Giambattista Bodoni's music font and its system for joint note-tails

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Introduction

The first step in music performance is the correct decoding of the musical text. For this reason, one of the key assets of the music publishing industry has always been the quality of the printed score. For many centuries, the production of scores relied on printing with movable type. This more or less comprised casting a set of metal pieces and arranging them together in a plate. This plate could then be inked and printed by stamping it on paper. Some sets of metal pieces, called *music fonts* (fig. 1), were specifically designed and developed to reproduce music notation. Printers could than easily mass-produce any music score. However, this did not come without its own problems. As we explain here, the limitations of this printing technique made it less and less profitable over time. Despite the many constraints of movable type for music notation, many punch-cutters and printers developed music fonts in an attempt to circumvent the limitations of the technology while striving to achieve the best layout quality. We shall focus on this particular topic by analysing the work of one of the most influential Italian typographers in history: Giambattista Bodoni (1740–1813).

This particular field of study involves both music notation and printing – more precisely, printing with moveable type as applied in music publishing. Our focus is primarily on typographical aspects but requires an understanding of the musical context. The topic is especially challenging for two reasons: first, it involves several academic fields at once, ranging from the history of music publishing and music notation to typography and printmaking. It is not easy to determine where one field ends and another begins. In some cases, these different fields even collide with each other (for example,

certain graphic artefacts or details in music notation might exist solely due to printing or musicological issues and are often a mix of both). Furthermore, this particular subject has rarely been the subject of academic investigation: at the current stage of my research, there is little literature to cite. This lack of specific, recent scholarly sources forces us to refer to those that are less recent, and less reliable. These sources sometimes contain contradictory information, and it is difficult to check their degree of trustworthiness. There are general texts and publications about the history of music printing, published by renowned experts in musicology and music-related fields. However, these writings often do not describe many of the mechanical details of the printing process (the number of characters, their shape and dimensions, how to set them together). From a design perspective, the history of printing tends to ignore music font making and production, as it is considered a niche field when set against the whole history of the printing industry. This deficit in the bibliography also affects our specific topic here, namely Bodoni's work on music notation. Despite a considerable number of writings about him, his practices and the many different writing systems he produced, there are very few studies or sources about his work on music fonts.[1] This lack of resources, while an obstacle to research, only encourages us to dig deeper into the subject, in hopes of bringing some light to a topic that has hitherto received only scant attention in academic literature. The only materials available about music moveable type and their use are those that were published by the very same printers and typographers that produced, used and sold music fonts alongside regular typefaces.

Some of the earliest, more insightful publications of this kind were published by Pierre Simon Fournier le Jeune.[2] They provide a record of how his typographical system was composed and how it contributed to improving current standards. However, this kind of publication was rare, and was of-

1 The only published article about this specific issue is the one by Stefano Ajani: »Bodoni e la stampa della musica«, in: *Graphicus* XLV (1964), Nos. 7–8, pp. 37–40. It offers an overview of the links between Bodoni and the music composers close to him but does not give details of the music font he produced.

2 Pierre Simon Fournier: *Manuel typographique, utile aux gens de lettres, et à ceux qui exercent les différentes parties de l'art de l'imprimerie*, Paris 1754; and by the same author: *Traité Historique et Critique Sur l'origine et Les Progrès Des Caractères de Fonte Pour l'impression de La Musique*, Berne 1765; and *Réponse à Un Mémoire Publié En 1766 Par MM. Gando, Au Sujet Des Caractères de Fonte Pour La Musique*, Paris 1766.

ten intended only to legitimise those endeavouring to improve the quality of the printed score compared to previous technology. The current article will use the available literature to try and sum up the knowledge needed for metal music font design, and will apply it in order to analyse certain typographical tools such as the matrices and punches used to produce the music font developed by Giambattista Bodoni.

This article focuses on one specific set of characters: those used for oblique joint note-tails. This peculiar set is of particular interest, because it addresses one of the most challenging tasks in moveable music type: the reproduction of diagonal lines. This moveable type system for music had an exclusive feature compared with other moveable type environments. In regular Latin typography with metal type, the characters were set one after another, side by side, in single lines of metal type. Our system of Western music notation, however, uses two axes to display information: the horizontal axis for the rhythm/duration and the vertical axis for pitch. So, to produce a line of music, the typesetter had to arrange the music characters in both horizontal and vertical dimensions. Music fonts were designed to work within a modular typographic system. The characters had various heights (corresponding to one or more modules), and they could be stacked vertically in order to represent the whole staff segment (fig. 4, left). The many segments placed one after the other formed the horizontal line of music. In order to achieve the flexibility needed to represent music notation, music fonts worked by dividing the musical shapes into different elements. Notes and other signs were divided into multiple characters (fig. 4, right). These characters were then stacked together to form the whole note/beamed note group (a group of notes connected by one or multiple tails).[3] This system enabled the same shapes to be used for many different combinations, which reduced the variety of characters one had to produce. The metal types could also be used upside down, depending on the context around them. By using all these solutions, moveable type made it possible to typeset note-heads, stems and single notation signs in a reasonably secure way. Stems and bar lines, as well as horizontal joint-tails, could fit well inside single, rectangular-shaped characters. The real challenge here was typesetting with diagonal or curved lines, because they deve-

3 In early XX century punchcutters and music font foundries used to separate musical shapes in the following categories: Note Heads, Stems, Prefixes, Hooks, Slurs, Tie Pieces, Staff lines, Clefs and Bars, in: [Anon.]: *Music Book Printing, With Specimen*, Boston: F. H. Gilson 1897.

lop their shape in both the horizontal and vertical dimension. Many signs fall in this category, but the principal signs that were most often-used were joint note-tails and slurs. Since the typographical grid is a group of rectangles, fitting a diagonal line into this pattern is a hard task. Moreover, drawing those signs usually matches the notational context surrounding them, so they might be shaped in many different variations, depending on their position and function. That is why in modern music typesetting (using music typesetting software), joint tails and slurs are not included as fixed musical shapes. Instead, an algorithm creates them on the fly, according to the pitches of the notes and the surrounding context. The various attempts that have been made to get around these limitations with moveable type are what makes this topic so fascinating an object of investigation.

The historical context

Giambattista Bodoni was one of the most influential, renowned figures in Italian typography and printmaking between the 18th and 19th centuries. His main work, the *Manuale tipografico*, which was published after his death in 1818, represents a summation of his achievements. It collects together his complete typographical production in all sizes (142 roman alphabets with their corresponding italics) and scripts (including Greek and exotic typefaces). Besides its great variety of languages and typographical systems, this manual also offers samples of music printed with moveable type.

These pages are of a quality overall that was hard to achieve with moveable type in contemporary music publishing. Bodoni's correspondence with Francesco Fortunati reveals that he produced his music font before 1780.[4] Despite multiple commissions for music editions, Bodoni never became a music publisher. His music font had little impact on the history of music publishing, mainly due to a fundamental shift that took place in music printing over the following decades. Music publishers began moving from printing

4 From a letter by Francesco Fortunati dated 8. 7. 1804: »[…] sorprendenti suoi caratteri, già da Lei medesima inventati venticinque anni sono, e sepolti nell'oblio, tosto che ne ebbe fatto delle prove non dubbie con altra mia composizione« (B. Pal. Pr, Epistolario Parmanse, Carteggio Bodoni, cass. 40).

with moveable type to metal engraving,[5] a technique that was much more flexible and could better address the formal needs of music notation. This change did not displace music fonts completely, but it greatly decreased the demand for music editions printed with moveable type. Despite the rise of new printing techniques, most music publishers continued to use moveable type well into the 19th century.[6] Bodoni was fascinated by using moveable type for music notation and was genuinely curious about applying his expert knowledge in this particular field, probably because he understood the challenges faced by anyone making a music font. In the years before Bodoni, music printing with movable type had been much improved by two well-known figures in music publishing: Johann Gottlob Immanuel Breitkopf (1719–1794) and Pierre Simon Fournier le Jeune (1712–1768). They introduced a music font with a detailed but concise character set that was able to provide most of the flexibility needed for music notation, but without needing too many characters. Inspired by these recent developments,[7] Bodoni decided to cut and produce moveable type for music himself. By Bodoni's time, music publishing could already look back on over 250 years of history. From the early 16th century to the second half of the 18th century, moveable type was the leading technology used in music score production and publication. During the lifespan of this printing technique, its craft evolved, and new music fonts appeared that achieved better quality and addressed new, emerging needs of music notation.

Moveable type was one of the most influential inventions of all time and represented a crucial milestone between the Middle Ages and the modern world. Not long after the first printed books were published in the mid-15th century, printmakers and publishers became aware of the potentially high demand for music publications if they could be mass-produced with moveable type. They consequently tried to adapt printing techniques to music notation. Some books containing music were produced and published not long after the invention of moveable type, but the short musical segments in these

5 Metal engraving provided the typographical coherence of moveable type, but without its formal constraints. Lithography was another reliable (and cheap) technique, but unlike moveable type and metal engraving it had not yet been mechanised, which meant it produced a totally different printed result.

6 Steven David Zohn: *Music for a Mixed Taste: Style, Genre, and Meaning in Telemann's Instrumental Works*, New York: Oxford University Press 2008.

7 Stefano Ajani: »Bodoni e La Stampa Della Musica«, in: *Graphicus* XLV (1964), Nos. 7–8, 37–40.

publications were written by hand in the text, sometimes on top of staff lines that had been printed. Many copies of these publications were never completed, and they are preserved today with just the blank staff lines, without the handwritten notes that were supposed to have been added.

The first attempt at printing all musical elements involved rudimental tools such as reversed type blocks and typographical rules.[8] The first complete music publication was produced in the early 16th century by Ottaviano Petrucci in Venice. His printing method was not the most practical, for it involved having three different impressions for each page: one for the staff, one for the notes, and one for the text. This process required extreme accuracy when putting the page correctly on the register for each overprint. If a mistake occurred during the placement of the paper, the notes would appear in the wrong part of the staff, with obvious repercussions for the functionality of the score. Petrucci was nevertheless able to achieve a balance between printing quality and the time and money invested. His system was further improved by other publishers and punch-cutters just a few years afterwards that enabled them to print musical notes together with the staff lines. This improvement was not without a downside, because the first attempts of this kind demonstrated the difficulties involved in joining the horizontal staff lines together, which meant that the score could look uneven. This defect was eventually resolved by using new metallic alloys and more precise production tools, such as those employed by Bodoni. His scores show a remarkable degree of printing accuracy. Most of the note-tails are horizontal, but some have oblique shapes. It is hard to detect where the moveable type joins together, and there are almost no breaks between the characters (fig. 2).

As already stated above, the complexity involved in setting music with moveable type lies in handling the two spatial dimensions. Drawing oblique lines was complicated in this typographical environment, and these lines were often made up of many pieces of type that had to join evenly together in the printing plate. To achieve this result, absolute precision in producing the moveable type was required, as was the precise typesetting of the typographical layout.

8 William Gamble: *Music Engraving and Printing: Historical and Technical Treatise*, London: Isaac Pitman 1923.

Analysis

Despite its name, the so-called *Manuale*[9] was not intended to be an essay about printing practices (as was the case with the manual for the one published by P. S. Fournier).[10] Instead, it was meant to show off Bodoni's production in a form that was closer to a printing specimen than a manual. At the end of this publication, there are three pages dedicated to music fonts that contain large folding sheets with musical scores in an elegant horizontal layout; two of the pages show modern Western music notation, while the last displays Gregorian chant.

These pages are unique for two reasons: not just because they are the only pages of music in the whole *Manuale*, but also because they are some of the very few pages of music printed with Bodoni's font.[11] The music examples printed in modern notation were composed by Gian Francesco Fortunati (1746–1821) at the request of Bodoni himself.[12] Here, Bodoni used two different printing techniques: one page was produced with two separate printing steps, for the notes and the staff lines respectively (page 273: »MUSICA impressa in due volte, cioè prima le linee, e poi le note«). This process was analogous to that used by Petrucci in the early 16th century. The other page was produced in one single printing step for all its elements (page 274: »MUSICA impressa in una sola volta, cioè le linee insieme alle note«). There is barely any explanation of the small composition itself. The typesetting of the page displays the title *Minuetto*, and then there is a composition on two staff lines comprising just fifteen bars of music, with a refrain in the middle. The notation used includes quavers, semiquavers, and demisemiquavers.[13] The lower line of music displays multiple changes of clef.

9 Giambattista Bodoni: *Manuale tipografico del cavaliere Giambattista Bodoni*, Parma: presso la vedova 1818.

10 See [Anon.]: *Music Book Printing, With Specimen*. Boston: F. H. Gilson 1897.

11 The only known publication besides the Manuale is one by Giovanni Mattei: *Elementi di canto fermo o sia gregoriano dedicati al nobilissimo sig. marchese canonico don Bonifazio Meli-Lupi*, published in 1834. A copy of this book is held by the Biblioteca Civica Centrale in Turin.

12 In his letters, Bodoni asked Fortunati for »un pezzo qualunque di musica, ma di genere difficile« to be printed in his last pages of the *Manuale*.

13 Different note durations corresponding respectively to an 8^{th}, a 16^{th} and a 32^{nd} of a whole note.

The Museo Bodoniano is the oldest printing museum in Italy and is located in Parma. Apart from the abovementioned *Manuale*, it also preserves all the punches and matrices produced by Bodoni. These were the fundamental tools for font production, and it was using these tools that Bodoni produced all the metal pieces used for his prints and editions. However, the archive of the museum lacks all later metal types, meaning that there is no real way of seeing the music font that Bodoni used to typeset the music scores in his manual; nor is it possible to typeset a new page of music once again. The present paper analyses the digital photos of the above-mentioned matrices and punches archived in the Museo Bodoniano, and takes a closer look at the last pages of the *Manuale*. The images here show the matrices from above, giving a clear view of every single element of the typographic system (fig. 2). The shapes over the matrices show the characters as they are meant to be on paper (the corresponding metal characters would have the same shape, mirrored horizontally). The font was designed for 28pt size.[14] The point size is measured by the height of the body of the character with all the five staff lines, plus some extra space at the top and the bottom of the character.

This size corresponds to the smallest typographic module of Bodoni's system. It seems that the two different printing techniques (one for the simultaneous printing of notes and staff lines, and one for printing the notes and the staff lines in two separate steps) would thus work with two different sets of type.[15] The matrices and punches stored at the Museo Bodoniano are divided into these two categories.[16] Despite this division, it seems that most of the characters (especially those for the joint note-tails) could fit both printing techniques. The presence of the staff lines on the drawing of the matrices (fig. 2[A]) is insufficient to prove the use of the corresponding char-

14 Stefano Ajani: »Bodoni e La Stampa Della Musica«, in: *Graphicus* (1964), XLV, Nos. 7–8, 37–40.

15 The original archive (»Inventario della collezione dei polzoni, matrici, ed altri oggetti relativi all'arte tipografica del cavaliere Giambattista Bodoni ora appartenenti alla sig.ra vedova«) mentions the following categories: »fregi e segni diversi, musica senza linee«, »fregi e segni diversi, musica prima più piccola colle linee attaccate«, »fregi e segni diversi, canto gregoriano«, »fregi e segni diversi, canto fermo da stanza«, »fregi e segni diversi, musica seconda detta piccola«, »fregi e segni diversi, musica nuova«, and »fregi e segni diversi, musica prima più piccola colle linee attaccate«

16 Maxey H. Mayo: *Techniques of Music Printing in the United States*, 1825–1850, Denton: University of North Texas, 1988.

acters, because some notational elements could have been placed below or above the staff lines. These pieces could thus potentially have been used for both printing techniques (single or double impression). Moreover, the shape of the straight, joint note-tails is intended to go over the staff lines, hiding them below the character. This feature makes it hard to say if the character was meant to be used inside or outside (i. e. above or below) the staff lines.

Another limitation in our analysis is the lack of spacing materials that were required to fill the empty spaces in the typographical composition. Even if these metal pieces were intended to leave no trace on the printed page, they could have given us a glimpse of the typesetting mechanism and the typographic system in general. Having no access to the final characters for analysis brings us to another limitation, namely our lack of knowledge about the kerned letters (fig. 1). In metal type, many individual letters and glyphs could extend their shape outside the typographic body, with one part of it extending over the body of the adjacent characters. This technique was applied for many characters of the Latin alphabet, and it was a common characteristic in music font characters. Unlike regular typography, the shapes of kerned characters extended both vertically and horizontally. It is hard to define which of Bodoni's metal types for music were kerned characters. Unfortunately, the matrices themselves that have been preserved do not tell us whether the corresponding final characters were kerned or not, or what part of their shapes were supposed to be kerned. At this stage of our research, this detail can only be deduced by looking closely at the printed page, checking the line breaks between the characters, and noting where the single shapes are drawn to extend over the breaks – and even here, we must admit to working within a certain margin of error (fig. 4[A]). Our analysis is concerned primarily with the printing process for a single impression. The double impression technique (with lines and notes printed separately) produces a more attractive print, but the single impression technique is the more practical solution.

One of the first elements in our analysis is the quantity of the punches and the matrices preserved at the Museo Bodoniano. This quantity does not in itself tell us anything about the quality of the system. In general, the more pieces in a typographic system for music, the more flexibility it has, which means a more precise, readable result. At the same time, a music font that has more and more pieces becomes hard to manage, because having more pieces of type makes for a slower and more difficult typesetting process. It

is possible to compare the number of characters in Bodoni's music font with other typographic systems. During the late 19th century, the average typographic system for music notation consisted of about four hundred different characters.[17] The following table shows the number of characters in Bodoni's font, compared with other contemporary music fonts.

Characters for Author	Characters for Characters	note-tails	Oblique note-tails
Johann Gottlob Immanuel Breitkopf (1719–1794)	about 300	-	-
Pierre Simon Fournier le Jeune (1712–1768)	about 160	36	29
Giambattista Bodoni (1740–1813)[18]	about 620	180	114

This table shows the great difference in the number of characters used for the different fonts. It also illustrates that a music font could be conceived and produced in many different ways, depending on different design approaches. The ease of typesetting, the flexibility of the system, and joining the characters: all these features had to be considered in order to define the shape and quantity of the characters to be designed. At the time Bodoni was working on his music font, there was no standard character set for it, so it was up to the punch-cutter to understand the correct ratio between the variety of forms (i. e. the flexibility of the system) and its ease of use.

Bodoni chose to develop an extended character set, which allowed him to typeset a large variety of note combinations. Since his typeface was not initially intended to be sold and used by other publishers, he probably put a priority on obtaining the best print result, rather than ease of use. If we analyse the percentage of characters for joint note-tails, it is clear how the number of these characters grows exponentially with the total number of characters. If we are to further investigate the typographic system for note-tails, it is essential that we should find a way of categorising these characters

17 [Anon.]: *Music Book Printing, With Specimen*, Boston: F. H. Gilson 1897.

18 Analysis of the photographic representation of the punches and matrices preserved at the Museo Bodoniano.

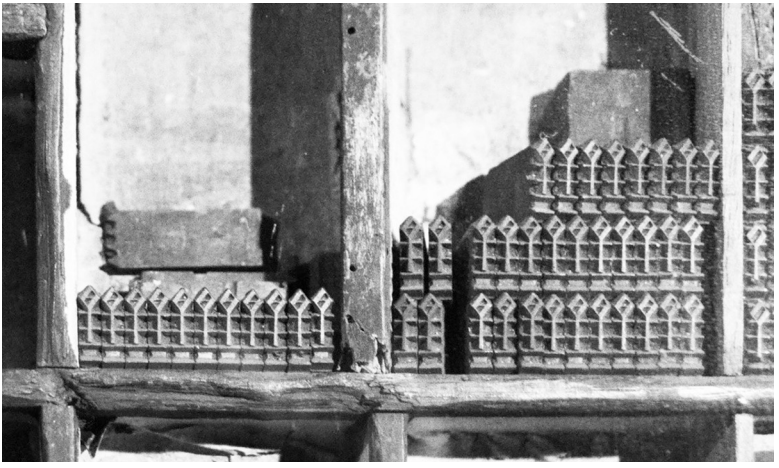
by dimension and shape. The *Manual Typographique* by P. S. Fournier shows us a way in which we might list the music font characters, for Fournier orders them by the number of their vertical modules. Another essential detail is the angle of the oblique tail. Despite the variety of shapes, the choice of angle for the note-tail was limited, as it was impossible at the time to design and produce a single character for every possible angle (see fig. 3). This would have meant producing and handling thousands of characters when typesetting. The presence of part of the stems inside the character is another useful detail that can help us to understand how they were used. Some of the matrices for oblique note-tail characters show no presence of a note stem, and it is difficult to tell how these characters were used (at this stage of our research, we might assume that they worked as kerned characters). There is also the horizontal dimension of the characters for the tails, which is not always proportional to the number of stems (see fig. 3). The ratio between the supposed length of the character and the number of stems can help us to understand if the character was supposed to represent a short note or a long note. The presence of the staff line is a useful detail, but it is not exclusive to the single impression system.

Possible further developments

The many pieces used in this moveable type system demonstrate the effort applied by Bodoni to achieving the best quality possible with his music font. With his tools, he was able to produce a near-clean, polished layout, despite the lack of flexibility in his printing method. The logic behind the production of note-tails was to ensure ease of use for the most common combinations of notes, also to enable him to typeset a great variety of less common combinations. This approach required him to produce many more characters than the other music fonts that were available at the time and necessitated a careful design of the whole system for the note-tails. In order to catalogue the variety of the shapes for the note-tails, it is necessary to analyse at least the following characteristics: vertical modules, angle of the tail, presence and number of stems, and width (and thus also the ratio between width and stems). Such an investigation could be taken further by means of in-depth archival work, retrieving and analysing images at a higher resolution from the printed specimens and the matrices. Such an approach could help us to acquire exact

measurements and more reliable information about the characteristics of the music font produced with the matrices preserved at the Museo Bodoniano. This analysis would be an initial step both towards further fieldwork on Bodoni's heritage in the music printing industry, and into other typographic systems for music such as those preserved in archives across Europe in the Plantin Moretus Museum (Antwerp), the Imprimerie National (Paris) or the Museum Enschedé (Harlem). By comparing their various design approaches, it will become possible to understand the concrete design choices of each typographic system. This might then help us in turn to comprehend fully the respective logic behind these elaborate sets of type.

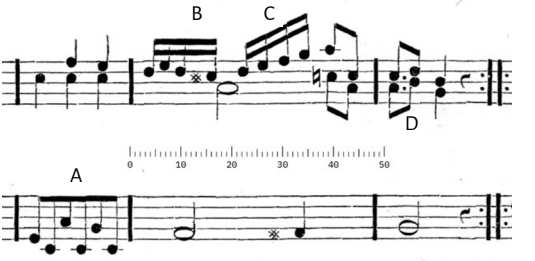
Fig. 1 Detail of a music font case with movable types from the mid-16th century, photographed at Museum Plantin-Moretus (Antwerp). Note-heads are square, as was usual at the time. On the left, it is possible to see the profile of a kerned character (during typesetting, the upper part of the note-head would fall over the upper/lower piece of type).



This image was manipulated to maximise the contrast in a black-and-white reproduction. The bars display some small breaks and misalignments along the staff lines and the note stems. [A] The horizontal note-tail falls just over the staff line, hiding it from the score. [B] The sharp sign is included below the note-tail; it may indicate that the same note-tail was broken into multiple characters with different lengths in order to accommodate the sharp

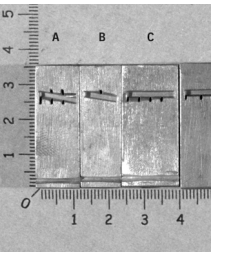
sign below. [C] Disproportionate slanting of the note-tail compared with the pitch of the corresponding notes. This detail testifies to the limited options for typesetting the oblique note-tails. [D] This page displays certain metrical mistakes, such as here, where the second note should be a semiquaver. While these mistakes make the score uneven, they have no relevance for the publication itself: the page was intended as a specimen of printed notes, rather than a score to be performed.

Fig. 2 Detail from p. 274 of the Manuale tipografico, music composed by Gian Francesco Fortunati, bars 6, 7 and 8.[19]



This image was manipulated so as to correct lens distortions and to maximise the contrast in b/w reproduction. [A][20] Matrix of an oblique tail for a 4-note group displaying a segment of staff line. [B] Matrix of an oblique tail for a 3-note group. By comparing the length and the number of stems on matrix [A] and [B], it is possible to see how the number of stems is not directly proportional to the horizontal length of the note-tail. [C] Horizontal note-tail for a 5-note group. This drawing could produce characters for both the single and double impression technique.

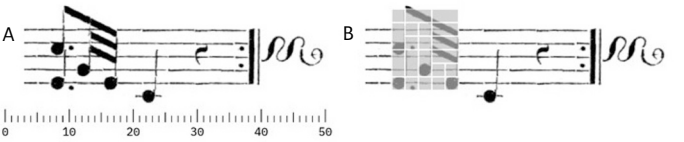
Fig. 3 Detail from a picture of a series of matrices for joint note-tails.



19 Biblioteca Palatina, su concessione del Ministro per i Beni e le attività culturali.

20 Biblioteca Palatina: *Fregi e segni diversi, musica seconda detta piccola*, su concessione del Ministro per i Beni e le attività culturali.

Fig. 4 Detail from p. 274 of the Manuale tipografico, music by Gian Francesco Fortunati, bar 15.



This image was manipulated to maximise the contrast in b/w reproduction. Reference metric in millimetres. [B] Same as [A], but demonstrating a possible deconstruction of the composition into single characters, with assumed matrices and ink breaks between the notation signs on the printed page (the breaks are visible in [A]). The black shapes crossing the typesetting grid are probably kerned characters.