

The Origins of the Musical Staff

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For Michel Huglo, master and friend

Who can blame music historians for frequently claiming that Guido of Arezzo invented the musical staff? Given the medieval period's unmanageable length, it must often be reduced to as streamlined a shape as possible, with some select significant heroes along the way to push ahead the plot of musical progress: Gregory invented chant; the troubadours, vernacular song; Leoninus and Perotinus, polyphony; Franco of Cologne, measured notation. And Guido invented the staff. To be sure, not all historians put it quite this way. Some, such as Richard Hoppin, write more cautiously that "the completion of the four-line staff . . . is generally credited to Guido d'Arezzo,"¹ or, in the words of the *New Grove Dictionary of Music*, that Guido "is remembered today for his development of a system of precise pitch notation through lines and spaces."² Such occasional caution aside, however, the legend of Guido as inventor of the staff abides and pervades. In his *Notation of Polyphonic Music*, Willi Apel writes of "the staff, that ingenious invention of Guido of Arezzo."³ As Claude Palisca puts it in his biography of Guido, it was that medieval Italian music writer's prologue to his antiphoner around 1030 that contained one of the "brilliant proposals that launched the Guido legend, the device of staff notation."⁴ "Guido's introduction of a system of four lines and four spaces" is, in Paul Henry Lang's widely read history, an "achievement" deemed "one of the most significant in the history of music."⁵ And in the most recent *Oxford History of Western Music*, we read that "the man responsible for this signal achievement," the staff, was "Guido of Arezzo, who around 1030 (in the prologue to an antiphoner) first proposed placing neumes on the lines and spaces of a ruled staff to define their precise pitch content." To this "legend in his own time," the history goes on to say, "we, who still rely on his inventions nearly a thousand years later, owe him a lot, as did all the generations of Western musicians preceding us."⁶

To be fair, this recent view of Guido as inventor of the staff owes its existence to an impressive tradition, long and deeply entrenched.

The second most widely disseminated medieval music treatise after Boethius's *De institutione musica* was Guido's *Micrologus*, often accompanied in the manuscripts by his other writings, including his prologue to his lost antiphoner (also known as the *Aliae regulae*), the source of his statements on the staff. As Christian Meyer has put it, the manuscript dissemination of Guido's works is "surprisingly coherent, speedy and wide ranging."⁷ Some seventy manuscript sources survive from the eleventh to the sixteenth century, with several copies made in the eighteenth century.⁸ From the eleventh century on, his writings were frequently commented upon and re-edited, as in the thirteenth-century *Metrologus* or the sixteenth-century *Introductorium*.⁹ As Fritz Reckow has put it, "Guido's theory after Guido" became its own distinctive phenomenon.¹⁰ The Guido legend included medieval illustrations of the Arezzo master passing on his musical knowledge to bishop Theodaldus, the dedicatee of the *Micrologus*, thus reinforcing his status as the staff's inventor.¹¹ The reception of Guido has continued well into modern times, as seen, for example, in one eighteenth-century re-envisioning of the master showing his antiphoner with its innovative staff and square notes to a seated Theodaldus (Figure 1). It has thrived especially in Italy, where strong views surround the famous monk who is integral to that country's cultural heritage. Among other things, there is a Guido postage stamp and several Guido monuments, including one where the man from Arezzo is christened "blessed Guido, the inventor of music" ("beatus Guido, inventor musicae").¹² At the celebration in 1994 of the millennial anniversary of his presumed birth date festivities took place in the town of Talla—his purported birthplace—that included concerts, an academic conference, and the dedication of a new monument to his name.¹³ It is safe to say, then, that the Guido legend is alive and well.

A few historians have attempted to pierce through the clouds of the Guido myth to arrive at a more nuanced and responsible account of his role in the development of the staff. Already in the eighteenth century, both Charles Burney and John Hawkins pointed out that the idea of placing pitches on lines had preceded Guido by at least a century.¹⁴ Gustave Reese, in his landmark *Music in the Middle Ages*, first published nearly seventy years ago, conceded that Guido had only "perfected staff notation" by improving "an imperfect system already in use."¹⁵ Even the *New Oxford History of Music* pointed out a half century ago that Guido's reputation "as inventor of the staff" was overrated, since "the staff . . . was in existence before his day."¹⁶ Yet, even if he did not invent it, most would at least agree that "it was Guido who developed the staff," in Jeremy Yudkin's careful wording.¹⁷ Dolores Pesce



Figure 1. Modern depiction of Guido handing his antiphoner to bishop Theodaldus. From Jacques Chailley, *La musique et le signe* (Lausanne: Rencontre, 1967), 23.

recently wrote that, even though the exact extent of his contribution to the development of the staff “cannot be definitively established . . . his essential role is unquestionable.”¹⁸

One thing is certain: a prototype of the staff existed a century and a half before Guido. As David Hiley has put it, in the late ninth-century treatise *Musica enchiriadis*, “A set of lines called *chordae* . . . are used, one for each pitch, a second apart.”¹⁹ This can be seen in Figure 2, in which, as with most remaining figures in this essay, the original has been altered in order to show more clearly patterns of pricking and ruling to be discussed shortly. On the left margin can be seen the single, regularly

comodantur. Per omni enim sonos feremur sub quibus de uero solus
 at-mpthora debet. Et inconstanti efficitur requit solus dicitur
 simphonia in fura un peccatis. tibus; uteris tons a ptao sono. et lon
 ganus. cui exat sub quart. Qua ppr & uox quae organalis dicitur
 uoce atreia q; cuocit principalis eo modo comitari sale. ut in
 quolibet uocacordo inqualibet particula infra tertium sonum
 nec pofitione descendit nec in clamaone leuet. obstante tria
 som inco sona uicua. q; ptao do e subiecti. a ue ut lucidiora fuit.
 exempli descriptione statuuntur. p ut possit fieri subaspct tujn.

hanc descriptione auendo facile scribitur quomodo mule
 scriptis duob; membris fiat subat uocandū sonū organalis uox
 responū mapere n potest. ita subit andē nomula pofitione ppr di
 & ob hoc infinalitate pofitionū auoce principali occupetur. ut
 ambe in unum conueniam.

¶ Ergo qm p dicitur oppositioe breui dicitur coartatur
 & nisi uirib; t in. sonū organalis uox spaciū habe. Idcirco p
 particulari pofitione & loca mutua. Vagantib; enim particu
 lis: Dum modo cantilena infursum prodect. modo in ima
 deponatur. & nunc qua eliba particula pofitionem.
 habet. circa superiores sonos. Nunc circa iminales. aliquam
 deo ca ptao uox tempuox organalis pofitionū finalitate coart
 subiequatur. ut subrus retardum sonum in quem uel fi
 nalitas particulae deuenit. t qui ptao uox ipse finalitatem
 subiet. Idcirco ordm leuacione uolent. nec ut finalitate deponat
 ceptū car. —. inq; exempli gratia

Figure 2. Letter notation from *Musica enchiridis*. Lat. 7211, fol. 9v, Bibliothèque nationale de France, Paris. Reproduced by permission.

spaced prick marks used to trace the main ruling lines of the page, as discussed below. These lines were originally conceived, not for music, but for plain text writing, as can be seen both above and below the musical staff: there is one line of text for every one ruling line. In the musical example, the syllables of this polyphonic song's text, "Rex celi domine," are distributed over six lines that represent the pitch distance of a step or half step in the song. In the Roman-style column at the left of the staff sit the mysterious "dasian" letters standing for each line's pitch.²⁰

Just what was Guido's contribution to this type of musical staff? Joseph Smits van Waesberghe claimed, in his biography of the medieval theorist, that Guido had made three new and essential changes to the staff in the prologue to his antiphoner (likely written around 1030). He had proposed (1) lines that were drawn closer together than before; these lines were distinguished by (2) different colors and (3) clef letters.²¹ Concerning Waesberghe's first point, it is not entirely clear that Guido meant that the staff lines should be "closer together." The Latin expression Guido used is "spisse linee," which could mean "closer together," as it has been understood until now; but a more common translation of "spisse" is "thick."²² Thus Guido might equally have recommended thick lines, rather than lines drawn closer together. Indeed, the latter meaning conforms better to the manuscript evidence. As detailed below, with a very few exceptions, we do not find more compressed staff lines (i.e., altered rulings of the page) in manuscripts either of Guido's treatise or of those written around Guido's time, but rather lines made thicker, or more visible, by coloring. Be that as it may, neither meaning of Guido's "spisse linee" substantially alters the fact that his idea of multiple lines for musical notes was clearly modeled on the *Musica enchiriadis* staff. Guido alludes to the *Enchiriadis* treatises several times in his writings, at one point in the *Regule* referring to "the notes of the *Enchiriadis*."²³ His musical examples in the prologue to the antiphoner clearly take their cue from the *Musica enchiriadis*.²⁴ And he ends the prologue by actually naming the *Enchiriadis* treatises ("the book *Enchiridion*"), attributing them to Abbot Odo.²⁵

Waesberghe's other two supposed Guidonian innovations—namely, the use of colored lines and clef letters—were not new to Guido either. We also find them in the *Musica enchiriadis* that inspired Guido's staff in the first place; it specifies that each line and its corresponding row should be "assigned its own color."²⁶ As Nancy Phillips has shown, some of the earliest manuscripts of the *Musica enchiriadis* use colored lines; the *Scolica enchiriadis* also used colors for its lines: red, green, yellow, and black.²⁷

In sum, the claim implied by Guido's status as "the one who invented the staff" is untenable. The Arezzo master's role in the staff's development lies less in any one of his presumed contributions than in a clever pedagogy of synthesis backed up by a fair bit of self-promotion. Guido's variant on the humility topos in the *Epistola* is telling: "Inspired by the love of God, I have shared . . . with not only you but also any others I could . . . so that when those who come after learn with the greatest ease the chants that I and all before me learned with the greatest difficulty, they may desire salvation for me."²⁸ In the long medieval

development of the staff, then, Guido adopted with some modifications already existing musical layouts until then confined to the *Enchiriadis* tradition.²⁹

Regardless of whether or not one calls Guido inventor of the musical staff, the debate surrounding this question brings up a far more important question, that of the origins of the staff in the Middle Ages. This topic is related to the broader domain of medieval page layout and the related topics of pricking and ruling. It is here that the solution to the riddle of the origins of the musical staff, as well as a more exact answer to Guido's role in its development, can be found. The field of codicology, or study of the book, is responsible for some important work on medieval page (i.e., parchment page) layout, or *mise-en-page*.³⁰ Notable advances in this area include the work of L. W. Jones and E. K. Rand on pricking, Léon Gillissen's contribution to the measurement of medieval rulings, and Albert Derolez's major study of layout in late medieval manuscripts.³¹ Music historians have been comparatively slow to broach the topic of page layout, and even more so the related topics of pricking and ruling. Arguably the first study of medieval musical page layout was a 1951 essay by Smits van Waesberghe that analyzed the different combinations of colored lines found in musical staves produced right after Guido's time, providing along the way a useful catalog of 170 mostly Italian manuscripts, to which I shall return later in this essay. Yet Waesberghe paid no attention to the layout of the entire page on which a given staff occurred, and he entirely ignored pricking and ruling patterns.³² Some ten years after this study appeared, Franciscan priest Stephen J. P. van Dijk focused on "a problem which so far has not had the attention of paleographers, namely the question of medieval music notation and, more particularly, of how a medieval scribe planned his ruling for both text and music."³³ By means of elegant drawings, van Dijk showed for the first time how changes in page layout for music had shaped the appearance of the staff (Figure 3). Unfortunately, van Dijk was something of a partisan historian. He credited his own order of Franciscans for having single-handedly developed a layout where "the stave is completely free from the ordinary texts" and where "the noted text is written as large as the ruling permits."³⁴ Although flawed in its details, van Dijk's investigations in the early 1960s raised the crucial question of layout in medieval music books. Thanks to him, other musicologists started in on the layout question in the ensuing decades, offering different perspectives. The most notable work is that of Michel Huglo on Dominican and Franciscan ruling regulations,³⁵ Yves Riou and Denis Escudier on the layout of early medieval sources,³⁶ and Andrew Hughes on later books.³⁷ No one yet has applied

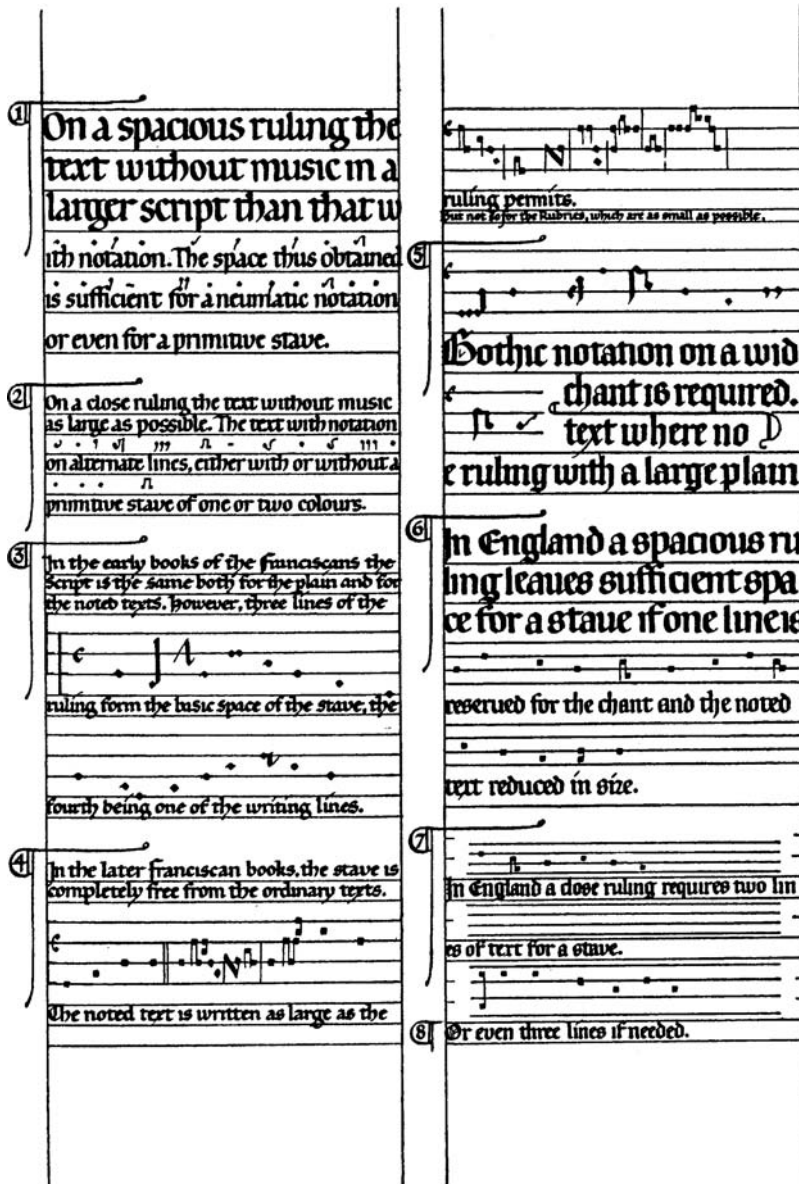


Figure 3. Stephen J. P. van Dijk's drawing of musical staves and text.

these gains made in the study of page layout toward an elucidation of the musical staff's origins; such is the purpose of this essay.

To discuss the relation of page layout to the staff, it is first important to clarify standard pricking and ruling processes in medieval book-making. The initial stage of preparing a sheet of parchment for writing

in the Middle Ages was to prick and then rule it. The importance of pricking and ruling is encapsulated in the following delightful lines by the thirteenth-century Swiss canon Conrad de Mure: “Once the pricks have been pricked a lead line follows them, and thanks to their guidance the line makes out a path.”³⁸ As Jones has made clear in the article cited earlier, the practice of pricking and ruling a manuscript dates back to the earliest tradition of parchment bookmaking in the West. Dry ruling was usually used until the late Middle Ages, at which time the lead lines mentioned by Conrad became more common.³⁹ So, for example, for a seventh-century copy of homilies by early church father Origen, in the manuscript Burney 340, belonging to the British Library (henceforth BL), twenty-three holes were pricked about 10 millimeters apart (Figure 4a). This was usually done one or more bifolios at a time; in this case, an entire gathering was pricked all at once. A variety of tools may have been used to produce these holes, such as a knife, an awl, or multi-pronged instruments, like a comblike board with nails, or a pricking wheel.⁴⁰ Although early historians, such as Jones, believed the latter tool was often used in the Middle Ages, recent scholarship has shown that the historical evidence points to the medieval use of simpler tools such as the awl rather than more complex ones such as the pricking wheel.⁴¹ The mysterious “ruling post” (*postis ad regulandum*) mentioned by the Carthusians was perhaps a simple board on which the parchment lay, and not necessarily the cryptic “metal object” mentioned by Anonymous IV, as I have recently proposed.⁴²

Behind the pricking wheel assumption just mentioned lurks the common tacit but unsubstantiated belief that medieval craftsmen always favored modernlike rapid and efficient technologies to speed up their

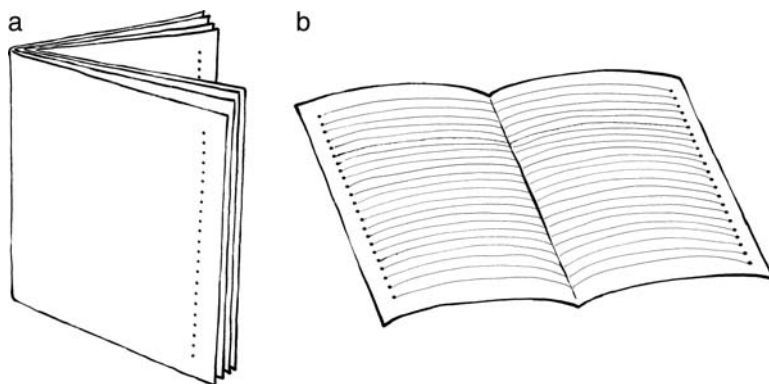


Figure 4a–b. Pricking of the page in Burney 340, British Library, London. Reproduced by permission.

work. It is worth questioning this belief, and I shall return to it later in connection with the rake. There are several problems with the notion that in the Middle Ages a more efficient tool such as a pricking wheel would have usually been favored over a simple awl. The first is that, in medieval craftsmanship, tradition and other virtues such as symbolism sometimes—though not always—trumped the modern virtues of speed and efficiency.⁴³ The second problem with assuming that medieval workers would have invented a pricking wheel in order to speed up their work is that, as for the rake, neither specimens of pricking wheels nor even references to this tool survive from the Middle Ages.⁴⁴ The final difficulty is that it is very hard to pierce through one or two leaves of parchment—let alone an entire gathering of four or eight leaves—with a pricking wheel or comb, as anyone who has tried the experiment will attest. A simple tool such as an awl, if used in combination with a hammer, provides the greater pressure needed to pierce through a surface as tough as treated animal skin.

Pricks visible in extant manuscripts suggest a medieval practice of pricking entire gatherings at once rather than one sheet or even bifolio at a time. For one, the pricks throughout an entire gathering (which in most cases studied in this essay is a quaternion of eight leaves) usually face the same direction. Furthermore, unevenness in the measurements between holes is often consistent throughout entire gatherings. Such is the case, for example, in the liturgical miscellany Paris, Bibliothèque nationale de France (henceforth BnF), fonds latin 1154, where the parchment clearly sinks around pricks on the recto side and points away from it with slight burs on the verso side. In another book, the eleventh-century Spanish antiphoner London, BL Additional 30850, different gatherings have distinct prick marks. That pricks were often made an entire gathering at a time is also the conclusion of a recent codicological study on the early books of the Carthusians.⁴⁵

Following its pricking, the parchment gathering was then opened, and across its open surface were drawn regularly spaced lines, thus providing the page's rule, or skeleton, so to speak (Figure 4b). I have recently suggested that Anonymous IV's expression *regulator* meant the person drawing these ruling lines, yet have previously claimed that the *regulator* denoted the individual drawing the musical staff.⁴⁶ Be that as it may, the person ruling the page traced his lines, often across an entire gathering (i.e., two folios), in dry point with some sort of knife or stylus, as was the usual practice prior to the twelfth century.⁴⁷ Only then could the text be written on each line. In the case of the Origen homily collection discussed above, there is a generous space between each line,

the so-called ruling unit, of around 10 millimeters, as mentioned earlier. This gives a spacious layout, with plenty of room around each line of text (around 6 millimeters over half the ruling) The design was so spacious, in fact, that there was room in this book to occasionally add punctuation marks and to supply missing letters, or even entire sentences, over a line of text.

It is interesting to observe that, although the seventh-century collection of Origen homilies predates the earliest extant musical notation and the *Enchiridion* treatises by some two hundred years, its layout almost suggests the idea of musical notes and that of a musical staff. In fact, we might say that the staff is nascent in the very layout of the medieval page. A set of parallel horizontal lines was a common sight for most medieval scribes. Anyone beginning to write on a fresh sheet of parchment in the Middle Ages would have been confronted with a set of evenly ruled lines that constituted the ruling of the page. It is no wonder that music scribes adopted the vertical-line grid universally used by medieval text scribes as the basic template for musical notation, in contrast to other non-Western notational systems (Japanese *kukushi*, for example) where a staff is not used to indicate pitch height. While it is true that medieval music scribes ultimately adjusted the text template by drawing the lines closer together, the basic concept of a staff nevertheless arose, in an unspectacular and natural way, from the ruling of the medieval page. In the same seventh-century Origen manuscript, the punctuation marks and missing letters written in the six-millimeter space above the text are suggestive of the size, location, and shape of musical neumes we first find two centuries later. Indeed, arguably the most widely accepted theory concerning the origins of musical notation in the Latin West is that it arose from the manuscript punctuation just mentioned.⁴⁸ For all of these reasons, therefore, the pricking stage in medieval book production would prove to be crucial in the history of music writing, since it determined the ruling and thus the contents of the page, including whether or not there would be a staff and, if so, what kind of a staff it would be. Without pricking there would have been no ruling, and without ruling, there would not have been a staff. The pricking patterns of medieval books both framed medieval music writing in a literal sense and ultimately generated the idea of a musical staff.

What I propose in this essay is a brief account of the origins of the musical staff. This history is necessarily sketchy, as future research will hopefully enhance or modify its details in the much-needed continuing study of the hundreds of surviving manuscripts offering pertinent evidence. One of the main difficulties with this type of work is the fact

that the majority of pricking patterns in manuscripts have disappeared with the trimming of the page, so that they usually cannot even be studied in the first place. In cases where they have survived, musicologists have usually assumed this sort of detail either too banal or not relevant enough to musical notation. Yet, as just mentioned, the pricking and ruling of medieval manuscripts is fundamental to the existence of that celebrated framework for notation, the staff. Of course, not all extant medieval music manuscripts have been studied for this essay, but it is possible to distinguish a chronological change, based on the scrutiny of over one hundred books, from the seventh to the fifteenth centuries, personally inspected for this study. There appear to have been three major phases in the development of the musical staff in the Middle Ages, that is, three main types of pricking and ruling patterns that eventually led to the late-medieval musical staff, the direct ancestor of the staff as we now know it. Significant changes in pricking patterns during the twelfth century were critical in this development, in particular the second phase outlined below. These patterns were implemented after Guido and his presumed innovations. Thus if anyone should be credited with the invention of the staff in music, it is less Guido than a large group of anonymous scribes who came shortly after him in the twelfth and thirteenth centuries and who adopted certain distinctive and ultimately influential page layouts for music. These scribes contributed equally, if not more, to our modern staff than anything Guido ever recommended in the eleventh century.

Before describing the three main phases in the history of the staff, it will be useful to briefly compare an early and a late medieval music page layout, in order to get a sense of the dramatic changes in music page layout detailed in this essay. Figure 5 is taken from a tenth-century liturgical collection that includes notated pieces; Figure 6 comes from a late thirteenth-century collection of *trouvère* songs that also mixes text-only sections with notated words. These two books were designed with very different readers in mind—one for liturgical use, and the other for the collection and possible performance of secular songs, but they nevertheless illustrate important changes in a majority of medieval music books over a long period of time. Figure 5 is typical of an early medieval music layout. The notes, or neumes, are small, squeezed in above the text. It is difficult if not impossible to read these notes accurately without prior knowledge of the tune, since there is not enough room to indicate height of pitch by placing one note higher than another. There is barely enough room to contain the melody. As can be seen in the top right-hand margin, the first line of music tumbles out onto the edge of the page.

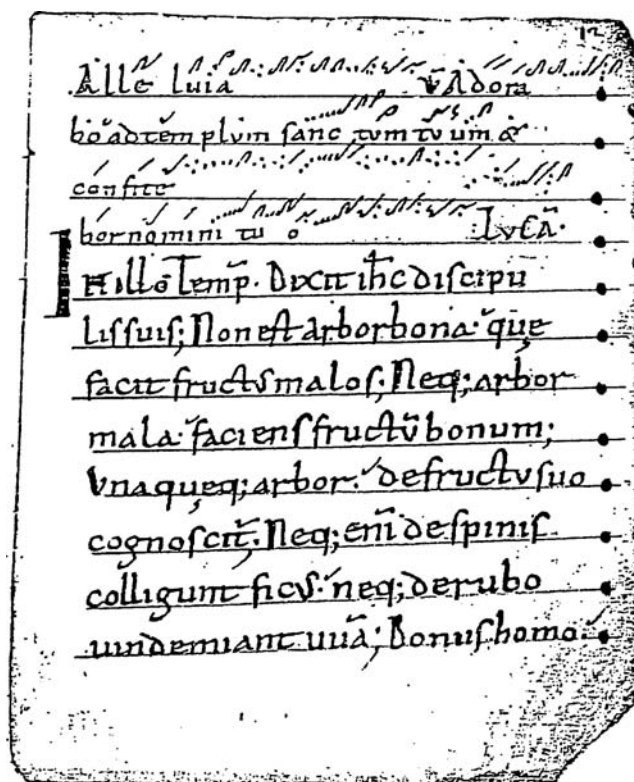


Figure 5. Palat. Lat. 489, fol. 12r., Biblioteca Apostolica Vaticana. Reproduced by permission.

A few centuries later, we find a very different layout for music, as seen in Figure 6. Most conspicuous is the presence of a four-line staff, usually entirely comprising red lines by this time. There are three main ways in which the invention of the staff had changed medieval music writing by the thirteenth century. First, music is given more space proportionately to the text. Secondly, whereas in the earlier layout musical notes are smaller or narrower than text letters, now the notes are at least the same size if not wider than the basic text module (i.e., not counting the ascenders and descenders of letters). Finally, music sits on a clearly delineated grid, the staff. This musical grid is independent of the main page ruling. That is to say, its ruling is divorced from the ruling of the page, a spectacular writing achievement that signals the independence of music from text. The staff confines the notes to the writing block, stopping them from floating into the margins, unlike the unruly melisma in Figure 5.

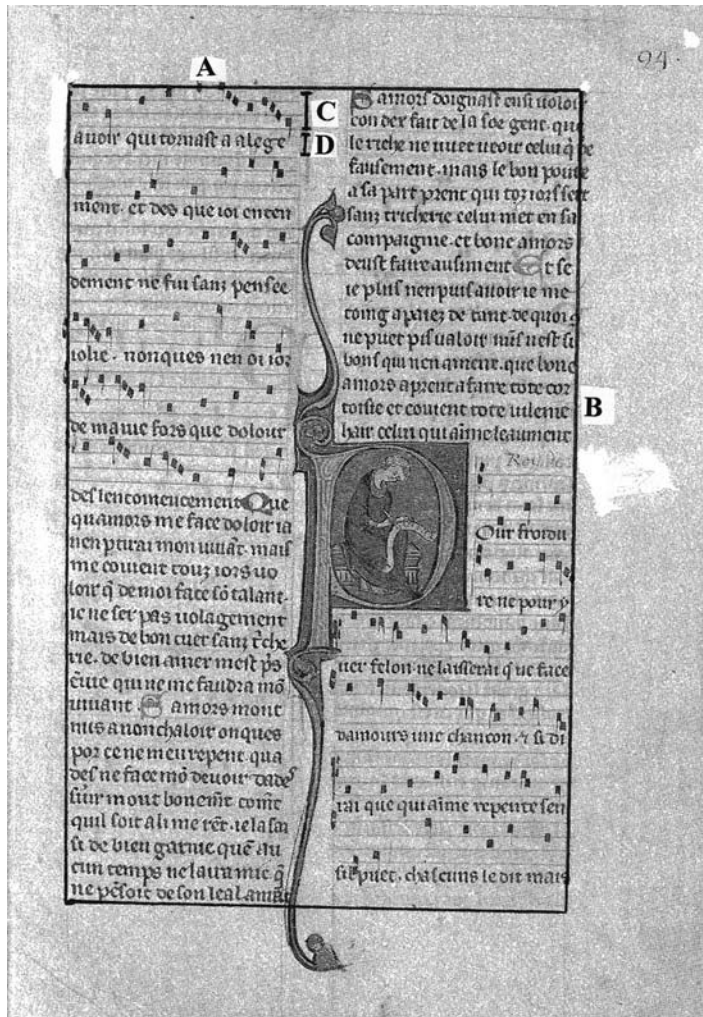


Figure 6 F. fr. 846, fol. 94r., Bibliothèque nationale de France, Paris. Reproduced by permission.

The result, by the late Middle Ages, is a legible and elegant musical text.⁴⁹ The clearly defined space for music in the four-line staff translates into a visually satisfactory balance of text and music on the page. This balance is reinforced by the general architecture of the page, carefully articulated in its various blocks and lines. It is probably not coincidental that the main writing block in Figure 6 corresponds to the dimensions of the Golden Rectangle so vital to Gothic architecture and art, including the craft of page layout.⁵⁰ It measures around 12 millimeters wide (line A in Figure 6) by some 18.5 millimeters high (line B). The ratio of width to

height (A:B) is roughly 1:1.6. This is also known as the Golden Ratio, described by Euclid and used throughout the Middle Ages. The Golden Ratio is based on the Golden Number, 1.618, what Mario Livio has recently called “the world’s most remarkable number.”⁵¹ In Figure 6, the proportion of musical staff to text echoes the writing block’s Golden Rectangle, for the heights of staff and text are also in something of a Golden Ratio to each other. The ratio of the staff height (line C in Figure 6, around 9 millimeters) to the height of the text (line D, 5.5 millimeters) is approximately equal to the ratio of their sum to line C; in other words, $C:D = C + D:C$, or $9:5.5 = 9 + 5.5:9 = 1.6$.⁵² Less important than this page layout’s exact dimensions or its relation to the Golden Ratio, however, is the general impression of proportion and symmetry it conveys and into which the musical staff so beautifully blends.⁵³

Phase One: Ninth to Eleventh Century

The earliest musical notation in the Latin West is found in about three dozen ninth-century sources not primarily designed for musical notation.⁵⁴ That is to say, these books are laid out for the main purpose of inscribing text, that is, letters of the Latin alphabet. As noted above for Figure 4, the usually generous space above the text letters invites such superscript additions as musical notation. The pricking pattern in such sources is the same as that of the seventh-century Origen homiliary from Figure 4: a straight vertical line of evenly spaced pricks. For example, the ninth-century Corbie evangeliary BnF lat. 11958 was punctured with thirty-two pricks spaced 9 millimeters apart, barely visible in the right-hand margin of Figure 7, and ruled accordingly. Musical notes have been added only to the opening page of the Gospel of Matthew on fol. 14r (Figure 7, top left). The text in this manuscript typically only takes up one-third of a ruling space (around 2.5 millimeters), leaving plenty of room (around 6.5 millimeters) for the musical notation that has been added on folio 14r.

The above is a representative and typical scenario in the earliest books with music notation. What characterizes this early phase is the lack of a page layout specific to music. Music scribes or notators (Latin *notatores*) simply made use of a given manuscript’s available ruling in lieu of designing a special one for music. Following the earliest extant sources with music just discussed from the ninth century, we find the first books solely or mostly devoted to texts with music in the following century; but still the pricking and ruling patterns are the same as in earlier times. The general practice in this first phase running from the ninth to the eleventh century, as in all subsequent manuscript

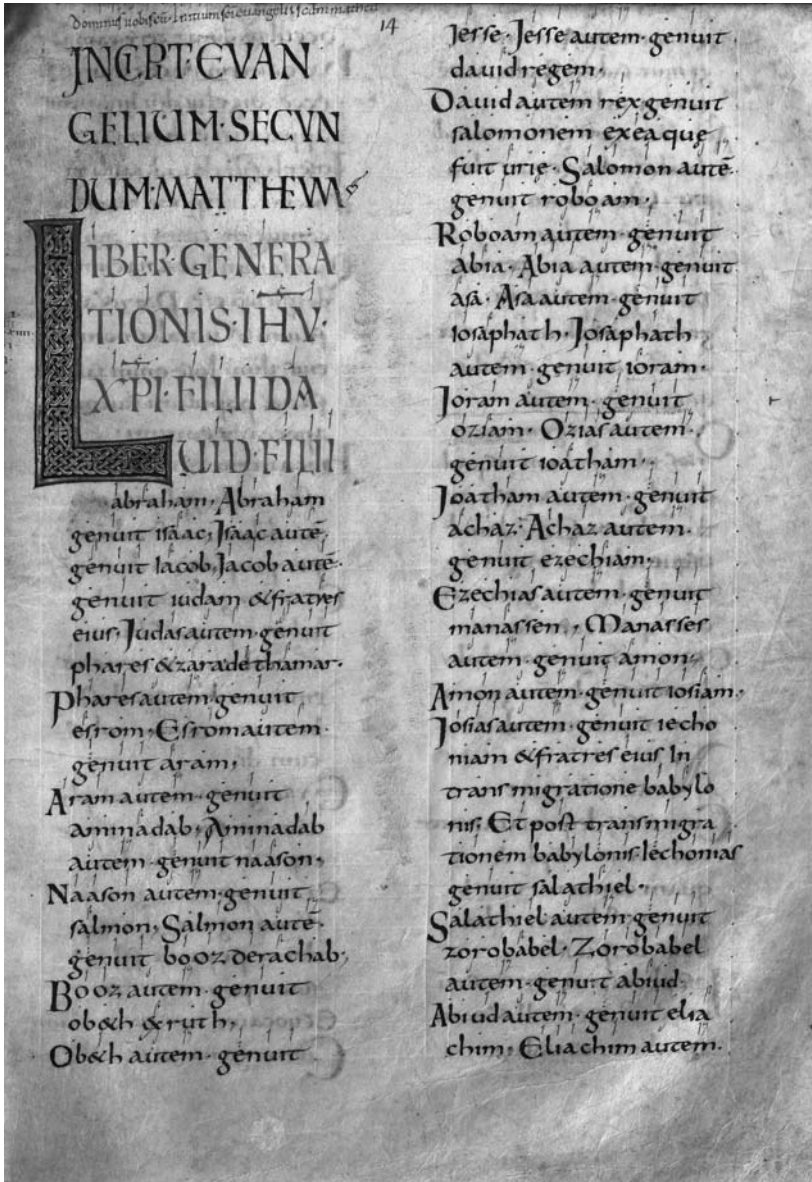


Figure 7. Fonds latin 11958, fol. 14r., Bibliothèque nationale de France, Paris. Reproduced by permission.

production, was for text scribes to write first, followed by music scribes. This meant that text scribes usually had to know beforehand where musical notation would be required. In books alternating exclusively text passages with combinations of text and musical notes, the text

scribe simply reduced the module or size of individual letters to indicate that these items should be sung (as was indeed the practice well before music notation was first used), making it propitious for the placement of musical notes later on. This is clear in Figure 5. The letters for the “Alleluia” at the top of this page are roughly half the size as those for the Gospel reading that follows at the bottom of the folio.

As the production of increasingly specialized music books such as troopers and sequentaries in the tenth and eleventh centuries accelerates, ruling spaces are often expanded to make more room for music than before, although the general kind of pricking and ruling pattern does not change. Music books from southern France especially expand the ruling width (sometimes as high as 20 millimeters), while shrinking the text down to as small a module as possible (usually to about one millimeter, not counting ascenders and descenders). This provides an unprecedented amount of space for musical notation (often more than 10 millimeters), meaning that music scribes can indicate height of pitch more accurately than before. Ultimately, this focus on pitch height in the Western Latin tradition—as opposed to certain non-Western notations alluded to above—comes with a loss of other indicators, such as ornamentation; by the thirteenth century, many of the liquescent notes have all but disappeared from square notation. The seeds for this transformation are sown during the first of three distinct phases of the staff, when Aquitanian and other scribes during this period become proficient at free-hand heighting of pitch. We see this tendency clearly in the neatly stacked compound neumes found in arguably the most famous medieval music book from the Limousin, the twelfth-century prosier BnF lat. 1139 (Figure 8).

Surprisingly, this heighting of pitch is apparently often accomplished with little guidance from a ruling line. Southern French books typically have only one line drawn in dry point as a pitch reference, as seen in Figure 8. In such cases, the text scribe writes on every other pricked line, leaving one dry line as a staff within a relatively large space. We see this, for example, in eleventh-century books from Narbonne (BnF lat. 780) and Toulouse (BL Harley 4951), which provide around 18 and 23 millimeters for music, respectively. Often, however, no extra line is drawn, leaving the scribe to accomplish heightened neumes without any guidance. This is understandable in relatively small books like the tiny troper from Sainte Magloire, BnF lat. 13252 (19.8 × 9.8 centimeters), whose pricks are 8 to 9 millimeters apart, leaving only around 6 millimeters for music; or in the Limoges collection BnF lat. 1154, where music is allotted some 7 or 8 millimeters.⁵⁵ But it is surprising to find no dry staff line in books with ample room for music,

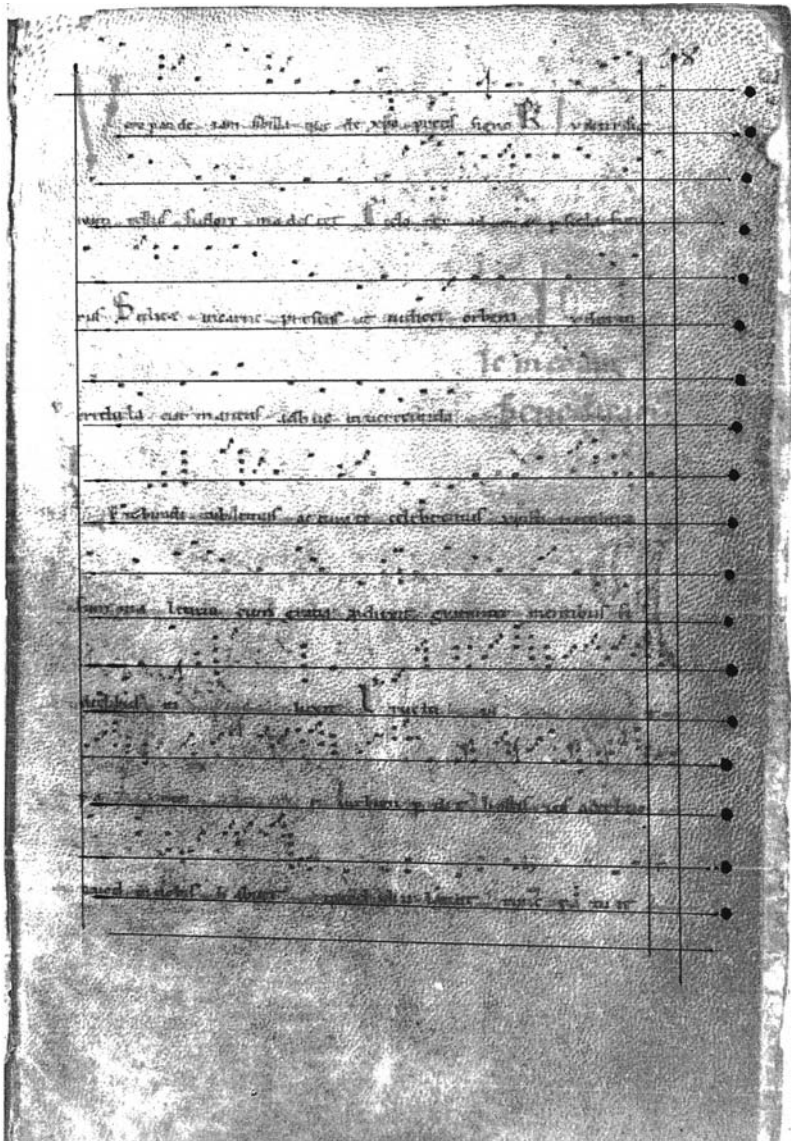


Figure 8. Proser from Limoges. Fonds latin 1139, fol. 58r., Bibliothèque nationale de France, Paris. Reproduced by permission.

such as the tenth-century troper from Aurillac later modified at the abbey of Saint Martial in Limoges, BnF lat. 1084, where music is given some 13 millimeters.⁵⁶ There is no ruling line here to guide notators in heighting the notes. Music scribes nevertheless acquit themselves well in such cases, demonstrating a surprisingly accurate heighting of pitches despite the absence of a dry line to guide their writing. In a few other

instances, an extra line is drawn in between rulings at variable heights according to the need of each staff. This is the case, for example, in the late tenth-century southern French troper BnF lat. 1118, where dry stave lines are drawn at varying heights within the roughly 20 millimeter main ruling unit.⁵⁷ Other books with this variable dry staff post-dating the original ruling include the Gaillac gradual, BnF lat. 776, and two tropers from Moissac, BnF lat. 887, especially fols. 1–5, and BnF lat. 1871.

In all these cases, the general pricking and ruling pattern is exactly the same as in medieval codices predating the advent of musical notation: a single vertical row of evenly spaced pricks. As mentioned earlier, this had been a longstanding way of preparing manuscripts well before musical notation appeared and would continue in music books long after new layouts for music were established in the second phase outlined below. It is not surprising to see it perpetuated in the Aquitanian tradition as late as the thirteenth century, one example being the Aquitanian processional cum troper, BnF lat. 1086.

The first-phase books mentioned until now are, for the most part, everyday or practical books for use in private or public Christian worship, books ranging from graduals and antiphoners to tropers and cantatoria.⁵⁸ Less often during the first phase, in specialized music theory treatises, musical notation occurs that takes up several ruling units for a given melody. There exists a problematic chronological gap between these treatises' composition and the extant manuscripts transmitting them. The *Musica enchiridis*, for example, survives in mostly eleventh-century manuscripts, with only one fragmentary source from the ninth century, when it was written.⁵⁹ So, to a certain extent, we must take it on faith that the layout in these later sources was in fact the one originally conceived in the ninth century by the *Musica enchiridis*'s author. This aside, the layout we find for music in these manuscripts is usually that discussed above for Figure 2, a staff of six ruling lines spaced a step or half-step apart, with pitch letters at the beginning of each line. Though confined to the rather rarefied world of medieval music theory, this staff predates Guido's time by a century and a half. It is not widespread in everyday books for liturgical use, which have the various phase-one layouts discussed earlier. Thus it was to Guido's credit, if indeed he was the first to do this, that he popularized the use of multiple rulings in common music books. What had previously existed only in theory—that is, in the learned *Enchiridis* treatises—Guido put into practice, launching the idea of multiple ruling spaces for music in the broader realm of everyday music books. This popularization, then, rather than an invention of the staff, was Guido's historical contribution to its development.

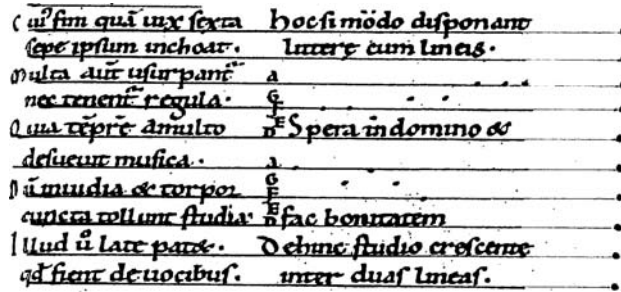


Figure 9. Example from Guido of Arezzo, *Regule rithmice* (ca. 1030). Fonds latin 7211, f. 93r, detail, Bibliothèque nationale de France, Paris. Reproduced by permission.

We now turn to Guidonian manuscripts. Like their predecessors, they belong to the first phase of the staff's history, rather than to a new phase of medieval layout for music. While it is certainly true that Guido's antiphoner containing the famous notational reforms outlined in his prologue has been lost, as is often deplored, it is equally true that, like the *Musica enchiridis*, no original or even contemporary versions of said prologue and related writings survive. The earliest manuscripts of Guido's prologue, originally written around 1030, date from the late eleventh or early twelfth century (exact dates are uncertain), with the bulk written from the thirteenth to the fifteenth centuries, as mentioned at the beginning of this essay. Consequently, the musical notation attributed to Guido occurs in a wide variety of formats, including an anachronistic late-medieval layout, as discussed for Figure 16 later in this essay. This aside, it is telling that, in more than one instance, the *Musica enchiridis* and *Scholica enchiridis* are transmitted in the same manuscript as Guido's works, including his prologue, attesting to the earlier discussed influence of the *Enchiridis* treatises on the master from Arezzo. Thus the evidence—both from Guido's prologue and its manuscript transmission—suggests that Guido's sense of music layout was inspired by these earlier ninth-century treatises. The manuscripts of the prologue and other related works by Guido such as the *Epistola* or *Regule rithmice* also reveal that, by the late eleventh century, the use of multiple rulings for musical notation had quickly become widespread practice. As seen earlier in the excerpt from the *Regule rithmice* (Figure 9), musical notes roam across two and a half ruling lines with letters on lines and spaces to indicate pitch. Guido's mysterious "spisse linee" is clear in this example. Rather than the occasional dry line in southern French sources, Guidonian books use the page's original pricks and ruling lines, as seen on the right side of Figure 9. These lines are perhaps "closer together" (in the usual translation of "spisse linee") than the earlier Aquitanian single dry-point staff, but they are equally

“thicker” (the alternate rendering of “spisse linee” proposed above) than the single dry-point staff, thanks in part to the red and yellow paint.⁶⁰

To sum up the changes in phase one, in the earliest music sources, notes are incorporated above a song’s text, with text and notes within the same ruling unit. A growing trend in southern French books of the tenth and eleventh centuries was to spread musical notes out across one larger ruling space. Sometimes more than two ruling spaces are used, most notably in ninth-century theoretical treatises and in Guido of Arezzo’s trademark notation. In all of these cases, though, the music scribe makes use of an existing page layout, instead of creating a special one for music.

The gains made for music layout during this first phase of the staff were considerable. By the late eleventh century, music compilers and writers had successfully attempted in a variety of ways to adapt existing pricking and ruling patterns to the purposes of writing music, from the wide spacing of Aquitanian books to the multiple ruling lines of Guidonian ones. By the end of phase one, Guido had popularized the use of several rulings and prickings for music, and accomplished clear, heightened pitch.

Yet despite their successful adaptation of existing page layouts to musical needs, these changes had brought into focus a problem that, by the late eleventh century, cried out for a solution. This was the issue of proportion, or spatial relation, between text and music in a given song. Bluntly put, Guido’s multi-linear approach accorded too much space for the musical notes of a song as compared to its text. Given that a text letter usually occupied roughly half a ruling unit and that music took up four ruling units in a four-line staff, the space devoted to music notes was often five or more times that of the text. This was inelegant from a layout point of view, especially as individual notes were smaller than a text letter. Whereas the text fitted comfortably in a single ruling unit, the notes floated about in an overly large space like so many fish lost in a giant musical sea. Most importantly, this phase-one layout resulted in a great waste of precious parchment, especially in books containing only music pieces. A solution had to be found that would retain the concept of multiple lines for music but alter the text-music proportion of the Guidonian layout, either by reducing the space for music or by increasing the size of the text. In the end, both of these would occur in a brilliant solution introduced in the twelfth century.

Phase Two: Twelfth Century

The visual disharmony between text and music on the page had become such a problem around 1100 that the same solution seems to have

been found nearly simultaneously in different places. During the course of the twelfth century, the solution to the music layout dilemma appeared in books from all across Europe—Italy, France, and England. Unfortunately, few of these manuscripts can be dated any more precisely than within a half century. The evidence suggests, though, that this new layout for music was a gradual development rather than an abrupt change. Ultimately, its success lay in the hands of those who, like Guido, managed to disseminate this layout widely. The enduring impact of the new layout in the twelfth century is especially indebted to the new monastic orders such as the Cistercians, and in particular of the Carthusians, who wedded their ingenious synthesis of layout and notational styles to an outstanding productivity in bookmaking.

It is important to stress that phase-one page layouts persisted throughout phase two, even in Italy where the experiments just mentioned first began. It should not surprise us that, in and around Guido's homeland, where his proposals were implemented in force, a conservative approach to layout prevailed. Nearly all manuscripts transmitting Guido's treatise made use of the old phase-one pricking pattern. So it is clear that the music layout modifications proposed by the famous monk from Arezzo in his prologue did not include pricking and ruling patterns.⁶¹ The same went for sources implementing Guido's proposals. As Waesberghe's impressive list of Guidonian sources shows, the bulk of the extant manuscripts originated north of Rome, and their flow continued unabated throughout the twelfth and thirteenth centuries. A good example of how these Guidonian books were prepared is the famous twelfth-century Ambrosian antiphoner from Milan reproduced in the fifth and sixth volume of the monks of Solesmes's *Paléographie musicale*, BL Additional 34209.⁶² This manuscript was pricked and ruled in keeping with the longstanding practice discussed earlier. Each gathering displays a single vertical row of forty-nine equidistant (3.5 millimeters) pricks. The prick marks exhibit exceptionally little wear throughout the entire book, and the burs created by the pricking tool's penetration make clear that each single hole was pierced through an entire gathering, and not leaf by leaf or binion by binion.⁶³ Three dry lines became the staff lines later colored in red and yellow, following Guido's prescriptions, and a fourth one became the text line. In other regions, throughout the twelfth century an even more conservative practice harking back to pre-Guidonian days occurred. The old custom of writing nondiastematic neumes within the same ruling as that of the text persisted, as for example in a Jumièges breviary from around 1173 (Rouen, Bibliothèque municipale 209–10).⁶⁴ In sum, during the twelfth

century, conservative phase-one page layouts for music still thrived even as their replacements began to appear.

These replacements with a new phase-two layout began cropping up in various sources during the twelfth century. From Italy up to England, the growing trend was the same: to increase the size of text and to reduce the space for music. The multi-line staff that Guido had advocated had definitively confined musical notation within a set number of lines that made up the staff. The staff now needed to be shrunk. Guido apparently never specified the number of lines in a staff, and the extant manuscripts implementing his ideas were appropriately inconsistent, presenting staves with three, four, or even five lines.⁶⁵ In theory, of course, the more lines on which to put musical notes, the better—as the *Musica enchiriadis* had shown. But practical considerations of space along with aesthetic considerations of visual proportion ultimately prevailed. It became paramount to restrict the number of rulings for music, most commonly down to three spaces defined by four lines. This was a natural compromise between the one or two ruling spaces of Aquitanian notation and the five or more spaces in the *Enchiriadis* treatises. If the space for music was slowly shrinking, it was still necessary to somehow increase text size just enough to achieve an elegant proportion between a song's text and its music. The resulting proportion by the late twelfth century sometimes approximated the Golden Ratio discussed earlier for Figure 6. With the music staff and its notes occupying more space than a text line, but not too much more, the music–text ratio was now with increasing frequency something near 3:5, or 1:1.6. Twelfth-century music scribes and compilers thus achieved a better visual balance between music and text, an elegant spatial truce after their tumultuous relationship throughout phase one. These scribes created for the first time a pricking and ruling of the page expressly for music.

This new pricking and ruling pattern for music appears quite clearly in more than one book from Nonantola, near Modena in northern Italy. In a troper (Rome, Casanatense, C IV 2) and cantatorium (Nonantola, Seminario Abbaziale, I) from sometime in the twelfth century, we see the following (Figure 10).⁶⁶ The pattern of puncturing the parchment is, from top to bottom, three pricks followed by a fourth prick set off to the right. Three ruling lines are then drawn for musical notes, with a fourth one dedicated to the text. As seen in Figure 10, there is a little more space around the fourth prick (5 millimeters as against 4 millimeters between the staff pricks). The result on the entire page of this slight modification in spacing gives the impression of a markedly increased spaciousness over previous layouts. In fact, it is still

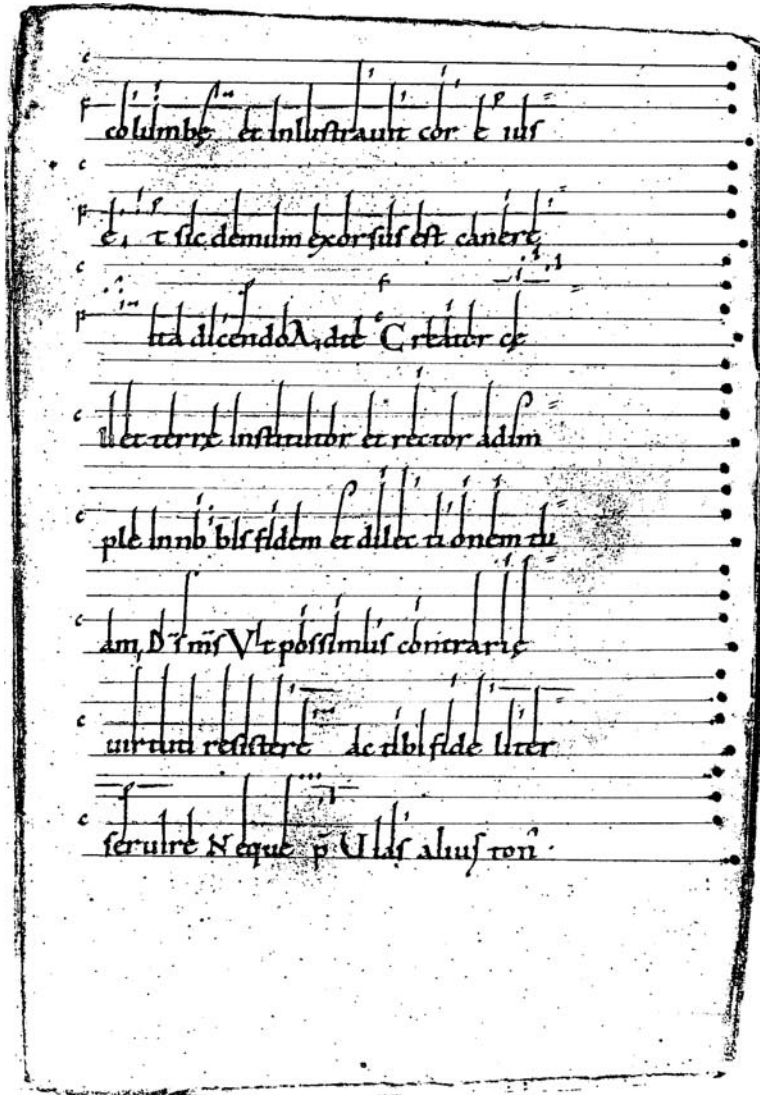


Figure 10. Pricking pattern in the Nonantola troper. C IV 2, Casanatense, Rome. Reproduced by permission.

perhaps too spacious for music, with the small music notes floating in an overly large area. Nevertheless, an important innovation is clear: the specially set-off prick for text grants more space to a song's words. Layout patterns similar to this one are found in other books that, likewise, cannot be dated any more precisely than sometime in the twelfth century. The pattern of three pricks for music plus one set off for text is found in a fragment from a north Italian antiphoner (Biblioteca Vaticana,

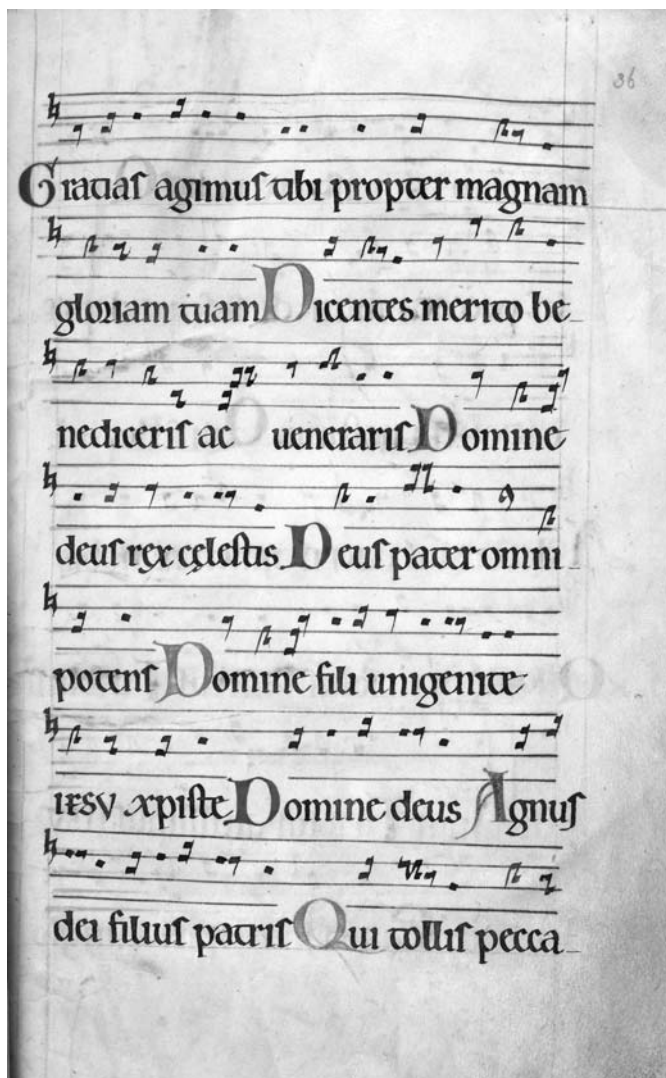


Figure 11. Pricking and ruling in the Saint Alban's troper. Royal 2 B IV, fol. 36r, British Library, London. Reproduced by permission.

lat. 10645, fol. 39, number 51 in Waesberghe's list of sources). We find the same configuration but with four pricks for music in a north-Italian gradual fragment (Biblioteca Vaticana, lat. 10645, fol. 37, Waesberghe's number 49), a troper from Narbonne (BnF, lat. 778), and in a troper cum gradual from Saint Alban's abbey (BL, Royal 2 B IV).

The Saint Alban's book is instructive because it brings out the layout accomplishments made during phase two (Figure 11). In this

English troper, as opposed to the Nonantola books, there is a marked contrast between the space for text and that for music. The space between staff lines is around 4 millimeters; the text ruling, dictated by a right-side prick every five lines, measures 8 or 9 millimeters—twice the size of a single staff ruling. Whereas the text module measures a standard 2 or 3 millimeters in the Nonantola books, the Saint Alban's text has been inflated to a four-millimeter module, not counting ascenders and descenders, and appears to nearly fill up its entire ruling space, amounting to 9 millimeters. Thus the English troper's text–music proportions roughly correspond to the Golden Ratio, some 14 millimeters for the four-line stave against 9 millimeters for text.

At least one instance of the twelfth-century spirit of experimentation covered so far finds its way into the transmission of Guido of Arezzo's works. The scribes writing up the small codex from the Abbey of Saint Évrout, BnF lat. 10508, experimented with drawing extra dry lines into music rulings, thus making individual staff lines, and so the entire staff, smaller.⁶⁷ The result is uneven, if not crude, but it comes close to the proportions achieved in other twelfth-century books discussed, such as the Saint Alban's troper; the text ruling is proportionately larger than that of music staves. Throughout much of the troper section in this manuscript (fols. 6r–42v), irregularly drawn dry lines within the existing ruling produce an average staff-ruling unit of 2.5 millimeters, whereas the text ruling receives a generous four-millimeter spacing. Having arrived at Guido's *Micrologus* and other works (136r–149r), the compilers returned to the layout of the troper section, drawing in extra dry lines where needed for musical examples. This case of a new page layout in Guido's works is the exception, however. A more representative layout of twelfth-century Guido manuscripts is that of the musical miscellany produced at the Abbey of Saint Wandrille (near Rouen), BnF lat. 10509.⁶⁸ Here, although a phase-two type of layout is found in the musical section of the book (fols. 1r–57v), the old phase-one layout—with no extra dry-line staff lines—is reserved for music theoretical works (fols. 58v–96r), including those of Guido.

A variant of the new pricking schema discussed above that also occurs in the twelfth century is that of four pricks for music, followed not by a single set-off prick as above but by a double prick for the text line, that is, two pricks side by side. The overall look on the page, as seen in Figure 12, is a row of vertical pricks with every fifth one a double prick. The proportions observed above for the Saint Alban's book are even clearer in a troper from Nevers, BnF nouv. acqu. lat. 3126. The pricking dictates a space for the text that is two times that of a single staff rule. The staff pricks are around 3 millimeters apart,



Figure 12. Pricking and ruling in a troper from Nevers. Nouv. acqu. lat. 3126, fol. 10r, Bibliothèque nationale de France, Paris. Reproduced by permission.

whereas the text ruling sits some 6 millimeters away from the nearest staff prick. We find this pattern in another book from Nevers, BnF nouv. acqu. lat. 1235, as well as in a gradual from Gubbio in central Italy, BnF lat. 1669. A variant on this is the well-known Old Roman antiphoner BL Additional 29988, where there are only three music staff pricks, as in the Nonantola books, but a double prick for text. As in the Saint Alban's book and the one from Nevers (n.a.lat. 3126), the text

ruling here is wider than staff rulings, though only by 1 or 2 millimeters. It has 3 to 4 millimeters for staff rulings, and 5 or 6 millimeters for the text.

It is significant that the new phase-two pricking pattern does not appear in sources clearly related to the ones just discussed but has been dated just prior to the twelfth century. For example, although the twelfth-century Narbonne troper BnF lat. 778 mentioned earlier exhibits the new double pricks and additional space for text, an eleventh-century book from the same city, BnF lat. 780 does not. The same situation applies to Old Roman sources. Although the twelfth-century antiphoner BL Additional 29988 exhibits a phase-two pricking and ruling pattern, Old Roman sources just prior to it use a phase-one pattern. An evenly spaced row of single pricks is found in the earliest Old Roman source dated 1071, the gradual Cologne (near Geneva), Martin Bodmer Collection C. 74, as well as in the Old Roman gradual Biblioteca Vaticana lat. 5319.⁶⁹ So, all of the evidence supports the assertion that the phase-two pattern was not introduced before the twelfth century.

To sum up what I have covered so far, this new pricking and ruling pattern appeared sporadically in twelfth-century sources as far south as Italy and as far north as England. Although varied in appearance, the new layout's purpose was everywhere the same: to isolate the text line with an offset or double prick in order to increase the size of the text and to grant it a visual prominence hitherto unseen in music layouts. With this phase, compilers of music books bid farewell to the awkward, large Guidonian staff rulings or to the Saint-Martial type of layout with its tiny text lying at the bottom of an inform, giant ruling for music. To borrow a typically twelfth-century thought, the phase-two pricking and ruling pattern was innovative; it belonged to the sphere of the *moderni* rather than the *antiqui*.⁷⁰

It is appropriate then, that the new phase-two music layout was first adopted in a systematic way by those twelfth-century *moderni*, the Carthusians.⁷¹ Founded by Reims cathedral chancellor Bruno of Cologne, the Carthusian monastic order established its first house high in the Alpine mountains outside Grenoble in 1084; it was known as the Grande Chartreuse. The sixteen Carthusian hermits adhered to the cenobitic ideal by residing together, yet they also maintained something of an eremitic lifestyle by each having individual cells fully equipped for a life of isolation. Thus the brothers observed matins, mass, and vespers together but spent the rest of their time alone in their cells. And a great deal of this time was devoted to the making of books. In his customary fifth Prior of the Grande Chartreuse Guigo I famously described the

various writing tools a Carthusian should have in his cell. They included a ruler and “ruling post” used for preparing the page.⁷² Making books continued to be a specialty of the Carthusians, even as the order spread throughout Europe, reaching down as far as southern Italy and as far north as Sweden by the late twelfth century.⁷³ The number of books produced at the Grande Chartreuse alone can only be estimated, since few have survived from the earliest period of book production, due in part to an avalanche in 1132; from the founder Bruno’s lifetime (d.1101), only one book, a luxuriously illustrated Bible, has survived.⁷⁴ Some 130 twelfth-century manuscripts survive from the Grande Chartreuse, but this is likely only a portion of the total number of books produced within its cells. Its library was compared in the late twelfth century to “an ocean of books.”⁷⁵

In this important activity of book production, the Carthusians turned out a remarkable number of music books in the twelfth century alone. Carthusian music writing reflected the order’s geographic proximity to Italy on the one hand and southern France on the other. From Italian music writing, the Carthusians borrowed the Guidonian colored lines; from southern France, they took the Aquitanian square-style notes.⁷⁶ Most significantly for this essay, they adopted the new pricking and ruling pattern then practiced in both regions, the phase-two layout for music. What is remarkable about the Carthusian implementation of this phase-two layout is its consistency and thoroughness. Here again, exact figures cannot be given, but it would appear that the number of extant sources poorly represents the actual number of music books produced by Carthusian houses in the twelfth century. Only a dozen musical sources from the twelfth to the early thirteenth century have survived.⁷⁷

The evidence of the earliest Carthusian music sources, all produced in French houses, is clear (Table 1). It is in the chant books of the Carthusians that we see the phase-two pricking pattern first adopted in a systematic manner. Nearly all of the extant Carthusian books with music exhibit a specific version of the phase-two pricking pattern: four equidistant pricks for music followed by a double one a little wider apart for text, as indicated in the far right column of Table 1. The measurements of these pricks vary from book to book. For example, Grande Chartreuse 23 has a spacing of 3.5 millimeters between music pricks and a 4 millimeters distance between the first staff prick and the text one; Grande Chartreuse 2/Miss. 1 has 4 millimeters for music and 6 or 7 millimeters for text; Grande Chartreuse 2/Grad. 5 has 4 millimeters and 5 or 6 millimeters; Grenoble 84 and BL Additional 31384, roughly 4 and 5 millimeters; and so on. Given this irregularity, it would appear

Table 1. Early Carthusian Music Books and their Pricking Patterns⁷⁸

Date	Current location	House of origin	Pricks
s.12in	Parkminster Charterhouse DD 10 (A 33)	Portes (Ain)	4 + 2
s.12in	Grenoble, Bibliothèque Municipale 84 (cat. 395)	Les Écouges (Haute-Savoie)	4 + 2
s.12ex	Grande Chartreuse 23 (Sélignac 23) ⁷⁹	Montrieux (Var)	4 + 2
s.12ex	Milan, Biblioteca Ambrosiana M 70	Seillon (Saône et Loire)	4 + 2
s.12ex	Grande Chartreuse 828	Grande Chartreuse	?
s.12ex	Grande Chartreuse 2/Miss.1 (751)	Grande Chartreuse	4 + 2
s.12ex	BL Additional 17302	Grande Chartreuse?	4 + 2
s.12ex	Grande Chartreuse 2/Grad. 5 (801)	Grande Chartreuse?	4 + 2
s.13in	BL Additional 31384	Reposoir (Savoie)	4 + 2
s.13in	Grenoble 467 (cat. 124)	Grande Chartreuse	4 + 2
s.13med	BL Additional 17303	Durbon (Haute Alpes)	4 + 2
s.13	Avignon, Bibliothèque Municipale 181	Durbon (Haute Alpes)	?
s.13	Loches, Bibliothèque Municipale 16	Le Liget (Loir-et-Cher)	?

that, as with the pricking process described at the beginning of the essay, there was not a single standardized tool in the twelfth century that could achieve a print-like uniformity among all books, or even among those of the same house.

That said, the Carthusian implementation of this pricking and ruling pattern is impressive. In fact, it is unprecedented, at least so far as we know.⁸⁰ In virtually all extant Carthusian music books across Europe—and we can assume that many more were produced that have not survived—the layout and music–text proportion is the same. The Carthusian pricking pattern consistently reduces the ruling size for the music staff and increases it for the text line. Taking the twelfth-century Grande Chartreuse gradual Grenoble 395 as an example, one sees a pattern similar to the Saint Alban’s troper (Figure 11), and the same as the Nevers troper (Figure 12). Figure 13 shows a standard Carthusian pattern of four single pricks for music lines followed by one double set for the line of text. The latter is a slightly wider distance away from the staff prick above it (5 millimeter) than the space between each staff prick (4 millimeter). Although music and text are not quite in the Golden Ratio found in some twelfth-century books, the resulting page layout does give the impression of bringing individual staff lines close together and of widening the space for the text. The ruling reinforces this space around the text with horizontal lines drawn all the way across the writing block at text lines only, a feature also found in the Nevers troper (Figure 12). These lines slow down the viewer’s eye and emphasize the slightly wider 5 millimeter ruling for text. As art historian Miloutine Borissavlievitch has emphasized, such things convey the appearance of symmetry, which is just as important as symmetry itself.⁸¹ The purpose of these lines is likely also practical; it is to ensure that the text scribe will write on the correct *linea*. After the inscription of the text, the musical notes were inscribed on the staff *lineae*, followed by the final application of green and yellow paint over certain lines—a tedious and archaic practice that would soon be eliminated.

To sum up, the Carthusians made a significant contribution to the musical staff as we know it. They popularized the phase-two layout with its special pricking pattern and enlarged space for music. Thanks to the proliferation of Carthusian houses throughout Europe and their legendary book production in the twelfth century, the brothers of Saint Bruno’s order ensured the standardization and reputation of the phase-two layout for music books. In so doing, they also guaranteed the slow but sure extinction of phase-one layouts.

98

nunc quinq; talenta tradidisti michi ecce alia quinque superlucratas sum tu
 pe serue fide is quia super pauca fuisti fide is supra multa re confitri am
 ma in gaudium do mini tu i
 equabar de testimoniis tui is in conspectu re gum et non confundebat et
 mestrabar in mandatis tui is que dilexi in me Beati immaculati cuius aem
 specie tua et pulchritu di ne tu a uirnde
 et prospere precor de et re qua Propere
 nita rem et manufacturam et tu
 in clam et aduener te mirabi linc dextera tu
 Heli is Hancu tur
 regi uirgines post eam praxine eius adducen

Figure 13. Pricking and ruling pattern in a Carthusian gradual. 84 (catalog 395), fol. 98r, Bibliothèque municipale, Grenoble. Reproduced by permission.

Phase Three: Thirteenth Century and Beyond

Most twelfth-century books, including those of the Carthusians, had followed the Guidonian application of color to certain staff lines, red for fa and yellow or green for ut. In a few other books, a practice began to appear that was likely prompted by the simple need to reduce the cost of book production. This was urgent in the thirteenth century, during which time relatively new music codices began to proliferate, from compact liturgical books such as the noted breviary and missal to

collections of vernacular lyric songs. Green and yellow paint were not as frequent in such books as red, the most ubiquitous color after black, because it was used for rubrics and decoration.⁸² Since, in the music staff, clef letters already identified pitch lines, the practice of multiple colors for staff lines was already superfluous. An all-red staff seems to have naturally presented itself as an obvious alternative to the expensive and time-consuming procedure of preparing green and yellow paint just for staff lines.

More than one music writer in the twelfth century decided to dispense with yellow and green altogether, in favor of drawing out staff lines with the readily available red ink. Although this relatively new practice varied from book to book, one might speak of a minority movement of all-red staff users in the twelfth century. One typical case, a Beauvais troper from around 1130, BnF nouvelles acquisitions latines 1064, exhibits a four-line red staff drawn above the text, all within a generous ten-millimeter space in each ruling.⁸³ The same all-red staff occurs a few decades later (around 1150) in the Durham compilation Cambridge, Trinity College Library O.3.55.⁸⁴ The pricking and ruling of this book is a straightforward phase-one pattern with a five-millimeter rule. The red staff fits comfortably above the text, with an extra ruling allotted for music. The Saint Alban's troper discussed above (Figure 11), despite its classic phase-two layout that almost invites Guidonian multiple colors, features an all-red staff. None of these instances of a red staff in the twelfth century appear to be the practice of any one group or scriptorium. Rather, they naturally occur as part of the experimentation in page layout that distinguished this period of music writing. The twelfth-century spirit of experimentation is especially clear where coeval but different layouts occur in the same book. The case of the Jumièges missal Rouen, Bibliothèque municipale A. 401 (catalog 267) is noteworthy, since liturgist René-Jean Hesbert described this book as having two different types of music notation ("deux types graphiques"), the one on a staff (mostly fols. 7–97) and the other without (mostly fols. 98–106bis).⁸⁵ Yet the notation in these two sections is the same; it is simply the layout that changes. In one section, an extra ruling has been skipped for music, allowing room for a small red staff, whereas a layout with no extra ruling prevails in the other section. Two other interesting cases of different coeval layouts in the same book are the companion twelfth-century pontificals from Ely, Cambridge, University Library Ll.ii.10 and Cambridge, Trinity College, B.xi.10.⁸⁶ The layout for both of these extravagant codices is mostly one extra ruling for music, with a few sections having no extra ruling for notation (e.g., fols. 74r–92v in the University manuscript and fol. 30v in the Trinity codex).

Phase three takes place in the thirteenth century and is the culmination of the twelfth-century innovations discussed above. In phase three, music compilers and notators take to its natural conclusion the concept, introduced in the twelfth century and propagated by the Carthusians, of increased space for text and reduced space for music. The ingenious but simple thirteenth-century solution to the proportion dilemma discussed earlier is something of an irony, considering the elaborate codes of pricking and ruling for music developed in the twelfth century. In the third phase, the specialized phase-two schemas are replaced with a simple, phase-one pricking pattern. Music is allotted two (or less often three) rulings, against one for the text. In this way, the text–music proportions introduced in the twelfth century are retained. In place of the Guidonian multi-colored staff, doomed to extinction because of the cumbersome preparation it required, we find a neat and plain solution: the compact all-red staff. This change is evident early in the thirteenth century. We see it, for example, in a missal from Évreux dated around 1225, BnF nouv. acqu. lat. 1773 (Figure 14). The writing column was ruled with twenty-six lines evenly spaced apart (8 millimeters); unfortunately, prick marks have disappeared with the trimming of the page. In musical sections, the text scribe has written in every other line. Since the text module is only 3 millimeters, this allows for some 12 millimeters for music. The compact all-red staff measures just 8 millimeters, leaving plenty of space around it and allowing the page to “breathe.” As for how the staff lines were drawn, I shall come to that shortly.

One way to document the shift into phase three is through the books of two new monastic orders of the thirteenth century, the *moderni* of their day, the Franciscans and Dominicans. Both orders were established in the 1220s, but the Dominicans were more focused on study and book production than the Franciscans. The fifth Master of the Dominican order, Humbert of Romans, like the fifth Carthusian prior Guigo I a century earlier, laid down rules towards a uniform writing practice throughout his order. In his instructions or “constitutions” on Dominican life, Humbert took care to list the tools his mendicant brothers would need for writing. They included pens (*pennas*), rulers (*regulas*), and candles for working at night.⁸⁷ As a result of this general emphasis on bookmaking, Dominican music writing was more forward-looking or innovative than that of the Franciscans. Both Franciscan and Dominican instructions for drawing the staff survive from the 1250s. One might assume from them that the two mendicant orders’ music-copying practices were the same, for the instructions are very similar. Of special interest to my topic is that both Dominican and

Deus p[ro]p[ter] tuu[m] q[ui]s domine
 demerit exaudi: ut q[ui]
 iuste p[ro]p[ter]at[us] n[ost]r[us] affligim[us].
 p[ro]p[ter]at[us] tue uisitatione con-
 solemur. Qui uniu[er]se: quia.
 Angelus domini. Factus.
 Benedictus es domine deus
 patrum nostrorum et laudabitur et glo-
 riosus in secula. Chorus Benedictus.
 Benedictum nomen glorie tue
 quod est sanctum. Chorus. Laudabitur
 et glorio sum in secula. Benedictus
 tuus in templo sancto glorie tu e.
 Laudabitur. Benedictus es qui sedes
 super thronum diuinitatis tue. Laudabitur
 Benedictus es qui sedes super thronum
 bin intuent abyssos. Et laudabitur.
 Benedictus es qui ambulat super
 pennat uentorum. Et Bene-
 dicant te celi et terra mare et omnia
 que in eis sunt. Et laudent te et
 glorificent in secula. Benedictus
 te omnes angeli et sancti tui. Et lau-
 dent. Gloria patri et filio et sp[iritu]
 tui sancto. Et laus et honor: p[ro]p[ter]
 tui et imperitium. Sicut erat
 in principio et nunc et semper et
 in secula. Amen. Amen. Et
 et honor. Benedictus es deus pater.

Figure 14. Pricking and ruling pattern in a missal from Évreux from around 1225. Nouv. acqu. lat. 1773, fol. 15r, Bibliothèque nationale de France, Paris. Reproduced by permission.

Franciscan instructions specify a staff with four lines spaced a little apart (*debito modo*).⁸⁸ What the Dominicans understood by *debito modo*, however, seems to have differed from the Franciscan notion of it. In contrast to the conservative Franciscans, the Dominicans and their music notation pointed to the future.

By contrast with the Dominicans' music writing practice, the traditional Franciscans usually followed the old-fashioned layout of the Carthusians who had flourished so close to Saint Francis's native Italy. It is important to stress the Carthusian-Franciscan connection with

respect to music layout. As mentioned earlier in this essay, modern Franciscan priest Stephen J. P. van Dijk had expressed his belief that his medieval brothers were responsible for the kind of layout in which “the stave is completely free from the noted text.” He went on to speculate that the staff had originated in Paris.⁸⁹ Yet, the extant evidence does not support this kind of generalization. To speak of a single place of origin is not a historically helpful statement. Besides, if any one group should be designated as the first to implement the kind of layout described by van Dijk, it is the Carthusians, and not the Franciscans. The evidence of Franciscan music books suggests a heterogeneous practice with a marked tendency towards the Carthusian type of layout.⁹⁰ This Franciscan conservatism endured well into the fourteenth century, as seen in the phase-two prick marks that survive on fol. 305r of the Franciscan missal BL Additional 16416.⁹¹

By contrast, the Dominicans’ propensities in music layout were progressive, as befitted this order whose political aggression stirred up such controversy in their day.⁹² Humbert of Romans was instrumental in codifying the Dominican liturgy, including its music. Much like the Carthusians before him, he aimed to standardize a previously varied liturgical practice. The Dominican liturgical codification begun in the 1230s and 1240s, was finalized after 1254 when Humbert became Master of the order.⁹³ This reform culminated in the production of a Dominican liturgical master book, finished around 1260. The exemplar survives as Santa Sabina XIV L 1; a smaller copy was made around the same time, BL Additional 23935 (Figure 15).⁹⁴ The Dominican taste for innovation is clear in the British Library copy of the Dominican master book. What is striking about the layout of this small (262 millimeters × 176 millimeters) but exquisitely produced codex is its compactness. The writing block only measures 173 millimeters × 115 millimeters, yet a remarkable number of staves fit in it; two columns with seventeen staves each yield a total of thirty-four staves per page. Comparing Figure 15 with the Carthusian layout in Figure 13, we see that the musical notes of the Dominicans are about the same size as the Carthusian notes, roughly a one-millimeter module, despite the overall reduced space for music. So with respect to the text size, the notes here are larger (as well as more angular) than those of the Carthusians. Looking at individual staves in Figure 15, we also notice the twelfth-century type of text–music proportion approximating the Golden Ratio: whereas the staff measures 5 to 6 millimeters, a line of text is about 3 millimeters wide (lines A and B, respectively, in Figure 15; cf. Figure 6). All of this is accomplished despite the absence of a special twelfth-century pricking pattern for music. In its stead, the innovative Dominican bookmakers

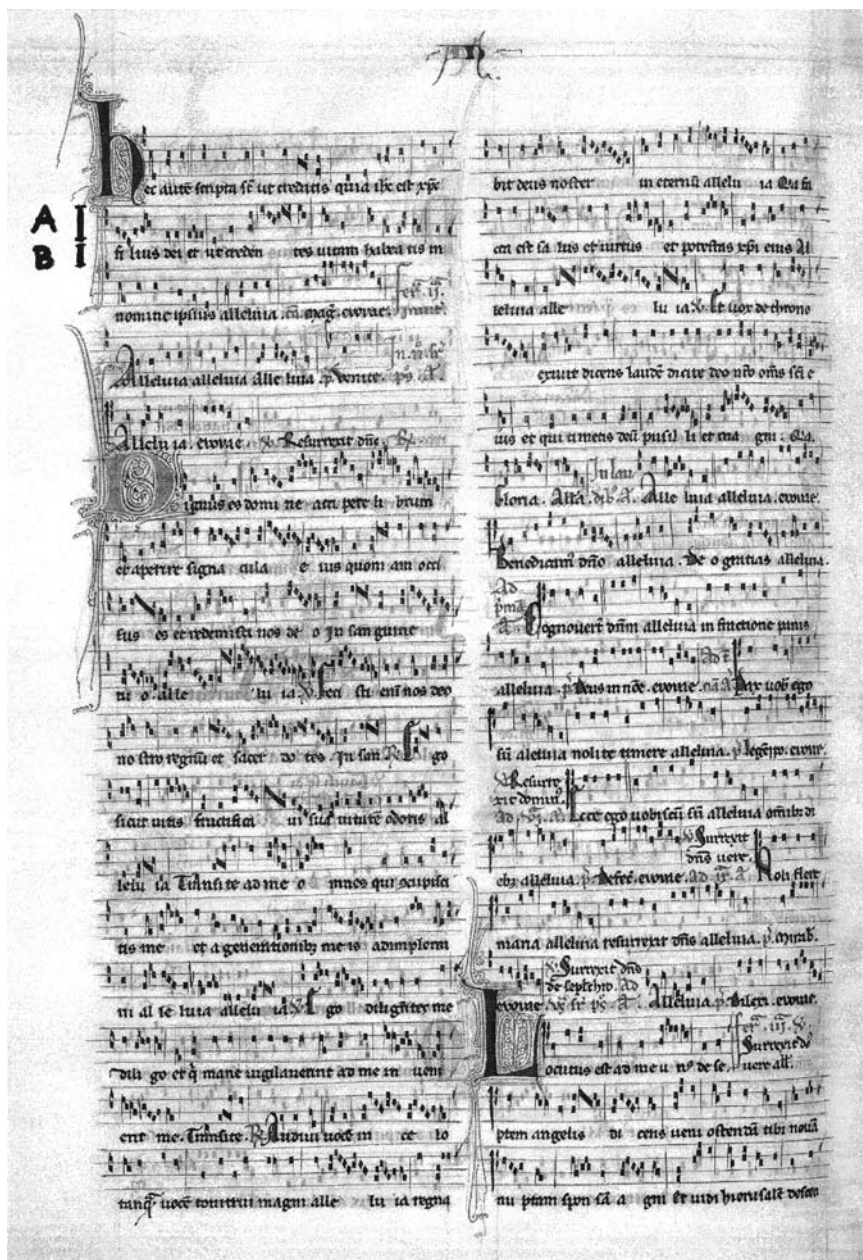


Figure 15. Dominican master book from around 1260. Additional 23935, fol. 294v, British Library, London. Reproduced by permission.

have made use of a simple phase-one type of ruling, with sixteen evenly spaced lines at around 2 millimeters each; unfortunately, the prick marks have disappeared with the trimming of the page, but presumably there were originally sixteen evenly spaced holes whence the lines were traced. The Dominican book features the relatively new all-red staff, as found, for instance, in the Évreux missal some thirty years earlier (Figure 14). In both cases, the red staff lines do not follow the ruling lines, since four of them had to fit elegantly within two ruling spaces. The staff lines were drawn independently of the ruling, without pricks or ruling lines as a guide.

How exactly were these staff lines produced? Was a multi-nib tool used, the so-called rake or *rastrum*, as is sometimes assumed for other music books from this period? The general assumption that a rake was used for drawing musical staves throughout the thirteenth century has gone unquestioned until now.⁹⁵ One writer has summed up the common position in his assertion that “ruling of staves by rake is found in England since the thirteenth century, and may be presumed to occur even earlier on the Continent.”⁹⁶ Others maintain this position while expressing some hesitation, as when Mark Everist writes, concerning the sources of Notre Dame polyphony, that “the exact congruence of stave-gauge points to the use of a *rastrum* or pair of *rastra* although certain inconsistencies lead one to question this; the exact mechanics of actually aligning the four or five lines is still something of a mystery, as is the exact control over line-length where a half-stave is required.”⁹⁷ The difficulty with research on the music rake is that the earliest reference to such a tool in connection with musical staves dates from the sixteenth century; and the earliest surviving music rakes date from the eighteenth century.⁹⁸ Thus no direct evidence survives to either prove or disprove the existence of music rakes in the Middle Ages.

It is vital to stress that the modern assumption that a music rake was frequently used before 1300 is similar to that operative in the case of the pricking wheel. Modern researchers sometimes assume that medieval craftsmen tended toward efficient, time saving technologies. This assumption is the product of modern prejudices. Our daily habits are conditioned by the remarkable technological changes that dramatically altered society following the Industrial Revolution, from electricity to the Internet. So it is somewhat reassuring to think of medieval craftsmen as just as obsessed with speed and technological innovation as we are. Although medieval laborers may have been interested in time-efficient technologies to some extent, as pointed out earlier in the case of whole gatherings pricked together, they equally prized other aspects of work, such as the symbolic perfection of setting pearls in the gold

lining of a bowl's rim, or the therapeutic repetitiveness found in the otherwise wearisome weaving of wool.⁹⁹ As Jacques Le Goff has put it, prior to the fourteenth century, "labor time was still the time of an economy dominated by agrarian rhythms, free of haste, careless of exactitude, unconcerned by productivity."¹⁰⁰ Greed for time and a preoccupation with technological innovation have not always been the virtues they have recently become.

In the case of the Dominican master book in Figure 15, it would be easy to assume that a rake was used, given the sheer number of staff lines in this little, voluminous codex, as in many other books from this period. If we consider that in Figure 15 alone there lay 136 staff lines (thirty-four staves at four lines each), and that there are roughly 450 folios containing music in this book,¹⁰¹ this means that well over 120,000 individual red staff lines were drawn out during the production of the Dominican master book. Couldn't one assume that a multi-nib instrument was used to ease this gargantuan, repetitive task?

The paleographic evidence from the British Library copy of the Dominican master book is clear, however.¹⁰² No multi-nib instrument was used to trace the staff lines. They were drawn one at a time. There are five things that confirm this. The first and most important observation is that the spacing between staff lines is markedly irregular. This is visible to the naked eye in Figure 15. Elsewhere, on the right-hand column of fol. 101r, for example, the spacing between the four lines for the last three staves is, from top to bottom, 2 millimeters/2 millimeters/2 millimeters; 1.5/2/1.5; and 1.5/2/2. And throughout the remainder of the book, spacing patterns come in a variety of other combinations. Such irregular spacing is sometimes the result of slightly unparallel lines, although they seldom occur since scribes were careful to draw straight lines in such an expensive book.¹⁰³ It seems unlikely that a rake with fixed nibs would have produced such varied spacing. Secondly, staff lines frequently end at different points in the staff. This is especially clear when a capital letter protrudes into the staff, interrupting several staff lines while the upper ones continue, or at the edge of a writing block where protruding lines are easily seen. If a rake had been used, all lines would have usually ended together. Thirdly, when blotting occurs at the beginning or end of a line, caused by slightly greater pressure on the pen at this point, it never occurs in all four lines, again confirming that each line was drawn out individually. Fourthly, the number of staff lines sometimes varies. At the top right-hand side of fol. 100r, for example, we find a five-line staff. Finally, when lines occasionally abruptly shift up or down, this occurs for only one staff line at a time (e.g., fol. 127v, right-hand column, third staff down, bottom line), rather than for the entire

staff, as in the “hiccup effect” discussed below for the rake. The combined evidence of these five observations—irregular spacing, uneven line endings, uneven blotting, varying number of staff lines, and individual line twists—all attest to the absence of a rake in the production of musical staves in this book. As astonishing as it may seem to us, each one of the 120,000 or so individual red staff lines in the British Library copy of the Dominican master book were drawn out one at a time.

Applying the five criteria I have just outlined to other books, it becomes clear that the rake was not used to produce most—if any—music manuscripts in the course of the twelfth and thirteenth centuries. This is the case for the liturgical corpus that constitutes the bulk of these books, beginning with all of the ones mentioned above. In the staves of the Évreux missal in Figure 14, for example, we see irregular spacing, uneven line endings, and a few individual line twists. Nor is the use of a rake apparent in vernacular chansonniers produced before 1300, as seen in the *trouvère* chansonnier BnF fr. 846 (Figure 6); the irregular spacing and uneven line endings are clear at a glance.¹⁰⁴ Rakes do not appear to have been used in thirteenth-century polyphonic collections such as the Notre Dame manuscripts, either. In W1 (Cod. Guelf., Helmstedt 628, Herzog August Bibliothek, Wolfenbüttel), for example, the parchment was pricked for text lines only; staff lines were clearly drawn out one at a time with a ruler.¹⁰⁵

Only in the fourteenth century was a mechanical tool popularized that would relieve scribes of the tedious twelfth- and thirteenth-century task of drawing out red staff lines one by one.¹⁰⁶ Use of the rake in books after 1300 can be determined by noting the five criteria discussed above. Pulling out at random a late medieval liturgical book from the bountiful shelves of the Bibliothèque nationale de France, the fifteenth-century Beauvais psalter lat. 773, it is easy to tell that a rake was used for musical staves here. Beginning with the first and most reliable criterion, one can see, even without measuring, that the spacing between the four staff lines is identical throughout this manuscript; every single staff measures, from top to bottom, 4 millimeters/4 millimeters/4.5 millimeters. Secondly, all staff lines usually begin and end together. Thirdly, when a thickening, thinning, or blotting of the line occurs, it is found in all four staff lines rather than just one (e.g., fol. 122v); a related phenomenon also common is that of a consistently missing line where one of the prongs has run out of ink. Fourthly, the number of staff lines never varies; there are only four lines per staff throughout the entire book. As for the fifth point alluded to earlier, twists or “hiccups” in all four lines of the staff, I did not find any in this book.¹⁰⁷ In general, they are not as common as one might think since, as with the Dominican

master book, the person ruling was careful to produce a consistent and even staff.

By the time this psalter was produced sometime in the fifteenth century, the rake for musical staves was frequently used in book production. Its earliest documented use appears to have been around 1300. It is particularly clear in one of the most outstanding manuscripts of the Middle Ages, the Chaillou de Pesstain's edition of the *Roman de Fauwel*, BnF fr. 146 from around 1316, whose staves were clearly produced with a multi-nib tool. The staff, consistently four-lined, is spaced evenly throughout the book; here and there all four lines end with blots, extend into the margin, swerve up at the beginning or end of the staff, and even occasionally "hiccup" together.¹⁰⁸ By the mid-fourteenth century, use of the rake is confirmed in the production of several of the major Machaut sources, including BnF fr. 1586 (Machaut manuscript C) produced around 1350, as noted by Lawrence Earp.¹⁰⁹ We find an unambiguous fourteenth-century instance of the "hiccup" effect in a late manuscript of Guido of Arezzo's *Regule* (Figure 16). The prick marks in this book are not visible, but the ruling certainly is, especially near the top of the writing column in Figure 16. Looking down at the two musical staves on this page, we see that they do not follow the main ruling pattern and were drawn independently. That they were drawn with a rake is clear in the bottom staff where all four lines suddenly swerve up together near the middle. This is not to say, incidentally, that all staves after 1300 were produced with a rake. As Diane Droste has shown in her important study on late medieval Sarum music books, staff lines were still being drawn individually with a straight edge well into the fifteenth century.¹¹⁰

If this all-red musical staff traced independently of the main ruling had become integral to the new look of thirteenth and fourteenth-century books, old customs still lingered in interesting ways. Looking again at Figure 16, and going down to the first music staff toward the bottom, we notice a curious detail on the left side near the beginning of the staff, right after the clef letters. There appear to be little prick marks on each line. In fact, these are not pricked holes in the parchment but deliberately drawn dots painted red, the same color as the staff. The only other such instance of these painted look-alike prick marks I have found is in a codex from the late thirteenth century, *trouvère chansonnier* BnF fr. 12615, where the same conspicuous red dots are found at the right end rather than the left end of the staff. As with the fourteenth-century Guido manuscript, these pseudo-pricks are apparently not practical in purpose, since they only occur on certain staves and are drawn quite deliberately (e.g., fol. 33r); in other words, they are

not indispensable to the drawing of the staff throughout these codices. Their presence in these few instances seems more aesthetically driven, like a recollection of the layout that had been so common in music books only a century or so earlier and was still occasionally used in the fourteenth century, as discussed earlier for the Franciscan book BL Additional 16416. It is possible that the look of pricks for every staff line, having become so strongly associated with the staff's visual appearance in the twelfth century, could still be appreciated over a century later, almost nostalgically, in the same way that today's outdated vintage cars sometimes wander out on to roads crowded with recent models. These red pseudo-pricks are not the first instance of old music layout habits dying slowly. We have also seen this in the long life of the phase-one layout. Still in the thirteenth and fourteenth centuries, by which time the music staff was nearly always drawn independently of the main ruling of the page and without guiding pricks, it was acceptable to bring back the old look of individual pricks for each staff line.

This essay has covered an intricate and lengthy history in a relatively short space, and it is hoped, that more research will flesh out and modify the broad outline presented here. The long history of the musical staff in the Middle Ages appears to have been something of an archlike departure from and return to simplicity. From the first phase of layout where music scribes used and adapted existing ruling lines, through a further period of experimentation in the twelfth century aimed at greater proportion and symmetry, the all-red staff eventually emerged in a third phase as the most straightforward and efficient solution to phase two's experiments. Thus the evenly spaced pricking and ruling pattern characteristic of phase one eventually returned in the third phase. If the rise of the rake did not exactly coincide with the waning of special pricks for music in the thirteenth century, it was perhaps because this third stage was initially viewed as transitory. But once the late medieval staff had become entrenched following the great wave of European book production in the thirteenth century, it was clear that music layout would undergo relatively little subsequent change. The look achieved in phase three essentially remained that of printed books and of all remaining music writing, right up to present-day digital scores. The music rake, which would eventually lead to even more time-efficient printed methods of producing the staff, was born of new work mentalities in the fourteenth century mentioned earlier. As for the later standardization of five rather than four lines, it is important to note that the number of staff lines often varied in medieval books, beginning with Guidonian manuscripts, as mentioned above. Especially in the notation of polyphonic works, a wide range sometimes necessitated the addition of a fifth or

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A finali uno tono . neq; cadunt amplius .
 Tertio tonus est no suble . finalis est quadratus .
 Fin quoq; debet esse continuum incipium .
 Unde quinta a finali . nec excedat calculum .
 Plage uo super quartis . no tendant pncipium .
 Inter illas uox tedi . h . iacet ignobilis .
 Contra tertia . et sexta frequentat' apud .
 Qui rei michi testis . lunctus est quosdam .
 principalem quoq; uocem qua ipam uoluit .
 Deuocent loco eius . sicut ita uocem .
 Cui' fin quiduis sexta . lege ipm inchoat .
 quidam quidem quicquam . nec tenent regula .
 Quia tempore amato . distulit musica .
 Dum inuidia et torpor . cuncta tollunt leticia .
 Illud uo late patet . quod fiant de uocibus .
 uelut sillabe . et partes cola . atq; comata .
 Conuenitq; lege uerbis . sicut arte metrica .
 Sicut litteris optimi uocare probantibus .
 Cantus ad dilectum cantu nichil est finitus .
 si alioque utant . saltem tribus mensuris .

· d · h · c · de · d · d · de · a · h · a · a · e · e · e ·

Est nomen domini benedictum in secula .
 Causa uo hinc uocandi neuina solent fieri .
 Que si sunt curiose habitata q; litteris .
 pro li modo disponant' intere cum litteris .

Opera in domino et fac bo uita tua .
 Chorus studij crescente inter dual lingua .
 Vox inponat' una . neque querit uario .
 Parise ut ho in rebus uaria positio .

Santi spiritus adit nobis gra a a .
 Et pprietas lenoz discernat' clarus .
 Qualdam lines signatus uariis est aditus .

In vetustissimo
 codice nullo
 nota sed littera
 tantum .

Figure 16. Guido of Arezzo, *Regule*. Harley 281, fol. 19r, British Library, London. Reproduced by permission.

sixth line. With the advent of print and the gradual disappearance of the movable clef common in handwritten books, the five-line staff became standard.¹¹¹

The musical staff as it had developed in the Middle Ages was a far cry from a single-man invention by Guido of Arezzo disputed at the beginning of this essay. If anything, it was the product of the anonymous ingenuity of many monks—Carthusians, Franciscans, Dominicans, and

others. In his bestseller novel *Roots*, Alex Haley paraphrased George Orwell when he wrote that “preponderantly the histories have been written by the winners.”¹¹² This is also true of the history of the musical staff. Until now, Guido has often received credit for the musical staff’s invention; he has been taken as a kind of winner in contributing most significantly to the modern staff. But other anonymous ones are the true “winners” in the history of the staff, to paraphrase Haley. Guido may have adapted music layouts from the *Enchiriadis* tradition in an ingenious way but he did not invent the musical staff. Neither did he introduce anything substantially new to existing medieval music layouts. As critical as his role was in disseminating the musical staff, Guido’s ideas would soon be superseded by those of others after him. Put in the context of the broader history of the musical staff, it is clear that Guido’s concept of manuscript layout belonged to an already old tradition in his day where music scribes simply availed themselves of the page layout that they found in existing books. Breaking away from this dependency was the innovation of hundreds if not thousands of nameless monks, in particular the anonymous Carthusian living in the isolation of his cell. Despite their fundamental contribution to the history of music writing, these scribes remain anonymous; they were not Guidos seeking fame and papal recognition, but lowly workers in the service of their order, religion, and craft.

Notes

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For the redaction of this essay, I am grateful to Christopher DeHamel, Albert Derolez, Michel Huglo, and two anonymous readers for their help and encouragement. In the decade of research leading up to this essay, I am grateful to all the libraries mentioned here and their staffs who assisted me in too many ways to mention, including permissions for the reproduction of images, but especially to the monks of the Grande Chartreuse for their hospitality and generosity in the spring of 2006.

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17. Jeremy Yudkin, *Music in Medieval Europe* (Upper Saddle River, NJ: Prentice Hall, 1989), 341.
18. Pesce, *Regule Rithmice*, 17. See also Angelo Rusconi's statement that Guido represented the end or arrival point of a period in music theory, a view closer to mine

- here. See also *Guido d'Arezzo, monaco Pomposiano* (Florence: Loe S. Olschki, 2000), 134.
19. David Hiley, "Staff," in *New Grove Dictionary of Music and Musicians*, 24:256–58. On the debated question of the *Enchiridis* treatises' authorship, see A. C. Santosuosso, *Letter Notations in the Middle Ages* (Ottawa: Institute of Mediæval Music, 1989).
20. On the dasian letters, see Santosuosso, *Letter Notations*, 20–21, and Nancy Phillips, "The Dasia Notation in the Manuscript Tradition," in *Musicologie médiévale: Notations et sequences. Actes de la table ronde du C.N.R.S. à l'Institut de Recherches et d'Histoire des Textes, 6–7 septembre 1982*, ed. Michel Huglo (Paris: Champion, 1982), 157–73.
21. Joseph Smits van Waesberghe, *De musico-paedagogico et theoretico Guidone Aretino eiusque vita et moribus* (Florence: L. S. Olschki, 1953), 50. See also Hans Oesch, *Guido von Arezzo* (Bern: Paul Haupt, 1954), 7, who lists "terzenweisen Aufbau des Liniensystems" as Guido's first contribution.
22. The Latin original reads as follows: "Quos ordines ut melius possis discernere, spisse ducuntur linee, et quidam ordines vocum in ipsis fiunt lineis, quidam vero inter lineas, in medio intervallo et spatio linearum" (Pesce, *Guido d'Arezzo's Regule rithmice*, 418, lines 56–59). Claude Palisca and Oliver Strunk's translation of this sentence reads as follows: "And in order that you may better distinguish these rows, lines are drawn close together, and some rows of sounds occur on the lines themselves, others in the intervening intervals or spaces" (Guido of Arezzo, "Prologue to His Antiphoner," trans. Claude Palisca and Oliver Strunk, in *Source Readings in Music History*, ed. Oliver Strunk, rev. Leo Treitler [New York: W. W. Norton, 1998], 212). Here is an alternate translation with a different rendering of "spisse": "So that you can better tell them apart, thick lines are drawn; some pitch-places are made on the lines, and others in between the lines, in the interval or space between the lines."
23. Pesca, *Regule rithmice*, 345; see also p. 357n26.
24. Nancy Phillips, "Musica and Scolica enchiridis: The Literary, Theoretical and Musical Sources" (PhD diss., New York University, 1984), 218; Pesca, *Regule rithmice*, 8–1, 569.
25. Pesca, *Regule rithmice*, 529n39, 530.
26. Hans Schmid, ed., *Musica et scolica enchiridis, una cum aliquibus tractatulis adjunctis: recensio nova post Gerbertinam altera ad fidem omnium codicum manuscriptorum* (Munich: Verlag der Bayerischen Akademie der Wissenschaften, 1981), 14, lines 8–10: "Similiter enim cordis a parte in partem ductis quaterna inter cords series continuatim describatur, ita ut unaquaeque series suo proprio sit insignita colore." Cf. Raymond Erickson and Claude Palisca, *Musica Enchiridis and Scolica Enchiridis* (New Haven, CT: Yale University Press, 1995), 8 and note 19.
27. Phillips, "Musica and Scolica enchiridis," 216–17.
28. Pesca, *Regule rithmice*, 445.
29. On Guido's biography, see Waesberghe, *De musico*, Palisca, *Hucbald*, *Guido*, 49–56 and Pesca, *Regule rithmice*, 1–3.

30. A good introduction to the topic is *Mise en page et mise en texte du livre manuscrit*, ed. Henri-Jean Martin and Jean Vezin (Paris: Éditions du Cercle de la Librairie, Promodis, 1990).
31. See L. W. Jones, "Where Are the Prickings?," *Transactions of the American Philological Association* 75 (1944), 71–86; and the articles by E. K. Rand cited on p. 71, n. 2; Léon Gillissen, "Un élément codicologique trop peu exploité: La réglure," *Scriptorium* 23 (1969): 150–62; Albert Derolez, *Codicologie des manuscrits en écriture humanistique sur parchemin*, Bibliologia 5–6, 2 vols. (Turnhout: Brepols, 1984).
32. Joseph Smits van Waesberghe, "The Musical Notation of Guido of Arezzo," *Musica Disciplina* 5 (1951): 15–53.
33. Stephen Joseph Peter van Dijk, "An Advertisement Sheet of an Early Fourteenth-Century Writing Master at Oxford," *Scriptorium* 10 (1956): 59.
34. The original drawing found in his "Advertisement Sheet," 61, was reproduced in van Dijk's *The Origins of the Roman Liturgy: The Liturgy of the Papal Court and the Franciscan Order in the Thirteenth Century* (Westminster, MD: The Newman Press, 1960), 216, with a similar one in his *Sources of the Modern Roman Liturgy: The Ordinals by Haymo of Faversham and Related Documents (1243–1307)* (Leiden: E. J. Brill, 1963), 112–13.
35. Huglo, "Règlement du XIIIe siècle pour la transcription des livres notés," in *Festschrift Bruno Stäblein zum 70. Geburtstag*, ed. Martin Ruhnke (Kassel: Bärenreiter, 1967), 121–33.
36. See Yves-François Riou, "Chronologie et provenance des manuscrits latins neumés," *Revue d'histoire des textes* 21 (1991): 77–13, as well as the earlier works cited there, and Denis Escudier, "Les manuscrits musicaux du moyen-âge (du IXe au XIIIe siècles): essai de typologie," in *Codicologica* 3, ed. Albert Gruys and J. P. Gumbert (Leiden: E. J. Brill, 1980), 38–42.
37. Andrew Hughes, "The Scribe and the Late Medieval Liturgical Manuscript: Page Layout and Order of Work," in *The Centre and Its Compass: Studies in Medieval Literature in Honor of Prof. John Leyerle*, ed. Robert Taylor et al. (Toronto: Pontifical Institute of Mediæval Studies, 1993), 151–214, and his *Medieval Manuscripts for Mass and Office: A Guide to Their Organization and Terminology* (Toronto: University of Toronto Press, 1995). See also the recent contribution by Helen Deeming, "Observations on the Habits of Twelfth- and Thirteenth-Century Music Scribes," *Scriptorium* 60 (2006): 42–46, where certain pricking and ruling patterns are discussed.
38. Wilhelm Wattenbach, *Das Schriftwesen im Mittelalter*, 4th ed. (Graz: Akademische Druck- und Verlagsanstalt, 1958), 210: "Puncti punctantur, sequitur quos linea plumbi, consilio quorum linea tendit iter."
39. Derolez, *Codicologie*, 1: 70. Jones's earliest specimens date from the fourth century; Jones, "Where are the Prickings?" 75–76.
40. Useful surveys of the ruling process, including tools with illustrations are found in Wattenbach, *Schriftwesen*, 206–19; Christopher De Hamel, *Scribes and Illuminators* (Toronto: University of Toronto Press, 1992), 23–26; De Hamel, *A History of Illuminated Manuscripts* (London: Phaidon, 2001), 45, and Randall Rosenfeld, "Tools for Producing Books and Documents in Roman Antiquity and the Middle Ages: A Summary List of Classes," *Scriptorium* 56 (2002): 168–69.

41. On the debate, see Randall Rosenfeld, “‘Pricking Wheels’, Their Physical Characteristics and Recorded Use,” *Gazette du livre medieval* 37 (2000): 18, and the articles by J. A. Dane and D. Muzerelle cited there.
42. Dominique Mielle de Becdelièvre, *Prêcher en silence: Enquête codicologique sur les manuscrits du XIIe siècle provenant de la Grande Chartreuse* (Saint-Étienne: Publications de l'Université Jean Monnet, 2004), 30. See John Haines, “Anonymous IV as an Informant on the Craft of Music Writing,” *Journal of Musicology* 23 (2006): 385. On the Carthusian ruling post, see also Rosenfeld, “Tools for Producing Books,” 169.
43. Although the topic of practical symbolism is poorly studied, see Rosenfeld’s important essay on symbolism in scribal culture, “‘Stone Tablets’ and the ‘Pen of the Ready Scribe’: Biblical Symbolism of the Tools of Written Communication,” in *The Medieval Bible as a Way of Life*, ed. Greti Dinkova-Bruun and Jennifer Harris (London: Routledge, 2007).
44. Rosenfeld, “‘Pricking Wheels.’”
45. Becdelièvre, *Prêcher en silence*, 37–41.
46. Haines, “Anonymous IV,” 385. See Haines, “The Transformations of the *Manuscrit du Roi*” *Musica disciplina* 52 (2002): 28, and Haines, “Lai Layout in the Paris Prose Tristan Manuscripts,” *Scriptorium* 59 (2005): 24.
47. Concerning ruling, Waesberghe explains that “a line is scored in the vellum with a stilum” (“Musical Notation,” 17). On the range of tools used for pricking, see Rosenfeld on ruling tools such as the knife or stylus (“Tools,” 162, 169).
48. David Hiley, *Western Plainchant: A Handbook* (Oxford: Clarendon Press, 1993), 366–67. Punctuation marks above the text in BL Burney 340 are found, for example, on fol. 6v, and supplied letters on fol. 20v, for example, where we find an entire line of text.
49. To be sure, there are exceptions to the general development just described. Not all late medieval manuscripts boast a more spacious or elegant layout than earlier ones.
50. See, for example, Nicola Coldstream, *Medieval Architecture* (Oxford: Oxford University Press, 2002), 68. On Golden proportions in page layout, see Jan Tschichold, *The Form of the Book: Essays on the Morality of Good Design*, trans. Hajo Hadeler, ed. Robert Bringhurst (London: Lund Humphries, 1991), 36–64, where Tschichold argues that Golden proportions in printed books are based on a medieval practice, as seen in the sketches of thirteenth-century artist Villehard de Honnecourt. Generally, on the Golden Rectangle, see Mario Livio, *The Golden Ratio: The Story of Phi, the World’s Most Astonishing Number* (New York: Broadway Books, 2002), 85, and Matila Ghyka, *Le nombre d’or: Rites et rythmes pythagoriciens dans le développement de la civilisation occidentale*, 17th ed. (Paris: Gallimard, 1931), 1: 44–45, esp. 58–59.
51. Livio, *Golden Ratio*; see also Miloutine Borissavlievitch, *The Golden Number and the Scientific Aesthetics of Architecture* (London: Alec Tiranti, 1958), 34.
52. See Livio, *Golden Ratio*, 3–4.
53. The importance of the impression of symmetry, rather than its mathematically precise manifestation is emphasized in Borissavlievitch, *Golden Number*, esp. 8–9 and 57.

54. For a survey of these sources, see David Hiley and Janka Szendrei, "Notation, § III, 1," in *New Grove Dictionary of Music and Musicians*, 18:88–91, and Solange Corbin, *Die Neumen*, Palaeographie der Musik 1 (Cologne: Volk-Verlag Gerig, 1977), 21–41, and the bibliography cited there.
55. On 1154, see Sam Barrett, "Music and Writing: On the Compilation of Paris, Bibliothèque Nationale lat. 1154," *Early Music History* 16 (1997): 55–96.
56. On 1084, see Heinrich Husmann, *Tropen- und Sequenzhandschriften, Répertoire International des Sources Musicales*, series B, vol. 5, pt. 1 (Munich: G. Henle, 1964), 120–22. Other examples of eleventh-century books without a dry staff include the eleventh-century Cluniac gradual and proser BnF lat. 1087.
57. On this book, see Husmann, *Tropen*, 124–26, and Ruth Steiner, "The Prosluae of the MS Paris, Bibliothèque Nationale f. lat. 1118," *Journal of the American Musicological Society* 22 (1969): 367–93.
58. On the different types of medieval liturgical books with music, see Michel Huglo, *Les livres de chant liturgiques*, Typologie des sources du Moyen Âge occidental 52 (Turnhout: Brepols, 1988); Hughes, *Medieval Manuscripts*, 118–23.
59. Manuscripts are listed in Schmid, *Musica et scolica enchiridis*, vii–viii.
60. Ironically, as in several other manuscripts of Guido's works, the manuscript in Figure 9 does not have the colored lines proposed by Guido.
61. In addition to the multiple-ruling staff in Figure 9 another representative type of notational layout in Guido manuscripts is that of text and music on alternating lines, i.e., a single-line staff, as seen, for example in BL Additional 17808 (For a description of this book's contents, see Pesce, *Regule rithmice*, 111–12).
62. *Antiphonarium Ambrosianum du Musée Britannique (XII^e siècle)*, *Codex Additional 34209* (Solesmes: Saint-Pierre, 1896–1900).
63. The tool pierced through the recto side and out through the verso side for each one of the eighteen gatherings (sixteen quaternions from fols. 4–130, with fols. 1–3 being three leaves and 131–35 a binion preceded by a single leaf).
64. The layout here is twenty ruling lines with a module of about 9 millimeters each.
65. Waesberghe, "Musical Notation," 18.
66. On these two books, see Ave Moderini, *La notazione neumatica di Nonantola* (Cremona: Athenaeum Cremonense, 1970), 62 (where Moderini summarizes the conflicting and approximate dates assigned to the cantatorium) and 68 (where he dates the troper "s.XI–XII" without further proof). Moderini suggests a date for the troper around 1166, date of the medieval Nonantola catalog; on which, see Giuseppe Gullotta, *Gli antichi cataloghi e I codici della abbazia di Nonantola* (Vatican: Biblioteca Apostolica Vaticana, 1955), 31–67. For images of these two manuscripts, see *Paléographie musicale*, vol. 2: *Le répons-graduel 'Justus ut palma' reproduit en facsimile*, pt. 1 (Solesmes: Saint Pierre, 1891), plates 15 and 18.
67. For a list of this manuscript's contents, see Pesce, *Regule rithmice*, 175–77.
68. For a list of this manuscript's contents, see Pesce, *Regule rithmice*, 178–80.

69. See images of pricking in both books in Max Lütolf, *Das Graduale von Santa Cecilia in Trastevere: Cod. Bodmer 74* (Cologne and Geneva: Fondation Martin Bodmer, 1987), 1:32, plate 1b and vol. 2 (facsimile edition of Bodmer 74), especially fols. 42v, 43r, 44v and 45r. Old Roman sources are discussed in Hiley, *Western Plainchant*, 531.
70. The *moderni/antiqui* distinction is frequent in twelfth and thirteenth century writing, and it is not just confined to music. See, for example, David Luscombe, *Medieval Thought* (Oxford: Oxford University Press, 1997), 77–80 and 133.
71. On the Carthusians, see most recently the collection of essays edited by Chantal Spillemaecker, *La Grande Chartreuse: Au-delà du silence* (Grenoble: Glénat, 2002).
72. Guiges Ier, Prieur de Chartreuse, *Coutumes de Chartreuse* (Paris: Editions du Cerf, 1984), 222–23.
73. Jean-Pierre Aniel, *Les maisons des chartreux, des origines à la Chartreuse de Pavie* (Geneva: Droz, 1983), 10–16 and plates I and XV. By the thirteenth century, there were Carthusian houses as far east as Poland and as far northwest as Ireland.
74. Becdelièvre, *Prêcher en silence*, 8, 18, and 119.
75. Becdelièvre, *Prêcher en silence*, 242; Becdelièvre, “Les moines copistes,” in *La Grande Chartreuse*, 105.
76. Generally on Carthusian chant, see especially Benoit-Marie Lambres, “Le chant des chartreux,” *Revue belge de musicologie* 24 (1970): 17–41.
77. On some of the sources listed in Table 1, see Hansjakob Becker, *Die Responsorien des Kartäuserbreviers: Untersuchungen zu Urform und Herkunft des Antiphonars der Kartause* (Munich: Max Hueber, 1971), xiii–xxii; Hüsch, “Kartäuser,” in *Die Musik in Geschichte und Gegenwart* (Kassel: Bärenreiter, 1958), vol. 7, col. 712; and MGG, *Sachteil* (Kassel: Bärenreiter, 1996), vol. 4, col. 1808 (the 1958 edition has the fuller manuscript list); Olivier Cullin, “L’écriture en question: La pratique musicale à l’épreuve des textes,” *Les représentations de la musique au Moyen Âge: Actes du colloque des 2 et 3 avril 2004* (Paris: Musée de la musique, 2005), 45; Becdelièvre, *Prêcher en silence*, 344–45, 397; Dom Augustin Devaux, “Les chartreux et la mélodie de leur graduel,” in *Cantus Planus: Papers Read at the Sixth Meeting, Eger, Hungary, 1993*, ed. László Doboszay (Budapest: Hungarian Academy of Sciences, Institute for Musicology, 1995), 1: 225–50, and his *Graduel cartusien*, vol. 1 (Salzburg: Institut für Anglistik und Amerikanistik, 2005), iii. I would like to thank Grande Chartreuse archivist Dom Luc Fauchon for his assistance and hospitality during my visit in May 2006, Marie-Françoise Bois-Delatte and Sandrine Marchand of the Bibliothèque municipale de Grenoble for their assistance during my several visits there, and Brother John Babeau of St. Hugh’s Charterhouse in Parkminster. Michèle Coulet, curator at Marseille’s Bibliothèque Municipale (Alcazar), informs me that manuscript Eb. 316 (150), listed by Hüsch and others as being a late twelfth-century Carthusian book, is neither Carthusian nor from the twelfth century.
78. Question marks in this table mostly indicate pricks that are not visible in the manuscript. On the different Carthusian houses, see Aniel, *Les maisons des chartreux*, 10–16 and plates I and XV.
79. The manuscript GC 23 was transferred to the Grande Chartreuse from the Chartreuse de Sélignac around the year 2000.

80. It is possible, of course, that a systematic pricking and ruling of music books existed prior to the Carthusians and that this evidence has been completely lost. On the paucity of evidence for Cistercian music copying practice, see Haines, "Manuscript Sources and Calligraphy," in *The Cambridge Companion to French Music*, ed. Simon Trezise (Cambridge: Cambridge University Press, forthcoming).
81. Borissavlievitch, *Golden Number*, esp. 8–9 and 57.
82. On red inks and their recipes, see Hamel, *Scribes and Illuminators*, 22; L. Holtz and E. Le Roy Ladurie, *Archéologie du livre médiéval* (Paris: C.N.R.S., 1987), 52; and Paul Binski, *Medieval Craftsmen: Painters* (Toronto: University of Toronto Press, 1991), 53 and 57.
83. A note by a modern hand on the opening unnumbered folio of this manuscript points out that the book contains prayers for Peter, Bishop of Beauvais, and for Louis VI the Fat of France (1081–137), so that it can be dated around 1130.
84. For a description of this book, see Susan Rankin's entry in *Cambridge Music Manuscripts, 900–1700*, ed. Iain Fenlon (Cambridge: Cambridge University Press, 1982), 33–35.
85. René-Jean Hesbert, *Les manuscrits musicaux de Jumièges* (Macon: Protat Frères, 1954), 907–09.
86. See *A Catalogue of the Manuscripts Preserved in the Library of the University of Cambridge*, vol. 4 (Cambridge: University of Cambridge, 1856–67), 25–26.
87. *Opera de vita regulari*, vol. 2, ed. Joseph Joachim Berthier (Rome: Marietti; repr. Turin, 1956), 266.
88. Huglo, "Règlement," 124: "In gradualibus quam in antiphonariis nocturnes et aliis . . . faciant notam quadratam et quattuor lineas . . . et fiant lineae modo debito distantes, ne nota hinc inde comprimatur ab eis" (Franciscan); "in antiphonariis et gradualibus et aliis libris cantus, fiant note quadrate cum quattuor lineis debito modo distantibus, ne nota hinc inde comprimatur ab eis" (Dominican). The latter could be translated as follows: "In antiphoners and graduals and other chant books, make notes square, with four lines spaced a little apart so that later, a note will not be constrained by them."
89. Van Dijk, *Sources of the Roman Liturgy*, 113–14.
90. See, for example, Heinrich Hüschen, "Franziskaner," *Die Musik in Geschichte und Gegenwart*, vol. 4 (Kassel: Bärenreiter, 1955), cols. 823–41, illustrations 3 and 4 and plate 34. Some Franciscan music sources are listed in Van Dijk, *Sources*, 1:157–25.
91. The prick marks on fol. 305, the only ones surviving in this book, are found at the top of the folio: four pricks some 3 to 4 millimeters apart followed by one 7 millimeters away from these. The pricking appears to be an initial incorrect effort since it does not line up with the staff and text lines on this page.
92. See, for example, William Hinnebusch, *The History of the Dominican Order* (Staten Island, NY: Alba House, 1966–73), 1:19–45.
93. Dominique Delalande, *Vers la version authentique du graduel grégorien: Le graduel des prêcheurs, recherches sur les sources et la valeur de son texte musical* (Paris: Cerf, 1949), 3–6.
94. Hiley, *Western Plainchant*, 322. On the Santa Sabina copy, see Leonard Boyle, "A Material Consideration of Santa Sabina MS. XIV L 1," *Aux origines de la liturgie*

dominicaine: Le manuscrit Santa Sabina XIV L 1, ed. Leonard Boyle and Pierre-Marie Gy (Rome: École Française de Rome, 2004), 19–42. For a description of the British Library copy, see Georgina R. Galbraith, *The Constitution of the Dominican Order, 1216–1360* (Manchester: Manchester University Press, 1925), 193–202.

95. Helen Deeming has put it well: “It has generally been assumed (although never proven) that a rake or rastrum was used” (“Observations,” 47). At least one codicologist assumed “that the rake had first been invented for music” (Johan Gumbert, private correspondence with this author, 30 October 1999).

96. Johan Gumbert, “Ruling by Rake and Board: Notes on Some Late Medieval Ruling Techniques,” in *The Role of the Book in Medieval Culture*, ed. Peter Ganz (Turnhout: Brepols, 1986), 48; Gumbert specifies that “I go by what Mr. [Andrew] Wathey told me” (note 18). Stanley Boorman equivocally states that, generally speaking for music manuscript production, “ruling normally involved the use of a rastrum” (“Sources, MS, § I, 3: Preparation and Copying,” *New Grove of Music and Musicians*, 23: 796).

97. Mark Everist, *Polyphonic Music in Thirteenth-Century France: Aspects of Sources and Distribution* (New York: Garland, 1989), 70. Andrew Wathey notes that the rake was clearly used in fifteenth-century sources, as discussed below; Wathey, *Music in the Royal and Noble Households in Late Medieval England: Studies of Sources and Patronage* (New York: Garland, 1989), 33.

98. Jean Wolf and Eugene Wolf, “Rastrology and Its Use in Eighteenth-Century Manuscript Studies,” in *Studies in Musical Sources and Style: Essays in Honor of Jan LaRue*, ed. Eugene Wolf and Edward Roesner (Madison, WI: A-R Editions, 1990), 239–42. Given the lack of specimens, speculations on the look of the rake have ranged from a comb-like instrument to one “fit with arrays of . . . dry quills”, as Rosenfeld has put it (“Tools for Producing Books,” 170n86; see also Deeming, “Observations,” 47–48).

99. John Munro, “Textiles,” in *Medieval Latin: An Introduction and Bibliographical Guide*, ed. F. A. C. Mantello and A. G. Rigg (Washington, D.C.: Catholic University of America Press, 1996), 476; John Hawthorne and Cyril S. Smith, eds., *On Divers Arts: The Treatise of Theophilus* (Chicago, IL: University of Chicago Press, 1963), 125–26.

100. Jacques Le Goff, *Time Work, and Culture in the Middle Ages*, trans. Arthur Goldhammer (Chicago, IL: University of Chicago Press, 1982), 44.

101. The sections containing music (not counting fols. 1–2 from the fourteenth century) are fols. 83–43 and 480–571.

102. What follows apparently applies to the Santa Sabina master copy as well (Boyle, “Material Consideration,” plate 9, where the prick marks are visible).

103. Hughes notes that lines that are unparallel and do not begin and end together, the second criterion given here, indicating that no rake was used (Hughes, “Scribe,” 169–70).

104. I made this claim based on only eight chansonniers (Haines, “Transformations,” 28–29), but a study of the remaining chansonniers confirms this. The chansonniers or sections of chansonniers where a rake was used date from the early fourteenth century (29n73).

105. Martin Staehelin, *Die mittelalterliche Musikhandschrift W1: Vollständige Reproduktion des "Notre Dame"-Manuskripts der Herzog August Bibliothek Wolfenbüttel Cod. Guelf. 628 Helmstedt* (Wiesbaden: Harrassowitz, 1995), 17.
106. This confirms Stanley Boorman's hunch that "rastra were evidently used in some manuscripts at least by the fourteenth century" ("Rastrology," in *New Grove of Music and Musicians*, 20: 843). The rake I discuss here is different from the ruling board attested in the late fifteenth century description of "due tabule ad rigandum" (Derolez, *Codicologie*, 1: 72). As Derolez states, the ruling board precluded the need for pricking the page (75).
107. Helen Deeming describes this phenomenon as "places in which all stave-lines 'wobble' in parallel" (Deeming, "Observations," 47).
108. *Fauvel Studies: Allegory, Chronicle, Music and Image in Paris, Bibliothèque nationale de France, MS français 146*, ed. Margaret Bent and Andrew Wathey (Oxford: Clarendon, 1998), plate II, middle column, lowest staff (slight hiccup) and plate III, left column, eleventh staff down (upward swerve), middle column, twelfth staff down (blotting), and right column, second to lowest staff (lines extended into margin).
109. Lawrence Earp, *Guillaume de Machaut: A Guide to Research* (New York: Garland, 1995), 77; Earp also notes use of the rake for Machaut manuscripts W and F-G (79 and 90).
110. Diane Droste, "The Musical Notation and Transmission of the Music of the Sarum Use, 1225–1500" (PhD diss., University of Toronto, 1983), 108, Table 5.
111. See, for example, Hiley, "Staff."
112. Alex Haley, *Roots* (New York: Doubleday, 1976), 688. The citation, though not credited, is from George Orwell's 1944 miscellaneous essay where he writes "History is written by the winners." Orwell, *The Collected Essays, Journalism and Letters of George Orwell*, vol. 3: *As I Please, 1943–1945*, ed. Sonia Orwell and Ian Angus (New York: Harcourt, Brace, 1968), 88.