Rhythmic trees in Bodleian Library MS. Bodley 515: visual metaphor in musical diagrams

Music was a subject of great intellectual interest throughout the Middle Ages, as evidenced by the numerous surviving manuscripts containing music theoretical material. The diversity of subject material which is often labelled as 'music theory' can vary from purely speculative ideas about the world soul or the harmony of the spheres, right through to elementary instruction materials for complete beginners. Whilst a significant portion of this theoretical interest in music was dedicated to explorations of intervallic theory as an extension of mathematics in the *musica speculativa* tradition, we are fortunate that a significant number of music theory texts have survived which focus on a form of music theory connected, to a greater or lesser extent, to some everyday musical practices. Such texts can offer useful insights into the likely performance and teaching approaches and help us to understand how various musical fundamentals might have been conceptualized. There are, of course, instances of significant divergence where different authors approach similar concepts and ideas in a variety of ways, along with instances where theoretical writings extend well beyond the boundaries of everyday musical practice.

In representing, explaining, theorizing and demonstrating ephemeral phenomena, not always aural, in a predominantly text-based (and most-likely silent) form, authors and scribes made widespread use of diagrammatic, illustrative and exemplary content. As such, manuscripts containing musical theory often include a range of non-text materials to communicate ideas, represent musical space and encode sounds onto the silent page. These range from short passages of musical notation placed within the body of a treatise text in a variety of formats, through to diagrammatic constructions occupying entire openings that would not be out of place in arithmetic and architectural writings. Far from being supplemental material, these diagrams and examples are integral to communicating the concepts and principles music theory treatises tried to explain and, ultimately, preserve. In some cases, these materials may be even more important in illuminating contemporaneous conceptualisations of musical ideas than a written text.[1] They offer an insight into not only

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[1] On the potential value of studying musical examples, see Jeremy Yudkin and Todd Scott, 'Ut Hic: Announcing a Study of Musical Examples in Five Thirteenth-Century Music Treatises', *Essays on Medieval Music in Honor*

the key principles but, importantly, the ways these diagrams were understood by musical thinkers, writers and readers.

Of course, the utility of examples and diagrams in supporting the memorisation of key concepts was widely recognized in the Middle Ages, well beyond the boundaries of musical theory, especially as good argumentative practice modelled on the works of rhetorical masters.[2] Indeed, rhetorical texts can be immensely useful in helping us to understand approaches to musical exemplarity. As Book 3 of the *Rhetorica ad Herennium* (c. 90 BCE) – a text which was thought to be by Cicero in the fourteenth and fifteenth centuries and exerted incalculable influence on intellectual thought at the time – observes, 'we ought to set up images of a kind that can adhere longest in the memory, and we shall do so if we establish images as striking as possible.'[3] Though not dealing specifically with written treatises, nor those focused on music, the essence of this statement rings true in many music theory treatises of the Middle Ages; striking images help ideas – and, in the case of music, sound – to adhere in the memory. Book 4 of the *Rhetorica* goes on to provide a more detailed explanation of effective exemplification strategies, especially with regards to the utility of critiquing practice. For medieval music theorists, examples and diagrams provided effective means of articulating aspects of their ideas not easily communicated in text-based form. As white mensural notation came to dominate, examples and diagrams became perhaps the most efficient means of demonstrating developments in music-notational systems and slippage between theoretical precision and commonly-understood notational practices. [4]

Considering musical examples and diagrams as equally important to text-based content of a treatise, what we might call the *main* text, enables much deeper levels of insight to be reached regarding the pedagogical logic that underpin many music theory texts and into the readerships for such material. Wider scholarship on medieval writings has recognized the

of David G. Hughes, ed. Graeme M. Boone (Cambridge, MA: Harvard University Press, 1995), pp. 471–485. The study announced by Yudkin and Scott did not come to fruition, emphasising the need for studies such as that undertaken in this article.

[2] The seminal work of Mary Carruthers is particularly illustrative in this regard. See Mary Carruthers, *Book of Memory* (Cambridge: Cambridge University Press, 2008); Mary Carruthers and Jan Ziolkowski (eds.), *The Medieval Craft of Memory: An Anthology of Texts and Pictures* (Philadelphia, PA: University of Pennsylvania Press, 2002; Carruthers, *The Experience of Beauty in the Middle Ages* (Oxford: Oxford University Press, 2013).

[3] Translation from Joseph Dyer, 'Didactic images in a thirteenth-century French music theory treatise: the *Scientia artis musice* of Hélie Salomon', *Plainsong and Medieval Music*, vol. 28, no. 1, (2019), pp. 1–27, at p. 25. For a recent recontextualization of the *Rhetorica ad Herennium*, see Jennifer C. Hilder, 'Recontextualising the *Rhetorica ad Herennium*', PhD, University of Glasgow (2015): http://theses.gla.ac.uk/6968/.

[4] Adam Whittaker, *Musical Exemplarity in the Notational Treatises of Johannes Tinctoris* (c. 1435–1511), PhD, Birmingham City University (2016), pp. 155–157. On the connections between sight and sound in the late Middle Ages, see Emily Zazulia, *Where Sight Meets Sound: The Poetics of Late-Medieval Music Writing* (New York: Oxford University Press, 2021).

importance of illustrations, diagrams and images in the ways medieval authors communicated their points, and there is growing interest in the musicological community in this area.[5]

Although wider issues relating to musical exemplarity and diagrammatology extend beyond the scope of this short article, a particularly interesting area in terms of music theory is the representation of rhythm in musical notation.[6] Of key importance here are the ways in which note values could be subdivided and how music theorists chose to explain such phenomena.

Subdividing musical notes

In the fifteenth-century, as white mensural notation came to dominate scribal practice for measured music, theorists sought to represent visually the relationships between different note values, and their subdivisions into smaller notes. Central to this challenge was the notion that note shapes did not have entirely fixed proportional values, with each rhythmic level being divisible into two (imperfect) or three (perfect) parts depending on the mensural scheme deployed by a composer.[7]

At this time, one of the most difficult aspects to communicate in a theoretical text was that the same visual note shape could be divided into 2 or 3 parts. Thus, it was not possible from looking at the note shape in isolation to determine if it was imperfect/minor (divided into 2 parts), or perfect/major (divided into 3 parts). This challenge was further compounded by the ways in which musical context could also have an impact on the duration of note shapes through the rules of imperfection and alteration, whereby note values (and durations) could be rendered longer or shorter depending on the preceding or following musical material, including at remote parts.[8] The sheer number of factors involved could lead to

[5] On examples in music theory texts, see Adam Whittaker, 'Signposting Mutation in some Fourteenth- and Fifteenth-Century Music Theory Treatises', *Plainsong & Medieval Music*, 26/1 (April 2017), pp. 37–61; Whittaker, 'Tinctoris and *signa congruentiae*: a new perspective', *Early Music History* 38, pp. 269–303; Cristle Collins Judd, *Reading Renaissance Music Theory: Hearing with the Eyes* (Cambridge University Press, 2000). On wider traditions of diagrams in later medieval manuscripts see Kathleen L. Scott, *Tradition and Innovation in Later Medieval English Manuscripts* (London: The British Library, 2007), esp. pp. 1–32.

[6] On the wider issues of musical exemplarity and diagrammatology, see Matteo Nanni, 'Musikalische Diagrammatik: Eine karolingische vision', in *Von der Oralität zum SchriftBild: Visuelle Kultur und musikalische Notation (9.-13. Jahrhundert)*, eds. Nanni & Henkel (Brill: Leiden, 2020), pp. 53–81, and the recent research project B11 Materiale Formierungen musiktheoretischer Konzepte: Praxeologie eines Fachschrifttums im ausgehenden Mittelalter, within the SFB Materiale Textkulturen: https://www.materiale-textkulturen.de/teilprojekt.php?tp=B11&up=. For a broader framing of diagrammatology, see Sybille Krämer, *Figuration, Anschauung und Erkenntnis: Grundlinien einer Diagrammatologie* (Suhrkamp, 2016).

[7] Some musicians (and musical scribes) working in the late fifteenth-century took particular delight in using the ambiguity in note shapes to create interesting puzzles for singers to resolve.

[8] Woodley, Ronald, 'Syncopated Imperfection and Alteration in Tinctoris's Theoretical Writings' (2013), *Johannes Tinctoris: The Complete Theoretical Works*, Early Music Theory http://earlymusictheory.org/Tinctoris/Articles/SyncopatedImperfection/#.

immensely complex mental acrobatics in particularly challenging notational passages and musical examples, often constructed to the delight of later theorists. Most day-to-day instances of imperfection and alteration would become second nature to an experienced performer, but there were doubtless instances which left singers rather puzzled.[9] The multiple durational and rhythmic possibilities afforded by a single note shape is perhaps most famously explored in Johannes Ockeghem's *Missa prolationum*, which takes precisely this point as its organising principle.[10] It forms the basis of its counterpoint through using the same note shapes in bipartite and tripartite division. As Emily Zazulia notes, 'the whole conceit of mensural reinterpretation is to extract different values from the same note shapes.'[11] Many musicians took extraordinary delight in exploring the possibilities of this aspect.

However, communicating and explaining the sonic impact of this visual ambiguity in a theoretical context was not straightforward. Explaining such a phenomenon, whilst certainly possible in text-based form, would do little to imprint visually the divisions into the mind of a reader; after all, the note shapes were the symbols that musicians would engage with when reading notation. As such, a variety of diagrams and illustrations were deployed to help explain the relationships between rhythmic values and the connections between the different types of note shape. This was not a new challenge and there were some established solutions that a theorist and/or scribe could draw upon. For example, 'Torkesey's triangle' (Figure 1), found with relative frequency in English manuscripts dating from the fourteenth and fifteenth centuries represents the grouping of shorter time spans (or notes) to form longer time spans within a single triangular diagram, albeit using black rather than void notation.[12] Although technically demonstrating all the possible mensural subdivisions, it is focused more on expounding numerical properties rather than the relationships within the different

[9] The sheer complexity of the processing involved has been a central question of the AHRC-funded project, 'Interpreting the Mensural Notation of Music: An Expert System Based on the Theory of Johannes Tinctoris', hosted at Royal Birmingham Conservatoire between 2017 and 2022: https://gtr.ukri.org/projects?ref=AH%2FP013910%F21. Building on data from the theoretical works of Johannes Tinctoris, the project aimed to develop an online software system to interpret mensural notation.
[10] For an exploration of other works using a similar conceit, see William Watson, 'The Other *Missa Prolationum*', *Journal of Musicology*, (2020) 37/1, pp. 267–304.
[11] Zazulia, *Where Sight Meets Sound*, p. 55.
[12] For one of the earliest surviving Torkesey's triangle diagrams, see fol. 71^{v} of Oxford, Bodley MS 842. Image available at: https://digital.bodleian.ox.ac.uk/objects/ae728674-dd6b-4478-827f-d3134339e790/surfaces/dc75804c-91b0-4059-9d89-edc7b0631cb8/. It was theorised in Johannes Torkesey's *Trianguli et scuti declaration de proportionibus musice mensurabilis* and is prominent in the *Breviarum* regulare musicae by Torkesey's student Willelmus.

mensural combinations musicians would encounter.[13] Whilst an outline of the various degrees of perfection could be expressed numerically, Torkesey's triangle did not emphasize the manifestations of these in specific combinations of *modus*, *tempus* and *prolatio* as they would have been encountered in *real* music in the fifteenth century, nor was that its principal purpose.

[INSERT FIGURE 1 NEAR HERE]

Figure 1 - Torkesey's triangle, as presented in Oxford, Bodleian Library, MS. Bodley 842, fol. 71v.

Many later manuscripts made use of diagrams akin to those used by modern scholars to show manuscript stemma, following a branched 'tree' approach, connecting discussions of mensural subdivisions to the mensural schemes in use in contemporary repertoire.[14] The manuscript Bodleian Library, MS. Bodley 515 (henceforth, Bodley 515) makes extensive use of such diagrams, though with an important peculiarity which forms the main subject of this short article. Of course, the image of a tree had long been associated with medieval scholastic writing, especially in tracing the connections between different aspects of a broader idea, or in representing familial relationships. In terms of musical subject matter though, the idea of rhythmic 'trees' can be traced back at least as far as the mention of the *arbor* of Johannes de Burgundia through a reference in Petrus de Picardia's *Ars mottetorum compilata breviter* from the early fourteenth century.[15]

No diagram of the *arbor* attributed to Johannes de Burgundia survives in the sources that preserve Petrus's treatise, but the text-based description is sufficiently detailed to enable a reconstruction, as Karen Desmond has shown.[16] In the *arbor* attributed to this Johannes de Burgundia, about whom we know little else, each of the note shapes is described and subdivided. Along with these subdivisions, other branches show ligature combinations

[13] The triangle draws on Boethius's *De institutione arithmetica*, where a triangular form illustrates the grouping of the *unitas* into duple and triple groups. See Richard Cohn, 'Graph-Theoretic and Geometric Models of Music', in *Mathematical Conversations*, eds. Smith et al. (World Scientific Publishing, 2016), pp. 237 – 255. Cohn's chapter also presents a realisation of this diagram in modern note values (p. 243). I am grateful to the anonymous peer reviewer for their helpful suggestions in this regard.

[14] An example of branched stem diagrams can be found on fol. 44^{v} of Oxford, Bodleian Library, MS Digby 90, available here: https://digital.bodleian.ox.ac.uk/objects/989997df-1a6e-4ced-84bc-a17a8ba3e9ba/surfaces/d012f271-2916-40f6-b718-0e95da02aeec/.

[15] See Karen Desmond, *Music and the* moderni, *1300–1350: The* ars nova *in Theory and Practice* (Cambridge: Cambridge University Press, 2018), pp. 184–197; and Christian Berktold, 'Die *arbor* des Johannes de Burgundia', *Cantus Planus: International Musicological Society Study Group. Communication à la 6e rencontre d'Eger (1993)* (Budapest, 1995), pp. 653–664.

[16] Desmond, *Music and the* moderni, p. 188.

with/without propriety, perfection, or imperfection and rest formations. In essence, Johannes de Burgundia's *arbor* presents the component symbols of the mensural system as it stood in the early fourteenth century as a single illustration; a map of the components of musical rhythm if you will. The approach does show the different categories and notational shapes but, importantly for the present discussion, it is not organized in terms of a mensural hierarchy and, as such, does not articulate the visual and durational relationships between these elements pictorially.

Before exploring the specifics of musical tree diagrams, a brief consideration of the important associations that depictions of the tree have important associations with medieval memorisation practices helps to establish a richer context. One of the best-known instances of early medieval tree-based representations of knowledge can be found in the works of the twelfth-century theologian, Hugh of St Victor. The *arbor sapientiae* is introduced in the conclusion of the second book of his *De archa Noe*, where it is used as a means of representing the connections between different components of spiritual life.[17] Carruthers notes that this:

> 'is an avatar of the first *lignum uitae* and grows in holy hearts as in an invisible Paradise…The order of the phrases themselves follows that of the growth of the tree and its fruit: planting, watering, the seed sometimes being sterile, sometimes rooting, germinating, opening, growing, strengthening, greening, learning and branching, flowering, fruiting, ripening, being harvested, and finally eaten.'[18]

In essence, the form of the tree becomes the structure through which points are meant to be understood by a student. Allied to this, the wider influence of the *arbor porphyriana* ('Tree of Porphyry') as a method of visually representing dichotomous concepts means that few medieval scholars would have gone without encountering trees in manuscripts, though not necessarily in visual form.[19] Thus, using an image of a tree, broadly construed, as an organising principle was deep rooted in traditions of exemplarity for depicting relational components. It is therefore not surprising that the musical *arbor* took hold as a useful means of organisation. Though clearly of intellectual significance and implicitly a commonplace in

[17] See, Hugh of St Victor, *De archa Noe*, ed. Patrice Sicard, Vol. 176 of *Corpus Christianorum* (Brepols, 2001). On the wider use of tree imagery in *De archa Noe*, see Conrad Rudolph, *The Mystic Ark: Hugh of Saint Victor, Art, and Thought in the Twelfth Century* (Cambridge: Cambridge University Press, 2014), pp. 59–342.
[18] Carruthers, *Book of Memory*, pp. 258–259.
[19] Annemieke R. Verboon, 'The Medieval Tree of Porphyry: An Organic Structure of Logic' in: A. Worm and P. Salonis (eds.), *The Tree. Symbol, Allegory and Structural Device in Medieval Art and Thought. International Medieval Research, 20*. Turnhout (Brepols: 2014) pp. 83-101.

music theory texts, few copyists went to such great lengths to emphasize the arboreal aspects of tree diagrams, visually rendering leaves, a trunk, branches and roots. In this regard, Bodley 515 is something of an exception, both in its transmission of a key theoretical text and more widely in terms of musical exemplarity. It is therefore worthy of a more detailed consideration in this regard.

Visual depictions of musical space in Bodley 515

Bodley 515 is a modest volume of musical theory which probably dates from the early years of the fifteenth century. The source opens with some brief remarks and diagrams, including a version of Torkesey's triangle, which precedes the *Quatuor principalia*, a text of key importance in musical theory of this time. Luminita Florea Aluas offers a detailed description of the manuscript in her edition and translation of the *Quatuor principalia*. As such, I offer only a brief summary here.[20]

The manuscript measures 210 x 150mm and is dominated by the *Quatuor principalia*. It is a parchment manuscript, bound with boards and endleaves that are taken from a fifteenth-century Latin grammatical treatise which has some explanations in English.[21] The cover uses two pastedown leaves from a fourteenth-century Latin physical treatise. The manuscript was probably completed over some time, possibly by a single scribe, though there is sufficient variation that this could conceivably be the work of two scribes with highly similar hands.[22] There are several leaves and large sections missing from this manuscript, most likely caused by a combination of issues in copying and misbinding, along with the loss of leaves over time due to deterioration and extraction. At the top of fol. 4^{r} an annotation reads "There is a Copy of this Book in MS. Digby 90", the manuscript (also housed in the Bodleian) which contains a more complete text of the *Quatuor principalia*. Rather than dealing with the differences in exemplification strategies between Bodleian Library, MS Digby 90 and Bodley 515, which is itself an interesting line of investigation,[23] the present

[20] Luminita Florea Aluas, *The* Quatuor principalia musicae*: a critical edition and translation, with introduction and commentary* (PhD diss., Indiana University, 1996) PhD, 154–156. On the subject of the identity of the author-compiler of this text, see pp. 5–29.
[21] For the full catalogue description, see https://medieval.bodleian.ox.ac.uk/catalog/manuscript_1540.
[22] Fols. 1-3 were probably an addition made after the *Quatuor principalia* and *Metrologus* (the other large treatise in this MS). Fol. 1 is a set of glosses on the *Quatuor principalia*, with marginal symbols that one can only imagine were intended to link up with passages in the main text. However, the marginal symbols are not picked up later in the text and so this is suggestive of a planned cross-referencing strategy that was either aborted, or never completed.
[23] Oxford, Bodleian Library, MS Digby 90 is available complete in full-colour digital facsimile: https://digital.bodleian.ox.ac.uk/objects/989997df-1a6e-4ced-84bc-a17a8ba3e9ba/. The similarities and differences between Bodley 515 and Digby 90 extend beyond the present discussion, though I did address them

note deals specifically with the rhythmic diagrams in Bodley 515. As noted earlier, these diagrams are noteworthy because of the ways they combine theoretical material with strong visual markers. I argue that these tree diagrams serve to emphasise the pedagogical function of non-text content and raise the profile of the visual aspects of the theoretical points within the text-example relationship.

Tree diagrams in Bodley 515

The tree diagrams in Bodley 515 are certainly among the most visually striking series of diagrams in this manuscript. As noted earlier, a key issue in rhythmic relationships was the possibility of duple and triple subdivisions at each mensural level, all represented visually by the same note shape. In the earlier part of Bodley 515, the scribe provides several branch diagrams with some light decoration in the form of coloured squares, borders and circles that don't form integral parts of the illustration. Following these, we find a sequence of six images of trees in Chapter 24. Each maps visually the proportional relationships which underpin different mensural combinations of perfect/imperfect modus and tempus, and major/minor prolation. These trees are found across fols. 48^{r}–49^{v}, with the scribe placing initially two trees on each side of the folio and then allocating a folio side to each of the two remaining trees on the recto and verso of folio 49 respectively.[24] They are the most extended sequence of illustrations in the treatise and it is striking that such a significant amount of page space (and scribal time) was given over to these. The visual scheme of these tree diagrams is most clearly expressed in the final illustration of the chapter and so it is prudent to begin the analysis with this illustration.

[INSERT FIGURE 2 near here]

Figure 2 - Tree diagram showing all-perfect/major mensuration in the Quatuor principalia. *Oxford, Bodleian Library, MS. Bodley 515, fol. 49^{v}.*

This figure occupies the entirety of fol. 49^{v} and shows an intricate tree diagram, framed in rather attractive corniced coloured blocks, with a chequerboard effect at the base of the 'trunk', itself decorated with textured notches. Combined these might be taken to evoke a

briefly in the following blog post: http://blogs.bodleian.ox.ac.uk/theconveyor/exemplary-difference-examples-in-historic-music-theory/.

[24] On tree diagrams and the apparent theoretical move away from these see Desmond, *Music and the* moderni, *1300–1350*, pp. 160–197. See also, Annemieke Rosalinde Verboon, *Lines of Thought: Diagrammatic representation and the scientific texts of the arts faculty, 1200–1500*, pp. 35–88

sense of a courtyard garden, offering an opportunity for a reader to engage their embodied memory through an association with a familiar place; the chequerboard squares representing floor tiles, the corner flourishes mapping the boundaries of the walls, and the tree the focal point of the garden.[25] Beneath the diagram is the caption, 'Triplex longa de modo perfecto et de tempore perfecto et de maiori prolacione' [Triplex longa of perfect modus and perfect tempus and major prolation], indicating that the tree shows what can be summarized as an all-perfect mensuration. In practice, this mensural level means that each note value level is divided into three equal parts, resulting in each note shape having its maximum durational value. Note shapes are presented in black ink and connecting branches are presented in red ink. Three main circular arrangements show the breve, semibreve and minim levels of notation, with the scored lines clearly visible and the longs organized in a similarly circular manner. At one time, it seems there may have been a yellow pigmentation to the border around the diagram and in the chequerboard, which has since faded over time.

The diagram shows the tripartite proportional relationships between each subdivided note value in note shapes. At the base of the trunk we see a triplex longa (later known as a maxima) – the longest note value. This note shape is connected to three longs, which in turn are linked to three breves (squares without a stem). Each breve is linked to three semibreves (diamond note shapes) which are then each connected to three minims (diamond noteheads with ascending stems). Semiminims are not included in any of the tree diagrams, possibly due to their status as theoretical peculiarities for some theorists across the late Middle Ages.[26]

Such relationships could be indicated in other more straightforward types of schematic diagrams, as they are in Digby 90.[27] What is most important for the present discussion is that it takes the imagery of a tree to heart in this branched diagram. As noted earlier, trees were used widely in medieval treatises across a range of non-musical subjects as way of organising contents and showing relational maps in single visual snapshot. However, it is rare to see such efforts, certainly in a music theory manuscript, being dedicated to making this type of diagram look so much like a tree. Clearly the visual imprint of this diagram is key to both its organising principle and its communicative power in this manuscript. As Florea notes, 'the instructive function…was somewhat left behind, while the

[25] I intend to discuss this aspect more fully in a subsequent publication.
[26] On the changing place of the semiminim in theoretical discussions, see Karen Cook, *Theoretical Treatments of the Semiminim in a Changing Notational World c. 1315-c. 1440* (PhD Dissertation, Duke University, 2012).
[27] See note 14, above.

decorative function of the arbors began to shine through.'[28] The equivalent diagrams in MS Digby 90 are certainly clear, but lack the visual imprint that this rendering has. Even in what appears to be a rather plain manuscript, Bodley 515 offers a hidden gem in a technical diagram, constructed to communicate a theoretical precept in an aesthetically pleasing and memorable form. Unlike the example of the Guidonian Hand found earlier in this manuscript (fol. 23r), which provides the visual outline of the Hand and decorations similar to those described above, but without the necessary syllabic labels on the relevant joints, these trees are nice to look at, accurate musically and, by extension, useful for theoretical exposition.[29]

Rather than viewing such differences as inconsequential variations in the *pictor*'s practice that have little material effect on the diagram at hand, the relationship between text and example and therefore the reading experience, are altered through this different presentation. Viewing such a diagram in terms of the broader intellectual tradition of tree diagrams, rather than as a straightforward expression of rhythmic connections, renders a slightly altered relationship between the illustration and the specific mensural combinations in play. In capturing the pictorial essence of the tree, the illustrator visually maps the idea that smaller note values are like the branches of a larger mensural unit, with each note shape offering branches until the full mensural relationship *flowers*, to extend the metaphor. It emphasizes the notion that larger notes are related to smaller notes (and vice versa) in powerfully visual terms.[30] Indeed, mensural hierarchies in discant are compared to flowers in the *Compendium de discantu mensurabili* of the fourteenth-century theorist, Petrus dictus Palma ociosa (*fl.* 1336).[31]

This approach raises important questions for the ways contemporary readers conceptualized specific mensural relationships, with the totality of form here representing a discrete unit which itself can be broken down in smaller constituent parts. Although Florea's

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[28] Luminita Florea, '*Virtus scriptoris*: Steps towards a Typology of Illustration Borrowing in Music Theory Treatises of the Late Middle Ages and the Renaissance', *Yearbook of the Alamire Foundation*, 6 (2007), pp. 77–95, at p. 93.

[29] Such an omission renders the diagram relatively pointless in terms of music-theoretical exposition. This is an instance where the theoretical components were perhaps slightly overlooked in favour of the visual appearance of a diagram. An image can be viewed at https://digital.bodleian.ox.ac.uk/objects/cac53bd7-9c2f-4c18-b60b-9e176fb3d0c9/surfaces/2c2c4ff8-b8aa-4643-91bc-09fe055c1147/.

[30] For a broader discussion of different conceptualizations of musical time, see Dorit Tanay, *Noting Music, Marking Culture: the Intellectual Context of Rhythmic Notation, 1250–1400* (American Institute of Musicology, Hanssler Verlag, 1999).

[31] In the preface to Petrus dictus Palma ociosa's *Compendium*, he describes the chapter on mensural music as addressing the 'mensural flowers of music' [de floribus musicae mensurabilis]. On this, and the broader subtlety of flowers in Cistercian music theory, see Christian Thomas Leitmeir, 'Arguing with Spirituality against Spirituality. A Cistercian Apologia for Mensural Music by Petrus dictus Palma ociosa (1336)', *Archa Verbi*, vol. 4 (2007), pp. 155–199, esp. pp. 169–177.

reading can be taken to mean that this approach leaves behind, or gives less prominence to, the instructional aspects, the realisation of the tree in visual terms could serve to enhance the instructional nature of the specific theoretical point. By extension, this could support and develop comprehension of the logic of the mensural system in highly memorable and accessible form.

An examination of how the tree diagrams function as part of the illustrations and examples used in the wider context of this section of the treatise offers up further evidence of a concerted effort in the production process to enhance the aesthetic appeal of these specific diagrams. Beginning on fol. 45^{v}, Chapter 23 – that which precedes the chapter with our elaborate tree diagrams – deals with the subdivision of the 'simplex longa'. Over the course of this chapter, the scribe makes use of twenty branch diagrams, variously decorated with simple line highlights, encircled dots, along with coloured geometric patterns to fill small gaps in the page layout. These decorative features are akin to those seen elsewhere in the manuscript and were probably added after the text and diagrams had been copied onto an individual folio, though well within the grasp of even a modestly accomplished text scribe. These are not applied in a particularly uniform style and seem to represent more of an 'ad-hoc' approach to decoration; they have little impact on the theoretical demonstration itself. These diagrams, though clear and effective, lack something of the aesthetic and pictorial appeal of the tree discussed earlier. Might this be because they do not represent the totality of the mensural system at all levels, instead giving a glimpse into specific levels?

The opening two diagrams of Chapter 24 would seem, at first glance at least, to undermine this line of thinking. These two diagrams represent the different subdivisions of all-imperfect/minor mensurations save for the categorisation of duplex or triplex longa, meaning the division of the maxima into two or three parts, with all subsequent levels being cast under bipartite division. As such, they represent the total scope of two branches of mensural subdivision and one would expect the visual representation strategy to be consistent across all of the diagrams in this chapter given that they map similar phenomena. Though the different style of decoration does not have a direct impact on the theoretical content of the diagram itself, its visual register feels slightly different from the illustrations that follow and it seems that a reader would be less likely to recall these images with such ease.

Looking closely at the design scheme of the tree diagrams across fols. 48^{r}–49^{v} in conjunction with the marked change in visual representation of similar theoretical material, it seems that something went awry between the planning and production phases of these diagrams. Such a barebones format was not the original intention. Most likely, there was

originally a plan for each of the eight possible fully-fledged tree diagrams to occupy half a folio side, meaning that the two rectos and two versos (four sides) would provide sufficient space to accommodate the eight diagrams. Such a strategy is executed on the recto and verso of fol. 48, though some of the smaller note values are admittedly quite cramped in their presentation. The decorative red line that runs horizontally through the centre of fol. 49^{r} provides two equally sized spaces for separate tree diagrams, as is the case for on the verso of the opening (see Figure 3).

[INSERT FIGURE 3 NEAR HERE]

Figure 3 - Tree diagrams showing different subdivisions across mensural levels in Chapter 24 of the Quatuor principalia. Bodleian Library, MS. Bodley 515, fol. 48^{v}–49^{r}.

Both the upper and lower sections of the diagram on fol. 49^{r} are accentuated by the curved cornice decorations, suggesting that the page was set up to contain two trees, each occupying half of the diagram. The presence of such a line cutting through the middle of an illustration probably suggests that these decorative touches were added before the theoretical content had been copied in; adding this bisecting line after the note shapes had been placed on the tree in a form that occupies the entire page would certainly been curious.[32]

Considering these diagrams sequentially, rather than as isolated images, also points to subtle changes in the ways note shapes are connected to branches of the trees. Looking closely at the first tree on fol. 48^{r}, the trunk is marked out with 8 notches for principal branches, only one of which is connected to note shapes. The other 7 serve a more decorative function and do not take on an active role in the demonstration. Indeed, they arguably undermine the sense of the mensural levels being connected to tree branches as a way of representing the totality of the mensural system. This leads to some rather awkward lines being drawn, such as those on either side of the long in the bottom left-hand corner of the diagram, where an additional red line has had to be drawn to connect to the trunk. Comparing this with the final two trees in this set of diagram shows that some small tweaks in approach were made, with the greater precision in aligning branches from the trunk being an example of this process in action. Such changes might suggest that the format of these diagrams was being refined as material was being copied into the manuscript; a scribe or an illustrator had an idea of how they wanted to represent this material, or possibly even a model they were following from a different subject area, but some of the finer details were worked out *in situ*.

[32] This order in which material was written onto the page would also help to explain the Guidonian Hand diagram found on fol. 23^{r} which presents the outline of a hand shape, but fails to include the syllabic annotations to each joints.

Following this line of inquiry is perhaps suggestive of some deviation from an exemplar copy here, with those involved in copying the manuscript attempting something that was visually more ambitious than that indicated in the exemplar copy. It was only during the copying process that there was a realisation that some small modifications would need to be made.

Striking images that adhere long in the mind

The tree diagrams in Bodley 515 offer an eye-catching and memorable way of representing musical time in terms of note shapes as expressions of different mensural combinations. The imagery is striking and the visual register of this part of the manuscript is quite distinct from pages which are dominated by text content alone. The visual aspects of this approach are clearly interesting and demonstrate a recognition of the power of images to efficiently and clearly represent such a concept. The decision to present this information in this way also points to an ongoing interest in tree-based conceptualisations of musical time, extending well into the fifteenth century. It shows both that trees remained a useful visual representation of the connections between different parts of the mensural system, but also that this author and/or scribe was concerned primarily with the visual relationships between symbols, as they would have been encountered in notation. In this description the numerical properties and their cognate degrees of perfection, are of less importance. This is significant because a reader could refer back to these single-view snapshots to understand the relationships across each level of a mensuration they encountered in practice.

Looking more broadly, this exemplification strategy draws attention to a recognition that visual aspects of diagrams had a significant role to play in the explanation of theoretical ideas. Whilst a text may be similar to other copies, different diagrammatic approaches and illustrative content can shift text-example relationships and possibly change the reading experience for a hypothetical reader altogether. Such approaches are important for the memorisation of key information and could be transformative for understanding in a pedagogical context. With the tree diagrams from Bodley 515, we have a diagrammatic arrangement which demonstrates specific relationships in graphical form, without detailing the numerical implications of such divisions; these are focused on the relationships between note shapes as graphical forms in their own right rather than a preoccupation with numerical properties. Thus, whilst contemporaneous texts deploy different explanatory approaches, the Bodley 515 scribe/Pictor draws on a rich vein of medieval knowledge organisation through diagrammatic choices.

The communication of music-theoretical material, especially that which explored the multiplicities of meaning between symbols and resultant sound, required authors and scribes to think creatively about how they represented these ideas on the page (and beyond). Such material invites us to consider multiple reading modalities for the texts, examining the role that non-text content played, and continues to play, in articulating and explaining the theoretical precepts at hand. By looking at these materials in this way, our understanding of the readerships and modalities of reading associated with music theory may become slightly less hazy. Recalling the passage from the *Rhetorica ad Herennium* presented earlier, these images are certainly striking and they may adhere long in the memory. It is for this reason that the presentation of this material in Bodley 515 is significant and establishes a striking image that emphasises the importance of musical diagrams, especially in otherwise modest volumes.