Music, Architecture, Proportion and the Renaissance Way of Thinking

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During the Renaissance, the language of proportion became a unified theory capable of encompassing the understanding of the world within a coherent theological, philosophical and artistic framework. Music, with its harmonic paradigm, plays a key role in this construction. From the fifteenth century through to the end of the sixteenth century, architects and architectural theorists made reference, both in new treatises and commentaries to Vitruvius, to musical matters, transforming architecture into the *summa* of knowledge. The affinity to music was grounded on both a common mathematical and rhetoric gnosiology. Formerly conceived of as ideal, numbers became eloquent, reinforcing the quantitative paradigm of proportion with its qualitative one. The language of proportion as a compositional tool reveals the shift between the Middle Ages and the Renaissance: while the Medieval *tèchne* based on modular thinking provides *beauty* and *universal truth* using the technique of repetition, the Humanist paradigm of variety produces *pleasure* and *individual truth* – a condition typical of the premodern.

1. *Pro-portio*

Growth and diminution, unvarying transformation; constant recreation, in time and in space, which resolves the multiplicity in the permanent unitary expansion of form, material and, especially, relationships – this is proportion. In other words, proportion consists of 'invariance and permanence; how to overcome duality and diversity (the large and the small)' (Zellini 1999: 21). The word comes from the Greek αναλογία – according to Euclid (*Elements*, Book V; Heath 1908, vol. 2, 112–186), the equality between two relationships. In modern terms: a:b=c:d. This is the first specification we must bear in mind: meaning is not constructed through binomial intimacy (*logos*), but rather through the relationship established – due to their affinities or

differences – between four terms. This classification was as clear in the Latin and scholastic Middle Ages (which distinguished between *proportio* – the relationship between two quantities – and *proportionalitas*) as it was in the Renaissance. On occasion, the etymological proximity between these two terms by the emergence of the vernacular in the sciences induced 'mistranslations' (*ratio* replaced *proportio*, while the latter term was assigned the meaning of *proportionalitas*; Rommevaux 2011). The semantic confines are floating – the *Trivium* strives for the numerical exactitude of the *Quadrivium*, but the scientific confines were not unstable (pro-portio, i.e. 'owing (due) to its share').

The thoroughly modern reductionist view that has relegated proportion to an aesthetic judgement based on an absolute value has without doubt come about – whether in accordance or in reaction – thanks to the Enlightenment, the theory of relativity and post-modernism. Yet, it would not have been possible without Plato's emphasis on the significance of the nature of the relationship: 'the fairest bond is that which makes the most complete fusion of itself and the things which it combines; and proportion is best adapted to effect such a union' (*Timaeus*, 31c; Hamilton and Cairns 1961). In using the term 'fairest', Plato adds quality to quantity – an added value that in the Christian Middle Ages, inevitably, became a theological attribute: only that which is intrinsically good could be 'fair'. These two values cannot be separated, but it was only in the Renaissance that this philosophical substrate became a creative space, and *poiesis* completed the *poesis*. Just as in the events in *Genesis* (1, 1):

> Then God said, 'Let there be light,' and there was light. God saw that the light was good. God then separated the light from the darkness. God called the light 'day', and the darkness he called 'night'. (United States Conference of Catholic Bishops 2011, 5)

The narrative imprint remained the same, as did the mythopoietic content: 'God said / And there was / God saw that it was good / Evening came, and morning followed: the first, second, third, fourth, fifth and sixth day' (United States Conference of Catholic Bishops 2011, 5). The first divine act was the imposition of a limit to the unformed and potentially limitless:

> Limit is what makes every object exist concretely, by constantly endowing it with its proper form and individuality [. . .] The unlimited is precisely this sort of principle. It appears to be a negative and destructive principle. For disrupting the order imposed by limit clearly means bringing reality back to an amorphous and disorganized state. (Zellini 1980, 14–25; Zellini 2005, 4)

Division of time creates space, and if the latter, in its objectivization, is by definition limited, the irreducible temporal infinity finds direction, and therefore meaning (in this case eschatological) in Providence. This is why the divine act was also 'good' and 'fair': 'imposing order means measurement; measurement means creation' (von Dechend 1973, 361–399, 369). As the Wisdom's bible verse (11, 20) – recited *ad infinitum* throughout the Renaissance – tells us: *Omnia in mensura et numero et pondere disposuisti* (*Wisdom* 11, 20): 'But you have disposed all things by measure and number and weight' (United States Conference of Catholic Bishops 2011, 723),

wherein *disposition* ('arrangement') is a synonym of *proportion*: a limit is defined and constituted in the presence of another body or agent that measures it (Bostock and Waterfield 1996, 203 b 20). Once again, the relationship is not dual, but multiple; its primary aim is to maintain the variation unaltered.

Why all this talk of the Renaissance? Because the Renaissance was the period of history in which the language of proportion began to manifest itself as an instrument of creativity, as much from a philosophical perspective as from an intellectual and artistic one. A comparative ontology opened a space in which quantitative and qualitative processes were able to systematize our understanding of the world into a coherent whole. These developments occurred and converged before the invention of functional algebra and the '*mystère des proportions*' (Perrault 1683, xxviii), which is at the root of aesthetics and of taste, and would end up changing the Renaissance coordinates. According to the happy but already old intuition of Luca Pacioli (1509) in *Divina proportione*, proportion began to establish itself as a divine concept just as the tower clocks of the merchants started to prevail over the divine temporality of the church bells. Not that the other epochs of humanity had not been acquainted with, studied, or used this language of proportion. Ancient Greece was the cradle, but the late Roman and Latin Middle Ages the nursemaid. One example of such an offspring is the liberal arts; the common mathematical root of the scientific *Quadrivium* – arithmetic, geometry, music and astronomy – exemplifies the analogical relationship without it being emancipated from its symbolic valence: this explains that, not the other way round. Instead, in the Renaissance it became a unified theory capable, like modern physics, 'of describing nature's forces within a single, all-encompassing, coherent framework' (Greene 1999, ix). This is echoed in Giuseppe Cardano's *Opus novum de proportionibus numerorum* (1570), and Johannes Kepler's *Harmonices mundi* (1619) – the last attempts to describe a closed and coherent world (Koyré 1957) before the *horror vacui* intuited and heard by Pascal had the ascendency.

As we will see, music played a key role in this construction. Proportion is the foundation upon which the harmonic principles were built that define the nature (consonance or dissonance) of sounds in terms of the Pythagorean *tetraktys*: 1:2, *diapason*, an interval of an octave; 2:3 *diapente*, an interval of a fifth; 3:4, *diatessaron*, an interval of a fourth – a musical experience that generates and returns to a philosophical experience. However, the language of proportion has an even more technical value: it was the basis for the division of time (definition of the different time signatures – correlated horizontally and synchronized vertically) and the invention of time-related notation, as opposed to the prosodic notation used in monodical liturgical (Gregorian) chants. It is true that the Pythagorean ratio is the legacy of the ancient Greeks – the Platonic and Pythagorean doctrine of musical intervals – and the Middle Ages (through Boethius), yet time signatures and the invention of notation were distinctly Renaissance processes. Although these had already begun in the fourteenth century, in the 1300s they were still labouring under the aegis of *mensura*, rather than *proportio*. Only later would proportion be employed by Prosdocimo de Beldemandis (*Tractatus practice cantus mensurabilis*, 1408), Ugolino da Orvieto

(*Declaratio musicae disciplinae*, about 1430–1440), John Hothby (*Regulae cantus mensurati*, mid–late-1400s) and Georg Eber von Aibling (*Sequuntur proportiones*, mid–late-1400s). They were proponents of a continental movement that would reach its zenith near the end of the fifteenth century in the *Proportionale musices* by Johannes Tinctoris (1472) (Busse Berger 1993).

More evidence of the pre-eminence of Humanist thought is provided by the emancipation of two disciplines that had hitherto been relegated to the category of an *ars mechanicae*: perspective and architecture; from the fifteenth century onwards, these two were finally granted the lofty status of *scientiae*. First and foremost, there was perspective. This was the proportion that measured, on the plane of a cross-section of a pyramid, with respect to Giotto's model, the distance between the *perspectiva articifialis* of Brunelleschi, Leon Battista Alberti (1404–1472) and Piero della Francesca (c. 1410–1492), and the *perspectiva naturalis* that characterized the Middle Ages – the vanishing point that fixes the visual horizon, the space occupied by shapes, and the interval that separates them from the eye of the beholder (Harries 2001). And then there was architecture, which, by laying down the rules for constructing not just buildings, but buildings that would reflect society, went beyond the category of art, becoming its *summa*. (Compare, for example, the only treatise to survive from the Roman era – Vitruvius' *De architectura* – and the first Renaissance treatise – Alberti's *De re aedificatoria* – 'the problem of building [a world]'; Choay 2006). The adoption of a musical reference by successive architects and architectural theorists from the fifteenth century onwards demonstrates how, in reality, the concept of proportion can alter nature. Quality began to catch up with quantity and unexpectedly revealed a condition of relationships, and therefore of feeling (Perniola 1991), that was rhetorical rather than mathematical, making it entirely pre-modern.

2. Architecture and Music

Vitruvius listed musical science among the disciplines that an architect should have some knowledge of (alongside geometry, optics, arithmetic, history, medicine, law, and astronomy) (*De architectura* I, 1; Morgan 1914). Furthermore, the fourth chapter of the fifth book of his *De architectura* is entirely dedicated to Aristoxenus' theories on harmonics. However, despite what certain historians, especially Medievalists, have concluded from their reading of the sources – occasionally overreaching in their eagerness to bolster their Pythagorean and Platonic worldview (Zara 2013) – the hierarchy of Vitruvian knowledge neither mirrors nor respects the quadrivial order; instead the *dictum* is encyclopaedic, lending to the architect the theoretical support he needs: 'The architect should be equipped with knowledge of many branches of study and varied kinds of learning' (*De architectura* I, 1; Morgan 1914, 3). Nevertheless, Vitruvius distinguishes between the competences of the different types of learning. For example, if physicians and musicians could compare the rhythmical beat of the pulse and its metrical movement, 'if there is a wound to be healed or

a sick man to be saved from danger, the musician will not call, for the business will be appropriate to the physician' (*De architectura* I, 1; Morgan 1914, 5). It is significant that Vitruvius placed the more terrestrial Aristoxenus, who used his ears rather than his intellect as organs of judgement, before the 'divine' Pythagoras (Walden 2014). The reasons for this are acoustic: the musical *ratio* served primarily to establish the distance, determined according to the type of Greek tetrachord (enharmonic, chromatic or diatonic) of the *echèia* (ἠχεῖα) – bronze or copper resonators used to amplify the voice of actors (*De architectura* V, 5; Morgan 1914, 143–146). Likewise, musical knowledge was also necessary to calculate the tension in the strings of catapults and other war machines in order to ensure a longer range, and for the construction of musical instruments like the water organ (*De architectura* X, 13, 15–17; Morgan 1914, 299–309). In particular, however, Vitruvius' architecture was based on faithful anthropomorphism: man is the measure of the world (McEwen 2003), and proportion was the synthesis of the design. Nevertheless, translations of his work produced in the late fifteenth century, sanctioned by the *editio princeps* established by Fra Giocondo and sent to press in 1511, promoted the language of proportion as an essential tool in architectural design – in a philological mix-up, '*ratione pro portione*' ('in function of reason') now read as '*ratione proportionis*' ('according to the principle of proportion') (Caye 2014).

Rudolf Wittkower, a German art historian who taught at the Warburg Institute, in his still influential work *Architectural Principles in the Age of Humanism*, placed architectural proportions under the aegis of musical numbering, making the harmonic – rather than the geometric or arithmetic – mean the alpha and the omega of architectural form; Renaissance musical theory, articulated in terms of spatial organization, provided architecture and architects with an ancient, and therefore legitimate, harmonical paradigm (Wittkower 1949). This interpretation was based on two foundation stones. The first of these is the *Memoriale per condur la fabrica della Chiesa […] Sancti Francisci a Vinea Venetiarum*, dated 1 April 1535 and written by the Franciscan monk Francesco Zorzi (Francesco Giorgi Veneto, 1466–1540). This work was commissioned by Andrea Gritti, Doge of Venice, to correct – according to the '*consonantissime proportioni*' ('most fitting proportions') – the presumed errors in the blueprint designed by Jacopo Sansovino, his official architect (Foscari and Tafuri 1983). Further support for this theory comes from an assertion made by Alberti, according to whom the rule of *finitio* (together with *numerus* and *collocatio*, the categories at the root of building design) was taken directly from music theory:

> The very same numbers that cause sounds to have *concinnitas*, pleasing to the ears, can also fill the eyes and mind with wondrous delight. From musicians therefore who have already examined such numbers thoroughly, or from those objects in which Nature has displayed some evident and noble quality, the whole method of outlining is derived. (*De re aedificatoria* IX, 5)

Thus, a principal expounded by Alberti was applied to real-world building design by Zorzi, almost a hundred years later. Zorzi's work was subsequently the inspiration

for the French architect Philibert De l'Orme who announced that he would focus on divine (and therefore musical) proportion in his sequel to his treatise *Premier tome de l'architecture* (1567); however, this second volume, owing to his premature death, never saw the light of day. On a European scale, there was the far more influential Andrea Palladio, whose *I quattro libri dell'architettura* (1570), although devoid of any gnostic or sapiential framework (as he was taught by the humanist Gian Giorgio Trissino), reveals his use of the harmonic mean in the dimensions of his buildings (a profane counterweight to the Christian sacrality of the time: the microcosm reflecting the macrocosm may not have been univocal, but it was pervasive). Even though the sparse and technical prose of Palladio in *I quattro libri* leaves little room for speculation, his designs are more explicit in his notes for the construction of Brescia Cathedral, in which he states that 'just as the proportions of voices are harmony to the ears, so those of measurement are to the eyes' (Boucher 1994, 239). These words echo those of his mentor, Daniele Barbaro – a *genio puerissimo* of the Venetian aristocracy, elected Patriarch of Aquileia, translator of Aristotle and Porphyry, editor of his uncle Ermolao Barbaro's translation of *Nichomachean Ethics*. In the three comments he published on Vitruvius' *De architectura*, in the vernacular (1556, 1567) and in Latin (1567) he states: 'that which is consonant to the ears is beautiful to the eyes [...] and those proportions, those that in voices give delight to the ears are the same as those that, when applied to bodies, delight the eyes' (Barbaro 1567; author's own translation). Barbaro's words clearly echoed Alberti's *dictum* (mentioned above), as did the letter Alberti wrote to Matteo de' Pasti at the site of the Tempio Malatestiano at Rimini, asking him not to alter the initial specifications of his design otherwise 'all that harmony is destroyed' (Grayson 1999, 255). The echo continued to resonate throughout the century and beyond, until it reached George Hersey, who, in an ahistorical and anachronistic historiographical paroxysm, interpreted this musical analogy so literally that he transposed the dimensions of Bernini's St. Peter's Baldacchin into a melody (in F minor) in duple metre, based on a linear correspondence between musical intervals and architectural measurements; not even Charles-Estienne Briseux, in his 1752 *Traité du beau essentiel*, had thought to formalize the analogy to such an extent (Hersey 2000, 22–51). If truth be told, however, such playful excesses may be more attributable to the followers – often more orthodox than their teacher – rather than Wittkower, who was, in reality, immune to such comparisons. In his opinion this was a symptom of corruption of the organic ideal proposed by the Renaissance masters.

Such methodological distortion did not spare even the opposite but complementary field – musicology. Let us start with the most emblematic and representative case, the isorhythmic motet *Nuper rosarum flores / Terribilis est locus iste*. Over time, thanks to the debate that has been raging for over 40 years, this motet has become a historical and historiographical paradigm that is occasionally established between a musical composition and a building. The motet itself was composed by Guillaume Du Fay – *magister cantus* of Pope Eugene IV's chapel, to celebrate the consecration of Florence Cathedral – which took place on 25 March 1436. It was this building itself, topped by Brunelleschi's famous dome, which is said to have been the inspiration behind the motet. This theory,

proposed by Charles Warren in 1973, hypothesized that there was a correlation between the sections of the motet and the dimensions of the cathedral (nave, apse, transept, dome height) due to their shared mensural, temporal and spatial relationships – 6:4:2:3 – derived from the fact that they follow the same pattern: 28 musical *breves* corresponds to 28 Florentine *braccia* (a measurement of about two feet). This theory was explicitly based on the epistemological model proposed by Wittkower (Warren 1973), and, as mentioned, has been at the centre of a storm of corrections, refutations, and amendments over the years, with still no sign of a consensus (Wright 1994; Trachtenberg 2001).

3. From *Ratio* to *Oratio*

Whatever the styles, approaches and methods of architectural and musical critiques, there remains one incontrovertible fact: the essentially mathematical character of musical proportion taken as evidence in the architectural literature – the quantitative numerical nature of music. That being said, a fresh look at the sources would have paved the way to the exploration of new possibilities, which, although already remarked upon, have thus far fallen on deaf ears.

For example, Manfredo Tafuri, as always the pioneer, has already warned against ascribing to Alberti a Pythagorean approach, which he did not possess. Indeed, he was a Paduan of the Aristotelian school, by no means of Florentine Ficino's neo-platonic Academy (Tafuri 1992; Tafuri 2006). After this call, Luisa Zanoncelli demonstrated a general reliance on musical sources relating to Alberti that were indirect, if not entirely erroneous (Zanoncelli 1999; Zanoncelli 2007). Furthermore, Christine Smith brought to critical attention a passage of the *Profugiorum ab aerumna libri III* impregnated with Augustinian piety that had nothing whatsoever to do with numbering sounds (Smith 1992, 80–97). Indeed, a glance at Alberti's entire *corpus* reveals his sceptical view on the Pythagorean and Platonic schools – he scoffs at it at various points in his career. And what of the term *proportio*? In his *De re aedificatoria* it is mentioned only ten times in six different passages, and only three times in association with musical *mathesis* (IX, 6). In fact, this was dreamed up by the authors of the sixteenth century, first and foremost Cosimo Bartoli. His translation into the vernacular caused the designation of that which Alberti knew as *numerus* in the original Latin as *proportione* – mistranslation reproduced by all the modern editions, which erroneously render 'numerus', or 'mensura', or 'ratio', as 'proportion'. In reality, Alberti's Latin vocabulary is very precise: the notion of 'numerus', instead of 'proportio', returns to the Ciceronian 'aurium mensura', which points out metrical poetry and music, not musical proportion. As for *concinnitas*, the context is rhetorical, not mathematical. Equally, we have to reassess Alberti's appropriation of music, as well the mention of harmony in the letter to Matteo de' Pasti: while the quadrivial reference may be useful to grant the discipline of architecture the liberal status that it has hitherto lacked, it also honours the recipient of the message, requiring at the same time unconditional adherence. Moreover, it does not on any account alter the design's principle constitutents.

As for De l'Orme, we may have been too quick to liken his work to Zorzi's *Memoriale*. Indeed, a careful examination of the references cited by the two authors shows that they do not coincide at all. What is more, there are vast differences between the two in terms of their terminological, and therefore conceptual, framework. In *Épître aux lecteurs*, for example, De l'Orme only uses the lexeme *harmony* once, later to completely abandon it in favour of references to *acoustics* (Zara 2016). It is therefore more likely that the 'divine' he attached to 'proportion' was extrapolated from Pacioli's *De divina proportione*, which has nothing at all to do with music – for him, sight was more important than hearing. The case of Palladio is even more significant regarding the methodological approximation of the interdisciplinary approach: eight out of his 44 villas cannot be considered *pars pro toto*, just as the villa cannot be considered representative of Palladio's entire *oeuvre*. In fact, statistical analysis has demonstrated that the architect did use musical proportions, but his architectural vocabulary, his grammar, also included arithmetic and geometric proportions in equal measure (Howard and Longair 1982; Zara 2007).

It is not a case of debunking or minimizing a musical presence in architecture – indeed, this can in no way be denied. However, by concentrating solely on the numerical – quantitative – aspect, we have forgotten that which underlies it: the qualitative aspect. In this regard, there can be no more elegant prose than that of Barbaro; he was, as mentioned above, ever faithful to Alberti's Aristotelean stance on the importance of both hearing and sight, but differed in his idea of the agent that mediated between the two: 'And just as 'oration' (*oratione*) *possesses* different forms and ideas to satisfy the ear, Architecture too has its own aspects and forms to satisfy the eyes' (Zara 2017). These forms, aspects and ideas were dictated not by the Pythagorean and Platonic doctrine of consonant relationships between musical numbers – *diapason*, *diapente*, *diatessaron* – but rather by the dissonant intervals (like the semi-tone), which are produced by one of the four fundamental operations applied to consonant relations, namely substraction, addition, multiplication and division:

> I then say to you that the tone and semi-tone, although they do not make Harmony and consonance, they are both worthy of consideration, because they distinguish the spaces of consonance and measure the Musical intervals, both due to the robust consonance of the one and the other when they join together, and, finally, because one attributes to the other the force to move the emotions. (Barbaro 1567, 232; author's own translation)

This idea, unprecedented in the theoretical literature, could scarcely be more innovative or precise. It is indeed the position of the semi-tone within the musical range that establishes the *ethos* appropriate to each mode. The case histories have been heterogeneous and varied; over time each philosopher and theoretician has proposed their own classification, and the expression of some sentiment or character, which has sometimes been associated with one mode and sometimes with another. Nevertheless, its function remains unalterable, immovable and undoubted: 'to move the emotions' ('*commuovere gli affetti*'). In other words, how musical composition is founded on a primary mode is prescribed by what we want to express. This function

is not without obstacles, some of which were highlighted *ab origine* by Plato, who would only admit Dorian – cheerful and virile – and Phrygian – warlike and martial – modes into the repertoire of his ideal city; the first would serve to shape educational songs for the youth, and the second would be the basis of stirring battle hymns (*Republic* 398a1–399c4; Hamilton and Cairns 1961, 634–644). The number, which for Plato indicated the truth of his polyhedral ideals, in reality subsumed all that Plato himself excluded from his ideal society, namely the powers of persuasion of rhetoric, and poetry's ability to move the emotions and to convince, irrespective of the truth. Through its inclusion in the reflections on the foundations of the new discipline, Architecture – no longer the third branch of medieval *armatura* (together with *coementaria* and *venustatoria*) – from the specific perspective of the language of proportion, musical theory reflected this ambivalence in the Renaissance. Solely by adding a syllable, *ratio* became *oratio*, a manifestation of the shift from the mathematical to the rhetorical paradigm.

Indeed, it was in the sixteenth century that Vitruvius' treatise, from a much-criticized text (as was the Albertian approach), became – to paraphrase Pier Nicola Pagliara – a *canone* whose principles were founded on the theory of the Architectural Orders (Pagliara 1986). All the dimensions of a building can be traced back to a single unit of measurement: the radius of a column. The entire theoretical castle constructed on the topic of architecture during the Renaissance can be summed up by the debate on the proportions of the Architectural Orders, 'because these constitute the most in-depth and coherent expression of the principle of the rule that makes them commensurable' (Szambien 1986 36; author's own translation). At the same time, however, the formal definition of the Architectural Orders was closely linked to their anthropomorphic origins, whose anthropological and geographical underpinnings were historically detailed by Vitruvius: Doric, Ionic and Corinthian (*De architectura* IV, 1; Morgan 1914, 102–106). There existed another indissoluble association with precise and explicit rhetorical functions – soft, solid and delicate – in the definition of the expressive value of architectural elements (Onians 1988; Rykwert 1996).

And so we come to the other side, which we have not yet considered, in the form of the only treatise that contains any mention of architecture in all the musical output of the Renaissance. *L'antica musica ridotta alla moderna prattica* by Nicola Vicentino (1555), contemporary with Barbaro's commentary on Vitruvius, states:

> Moreover, architects often match in one edifice the diverse style of the structural orders, as is shown by the celebrated Vitruvius, who said that the Doric order may be accompanied by the Attic, and the Corinthian by the Ionic. They are so well connected and united that, even though the styles are diverse, nonetheless the expert artificer may use his judgement to construct the edifice and proportion it with various ornaments. Likewise, composers of music may use artifice to make various mixtures of fourths and fifths from other modes and thus to adorn the proportioned composition with a variety of steps according to the effects of the consonances applied to the words. (Maniates and Palisca 1996, 150)

Here, Vicentino draws a poietic parallel with the rules governing composition. However, in reality, the affinity between music and architecture built on both a common gnosiology between Orders and modes and a similarity in the respective creative processes, had already been formalised half a century before in Francesco Colonna's *Hypnerotomachia Poliphili* (1499). Written in the shade of the cloisters of the Franciscan monastery that Francesco Zorzi later passed through, Colonna's *Dream of Poliphilus* is a philosophical and philological work of literature, but also an informative source on architecture, and it has been critiqued as such (Borsi 1995). It has been declared so authoritative as to have misled the historians, who on at least two different occasions have hypothesized that it was written by Alberti (Lefaivre 1997; March 2015). In fact, despite the stylistic differences between Alberti's hand and Colonna's cryptic, mannered and voluptuous idiom (Nuovo 2007), its paternity – whether Venetian or Roman – has been long disputed, although now the evidence seems to favour the former. Even though the parallels between the Architectural Orders and musical modes is only hinted at by Colonna – without the carefully circumscribed, biunivocal transpositions of Vicentino – he does allude to their common expressive function; he ascribes the '*Dorio modo & tono di cantare*' (f. i^r) a similar role to that prescribed for the Doric Order in *De re aedificatoria*, '*ad laborem perennitetatemque aptius*' (IX, 5). Similarly, he assigns a Lydian mode to his song of Venus, whose temple was erected on Corinthian columns – both mode and Order befitting the goddess of love. However, how his Poliphilus assimilates the respective trades of architect and musician tells a very different story:

> This is why I have spoken in several places about the proper goal of architecture, which is its supreme invention: the harmonious establishment of the solid body of a building. After the architect has done this, he reduces it by minute divisions [*per minute divisioni el reduce*], just as the musician sets the scale [*intonatione*] and the largest unit of rhythm [*mensurato tempo*] before subdividing them proportionately [*concinnamente*] into chromaticisms and small notes. By analogy with this, the first rule that the architect must observe after the conception of the building is the square, which is subdivided to the smallest degree to give the building its harmony and consistency and to make the parts correlate with the whole. (Godwin 1999, 47)

Once again, the key lexis is '*concinnamente*', akin to Alberti also on his *divisare* ('devising') (*De re aedificatoria*, *Incipit*), and – indirectly – to the corresponding proportional analogy described by Francesco di Giorgio Martini (Maltese and Maltese-Degrassi 1967, 37–38). This excerpt proclaims the emancipation of the architect, who is compared not to the musician – an instrument player, a *cantor* from the Medieval tradition – but rather to the *musico* – a theorist capable of mastering both the vertical (the *intonatione*) and the horizontal (the *mensurato tempo*) of the *scientia musica*, via the implicit mental attribute that is notation (the *quadratura*). Remember that Alberti use the same Latin word, '*musico*', in the passage quoted above, once again wrongly translated as 'musician' (Rykwert *et al.* 1988, 305). This is a detail that should not be ignored: for Alberti, as for Colonna, the musical comparison changes the tone of the quadrivial legacy from the discipline to the architect. However, these borrowings aside, the importance lies elsewhere. Colonna implies that the Medieval

tèchne has been superseded by focusing on the change of paradigm from modular to unitary. By these means he demonstrates a rare and full awareness of the cultural processes underway: '*Lo Architecto perminute divisione el reduce*' (Godwin 1999, 47). Therefore, the architect no longer conforms to the medieval practice of stretching ropes *ad triangulum* or *ad quadratum* to produce geometric figures upon which the forms and dimensions of a building are constructed (as in the three hands evident in Villard de Honnecourt's thirteenth-century portfolio). Instead, he creates a standard – a measurement subject to the proportional unit upon which each part of the design is based. Likewise, the composer no longer defines *in extenso* the length of the composition on the *talea* – the rhythmic scheme – and *color* – the melody – of the voice of the *tenor*, the lowest voice; instead, on an unbroken *continuum*, the *cantus firmus* that has been organized by *talea* and *color* becomes a punctual support to the harmony. The horizontal, or longitudinal, dimension has been replaced by the vertical dimension, and by the subsequent dynamic relationship that derives from the establishment of a new formal agent: the cadence (Zara 2013).

Only five mentions of architecture in the musical literature precede that by Vicentino. The first two are in treatises drafted in Paris during the first half of the fourteenth century. In one, Johannes de Grocheio states in his *Ars musicae*: 'The *tenor* is the upper part upon which all the others are based, just as all the parts of a house or building are based on its foundations' (Page 1993, 37). In the second, Jacobus Leodiensis, in his *Speculum musicae* (VII, 3) continues:

> Thus it is the *tenor* upon which the descant is borne, just as a building is borne by its foundations. Like the *cantus*, the *tenor* is named as such because it sustains and provides a foundation for the descant. Who could compose a descant without a *tenor*, and, equally, who could build without a foundation, so that it does not grow according to the will of the constructor, but according to the demands of the foundation? In the same way, in order not to compose inconsiderately, it is necessary to write down the notes according to the demands and proportions of the notes of the tenor himself, so that they accord with them. The descant therefore depends on the *tenor*: it must be regulated by him, and with him there must be accord, not discord. (Bragard 1973, 9)

The definition by Leodiensis inspired three other authors of the second half of the fourteenth century: the anonymous of the treatise *Quatuor principalia musicae* ('[...] as a stable edifice cannot be built on an unstable foundation, similarly, the descant cannot be pronounced without dissonance on an unstable tenor'; Aluas 1996, 523); the anonymous of the essay *Cum notum sit* ('And because just as someone is not able to build above unless a foundation should be first made, thus anyone is not able to descant well and firmly unless he should first learn and understand counterpoint'; Di Bacco 2001, 299); and Philipoctus de Caserta in his *Regule contrapuncti* ('Just as one is not able to direct himself without a foundation, so man is not able to descant well and firmly without first understanding counterpoint'; Wilkins 1964, 95).

All these theorists use metonymy to equate the role of the *tenor* – the foundation for the superimposed voices of pre-established duration in polyphony – and later the

counterpoint, with the foundations of a building (Taycher 2016). And, two centuries later, Tinctoris, in his *Diffinitiorum musice* (1472), the first dictionary of music, defines the tenor as: '*cuiusque cantus compositi fundamentum relationis*' (Parrish 1963, 64–65). The tenor is still the foundation, therefore, but of a relationship now dictated by *proportio*, rather than *mensura*.

4. The Renaissance Way of Thinking

The network of semantic relationships that Poliphilus' journey reveals opens up new avenues for our understanding of the change that was underway. *Talea* and *color* were no longer the raw materials used for a modular construction. As stated by Johannes de Garlandia in his *De mensurabili musica* (c. 1260), '*color est pulchritudo soni vel obiectum auditus, per quod auditus suscipit placentiam*' (Reimer 1972, 95) – a principle of beauty, therefore, which, through repetition and the satisfied expectation that it provokes, generates pleasure. Two centuries later, it is once again Tinctoris who, thanks to his theoretical accomplishments and his polygraphic activity covering all fields of musical knowledge, may be taken as a witness to testify to the shift induced by the Renaissance. In his *Liber de arte contrapuncti* (1473), this seminal theoretician in his summary of the last of his eight rules of counterpoint determining musical composition, completely overturns the then current ideas about composition:

> The eighth and last rule [of composition] is that variety must most accurately be sought for in all counterpoint for, as Horace says in his *Poetics*: 'One who sings to the kithara is laughed at if he always wanders over the same string.' Wherefore, according to the opinion of Tullius [Cicero], as variety in the art of speaking most delights the hearer, so also in music a diversity of harmonies vehemently provokes the souls of listeners into delight. (Luko 2008)

In other words, of all the technical procedures – melodic, rhythmic and harmonic – that Tinctoris deduced in the works of the composers that had preceded him, *variety* was the most important – the very soul of counterpoint, a rhetorical spirit whose tutelary deities were Horace and Cicero rather than mere musicians, i.e. poets, rhetoricians and men of letters. In such attribution of philological and archaeological activity in the classical cultural texts, we are able to recognize the *primo mobile* of that dynamic and creative dialogue at the origin of the humanist experience; this was not defined by mere repetition and conservation, but rather its reinvention, whichever discipline was involved (Egbi 2016). The mathematical sciences, and everything else governed by numbers, were not immune to this activity, especially not architecture. In the dialogue between art and science, between manual and intellectual dexterity, between the perceptible and the intelligible, the gnosis derived from the *archivium* explicated the former and founded the latter (Caye 2011). Formerly conceived of as ideal, numbers became eloquent. By participating in the constitution of architectural knowledge, musical science does not provide a basis for the discipline, but its treatment does outline its principles. In its peculiarity, it

clarifies the entirely Renaissance shift in architectural mathematics from a quantitative concept based on *symmetria*, to a qualitative one based on *euritmia* (Zara 2011). What this is, and in what way it is demonstrated via that 'fairest' (and musical) bond that is proportion, was explained by Palladio in a letter to Count Giovan di Pepolli: '*Dee il corpo con membri e questi con quello aver insieme armonica proporzione, e che da quello nasce poi quel bello che da gli antichi greci Heuritmia vien detto*' (Portoghesi 2008, 177); in English: 'The body with its members, as well the members with the body, must to be tied up together by means of harmonic proportion, and this relationship produces that beauty which since the times of the ancient Greeks has been called Eurhythmy' (author's own translation). Above all, however, Barbaro's commentary on Vitruvius provides us with an even more precise description:

> Just as in singing a concert of voices is required, in which furthermore the voices are right, as well as agreeing in the consonances, a certain temperament is needed to make all the harmony sweet and pleasant, just as occurs with those musicians who sing with their usual company, because they have gradually become comfortable with one another with discretion. This fair manner, in Music as in Architecture, is called Eurythmics – mother of grace and delight both in immobile things and in those that move. (Barbaro 1567, 33–34; author's own translation)

Thus, the mathematical assumption (the 'right' voices 'agreeing in the consonances'), is replaced by the inescapable feeling conveyed by a 'certain temperament'. While this may not be measurable, it is appreciable; the ability to sing in perfect harmony is dictated not by numbers, but by a long familiarity with each other's voices. By extending the poetic dimension to the poietic, the language of proportions attests not only to a broadening of the paradigm, but also the specificity of Renaissance feeling. While in the Middle Ages it was repetition that provided meaning, beauty, and universal truth, for the Humanist, until the modern age, it was variety that provided meaning, beauty, and individual truth – in other words, the spice of life.

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