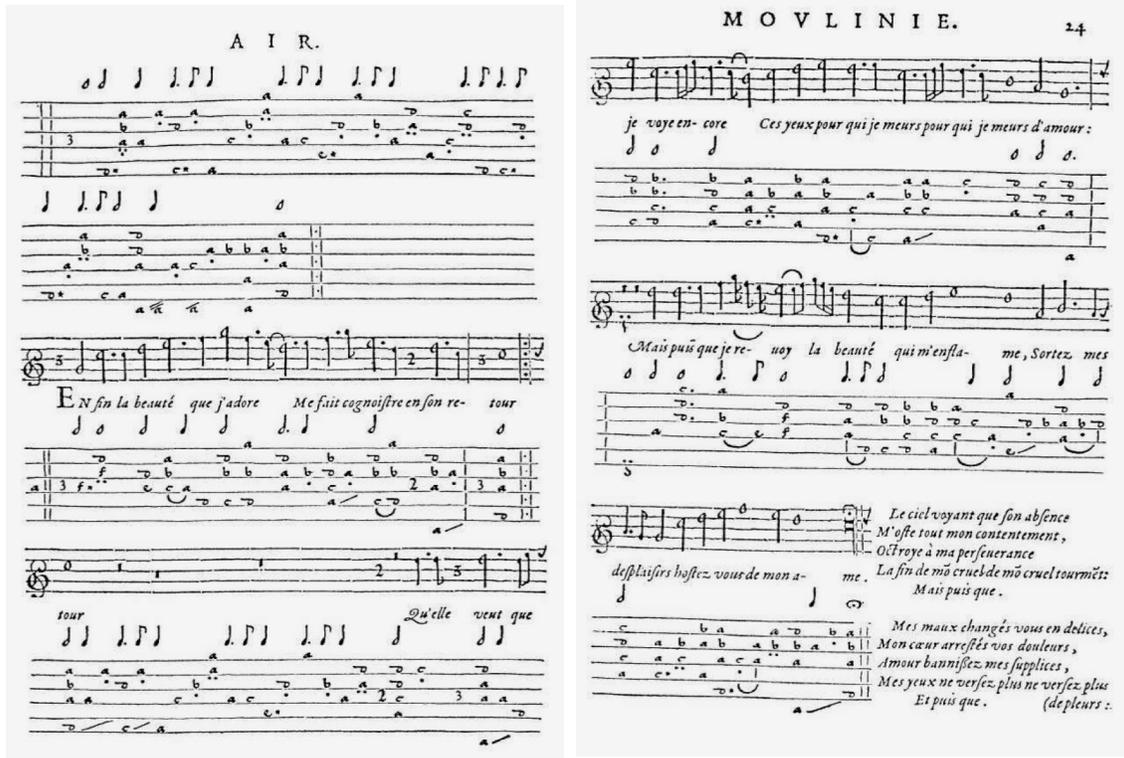
Figure 38: A direct comparison between the Josquin manuscript (fig. 33) and the printing (fig. 37). Note that the print uses a different clef. It also contains some errors and variants, probably due to a different manuscript copy.

Obras a tres Morales. Orphenica Lyra. Libro primero.

ascendit in
celum, et ascendit in caelum,
sedet ad dexteram patris,
iterum veniturus est iudicare vivos & mortuos,
iudicare vivos et mor

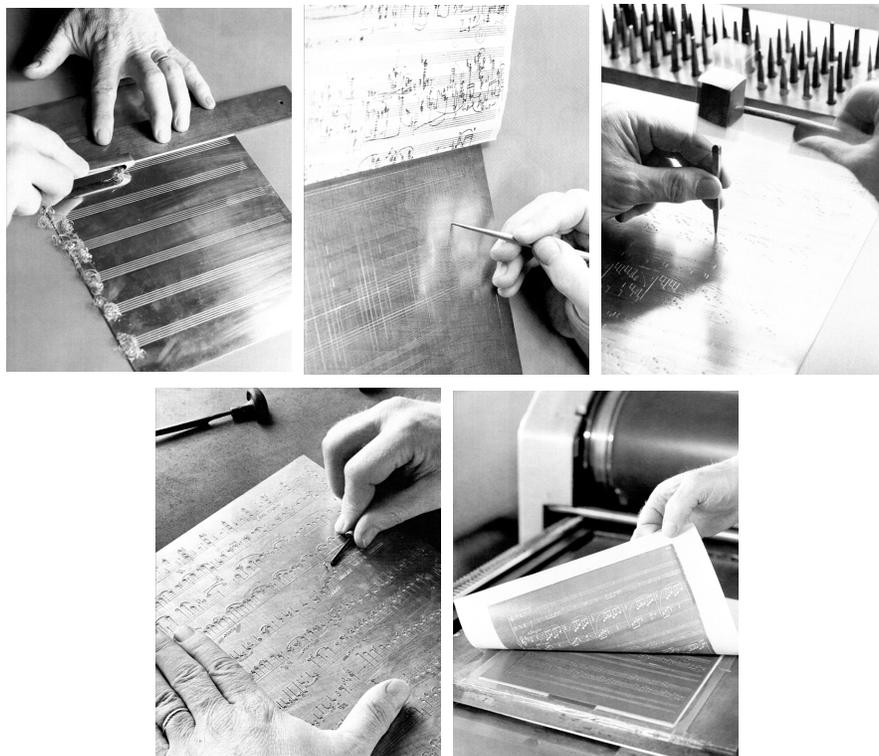
http://www.bibliotecavirtualdeandalucia.es/catalogo/catalogo_imagenes/grupo.cmd?path=1000562&presentacion=pagina&posicion=29

Figure 39: A page from Miguel de Fuenllana's *Orphenica lyra* (printed 1554), a tablature for the vihuela (an early guitar), with bars. Red numbers indicate the melody. A rhythm indicator is only specified if a rhythm changes.



<http://imslp.org/wiki/Special:ImagefromIndex/246223>

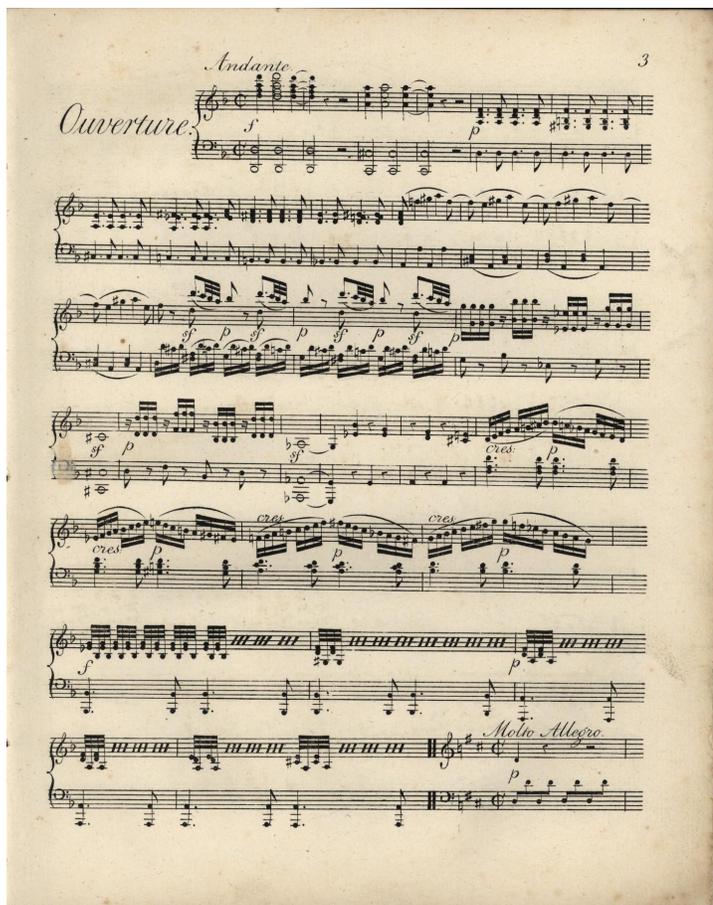
Figure 40: A copper plate engraving of the air *En fin la beauté* from Etienne Moulinie, published 1624.



<http://www.musicprintinghistory.org/music-engraving/13-about-music-engraving>

Figure 41: The process of manual music engraving. For complicated scores, it could easily take a day to finish a single plate.

Figure 42: A lithography print from 1805 of a piano reduction of Mozart's overture to *Don Giovanni*, produced by Johann André's printing company in Paris (he held a patent on lithography).



<http://www.wurlitzerbruck.com/images/MUS/Mozart%20Don%20Giovanni%20Overture%2010589.jpg>

Poco più mosso.

<http://imslp.org/wiki/Special:ImagefromIndex/69058>

Figure 43: An excerpt of Rachmaninoff's second piano sonata, engraved in 1914.