

Johannes Boen, *Ars [musicae]*

▣ ▪ • ↓ Hec sunt quatuor note, quibus omnis mensurabilis contextitur cantelena. Quarum prima longa, secunda brevis, tertia semibrevis, et ultima minima nuncupatur. Non quin longior sonus aut minor dari possit quocumque sono dato, sed ideo hiis quatuor dumtaxat contenti simus, ut presens nostra scientia habeat certam metam; ne si de duplicibus longis et adhuc longioribus, item de semiminimis et adhuc minutioribus tractemus, ad infinitatem prolabamur. Omnium enim natura constantium positus est terminus et ratio magnitudinis et augmenti, nec anhelitus hominis sufficere posset ad tante diurnitatis vocis sub uno spiritu pronuntiationem, sic nec auris iocunditatem caperet si sonus forte fieret adeo diminutus. Quare autem sic vocentur, voluntatis questio est.

Sed ecce qualiter figurentur: due prime sicut et due ultime in qualitate corporum conveniunt, et stat earum differentia in quodam tractulo, qui tractulus nomine plica vocari potest vel proprietas vel cauda. Et quamvis longa<m> sic signamus cum cauda descendente, potest nihilominus cauda eius ascendere, ut hic: ↓, maxime quando textui adeo vicina steterit, ut textus eius descendentem caudam offuscare cogeret. Scribunt aliquotiens aliqui longam cum duplici cauda, quod magis faciunt propter decentiam quam necessitatem, ut hic: ↯. In quibus positionibus attenditur que sit cauda eius longior, ut si posterius latus, quod dextrum vocant, longiorem caudam contineat, continebit et nomen longe, si e contra, nominabitur ipsa brevis. Sic ergo patet breviter cognitio omnium quatuor notarum per se positarum et extra ligaturam.

In ligatura omnes intrans preter minimam. Figuratio autem earum que intrans ligaturam vario modo fit, secundum quod aptius valeant ad invicem colligari.

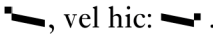
Longa alteri vel aliis colligari potest, et tunc pro iure suo obtinuit, quod primum locum occuparet vel ultimum, ac si propter fortitudinem suam prima bellum valeret ingredi vel ne socie sue darent terga fuge. Quando ergo in anteriori loco se stare senserit,




▣ ▪ • ↓ These are the four notes with which every measurable song is woven together. The first of these is called longa, the second breve, the third semibreve, and the last minim. Not that a longer or shorter sound could not be assigned [to a note] if one were given. But we should be content with these four alone, so that our science may have a certain goal – lest we lapse into infinity by dealing with duplex longas and still longer ones, and likewise semiminims and still more minute ones. For it is in the nature of all constant things that there is a limit and rationale set to magnitude and increase. Neither would human respiration be adequate for the performance of so large a duration of sound in one breath; nor perhaps would the ear find [any] pleasure if a sound were very short. Why [the notes] should have their particular names, however, is a matter of will [rather than of nature].



Behold how [the notes] are figured. The first two and the last two agree with respect to the [the shapes of their] bodies. The difference between [each pair] rests in a certain line, which line may be called a plica, or propriety, or tail. And although we notate the longa with a descending tail, nevertheless its tail can also ascend, as here: ↓, especially if it stood so close to the text [of the song] that the text could not help obscuring its descending tail. Some people sometimes write the longa with a double tail, as here: ↯, which they do for the sake of propriety more than out of necessity. In these ways of writing one must note carefully which of the tails is longer, so that, if the posterior side which is called the right [side] were to have the longer tail, then it shall also have the name of longa, but if [it is] the other way round, then it shall be named a breve. This, in short, is the knowledge of all the four notes [when they] are placed by themselves, outside of ligatures.

All [notes] except the minim go into the ligature. Yet the figuration of those that go into a ligature varies according to how they may be best bound together.



A longa may be tied together with another [note], or other [notes], and then it holds the special privilege of occupying either the first place or the last – as if, because of its strength, it should be the one to have the valor to step into battle, lest his companions might turn their backs in flight. But when it




tante magnamitatis effertur vesania, quod per unam suam sociam deprimere videatur, ut hic: . In quibus positionibus cito sciri potest primam longam fore, eo ipso quod sequens ipsam faciem sic declinat. Si autem secunda sequens altius elevari presumeret quam prima, amplius prima non censeretur longa. Et caveat sibi scriptor, ne huiusmodi longe in ligatura caudam attemptet apponere a parte ante, quam extra ligaturam non habebat. Patet ergo, quod duas condiciones habeat prima de ligatis, si ipsa longa nominari debeat. Prima condicio est quod non habeat caudam a parte sinistra. Secunda condicio est quod proxima cui coniungitur sit descendens.



Ad hoc quod ultima de ligatis longa vocetur, due etiam requiruntur condiciones. Prima, quod ipsa descendat, ac si faciem propter verecundiam deprimeret totius ultimum locum possideat. Secunda condicio est, quod quadrata sit et non quadrangularis, ut hic: . Hic ultima dicitur longa propter duas condiciones predictas: quia descendens et quia quadrata. Si vero ascenderet, non esset longa, ut hic: ; idem si descenderet et non esset quadrata, ut hic: .

Predictis ergo duobus modis dumtaxat scribitur longa in ligatura vel extra. Nec alio modo scribi debet, quin satis cognoscatur per caudam qua utitur extra ligaturam, ut hic:  ubi prima longa est non obstante quod proxima sequens transcendat ipsam; ut hic: , ubi ultima longa est, quamvis ipsa non descendat. In quibus positionibus satis se manifestam prebet longa per caudam. Brevis qualiter scribi debeat, longum esset pertractare, eius ideo notitiam *per locum a sufficienti divisione* docebo invenire. Data enim quacumque nota, si eam scivero non esse longam, semibreve aut minimam, sequitur quod erit brevis, quia non plures note sunt quam quatuor, ut predixi.




Ad ipsius semibrevis ergo agnitionem in ligatura procedamus. Unde notandum, quod quasi contrario modo scribitur semibrevis in ligatura et extra: nam extra ligaturam scribitur sine cauda, in ligatura vero ipsam habet. Et est cauda semibrevis







realizes that it occupies the first place, it is carried away by a madness of such grandiosity that it seems to push down [the next] of its companions, as here: , or here: . In these notations one can readily tell that the first shall be long, because the next one turns down [its] face. However, if the second [note] would presume to be higher than the first, then the first would no longer be reckoned a longa. And let the scribe take heed not to try to append a tail on the left side of that longa, within the ligature, which it did not have outside the ligature. It is evident, therefore, that the first ligated [note] must meet two conditions if it is to be named a longa. The first condition is that it should not have a tail on the left side. The second condition is that the neighbor to which it is joined should be descending.

Two conditions are required also for the last of the ligated [notes] to be called a longa. The first [is] that it should descend, as if it lowered [its] face out of bashfulness, [and] should take the last place of all. The second condition is that it should be square and not quadrangular, as here: . The last [note] here is called longa because of the aforesaid two conditions: because [it] descends and because [it is] square. But if it ascended, like so: , then it would not be a longa, nor would it [be one] if it did descend but was not square, as here: .




It is only in the aforesaid ways, then, that the longa is written within the ligature or outside it. And it must not it be written in any other way, for it is recognized sufficiently well by the tail which it uses outside the ligature, as here: , where the first is long even though the subsequent neighbor rises above it, [and] as here: , where the last is long even though it does not descend. In notations like these the longa presents itself clearly enough by its tail. It would be tedious to discuss at length how the breve should be written [in a ligature], therefore I shall only teach [the reader] how to determine it through the argument of sufficient division [that is, by exclusion]. For if I shall have determined, for any given note, that is not a longa, semibreve, or minim, then it follows that it must be a breve, since there are no more than four notes, as I have said before.







Let us then move on to the determination of semibreves within ligatures. In which connection it must be noted that semibreves within and outside ligatures are written almost in contrary fashion: for outside the ligature they are written without a tail, but within the ligature they do have one. And the

ascendens sicut erat ipsius minime, ac si minima caudam quam extra ligaturam semibreui abstulit, facta recompensatione infra ligaturam ei mutuo prestaret. Cum ergo oporteat semibreve sic caudatam esse ut cognoscatur, oportet ut cauda eius lucide perpendatur, ut hic: , ut hic: , ut hic: , ubi prima semibrevis est propter caudam ascendentem. Et quia prima semibrevis est, necessario et secunda sequens proxima semibrevis erit, quasi modum Jacobitarum servare vellent, eo quod due semper simul stare volunt. Ad hoc ergo quod aliqua de ligatis semibrevis dici debeat, due condiciones requiruntur: scilicet quod sit prima et quod caudam habeat ascendentem, ut in exemplo predicto. Et semper si prima semibrevis est, et secunda sequens semibrevis erit.

Nunc qualiter brevis cognosci poterit, inspectis hiis que dicta sunt de longa et semibreui, leviter apparebit. Concluditur namque ex precedentibus, brevem poni posse in omni loco ipsius ligature. In principio enim ponitur cum cauda descendente a parte sinistra, et tunc sequens figura descendit, ut hic: , ubi prima brevis est propter caudam descendentem. Si enim non haberet caudam, longa esset; vel si cauda eius ascenderet, semibrevis esset. Potest esse brevis in principio sine cauda, et hoc quando secunda sequens esset in ascensu, ut hic: , vel hic: , ubi prima brevis est, quamvis sine cauda, eo quod secunda ascendit. In medio ligature potest brevis poni, et tunc non cognoscitur per habitum vel privationem caude, sed quia in medio ligature situata est, quasi medius locus proprius ipsius esset. Et pro regula dici solet: omnis media brevis. In fine ligature scribitur brevis ascendendo sine cauda, ut hic: , vel hic: , vel descendendo in corpore non quadrato, ut hic: . Et hec sufficiant dicta de figuris notularum.

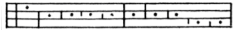
De pausis hoc tenendum est: quot spatia pausa occupat, tot breves ipsa representat. Pausa longe tria vel duo spatia transire habet, prout longa valoris extiterit. Pausa brevis unum spatium transit. Pausa semibrevis dimidium spatium, sub linea

tail of the [ligated] semibreve is an ascending one just like that of the minim – as if the minim, having taken the semibreve’s tail outside of the ligature, returned it as a loan within the ligature. Therefore, since it is necessary for the [ligated] semibreve to be tailed in order that it may be recognized, its tail must be drawn clearly, as here: , as here: , as here: , where the first is a semibreve because of the ascending tail. And since the first is a semibreve, the subsequent second neighboring [note] shall necessarily be a semibreve as well, as if they wanted to observe the custom of the Dominicans who always want to be together in pairs. Two conditions are required if one of the ligated [notes] is to be called a semibreve: namely, that it should be the first [note of the ligature], and that it should have an ascending tail, as in the aforesaid example. And when the first is a semibreve, then the subsequent second one shall always be a semibreve as well.

By considering the things we have said about the longa and semibreve, it shall [now] be readily apparent how to recognize the breve. For it follows from the preceding [statements] that a breve can be notated anywhere within the ligature. For at the beginning it is notated with a descending tail on the left side, and then the subsequent note descends, as here: , where the first is a breve because of the descending tail. But if it were not to have a tail, then it would be longa; or if its tail ascended, it would be a semibreve. At the beginning it can also be a breve without a tail, namely, when the subsequent second [note] ascends, as here: , or here: , where the first, even though it has no tail, is a breve because the second [note] ascends. The brevis can be notated also in the middle of the ligature, and then it is recognized, not by the presence or absence of a tail, but rather by its very placement in the middle of the ligature, as if the middle were its proper home. By way of rule one customarily says: every one in the middle is short. At the end of the ligature the breve is written without a tail when it ascends, as here:  or here: , or, when descending, as a body that has no square shape, as here: . And let these statements about the shapes of the notes suffice.

About rests the following is to be held: a rest represents as many breves as it occupies spaces. The longa rest must cover three or two spaces, according to how much the longa shall be worth. The breve rest covers one space. The semibreve rest [takes up] a half space, hanging down from the

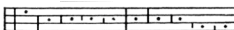
descendendo. Pausa minime medium spatium, supra lineam tamen stando. De singulis ecce per ordinem exempla:

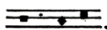

 Hec omnia ad voluntatem facta sunt, et sic in melioribus vide cantelenis.

Punctis autem in cantu utimur propter certitudinem habendam, ut incertatio que in computatione modi temporis vel prolationis suboriri posset, per puncta extirpetur. Duplicem quidem punctum necessario ponendum consideravi, videlicet aut propter divisionem aut perfectionem, ut ex sequentibus apparebit.

Primo:  Secundo: 

Ad valorem consequenter predictarum notarum quatuor accedamus. Potest autem longa valere tres breves ad plurimum, item brevis tres semibreves, et semibrevis tres minimas. Ergo a primo ad ultimum computando potest longa valere minimas viginti septem. Minimam vero minorem continere suppono non debere, ut minima se habeat in cantu tamquam unitas in numero, in quam omnis numerus resolubilis est et in qua status fit ne processus fieri habeat in infinitum. Quando autem sic quelibet nota in se numerum includit ternarium, vocatur totus cantus huiusmodi perfectus de modo, tempore et prolatione. Perfectus quippe de modo quia longa valet tres breves, perfectus de tempore quia brevis valet tres semibreves, perfectus de prolatione quia semibrevis valet tres minimas. Sic quod modus attenditur in longis, tempus in brevibus, prolatio vero in semibrevis. Potest etiam longa valere duas breves, et brevis duas semibreves, et semibrevis duas minimas. Et tunc est totus cantus huiusmodi imperfectus, scilicet de modo tempore et prolatione, eo quod undique per binarium proceditur. Perfectio enim omnis in numero ternario consistit, imperfectio vero in numero binario. Per has duas species numerorum, scilicet aut per ternarium aut per binarium, natura incitat ut procedat omnis cantus, ut in tripudiis experimur et choreis, quasi mensuram cuiusvis alterius numeri qui non sit reducibilis ad has natura penitus abhorreret. Sed non est necesse ut hec tria, scilicet modus tempus et prolatio, seinvicem sequantur, ut qualiscumque fuerit modus, tale debeat esse tempus vel prolatio. Non enim sic note coartant, quia

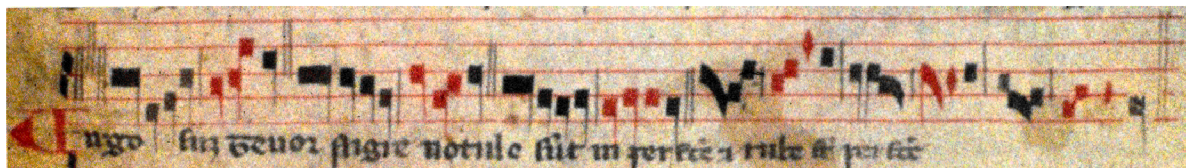
line. The minim rest [also] half a space, standing however above the line. Behold the examples of each in order: . These are all made at the pleasure [of the composer], as you can see in the better chansons.

However, we use dots in song to have greater certitude, so that any uncertainty that might arise in the computation of mode, tempus, and prolation may be eliminated by dots. I have considered that [there are] two dots [that] must be notated out of necessity, namely, for the sake of division or of perfection, as shall be apparent in the following [examples]. Firstly: , and secondly: .

Let us now turn to the values of the aforesaid four notes. The longa may be worth three breves at most, the brevis three semibreves, and the semibreve three minims. So, counting from first to last, the longa may be worth as much as twenty-seven minims. I do not hold that the minim should contain [anything] smaller, for the minim should function in song in the same way as unity [one] in number, [being the one] to which every number is reducible, and in which there is fixity lest there should be infinite regress. Now when each note encloses within itself the ternary number, then the whole song is called perfect in modus, tempus, and prolation. Perfect in modus because the longa is worth three breves, perfect in tempus because the brevis is worth three semibreves, and perfect in prolation because the semibreve is worth three minims. So modus pertains to longas, tempus to breves, but prolation to semibreves. A longa may also be worth two breves, and a brevis two semibreves, and a semibreve two minims. And then the whole song is imperfect, namely, in modus, tempus, and prolation, because it proceeds in binary numbers throughout. For every perfection resides in the ternary number, but imperfection in the binary number. For as we can tell in dances and in round dances, Nature wills that all song should proceed only by those two species of numbers, that is, by either the ternary or the binary, as if she deeply abhorred measures [fashioned from] other numbers that are not reducible to these. Yet it is not necessary for these three, that is, modus, tempus, and prolation, to copy each other exactly, so that whatever the modus may be, tempus and prolation must be as well. Notes are not restricted in this way, for the longa may be worth three

longa potest valere tres breves, brevi valente duas semibreves; item brevis potest esse ternaria, longa binaria existente. Solet aliquotiens cantor lascivia ductus in eodem cantu variare modum, ut nunc processus fiat per ternarium, nunc per dualitatem. Sed tunc oportet, quod huiusmodi cantus bene distinguatur per distinctos colores, ut in tenore moteti *In arboris emphiro*. Eodem modo de tempore et prolatione.

breves even when the breve is worth two semibreves; also the breve may be ternary even when the longa is binary. Sometimes a singer may change the modus within one and the same song out of playfulness, so that it proceeds by the ternary [number] at one point and by duality at another. But then it is necessary for the song to be well differentiated through [the use of] different colors, as in the tenor of the motetus *In arboris emphiro*. And in the same way in tempus and prolation.



tenor of *Tuba sacre fidei*/*In arboris emphiro*/*Virgo sum* (Ivrea, fol. 15v)

Perfectio itaque cuiuslibet note sub numero fit ternario. Quia tamen difficile est discernere perfectum ab imperfecto, advertendum est quod aut placet factori facere vocem unam continuam, quam postea in eodem cantu vel in tenore tribus vocibus mensurat equalibus, et tunc talis vox perfecta erit et una nota distinguenda; quod si prolixè tenta sit, designatur per longam, ut hic: ¶ que nota perfecta dici potest, si tribus brevibus mensuretur. Aut placet facere duas voces et inequales, sic ut maior vox duas partes ternarii numeri comprehendat et alia unam; tunc huiusmodi due perfectionem statuunt, ut hic: ¶▪, ut hic: ▪¶, in quibus positionibus suppletur per minorem defectus perfectionis in maiore. Aut placet factori tres facere voces distinctas et equas; tunc huiusmodi tribus vocibus tres note respondebunt plenam perfectionem importantes, ut hic: ▪▪▪. Eodem modo quo exemplificatum est in modo, exemplificari potest in tempore; et ita in prolatione, quia sicut est in longis, sic et in minimis debet esse. Nam potest tempus perfectum sub una sola voce comprehendi, ut hic: ▪, vel hic sub duabus: ▪♦, vel hic: ♦▪, vel sub tribus ut hic: ♦♦♦. Sic et prolatio sub una, ut hic: ♦, sub duabus, ut hic: ♦↓, vel sub tribus, ut hic: ↓↓↓. Undique presupponendo quod nulla perfectio sub duabus vocibus equalibus comprehendi possit. Nisi forte hoc

So in any note, perfection resides in the ternary number. However, since it is not easy to distinguish perfect from imperfect, one should note that either [1] it pleases the composer to fashion one continuous pitch, which he thereafter measures in three pitches of equal duration in the same cantus, or in the tenor, and then that pitch shall be perfect and it is to be designated by one note; and if it be drawn out, then it is denoted by a longa, like so: ¶, which note may be called perfect if it is measured in three breves. Or [2] it pleases [him] to make two pitches of unequal duration, in such a way that the longer pitch comprises two parts of the ternary number, and the other [pitch] one; then those two pitches together make a perfection, like this ¶▪ or this ▪¶, in which notation the defect of the perfection in the larger is made up by the smaller. Or [3] it pleases the composer to fashion three distinct pitches of equal duration; then three notes shall correspond to those three pitches, together making up a full perfection, like this: ▪▪▪. And just as we illustrated [this] for modus, so one could illustrate it for tempus, and likewise also for prolation; for as it is in longas, so it must be in minims. For perfect tempus can be made by one pitch, as here ▪, or by two, here ▪♦ or here ♦▪, or by three, as here ♦♦♦. In the same way prolation by one, as here ♦, by two, as here ♦↓, or by three, as here ↓↓↓, everywhere understanding that no perfection can be made by two

fieret adiunctione punctorum, ut hic: ◻ ◻, ubi duo puncta terciam brevem operantur; vel ut hic: ◻ ◻ ◻, ubi tempus perfectum perficitur propter puncta. Et non solum potest perfectio inesse uni duabus aut tribus vocibus, sed tot vocibus quot unitates in se concludat. Ex hoc trahuntur diversa correlaria, scilicet quod ex una, ex duabus, ex tribus, ex quatuor, ex quinque vocibus, et ultra ad viginti septem, potest perfectus consistere modus. Ex quatuor, ut hic: ◻ ◻ ◻ ◻, pro brevi tres semibreves statuendo; ex quinque, ut hic: ◻ ◻ ◻ ◻ ◻; et sic de singulis.

Imperficitur autem omne perfectum, quoniam numerus ternarius sub duabus vel pluribus vocibus inequalibus habet mensurari, ut hic: ◻ ◻. Que due, ut dixi, perfectum complent modum, quia quantum longior perdit, tantundem minor refundit, vocaturque longior imperfecta propter ablationem sue tertie partis. Sic etenim, nota unde imperfectio fit, est tertia totius. Non enim a maiori nota potest longa imperfici quam a brevi, quia longa longam imperficere non potest, nec equalis equalem; sed minor maiorem, sicut quelibet pars suum totum. Et sicut brevis imperficit longam, sic semibrevis brevem, et minima semibrevis. Ergo a primo ad ultimum sequitur, imperfici posse notam a maiori parte quam a sua medietate, ymmo a maiori parte quam sint due tertie totius. Quod est notabile, et probatur hoc modo.

Constat enim longam omnimode perfectam imperfici posse a sua tertia parte, ut in exemplo supra posito; sed cum adhuc eadem longa duas in se breves contineat quarum quelibet numerum ternarium includit, quia tres semibreves, sequitur quod adhuc a duabus semibrevibus valeat minorari. Item ex quo insuper quatuor semibreves retinet, quarum quelibet tribus minimis equipollet, sequitur quod a quatuor minimis non obstantibus prioribus diminutionibus imperfici perhibetur.

Ergo, diligenti facta computatione, evidenter concludi poterit, quod ex maiori parte quam sunt due tertie totius, ipsa imperfecta erit. Clare siquidem probatum est, quod sic nota evacuari potest per

pitches of equal duration—unless perhaps it were through the addition of dots, as here ◻ ◻, where the two dots make up the third breve, or as here ◻ ◻ ◻, where perfect tempus is completed by the dots. And not only may perfection exist in one, two, or three pitches, but it includes within itself as many [possible] pitches as [it does] unities. And several corollaries may be drawn from this, for example, that perfect modus may consist of one, of two, of three, of four, of five pitches, and so on, until as many as twenty-seven. Of four, as here ◻ ◻ ◻ ◻, positing three semibreves for the breve; of five, as here ◻ ◻ ◻ ◻ ◻; and so on for each.

But every perfect thing involves imperfection, because the ternary number must be measured by two or more pitches of unequal duration, as here ◻ ◻. These two, as I said, complete a perfect modus, because the smaller pours back as much as the longer loses, and it is called the longer imperfect because of the taking away of its third part. Here, then, the note which causes the imperfection is the third of the whole. But a longa cannot be imperfected by a note larger than the breve, because a longa cannot be imperfected by a longa, nor indeed can anything cause something to which it is equal to be imperfected. But the thing that is smaller [may imperfect] that which is larger, just as any part [can imperfect] the whole to which it belongs. And just as the breve imperfects the longa, so the semibrevis [may imperfect] the breve, and the minima the semibrevis. It follows from first to last, therefore, that a note can be imperfected with respect to any part greater than its half, indeed in any part greater than two thirds of any whole. Which is remarkable, and it is proved in this way.

It is clear that a perfect longa can be imperfected overall by one third, as in the example given above. But as the same longa now contains within itself two breves, both of which include the ternary number, then, since [there are] three semibreves [to each breve], it follows that it is now capable of being diminished by two semibreves. After which it retains four semibreves, each of which shall be equipollent to three minims. [From which] it follows that it may be [further] imperfected by four minims, notwithstanding the previous diminutions.

So, after making a careful reckoning, we shall be able to conclude that [the longa] shall be imperfect in the part that is greater than two thirds of the whole. And thus it is demonstrated clearly that a note can be voided through

imperfectionem, ut non remaneat tertia totius, ipsa tamen remanente sub propria sua forma.

Non enim plus octo minimis nunc valebit, que prius valuit viginti septem. Tollit enim brevis sibi modum, due semibreves sibi tempus, et quatuor minime prolationem; ut iam omni perfectione denudata sit, que omnimoda perfectione prius poterat superbire.

Sed circa hanc ipsam longam queri potest, utrumne per unam minimam adhuc valeat minorari. Et videtur quod sic. Ex quo adhuc ternarium bis in se contineat et dualitatem, sequitur eam posse duabus minimis exminuiri. Sed dico quod non. Satis enim afflicta est, *nec afflicto debet dari afflictio [De clerico debili]*. Quod autem duos ternarios continet, illos non quasi proprios, sed quasi mendicatos et ex misericordia concessos habet, ne ex inopia pereat omnino. Si namque minima aliquam notam imperficit, hoc est ratione semibrevis ternarie in illa nota concludere; nunc autem ipsa sic depauperata est, quod nullam retinuit huiusmodi semibreve.

Sed contra videtur, quod ymmo ipsa minima possit notam imperficere quantumcumque nota illa fuerit de prolatione minori. Nam hoc potest brevis, ergo et minima; facilius enim est minorem partem auferre ab aliquo toto quam maiorem. Quod autem brevis hoc potest, ecce practicum. Sit prolatio minor, sed modus perfectus, perficiaturque modus sub duabus vocibus, ut hic ♯; ecce longam imperfectam per brevem. Si ergo ante imperfectionem talem non potuisset auferri minima, sequeretur propositum quod scilicet facilius sit abstrahi partem magnam quam parvam. Eodem modo in tempore perfecto posset brevis imperfici per semibreve, per minimam autem minime. Item sic nec semibrevis in tempore imperfecto nec brevis in modo imperfecto haberet aliquam potestatem imperficiendi. Ad hoc dicitur quod verum est, quia non habet imperfectio notarum fieri per violentiam quali predones uti solent, et argumentum presupponitur.

Sed occurrit questio magis necessaria: utrum due tertie per quas aliqua nota imperfecta est, valeant

imperfectionem, so that there should not be any third of any whole left, even though it retains its own [notational] form.

Yet [that longa] shall not be worth more than eight minims now, where previously it was worth twenty-seven. For the breve takes the [the third part of the] modus to itself, the two semibreves [of] the tempus, and four minims [of] the prolation; so that now it is now wholly despoiled of all perfection, when before it could pride itself in perfection in every way.

Yet it may be asked about that longa whether it could still be diminished by one more minim. And it seems that it can. For since it contains within itself twice the ternary number plus the duality [$3 + 3 + 2 = 8$ minims], it follows that it can be diminished by two minims. However, I say that it cannot. For [the longa] has already been completely dispossessed, and *dispossession should not be visited upon one who is already dispossessed*. Now although it does have two ternary numbers, it does not have them as its own, but rather as things begged for and granted out of pity lest it perish altogether in poverty. For when the minim imperfects a note, it is by reason of the ternary semibreve enclosed within that note; but now that very [note] has been reduced to poverty, so that it has not retained any such semibreve.

But on the other hand, it seems to the contrary that the minim may imperfect the note as much as that note shall be of minor prolation. For the breve can do this, therefore the minim also; for it is easier to take away the smaller part from some whole than the larger. [To see] that the breve can do this, look at practical [music]. Let the prolation be minor, but the modus perfect, and let the modus be perfected in two pitches, as here ♯; behold the longa made imperfect by the breve. So if the minim could not be taken away before that imperfection, the proposition would follow, namely, that it is easier for a big part to be taken away than a small one. In the same way the breve can be imperfected by the semibreve in perfect tempus, but not at all by the minim. And thus, also, the semibreve would not have the power to imperfect in imperfect tempus, nor the breve in imperfect modus. The answer must be that this is true, for the imperfection of notes should not be brought about by violence such as robbers are wont to use, and the argument is presupposed. [*I cannot make head or tail of this question, or its answer.*]

But a more necessary question arises: whether it is possible to notate precisely, in two [notational] bodies, the two thirds by which a note is

precise sub duabus corporibus figurari. Videtur quod sic. Nam non est inconueniens ex quo una tertia que brevis est sub uno signetur corpore, quod et due semibreves et tres minime sub alio corpore colligantur. Licitum enim est pro tribus minimis semibreuem poni, pari ratione licebit pro tribus semibreuibis poni brevem. Dico quod non, juxta ea qua proximo dixi supra. Nam sicut minima non imperficit nisi in prolatione maiori, sic nec brevis nisi in modo perfecto. Si ergo longa imperficeretur per duas breves, sequeretur quod eius perfectio in modo fuisset duplex; quod est contra suppositum in hac arte. Supposui namque longam posse tres ad plurimum valere breves, ergo per eam non signabitur nisi unus modus perfectus. Item pari ratione possent ille due breves colligi in unam longam, et sic longa imperficeretur a longa; quod absurdum est juxta regulas predictas.

Cum autem possibile sit variis modis notam imperfici, ne qua confusio generetur in practica tante imperfectionis, date sint quedam regule per quas certitudo in imperfectionibus habeatur. Et est prima: in omni cantu longa ante punctum valet tres breves. Et sic punctus perfectionis operatur et debet poni bene prope notam quam indicat perfectam esse, ad differentiam puncti divisionis, ut hic: ♪ ♩. Punctus enim divisionis potius coniungitur note sequenti quam precedenti.

Secunda regula est: in modo perfecto longa ante longam valet tres breves, ita quod sit idem iudicium ad hoc de longa sequente longam et de puncto. Consimiliter est dicendum de brevi in tempore perfecto et de semibreui in prolatione maiori. Quia ergo necessarium est propter certitudinem habendam, ut longa ante longam valeat tres breves, ideo placuit inventoribus huius artis aliam dare regulam. Si cantorem delectet inter duas longas ponere medium modum perfectum, quem in duabus vocibus discretis et inequalibus pronuntiare disponit, puta precedente minore voce et maiore sequente, tunc huiusmodi duas voces non per brevem et

imperfect. [*That is, a completely imperfected longa has lost a combined value of 19 minims from its original 27. Since 18 minims make up two-thirds of 27, the question is whether those two-thirds can be notated by two breves equaling 9 minims each.*] It seems yes. For given that one third, which is the breve, is notated in one body, it is not inappropriate that two semibreves and three minims are bound together in another body. For it is allowed to write a semibreve for three minims, and by a similar reasoning it shall be permitted to notate a breve for three semibreves. But I say no, according to what I just said above. For just as the minim does not imperfect, except in major prolation, so the breve does not, except in perfect modus. So if the longa were imperfected by two breves, it would follow that its perfection in modus had been twofold, which contradicts the presupposition of this art. For I have presupposed that the longa may be worth three breves at most, therefore the only thing that shall be signed with it is perfect modus. Also, by the same reasoning, those two breves in turn could be bound together in one longa, and then the longa would be imperfected by a longa; which is absurd according to the aforesaid rules.

But since it is possible for a note to be imperfected in several ways, certain rules have been issued to have certainty in imperfection, lest confusion would arise in the practice of so many [different ways of] imperfection. And the first is: in every song, a longa followed by a dot is worth three breves. And this is how the dot of perfection operates, and it must be notated quite close to the note which it indicates to be perfect, to distinguish it from the dot of division, like here: ♪ ♩. For it is better to join the dot of division to the note following it than that preceding it.

The second rule is: in perfect modus, a longa before a longa is worth three breves; so the same judgement applies to the longa following a longa and to the dot. The same is true of the breve in perfect tempus and the semibreve in major prolation. And since it is therefore necessary, in order to have certainty, that the longa before a longa be worth three breves, therefore it has pleased the inventors of this art to issue another rule. If it delighted the singer to notate, in between two longas, a perfect modus which he disposed to be performed in two distinct and unequal pitches, for example, the shorter pitch preceding and the longer following, then he should not build those two pitches by a breve and by a longa, lest the longa would be drawn out longer

per longam construat, ne longa longius protrahatur quam velit, sed per duas breves quarum secunda debet alterari, id est bis sub una voce pronuntiari. Et est regula talis: in modo perfecto quando due breves concurrunt inter duas longas, secunda alteratur; si vero quinque, alterabitur quinta; si octo, octava; dum tamen due ultime a precedentibus per punctum divisionis distinguantur. Idem est de semibrevis et minimis. Sic ergo necessitas coegit hanc regulam poni propter precedentem, et numquam habet alteratio locum nisi in cantu perfecto. Hec debet nota alterari ubi loco illius longior posset poni: nam non ponitur alteratio nisi necessitate cogente. In hoc enim differt punctus a longa: non enim alteratur nota ante punctum sicut ante notam.

Circa alteratam notam queritur, utrum imperfici possit quoquomodo. Et videtur quod sic, quia sic factor potest cantare cum tempore, ut ipsa alteranda nota per semibrevis vel minimam imperficiatur. Et debet ars huiusmodi conceptum sequi et non enim conceptus artem: sunt enim figure propter cantum invente et non cantus propter figuras. In contrarium arguitur. Si imperficeretur, hoc vel esset a parte ante vel a parte post. Non a parte post, quia jam alteratio non esset necessaria, eo quod si inter ipsam alteratam brevem et sequentem longam staret semibrevis vel minima media, tunc loco illius alterate note posset poni longa binaria. Nec a parte ante, quia stat loco longe binarie. Cum ergo huiusmodi longa, cuius ipsa vicaria est, non posset imperfici a parte ante, sequitur quod nec brevis illa.

Ad hanc questionem respondit Johannes de Muris in suo tractatu de hac materia, quod imperfici potest ex utraque parte mediate, ipsa tamen remanente alterata. Hoc idem dicit de longa ante longam quod utrobique potest imperfici, ipsa nihilominus remanente perfecta. Sed dicit quod huiusmodi imperfectio per partem fit remotam, in quam non immediate resolubilis est, sed mediate, puta per semibrevis vel minimam, non autem per partem propinquam utpote brevem. Et dicit: quamdiu enim non per partem propinquam imperficatur, ipsa remanet sub numero ternario. Sic ergo secundum

than he wanted [that is, perfected *ante similem*], but by two breves of which the second must be altered, that is, sung twice in one [continuous] pitch. And this is the rule: in perfect modus, whenever two breves occur between two longas, the second is altered; but if five, the fifth shall be altered, [and] if eight, the eighth, providing that the last two be separated from the preceding ones by a dot of division. The same is true of semibrevis and minimis. Necessity compels us, therefore, to posit this rule along with the previous one, and alteration shall never take place except in perfect song. This note must be altered in any location where a longer one could be written in its place: for one does not notate alteration except when compelled by necessity. In this regard the dot differs from the longa [as an agent of perfection and alteration]: for a note is not altered before a dot like it is before a note.

Concerning the altered note the question arises if it may also be imperfected in any way. And it seems yes, because the composer would thus be able to sing with [perfect] tempus, so that the [breve] that is to be altered can be imperfected by a semibrevis or minim. And art must follow the conception, and not the conception the art: for figures are invented for the sake of song and not song for the sake of figures. But against this it may be argued that if [an altered note] were imperfected, this should be either *a parte ante* or *a parte post*. Not *a parte post*, for alteration would not be necessary in that case, as there would be a semibrevis or minim standing between the altered breve and the longa following it, in which case one could notate a binary longa in place of the altered note. Nor *a parte ante*, because it fills the place of a binary longa. Since that longa, of which it is the substitute, cannot be imperfected *a parte ante* [since it is perfected *ante similem*], it follows that neither [could] the breve.

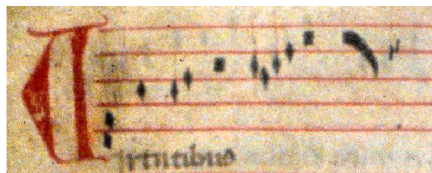
Johannes de Muris, in his treatise on this matter, responds to this question that [the note] can be imperfected in both mediate parts, with the [note nevertheless] remaining altered. He says the same about the longa before the longa, that it can be imperfected in both parts, with the [note] nevertheless remaining perfect. Yet he says that this kind of imperfection takes place by a remote part, into which it is reducible not immediately but rather only mediately, for example, by the semibrevis or minim, but not by a nearby part like the breve. And he says: as long as it is not imperfected by the nearby part, it remains under the ternary number. According to him, then, the

ipsum brevis altera in tempore perfecto imperfici potest ex utraque parte per unam semibreve et adhuc per quatuor minimas. Nam semibreves et minime imperficientes ipsam non sibi tollunt numerositatem binariam quominus altera vocari possit, nec per ipsas censebitur imperfecta quantum ad sui totalitatem, sed ad partes eius. Salva tamen reverentia tanti artificis, magis arbitror dicendum ipsam alteratam notam nullo modo imperfici debere, nec etiam longa ante longam. Ratio mea grossa est, sed in hac materia satis acuta, quia si imperfici possent qualitercumque, jam confusio, propter quam tollendam predictae regule tradite fuerunt, non cessaret, quin ymmo tanta adhuc fieri posset imperfectio quod nulla certitudo haberetur. Et ad argumentum quod ars imitatur naturam etc., verum est, in quantum potest. Sed fateor, quod hec ars adeo sufficienter tradi non possit ut totum sic in scriptis redigi possit quidquid in voce possibile sit proferre aut in instrumentis modulari, tunc enim sine dubio incertationes fierent supra modum. Et ob hoc cotidie perpendo meliores musicos opera suarum manuum in planioribus tradere scripturis, ne confusio seu nimia figurarum inculcatio tollat ipsius melodie plenitudinem, aut ipse cantor exterritus cantum sepeliat in obscuris.

Predictam regulam: longa ante longam valet tres, multi non solum strictissime servant propter causam antedictam, sed et extendere conantur, ut nota ante longiorem se in proximo genere sub imperfectione cadere possit, verbi gratia semibrevis ante brevem aut brevis ante longam. Et ideo loco talium utuntur minoribus notis quas alterandas aiunt. Verumtamen si longior sequens non esset longior de proximo genere, ut si post semibreve sequeretur longa, tunc demum semibreve imperficere liceret. Non autem si post semibreve sequeretur brevis. Sed cum novitas non sit ponenda sine necessitate, dico regulam tenendam ut verba jacent. Dicit enim sic: longa ante longam, non autem longa ante longiorem. Ut sit sensus: similis ante similem nullam capit imperfectionem. Et hoc in primis quatuor notulis illius excellentissimi moteti *Virtutibus* clare possumus contemplare. Ex hoc subinferri potest, quod numquam minima alteratur ante brevem, item nec semibrevis ante longam.

second [altered] breve can be imperfected in perfect tempus in either part by one semibreve and still by four minims. For the semibreves and minims that imperfect it do not take from it the binary numerosity by which it may be called *altera*, nor, because of them, shall it be deemed imperfect as far as its totality but only as far as its parts. Saving however the reverence of so great a maker of art, I think it better to state that the altered note must not be imperfected in any way, nor also the longa before the longa. My powers of reasoning are crude, but sharp enough in this matter, for if [those notes] could be imperfected in any which way, there would be no end to confusion (for the sake of whose elimination the aforesaid rules were handed down), on the contrary, there could be so much imperfection now that there was no certainty to be had at all. And as far as the argument that art imitates nature, etc., this is true, as far as [art] is able to. But I say that this art could not be handed down so sufficiently that all of it—anything that may be performed with the voice or played on instruments—could be written down, for then without doubt there would be uncertainties beyond measure. And because of this I esteem every day the better musicians, who hand down the works of their hands in plainer writings, lest confusion or too great a burden of figures would diminish the fullness of melodious sound, or the singer himself, struck with fear, would bury the song in darkness.

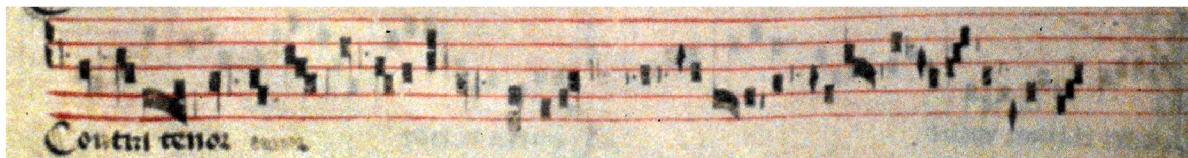
For this reason many people not only observe the aforesaid rule, that a longa before a longa is worth three, but also try to extend it, so that a note before a proximate longer one can fall into imperfection, for example, the semibreve before the breve, or the breve before the longa. And so they use in their place smaller notes which they claim are to be altered. However, if the longer [note] that follows would not be proximately longer, like when a longa follows the semibreve, then at last it would be permissible to imperfect the semibreve. But not if the semibreve were to be followed by a breve. But since novel things should not be posited without necessity, I say that the rule is to be held just as the words have it. For it says: long before long, not: long before longer. So that the meaning is: like before like does not suffer any imperfection. And we can clearly see this in the first four notes of that most excellent motetus *Virtutibus*. From this it can be inferred that the minim is never altered before the breve, also neither the semibreve before the longa.



motetus of *Impudenter circivivi/Virtutibus*
/Alma redemptoris mater (Ivrea, fol. 5r)

Occasione dictarum regularum subtilia quedam posterius inventa sunt, que sincopationes vel saltus usualiter dicuntur: ut ex quo similis ante similem imperfici nequeat, quod ideo nota primo loco posita trahitur non ad notam proximo, sed tertio vel ulteriori loco positam, et cum ea computatur, ut in contratenore de *Rex quem metrorum*.

By occasion of the said rules, certain subtle things have subsequently been invented which in everyday use are called syncopations or leaps, so that, since like before like cannot be imperfected, the note written in the very first position is not related to the next note, but rather to one written in third place or beyond, and is counted with it, as in the contratenor of *Rex quem metrorum*.



contratenor of *O canenda vulgo/Rex quem metrorum*—/Rex regnum (Ivrea, fol. 55r)

Similiter, si post minimam due vel plures sequantur semibreves, non tunc poterit huiusmodi minima computari cum prima, quia imperfici non potest propter regulam, pari ratione nec cum secunda, ergo cum ultima quam nihil sequitur, unde perfectionem nanciscatur. Quo casu multotiens opus est puncto divisionis ante minimam predictam, ne credatur ad notas protrahi anteriores. Posset etiam esse casus e contra, quod ipsa minima non notam sequentem, ymmo longe ipsam sequentem posset imperficere; ut si primo poneretur brevis, deinde due vel plures semibreves quarum ultima puncto perfectionis suffulta sit, et postremo ponatur minima, tunc minima cum neutrum valeat imperficere semibrevis, necessario habebit imperficere brevem. Sic ergo variis modis varie fiunt positiones. Hoc tamen advertendum, quod in proferendo huiusmodi cantum discat juvenis primo medias notas dividere et in divisione suas socias cuiuslibet note proxime attribuere; ut certificatus per

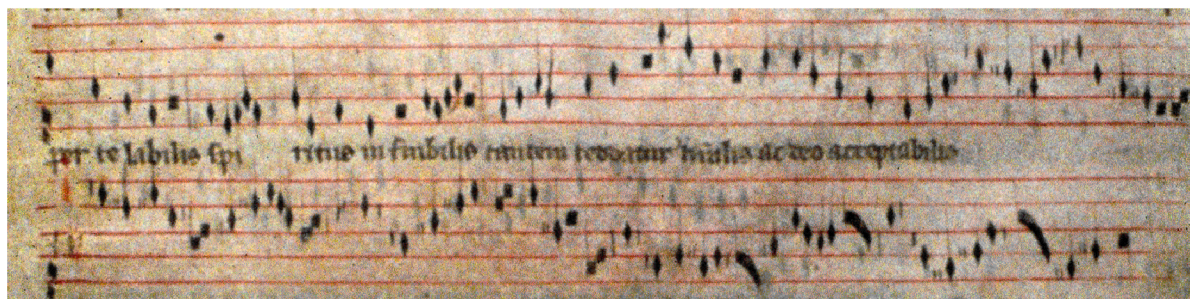
Likewise, if two or more semibreves follow the minim, then this minim cannot be counted with the first one, because [the latter] cannot be imperfected according to the [*similis ante similem*] rule, and for the same reason neither with the second, therefore with the last, which is not followed by any other note, and from which perfection may be obtained. In this case the dot of division is needed oftentimes before the aforesaid minim, lest it be believed to be related to the previous notes. But the contrary may also be the case, that this minim can imperfect not the following note but rather one following it at a long distance; so that when the brevis is written in first place, thereafter two or more semibreves, of which the last is supported by a dot of perfection, and finally one notates a minim, then the minim, since it can imperfect neither of the semibreves, shall of necessity have to imperfect the breve. Thus, therefore, they can be notated in several ways. Yet one should pay heed that in performing this song, a youth should learn firstly to divide the middle notes, and in this division assign their companions of whichever

numerum distinctum, possit paulatim postea dictum cantum sub continuitate proferre securus.

Nunc quia pause multam similitudinem habent cum notis, utrum ergo pause imperfici alterarive possint videamus. Et quidem dicendum est quod non, quasi in hoc pausis deferendum sit maxime propter difficultatem tollendam, que maior fieret in pausis si imperficerentur quam in notis. Difficilius siquidem est pausare quam cantare. Si ergo imperfectiones aut alterationes fierent in pausis, difficultas difficultati adderetur. Item imperfici est ab aliquo aliquid auferri, sed cum pausa nihil sit quia privationem importat, ergo ab ea nihil auferri potest. Hec forte fuit causa quod in moteto *Virtutibus* due pause duarum minimarum scribuntur et non una sola.

nearest note; so that, having ascertained the precise number, he may afterwards, little by little, perform the said song securely with continuity.

Now because rests have much similarity with notes, let us therefore see if rests, too, may be imperfected or altered. And it is to be said no, as if in this matter one must set aside rests, above all in order to remove difficulty, which would be greater in rests, if they were imperfected, than in notes. For indeed it is more difficult to be silent than to sing. So if there would be imperfections or alterations in rests, one would be adding a difficulty to a difficulty. Also, to be imperfected means that something is taken away from something, but since a rest is nothing, and contributes only privation, nothing can be taken from it. This was perhaps the reason why two rests of two minims are written in the motetus *Virtutibus* and not one alone.



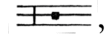
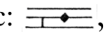
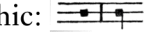

conclusion of the motetus of *Impudenter circūvi/Virtutibus/Alma redemptoris mater* (Ivrea, fol. 5r)

Item et in tenore *Flos virginum* due signantur pause semibreuium inter duas breves et neutra alteratur.

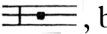
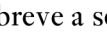
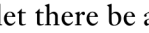
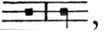
Also, in the tenor [of] *Flos virginum* two semibreve rests are notated between two breves, and neither is altered.



tenor of *Apta caro plumis ingenii/Flos virginum/Alma redemptoris mater* (Ivrea, fol. 5v)

Sic ergo ratione patet et auctoritate hoc fieri non debere. Sed contra videtur, quod *color* pausam cogat imperfici, ut in modo perfecto scribatur primo pausa longe binarie, deinde post pausam sequatur brevis, ut hic: , fiat postea incisio figurarum et mutetur modus in tempus, si autem in decisione facienda *color* servabitur, non multiplicabuntur figure, sed sub eodem numero remanebunt; et sequitur quod pro pausa longe fiet brevis et pro brevi semibrevis, ut hic: , ubi semibrevis imperficit pausam. Item videmus in aliis, quod pausa imperficiat notam. Si ergo equitas servabitur, debet et nota imperficere pausam. Eodem modo probatur in alterando: fiat prius brevis deinde pausa binaria et tertio loco longa, ut hic:  fiat postea diminutio totius et mutetur modus in tempus stante colore et scribatur ita:  videtur utique necessarium, si *color* servabitur et tempus perfectum erit, quod alteranda erit pausa. Non obstat ymmo, ut videtur, huiusmodi *color* repugnantiam implicaret, nam in uno casu vult *color* ut mutetur pausa longe binarie in pausam brevis imperfecte, in alio casu exigit ut eadem pausa vel consimilis mutetur in pausam semibrevis; et sic non de similibus simile iudicium servaretur. Quamobrem non magis existimo repugnare colori si pro una pausa in decisione facienda due pause statuatur. Consulo tamen pro colore in suo integro statu servando, quod non pausa longe binarie fiat, sed loco eius due pause brevium figurentur. Tunc enim partes in decisione facienda correspondentes ad sua tota se habebunt.

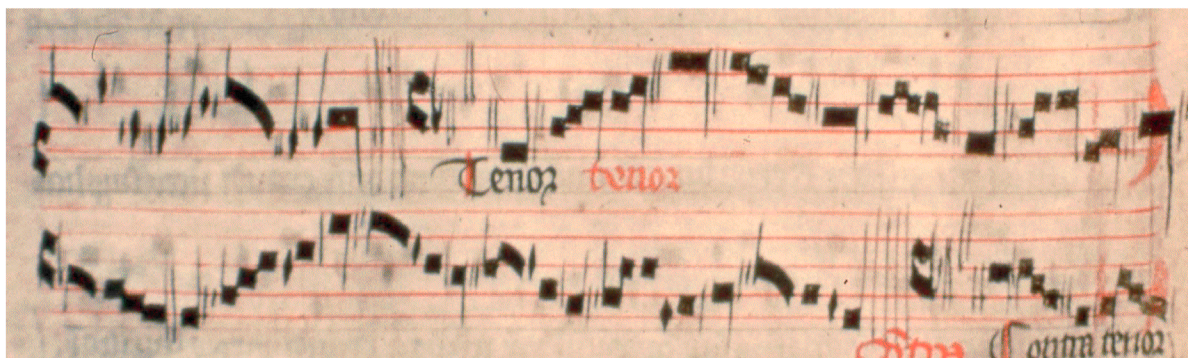
Quia de colore mentionem fecimus, ideo quid sit *color*, qualiter inventus fuit, et qualiter habet fieri, parum pertractemus. Est ergo *color*, prout in cantu utimur, aliquarum figurarum in aliqua similitudine comparabilitas. Fuit autem inventus *color*, ut figuram perditam vel negligenter positam per correspondentiam reperire valeamus. Et habet fieri hoc modo. Primo quidem inspicias quot corpora notarum habeas que *colorare* volueris. Sint verbi gratia triginta, hunc numerum multis modis dividere potes. Divide ipsum ergo, gratia exempli, in quinque partes equales, et tunc quelibet pars retinebit notas sex, nam sexies quinque triginta constituunt. Ordina

Thus it is apparent through reason and authority that this must not be done. But against this it would seem that *color* may force a rest to be imperfected, as when in perfect modus one writes at first a rest of a binary longa, then after the rest follows a breve, like so: , but thereafter let there be a cutting [diminution] of figures and let modus be changed into tempus. Now if in cutting the *color* shall be preserved, then the figures shall not be multiplied but rather shall remain the same number. It follows that for a longa rest there shall be a breve [rest], and for a breve a semibreve, as here: , where the semibreve imperfects the rest. Also we see in other things that a rest imperfects a note. So if equity shall be preserved, then a note must also [be able to] imperfect a rest. One can prove this in the same way for alteration: let there be a breve, then a binary rest, and in the third place a longa, like so: , and thereafter let there be diminution of the whole and let modus change into tempus while *color* remains, and let it be written thus: , and if the *color* shall be preserved and tempus shall be perfect, it certainly seems necessary that the rest must be altered. It is not a problem, it seems, that this *color* would present a contradiction, for in one case *color* dictates that a rest of binary longa be changed into an imperfect breve rest, but in the other it demands that the same [binary longa] rest or a similar one be changed into a semibreve rest; and consequently there would not be like judgement about like things. Therefore I do not think that it greatly contradicts the *color* if in making diminution one notates two rests for one rest. But I do counsel, in order that the *color* should keep its integral state, that there not be a binary longa rest, but in its place there be written two breve rests. For then the parts relate in correspondence to their wholes in making diminution.

Since we have referred to *colores*, let us therefore deal a little with what is *color*, how it was invented, and how it must be done. *Color*, therefore, as we use it in song, is a comparability of certain figures in a certain likeness. Now *color* was invented in order that we should be able to find, through correspondence, a figure that was lost or negligently written. And it is done in this way. First, you should indeed inspect how many bodies of notes you have that you shall want to *colorare*. Say there are thirty, for you can divide this number in many ways. Now divide it, for example, in five equal parts, and then each part shall retain six notes, for six times five makes thirty. Then arrange the first part in such a way that it has six.

ergo primam partem ut habeat sex. Sic ergo disposueris sex notas secunde partis ad similitudinem sex notarum in prima parte, ut prima nota correspondeat prime et secunda secunde. Et sic consequenter erit cantus ille colore iunctus. Isto modo fuit color factus in tenore *Virtutibus*. Cepit enim primo triginta corpora que divisit in partes quinque, quarum partium quelibet alteri similatur, quia post sex notas incipit septima que similis est note prime, item post duodecimam incipit tertiadecima que prime et septime similatur, et sic ulterius. Sed quia nimis brevis mansisset tenor si solis triginta corporibus fuisset usus, ergo adiunxit et alia triginta que medietatem faciunt aliorum et servatur in ipsis idem color qui prius.

Thus also you shall dispose six notes of the second part in likeness of the six notes in the first part, so that the first note would correspond to the first, and the second to the second. And continuing this way, the song shall be joined together by *color*. In the tenor [of] *Virtutibus*, *color* was made in this way. For [the composer] took, firstly, thirty [notational] bodies which he divided into five parts, each of which part was made in likeness of the others, for after six notes begins the seventh which is like the first notes, also after the twelfth begins the thirteenth, which is like to the first and seventh, and so on. But since the tenor shall have remained too short if it uses only thirty bodies, therefore he has added another thirty which make up half of the others, and in them the same *color* must be preserved as before.



tenor of *Impudenter circuivi/Virtutibus/Alma redemptoris mater* (Apt, fol. 14r)

Sic in tenore *Flos virginum* actor non contentus numero tricenario, ipsum numerum duplicavit ad corpora sexaginta. Sexagenarium autem numerum secuit in partes tres, et obtinuit quelibet pars notas viginti. Primas ergo viginti bene sic disposuit, quod consimilis dispositionis pulchrum colorem in sequentibus duabus partibus conservavit. Quia tamen color plus visui obicitur quam auditui, ideo non tantam curiositatem seu expensas intelligentium consulo circa ipsum fieri in hac materia, quo magis melodie derogetur et oculus occasionem habeat unde juxta sonum impropere possit auri.

Likewise, in the tenor [of] *Flos virginum* [see above, p. 12] the composer, not content with the number thirty, has doubled that number to sixty [notational] bodies. But he has divided the number sixty into three parts, and each part has received twenty notes. So the first twenty he has properly disposed in such a way that he has preserved a beautiful *color* of the same disposition in the subsequent two parts. But since *color* is more apparent to the sight than to the hearing, I do not counsel that one should devote so much curiosity or expend intellectual effort on them in this matter, in which one sooner diminishes melodious sound and gives opportunity to the eye, when according to sound one could hasten to the ear.

Viso de figuris notularum et de earum valoribus, consequenter dicturi de earum clavibus et clavium inventoribus, stilum acuamus. In sono quatuor considerari possunt, scilicet longitudo, brevitatis, acuties et gravitas. De longitudine et brevitate sonorum supradicta sufficient, propter acutiem et gravitatem claves invente sunt. Igitur in dubium verti non debet, quin longe ante clavium inventionem natura homines incitaverit ad cantum; sicut adhuc layci cantant, quamvis scientiam clavium ignorant. Nonne oculus prius colori incitur, quam intellectus concipiat unde fiat color? Sic auris prius ad sonum se vertit quam intellectus concipiat qua debeat clave locari.

Legimus autem David instituisse psalterio, Pitagoram legimus invenisse musicam; possibile est David Pythagoram precessisse. Ante hos duos, ut existimo, Tubal fuit de genere Caym, qui ut dicitur quarto Genesis, fuit pater canentium in cythara et organo. Et nondum legimus proportionem clavium inventas fuisse. Incitante ergo natura ceperunt homines in instrumentis aptare hoc quod prius erat in voce, et sic crescente subtilitate gradus inquirere inter voces. Et extentis quibusdam cordulis forte in psalterio vel cythara, sonum unius corde supra sonum alterius in tantum intendebant quod ad punctum quo dyapason residet pervenerunt. Et hunc sonum comparatum ad alium optimum dicebant, et ipsum inventis ceteris gradibus dyapason vocabant: a *dya* quod est de et *pan* quod est totum et sonus soni, quia omnes gradus armonicos postea includere sunt experti. Inter quas duas cordas, tertiam mediam extendebant, eam usque ad dyapente intendendo. Et compulsantes insimul eam cum prima, bonam melodiam invenerunt, quam postea dyapente dicebant: a *dya* quod est de et *penta* quod est quinque, eo quod postea invenerunt ipsam, inter quinque cordas statuendam. Sed cum tres supradictae cordule pariter compulsari non poterant quin tertium gradum redderent, puta gradum quem faciebat media corda ad acutiorem terminum ipsius dyapason, ad hunc aures prebebant et ipsum dyatesseron postea appellabant: a *dya* quod est de et *tesseron* quatuor, quia ipsum sub tetracordo id est sub quatuor cordis postea ponebant.

Having reviewed the figures of the notes and their values, let us now sharpen the pen for what is to be said about their keys and about the inventors of the keys. In sound there are four things that may be considered, namely, long duration, short duration, high pitch, and low pitch. As for long and short durations of sounds, let the things said above suffice. Keys were invented for the sake of high pitch and low pitch. [But] one must not, therefore, be in doubt, for nature incited humans to singing long before the invention of keys; just like laypersons still sing today, even though they have no knowledge of the science of keys. Is not the eye cast on color before the intellect understands whence color arises? In the same way the ear is bent to a sound before the intellect understands in which key it is to be located.

Now we read that David had instituted the psalter, we read that Pythagoras had invented music; it is possible that David came before Pythagoras. Before those two, I believe, there was Tubal, of the stock of Cain, who, as said in the fourth [book] of Genesis, was the father of those who sing on cythara and organ. And we do not read as yet that the proportions of the keys had been invented. At the inciting of nature, then, humans began to adapt to instruments what had previously been in the voice, and thus to search out, with increasing subtlety, the steps between voices. And having strung certain strings, perhaps on the psaltery or the cythara, they stretched the sound of one string above the sound of another to such a degree that they reached the point at which resides the diapason. And they said that this sound was better, compared to the other, and after they had found other steps as well they called it diapason, from *dya* which means “from,” and *pan* which means “all”, and *sonus* [which means] “sounds,” because they found out later that it includes all harmonic steps. Between those two strings they strung a third one in the middle, stretching it up to the diapente. And striking it together with the first, they discovered good melodious sound which they called diapente, from *dya* which means “from,” and *penta* which means “five,” because they discovered later on that it is to be positioned between five strings. But since the three aforesaid strings could not be struck together without yielding a third step, that is, the step between the middle string and the high pitch of that diapason, they listened to it carefully and then called it diatessaron, from *dya* which means “from,” and *tesseron*, “four,” because they afterwards placed it under the tetrachord, that is, under four strings.

Ecce qualiter circa inventionem graduum a certioribus procedebant et qualiter media corda respexit utramque. Non tamen quia ipsa fuerit media equaliter distans ab utraque distancia de qua loquimur, videlicet musicali. Est enim maior gradus dyapente quam dyatesseron, ut inferius patebit. Non autem adhuc tonus inventus est ex quo apparet quanto gradibus minores extant quod tanto industriam requirunt maiorem. Cum autem certificati essent de dyatesseron, indagantes ulterius, nedum ipsam dyatesseron supra ut prius, sed et infra dyapente disponebant: et sic tonum invenerunt. Ut si sint tres corde, quarum prima resolvit dyatesseron ad mediam et ad ultimam dyapente, sequitur quod media et ultima faciunt tonum. Hunc autem tonum gradum sufficientem dicebant. Nec in inventionem toni tres corde simul compulsabantur, sicut in inventionem dyatesseron, sed una post aliam successive. Certificati quidem de tono, statim tono tonum coniungentes, ipsum dytonum invenerunt inter tres cordas, quarum prima se habebat ad mediam sicut media ad tertiam. In inventionem dytoni oportet quod media corda equaliter participaverit utrumque extremum, nam omnes toni equales sunt, ut inferius demonstrabo. Invento autem dytono, statim semitonium minus prorupit. Est autem semitonium minus excessus quo dyatesseron superat distantiam dytonalem. Quod bene minus dicitur, quia directam medietatem toni nullatenus attingit, vel ideo minus, quia in ipso predecessores nostri ut in gradu minimo ultimate quieverunt.

Sic ergo inventis gradibus, cuilibet gradui nomen appropriaverunt. Dyatesseron tetracordum aiebant, quia tres gradus inter quatuor cordas concludebat. Dyapente penthacordum, eo quod tres tonos cum semitono continebat. Dyapason, eo quod ex omnibus gradibus constat simul captis.

Comma et apothome per eundem modum leviter inveniri poterant. Supposito namque quod certus sim de tono et semitono minore, ut supra dicebam, dividam tonum in duo semitonia minora et inveniam quod non complebunt tonum. Defectus ergo ille quo a tono deficiunt, comma vocatur. Semitonium autem minus cum commate faciunt apothomem. Apothome et minus semitonium

Behold how, in the discovery of steps, they proceeded from things that are more certain, and [also] how the middle string relates to both. Not, however, because that middle one is equally distant from either by the type of distance we are discussing, that is, a musical one. For the diapente is a larger step than the diatessaron, as shall be apparent below. But the tone had not as yet been invented, from which it is apparent that the smaller the steps are, the more work they require. But once they had established the diatessaron with certainty, then, investigating still further, they disposed that diatessaron not just above [the diapente] as before, but also beneath the diapente; and thus they discovered the tone. So if there are three strings, of which the first makes a diatessaron to the middle and a diapente to the last, it follows that the middle and the last make a tone. But they called this tone the step that is sufficient. They did not strike the three strings together in the invention of the tone, like [they had] in the discovery of the diatessaron, but one after the other, in succession. Having ascertained the tone, and immediately joining tone to tone, they discovered the ditone between three strings, of which the first relates to the middle as the middle to the third. But in the discovery of the ditone it is necessary that the middle string shall have participated equally with both outer ones, for all tones are equal, as I shall demonstrate below. Once the ditone had been invented, however, immediately the minor semitone burst forth. For the minor semitone is the distance by which the diatessaron exceeds the ditonal distance. And it is rightly called minor, because it does not attain the direct half of the tone, or minor because our ancestors finally ceased work with this one, as being the smallest step.

After the steps had thus been invented, they assigned names to each step. They called the diatessaron a tetrachord, because it included three steps between four strings, the diapente a pentachord, because it contained three tones and a semitone, [and finally] the diapason, because it consists of all steps taken together.

The comma and apothome could easily have been discovered in the same way. For if it is understood that I know the tone and the minor semitone, as I said [I did] above, I shall divide the tone into two minor semitones and shall discover that they do not add up to a complete tone. The amount by which they fall short of the tone is called the comma. But the minor semitone and the comma together make an apothome. The apothome and the minor

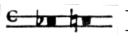
constituunt ipsum tonum. Potest ergo vocari apothome maius semitonium, eo quod plus continet quam medietatem toni. Hiis duobus, scilicet commati et apothome, veteres nullas speciales claves dederunt, quoniam forte gradus quos faciunt non apud eos melici fuerunt. Cogebantur tamen de eis inter cetera mentionem facere, eo quod alii gradus armonici reperiri non poterant, quin ipsum comma et per consequens apothome procederent in lucem. Qualiter de novo inventum sit comma, et apothomem posse inter claves poni inferius declarabo. Sed cum alii gradus non sint quam quos nos prediximus, vel qui ex predictis componibiles sint, leviter patet tonum in duas equales medietates et armonicas dividi non posse. Est enim comma secundum Boetium ultimum auditui subiiciens minimaque proportio. Deinde semitonium minus, deinde apothome, deinde duo semitonia minora, que a tono in commate deficiunt ut diximus, deinde tonus, qui tonus secundum Boetium continetur inter octo et novem. Sic ergo tonus non habet medietates armonicas. Item nec dyatesseron dyapenthe aut dyapason, quos omnes gradus ipsum semitonium minus cum commate mensurat equaliter et precise. Quasi semitonium minus et comma duo essent principia omnis melodie cantus dyatonici secundum quem se invicem respiciunt omnes claves manuales.

Quod antiquitas in cordis invenit, hoc posterioritas in clavibus disponebat. Sunt autem claves manuales viginti, scilicet g-ut, a-re, b-mi, etc. Quarum nomina litteras per se continent et sillabas, ut littera clavem et sillabe notas representent. Sillabe sex sunt, scilicet ut, re, mi, fa, sol, la. Que pro gradibus sufficiunt, et invente fuerunt in ymno *Ut queant laxis resonare fibris*, quamvis cantus illius ymni postea variatus sit. Littere vero septem sunt: a, b, c, d, f, g. Que ideo plures sunt quam sillabe, quia necesse est numerum cordarum seu clavium superare numerum graduum in unitate. Requirit enim quilibet gradus duas claves, et duo gradus tres claves, ut leviter patet intuenti. Quare autem manus incipit a g et non ab a, satis dissolvatur inferius. Quelibet clavis una littera contenta est, per quam ipsa cognoscatur; excepta decima, que b-fa ♯-mi dicitur et illa duplici littera signatur, scilicet b et ♯, quia virtutem in se continet duplicis

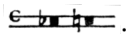
semitone together make a tone. So the apothome may be called the major semitone, because it contains more than half of the tone. The ancients did not assign any special keys to these two, that is, the comma and apothome, perhaps because the steps were not [considered] tuneful among them. Yet they were compelled to mention them, amongst other things, because other harmonic steps could not be identified unless the comma and consequently the apothome stepped forward into the light. I shall explain below how the comma may be newly found, and how the apothome can be placed among the keys. But since there are no steps other than those of which we have spoken, or than those that may be put together from them, it is readily apparent that the tone cannot be divided into two equal and harmonic halves. For according to Boethius the comma is the last thing, and the smallest proportion, still perceptible to the hearing. Then the minor semitone, then the apothome, then two minor semitones, which fall short of the tone by a comma, as we have said, then the tone, which tone, according to Boethius, is contained between eight and nine. Thus the tone does not have a harmonic mean. Also neither the diatessaron, diapente, or diapason, all of which are measured equally and precisely by the minor semitone step with comma—as though the minor semitone and the comma are the first principles of all melodious sound in diatonic song, according to which all keys of the hand are related to one another.


What the ancients discovered on strings, their successors disposed in keys. For there are twenty keys of the hand, namely, g-ut, a-re, b-mi, etc. Their names contain single letters and syllables, with the letter representing the key and the syllables notes. There are six syllables, namely, ut, re, mi, fa, sol, la. They suffice for the keys, and they were found in the hymn *Ut queant laxis resonare fibris*, although the tune of that hymn has varied later on. But there are seven letters: a, b, c, d, e, f, g, so there are more [letters] than there are syllables, for it is necessary that the number of strings or keys should exceed the number of steps by one. For each step requires two keys, and two steps three keys, as is readily apparent to the observer. But why the hand starts from g and not from a, will be made sufficiently transparent below. Each key is content with one letter by which it is recognized, except the tenth, which is called b-fa ♯-mi, and it is signed by two letters, namely b and ♯, because it contains within itself the

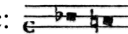
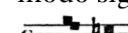
clavis, secundum quod mollius et durius sonus in illa clave fieri possit, id est gravius vel acutius. B rotundo sonus gravior attribuitur, sed acutior ♮ quadrato. Quod autem una clavis plures sillabas continet, hoc est propter diversos eiusdem clavis ad alias respectus. Respicit enim unaqueque aliam, cum qua dyatesseron adimplere possit. Verbi gratia sillaba ut in g-ut respicit fa in c-fa-ut; item re in a-re respicit sol in d-sol-re, et sic de aliis ut tota manus per tetracorda procedere videatur.


Claves autem manuales sic artificialiter ordinate sunt, ut inter quascumque duas proximas claves tonus sit vel semitonium minus. Tonus est distantia seu intervallum inter duos sonos prime clavis et secunde, scilicet inter ut et re, vel secunde et tertie, puta re et mi. Semitonium minus est intervallum tertie clavis et quarte, videlicet inter mi et fa. Antiquitus placuit dyatesseron sic dividi, ut semitonium minus sic collocaretur inter duos tonos, et secundum hoc manus incipit ab a-re. Postea vero placuit ut duo toni prederent et minus semitonium sequeretur, et secundum hoc clavis erat addita que g-ut appellabatur. Cuius diversitatis causa non bene video, nisi quia forte littera prima nominis huiusmodi inventoris G potuit exitisse. Dicit namque Guido in suo *Micrologio* g-ut clavem adiunctam esse, que littera ideo servat grecum sonum Gam, ne contingat in unam sillabam cum sillaba sequente ut. Inter mi et fa et e contra fa et mi undique semitonium minus resonat, excepto in b-fa ♮-mi. Ibi namque fa et mi apothomen reddunt, ac si ibidem dispositio manus inciperet permutari, forte quia media clavis est. Nam usque ad illam clavem ter dyatesseron precessit semitonio supra dytonum collocato, de cetero manus sic procedit, ut dytonus supra semitonium minus statuatur. Et sic videtur ibi sex tetracorda distingui per semitonium maius, forte ut apothome lucide videatur vel ut tritonus, licet durus sit, non omnino reiciatur. Potest ergo in clave b-fa ♮-mi signari apothome, ut hic:  In qua positione prima nota graviorem sonum representat quam secunda in semitonio maiore. Nam inter primam et c-sol-fa-ut tonus est, inter secundam vero et c-sol-fa-ut semitonium minus. Est ergo

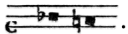
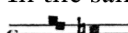
power of two keys, according to which there may be a softer and a harder sound in that key, that is, lower or higher. The lower sound is assigned to round b, but the higher to square ♮. The reason why a key contains more than one syllable is that there are different relationships between the same key and others [surrounding it]. For each has a relationship to another with which it can complete the diatessaron. For example, the syllable ut in g-ut relates to fa in c-fa-ut; also, re in a-re relates to sol in d-sol-re, and thus also the others, so that the whole hand would seem to proceed in tetrachords.

But the keys of the hand are artfully arranged in such a way that between any two neighboring keys there can be only either a tone or a minor semitone. The tone is the distance or interval between the two sounds of the first and second keys, that is, between ut and re, or of the second and third, that is, re and mi. The minor semitone is the interval between the third and the fourth keys, namely, between mi and fa. The ancients liked to divide the diatessaron in such a way that the minor semitone would be located between the two tones, and according to this the hand should start at a-re. But later on it was preferred that the two tones would come first and the minor semitone would follow, and accordingly a key was added which was called g-ut. But I do not see well the reason for that difference, except perhaps that the first letter of the inventor's name, G, should stand out. For Guido says in his *Micrologus* that g-ut is an adjunct key, which letter therefore preserves the Greek sound Gam, lest it should occur in one syllable with the syllable following being ut. Between mi and fa, and conversely fa and mi, resounds the minor semitone, everywhere except in b-fa ♮-mi. For in that location, fa and mi produce the apothome, as if the disposition of the hand began to change in that same place, perhaps because it is a middle key. For up to that key there have been three diatessara with the semitone placed on top of the ditone, but after that the hand proceeds with the ditone placed on top of the minor semitone. And thus it seems that six tetrachords are being distinguished there by the major semitone, perhaps in order that the apothome would appear lucidly, or that the tritone, even though it is hard, would not be altogether rejected. The apothome may therefore be signed in the key b-fa ♮-mi, like this: . In this notation the first note represents a sound that is lower than the second by a major semitone. For between the first and c-sol-fa-ut there is a tone, but between the second and c-sol-fa-ut a minor semitone. So the first is lower

maior gravitas prime quam secunde in excessu quo tonus excedit semitonium minus. Sed hoc est apothome per ea que dicta sunt, ergo inter dictas notas existit semitonium maius. Ex quo concludi potest, quod plus distent ille due note eiusdem clavis quam faciant hec due note in clavibus tamen diversis, ut hic:  Pro regula tenendum est utique, quod b-fa littera aggravat, et ♯ mi littera acuit quelibet suam quamlibet proximo sequentem spatio semitonii maioris.

Moderni maiori ducti lascivia, quasi nani super humeros gygantum plus longe respicientes quam veteres, tamquam cotidiana positione clavium fastiditi, ad subtiliores positiones dictas litteras b-fa ♯-mi etiam in aliis clavibus statuendo, se rationabiliter profundarunt, ut hic:  Que positio, si possibilis sit, tamen preter naturam manus est, quia in ipsa non altiori clavi datur nota acutior, ymmo e contra gravior, ut probatur. Nam si littera b-fa primam notam non prederet, distantia siquidem inter ipsam et c-sol-fa-ut dytonalis esset. Cum ergo per regulam huiusmodi distantia truncata sit per apothomem, remanet tantummodo tonus cum semitono minore. Preterea esset inter c-sol-fa-ut et secundam notam tonus precise, si ♯ quadratum removeretur, quod per suam presentiam sequentem notam acuit, ut ad tonum addat semitonium maius. Habito ergo respectu ad clavem c-sol-fa-ut, certum erit posteriorem notam acui supra primam illo excessu quo semitonium maius excedit ipsum minus, quod omnes dicunt esse comma. Eodem modo signari possunt et duo minora semitonia inter claves, ut hic:  Sic ergo novum genus modulaminis, quod nec dyatonicum nec cromaticum nec enarmonicum ymmo commaticum dicitur, posset inveniri. Dyatonicus cantus est quo dyatesseron dividitur in tonum et tonum et semitonium minus, ut est cantus communis. Chromaticus qui constat ex triemitonio inter duas cordas, et dicitur a cromo quod est color, quia aliqualem colorem sapit cum dyatonico. Conveniens namque erat tonum inter tres cordas signari, quia duos gradus continet, scilicet apothomem et semitonium minus. Sed quia triemitonium, id est duo minora semitonia et apothomem, signarent inter duas cordas tantum, ideo

than the second by the same distance that a tone has in excess of the minor semitone. And that, according to what was said before, is the apothome. Therefore between the said notes there is a major semitone. From this it may be concluded that these [two] notes in the same key [b-fa ♯-mi] are separated by a greater distance than, for example, these two notes in different keys: . Certainly we should hold as a rule that the letter b-fa lowers, and any [letter] ♯ mi raises, any [note] immediately following it by the space of a major semitone.

The moderns, led by greater wantonness, being, like dwarves upon the shoulders of giants, able to see farther than the ancients, have with the aid of reason moved on to more subtle notations, as though [they had] grown tired of the everyday placements of the keys, now placing the said letters b-fa ♯-mi also on other keys, like so: . Even if this notation is possible, it is however beyond the proper nature of the hand, because it does not give a higher [pitch] to a higher key, but rather a lower one, as is shown. For if the letter b-fa did not precede the first note, the distance between it and c-sol-fa-ut would be that of the ditone. But since that distance is truncated by an apothome, in accordance with the rule, there now remains only a tone plus minor semitone. Moreover, between c-sol-fa-ut and the second note there would be precisely one tone if the square ♯ would be removed. But by its presence [the square ♯] raises the note following it, adding a major semitone to the tone. Relative to the key c-sol-fa-ut, then, the second note is definitely raised above the first by the same [amount] by which the major semitone exceeds the minor one, which [amount] everybody calls the comma. In the same way two minor semitones can be signed between keys, as here: . In this way, then, one might be able to invent a new type of melody, which could be called, not diatonic, or chromatic, or enharmonic, but rather commatic. Diatonic song is that in which the diatessaron is divided into tone, tone, and semitone, and this is the common song. Chromatic is that which consists of a trihemitone between two strings, and it is so called after *cromus* which means “color,” because it smacks of a certain color with the diatonic. For since [the tone] comprises two steps, namely the apothome and the minor semitone, it was convenient to sign [it] between three strings. But because they signed the trihemitone, that is, two minor semitones plus apothome, only between two strings, therefore that

cantus ille incompositus dicebatur. Enarmonicus cantus constabat ex dyesi et dyesi et dytono. Dyesis medietas est limmatis, id est semitonii minoris, qui nullum gradum armonicum facit apud nos. Huic tamen minori semitono tres dabant cordas et dytono duas. Bene ergo Boetius hunc cantum enarmonicum dicebat, quasi extra omnem armoniam, et incompositum, eo quod durus dytonus duas solummodo cordas obtinuit et molle semitonium cordas tres, etc.

Postquam autem tonus primum sit intervallum quo claves manuales procedunt et uterque sonus ipsius toni gravis sit, sed alter eorum gravior, cum etiam uterque acutus sit, sed alter eorum acutior, videamus ergo in quantum alter sonorum debeat esse altero acutior seu alter altero gravior, ut sic circa omnes armonicos gradus certitudinem veram habeamus. Et quidem dicendum est quod in proportione sesquioctava prout hic Pictagoras demonstrative adinvenit. Supponendum quidem est, ut dixi, ab initio homines cantasse et in cantu prout natura dabat fecisse intervalla, id est descensus et ascensus. Delectabatur in hoc auris, sed mirabatur intellectus. Studens ergo Pictagoras intellectum quietare, transiit a casu domum cuiusdam fabri ubi malleos in sonis dare gradus audiit quales hactenus usi fuerunt homines in cantelenis. Statimque malleos ponderare incipiens, expertus est gravissimum malleum gravissimum dare sonum, quia dum in bilanta libraret contra illum quem cum ipso tonum constituit, invenit pondus illius octavam partem supra pondus alterius continere. Et dum sic per singulos operatus est, experientia artem fecit, nam concludendum reperit juxta proportiones ponderum proportiones esse sonorum. Sic ergo prius erat cantor quam musicus. Docuerat enim usus aurem prius certam esse de tono quam erat intellectus speculantis certus de toni proportione. Cumque sic Pytagoras in corporibus invenit, statim ad mathematice speciem, puta arismetricam, se retulit proportiones graduum in numeris statuendo. Dyapason inter duo et unum, que dupla proportio nuncupatur. Dyapente inter tria et duo, que sesquialtera dicitur, eo quod tria continent semel duo et eorum medietatem. Dyatesseron inter quatuor et tria, que proportionem faciunt sesquiterciam, eo quod quatuor semel tria continent et cum

[chromatic] song was said to be non-composite. Enharmonic song consisted of diesis, diesis, and ditone. The diesis is half a limma, that is, [half of] the minor semitone, which amongst us makes no harmonic step at all. For they gave this minor semitone three strings and the ditone two. So Boethius was right to call this song enharmonic, as it were: outside of all harmony, and non-composite, because the hard ditone has received only two strings, but the soft semitone three strings, etc.

After this, however, the tone is the first interval by which the keys of the hand proceed. And [given that, when] both of its sounds are low, one is lower, and when both are high, one of them higher, let us therefore determine the exact amount by which one of the two sounds must be higher than the other, or lower than the other, so that we may arrive at true certainty concerning all harmonic steps. And the answer must that [this amount resides] in the sesquioctave proportion, as Pythagoras discovered by way of demonstration. It is to be presupposed, as I said, that from the beginning humans have sung and made intervals as nature gave them, that is, descents and ascents. The ear delighted in this, yet the mind wondered. Pythagoras, then, seeking to quiet the mind, by chance went past the house of a smith where he heard hammers produce the [same] steps in sounds as humans had until then used in songs. He began at once to ponder the hammers, and determined by trial that the heaviest hammer produced the lowest sound. For when he weighed it in the balance against the one from which it differed by a tone, he discovered that its weight contained the eighth part more than the other weight. And then he proceeded with the individual [hammers], arriving at science by trial, for the conclusion he found was that that the proportions of the sounds were analogous to the proportions of the weights. In this way, then, the singer came before the musicus. For use had already taught the ear to be certain of the tone, before the mind of the inquirer [could be certain] of the proportion of the tone. And no sooner had Pythagoras found this in [material] bodies, or he turned to the mathematical species, that is, arithmetic, converting the proportions of the steps into numbers. Diapason between two and one, which is called the duple proportion. Diapente between three and two, which is called sesquialtera, for the reason that three contain one and a half times two. Diatessaron between four and three, which makes the sesquitercia proportion, because four contains three plus the third

hoc unitatem que est tertia pars ipsorum trium. Tonum vero invenit existere inter novem et octo, que sesquioctava dicitur, quia novem supra octo continet unitates, que unitas est octava pars de octo. Et sic de singulis aliis musicalibus intervallis.

Non solum juxta proportionem ponderum solidorum corporum, ut Pythagoras invenit, sed etiam ad similitudinem proportionum cordarum proportiones esse in sonis posteritas adinvenit. Docuit enim experientia equilongas cordas et equaliter extensas, ceteris paribus, equales, id est unisonos, dare sonos. Quo supposito, hoc quod sub multis cordis fecerant, postea in monocordo, id est in una corda, fieri demonstrabant in hunc modum. Extendatur corda in istrumento que pulsata sonum reddat et primam notam, puta ut, cuius corde primum punctum ad modum monacordi Boetii signetur g simplici, que littera primam clavem manualem indicat. Et gradatim per omnes claves cordam illam dividam donec ad g secundum, puta g-sol-re-ut, pervenero; ibidem usurus gg duplici, eo quod g-sol-re-ut ad g-ut dicitur clavis duplex.

Contentabor in divisione huiusmodi corde decem punctis, dumtaxat tedium punctorum abhorrendo, cum cognitis illis decem de facili proportio cuiuslibet ceterarum clavium, ex quibus tota manus confecta est, ad aliam poterit indagari. Sit gratia exempli tota corda gk. Hanc cordam dividam in plures partes, sic tamen, quod partes eque intense se habeant, ut prius; et visu percipiemus et auditu, quod ceteris paribus sicut se habebit tota corda ad eius partem in longitudine et brevitate, sic sonus totius ad sonum partis in acutie et gravitate.

Divisa namque tota gk corda in novem partes equales, quarum prima pars sit ga, sonabit ak tonum supra gk: a-re super g-ut, nam tota corda gk ad dictam partem ak se habet in proportione toni, scilicet sesquioctava. Divide secundo ak cordam in novem partes equales, quarum ab sit prima, sonabit utique bk tonum super ak: ♯ mi super a-re. Divide tertio totam gk cordam in quatuor partes equales, cuius quarta sit gc, sonabit autem ck dyatesseron super gk et per consequens semitonium minus super bk: c-fa-ut supra ♯-mi.

part of three. But he found that the tone exists between nine and eight, which is called sesquioctave, because it contains nine units [of one] over eight, which unit is the eighth part of eight. And likewise the other musical intervals, one by one.

But in subsequent generations discovered that proportions in sounds do not only correspond to the proportion of the weights of solid bodies, as Pythagoras discovered, but also to the proportions of strings. For experience has taught that, other things being equal, strings of equal length and equal tension produce equal, that is: unison, sounds. This being understood, they demonstrated that this—which [at first] they had done on many strings but thereafter on the monochord, that is, on one string—may be done in the following way. Let a string be strung on an instrument that, when struck, produces a sound [which is] the first note, say, ut, with whose string we will mark the first point single g after the manner of the monochord of Boethius, which letter indicates the first key of the hand. And I shall divide that string, step by step, through all keys, until I shall reach the second g, namely, g-sol-re-ut; in that same place double gg shall be used, because g-sol-re-ut is called the double key relative to g-ut.

In this division of the string I shall content myself with ten points, abhorring the tedium of points, with which ten, once they are established, it shall be easy to investigate the proportions, relative to another, of any of the other keys from which the whole hand is put together. For example, let the whole string be gk. I shall divide this string into several parts, but in such a way that the parts have the same tension, relative to each other, as before; and we shall perceive by seeing and hearing that, other things being equal, just as the whole string shall relate to any part in length, so [shall] the sound of the whole [relate] to the sound of the part in pitch.

For when the whole string gk is divided, [firstly,] into nine equal parts, of which the first part shall be ga, then ak shall sound a tone above gk: a-re above g-ut, for the whole string gj relates to the said part ak in the proportion of the tone, namely, sesquioctava. Now, secondly, divide the string ak into nine equal parts, of which ab shall be the first, and certainly bk shall sound a tone above ak: ♯ mi above a-re. Then, thirdly, divide the whole string g-k into four equal parts, of which the fourth be gc; and ck shall sound a diatessaron above gk, and consequently a minor semitone above bk: c-fa-ut above ♯ mi.

Divide quarto cordam gk in tres partes equales, quarum gd sit prima pars, sonabit dk dyapenthe ad cordam gk et per consequens d-sol-re supra c-fa-ut. Divide quinto dk cordam in novem partes equales, quarum sit de prima, faciet autem dk corda sesquioctavam proportionem ad ek, ergo tonum, videlicet e-la-mi supra d-sol-re. Divide sexto gk cordam in sedecim partes equales et contineat gf illarum partium septem, necesseque erit cordam fk continere residuas novem, sonabitque fk supra gk f-fa-ut supra g-ut. Divide septimo totam cordam gk in duas medietates, et sonabit tota corda dyapason ad eius medietatem, puta g-sol-re-ut supra g-ut. Si autem ad altiores claves velimus ascendere, operemur eodem modo circa secundam medietatem corde, sicut fecimus circa ipsam totam. Videlicet dividendo secundam medietatem in novem partes equales, et facient octo illarum partium tonum supra totam medietatem et per consequens tonum cum dyapason ad totam gk cordam. Et hoc modo gradatim procedendum est usque ad quadruplum dividendo totam cordam in quatuor partes, quarum ultima sit hk, que sonabit quadruplum super gk, puta secundum g-sol-re-ut super g-ut: tertium g super primum. Et quia cantus supra dyapason non est nisi reiteratio cantus infra dyapason cum additione nominis duple vel alterius proportionis ad duplum multiplicis, ideo in clave g-sol-re-ut littere precedentium reiterantur.

Explicit ars Johannis Boen de Rijnsborghm Hollandini ad rogatum quorundam juvenum sub brevitate formata.

Fourth, divide the string gk into three equal parts, of which gd be the first part, and dk shall sound the diapenthe relative to the string gk, and consequently d-sol-re above c-fa-ut. Fifth, divide the string dk into nine equal parts, of which the first is de, then the string dk shall make a sesquioctave proportion, and hence a tone, to ek, namely, e-la-mi above d-sol-re. Sixth, divide the string gk into sixteen equal parts, and let gd contain seven of those parts, and the string fk shall necessarily contain the remaining nine, and it shall sound fk above gk, f-fa-ut above g-ut. Seventh, divide the whole string gk into two halves, and the whole string shall sound the diapason relative to its half, that is, g-sol-re-ut above g-ut. But if we should wish to climb up to higher keys, we should operate in the same way with the second half of the string as we did with the whole first [string]. That is to say, by dividing the second half into nine equal parts, and eight of those parts shall make the tone above the whole half, and consequently a tone with diapason relative to the whole string gk. And in this way, one should proceed step by step, until the quadruple, dividing the whole string into four parts, of which the last be hk, which shall sound the quadruple above gk, that is, the second g-sol-re-ut above g-ut: the third g above the first. And since song above the diapason is nothing but the repetition of song beneath the octave with the addition of the name of dupla or of another proportion that is a multiple of the dupla, therefore the letters of the preceding ones are repeated in the key g-sol-re-ut.

Here ends the *Ars* of Johannes Boen of Rijnsburg in [the County of] Holland, conceived in brief form at the request of certain youths.