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## Earthly Music and Cosmic Harmony: Johannes Kepler's Interest in Practical Music, Especially Orlando di Lasso

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Dedicated to Curtis Wilson

The great mathematician and astronomer Kepler (d. 1630), in his “*Harmonia Mundi*” ... speaks upon the subject of Music like a man who had not only thought of it as a science subservient to the laws of calculation, but studied it as an elegant art, and been truly sensible to its powers.

—Charles Burney, *A General History of Music*, 1776<sup>1</sup>

### Abstract

Practical music has a significant place in Johannes Kepler's *Harmonices mundi libri V* (1619), previously considered a purely theoretical work. Though he disclaims skill in composition or performance, Kepler had a musical education and refers repeatedly to Orlando di Lasso, especially the motet "In me transierunt." Kepler connects contemporary polyphony with his attempt to notate the songs of the planets according to heliocentric astronomy. The incipit of "In me transierunt" shares the same solmization as Kepler's song of the earth (mi fa mi), whose plangent evocation of "misery and famine" accords with the motet's "wailing" Phrygian modality.

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## 1. Introduction

**1.1** Johannes Kepler is often remembered as a unique, idiosyncratic theorist who applied ancient concepts of cosmic harmony to emergent modern astronomy. In many accounts, Kepler's *Harmonices mundi libri V* (1619) culminates in his so-called Third Law of planetary motion: "the proportion between the periodic times of any two planets is precisely the sesquialterate proportion [i.e., the  $3/2$  power] of their mean distances."<sup>2</sup> This surprising connection emerged from Kepler's persistent search for harmonic relations among planetary data and became a crucial touchstone for Newtonian celestial mechanics. Accordingly,

scholars have tended to depict Kepler as a neo-Platonic thinker mainly concerned with cosmic archetypes rather than earthly matters.<sup>3</sup> Without denying the truth of this view, I wish to consider another, neglected facet of Kepler, his keen interest in practical music and contemporary compositions, not just pure theory. Kepler's strong feeling for what he called the "song of the earth" illuminates and complements his cosmic concerns.

**1.2** To be sure, the prevalent view of Kepler as pure theorist accurately reflects the bulk of his writings. The reader of *Harmonices mundi* encounters lengthy series of geometric-style propositions concerning the ratios of sides of polygons, viewed from the perspective of neo-Platonic philosophy. Indeed, the work concludes with a polemic against the English Rosicrucian Robert Fludd, from whom Kepler distinguishes himself "in the way in which a practitioner does from a theorist." According to Kepler, Fludd "has advice on the composition of figured melody, an art which I do not profess" and "also digresses to various musical instruments, to which I had not even given thought."<sup>4</sup>

**1.3** Though the moments when Kepler turns to actual musical compositions are few and brief, they give a further insight into his sensibility. In those moments, he characteristically gives examples from compositions by Orlando di Lasso. Kepler does not say much or go deeply into these examples, yet they are still interesting because they figure in an astronomical work. Indeed, in the long tradition linking music and astronomy, Kepler is remarkable for citing specific musical examples, not just theoretical generalizations. I wish to explore what these examples might mean in the context of his whole project.

**1.4** Such inquiries face many pitfalls. For instance, Erwin Panofsky argued that Galileo Galilei's artistic judgments, particularly his antipathy to mannerist art and its predilection for oval shapes, influenced his scientific views, including his rejection of the elliptical orbits found by Kepler in his First and Second Laws of planetary motion.<sup>5</sup> Such assertions must be carefully balanced, for surely Galileo's artistic views were one factor among many, not simple determinants of his scientific views.<sup>6</sup> I will take a different

approach, not relying on questionable generalizations from sweeping terms like “mannerism” but rather on Kepler’s explicit use of musical examples at critical points in his argument. In so doing, I will try to explore how his feeling for this music may have informed his scientific views.

## 2. Kepler’s Musical Background and Activities

**2.1** From early childhood, Kepler was steeped in the musical traditions of Württemberg Protestantism, in school and in church.<sup>7</sup> Beginning in his fifth year, he practiced German psalmody as well as the Latin sequences and hymns that he later cites in *Harmonices mundi*.<sup>8</sup> This daily singing was supplemented by weekly lessons in theory. The standard of musical cultivation as well as of theoretical instruction in Württemberg was quite high, including also contrapuntal music.<sup>9</sup> Michael Dickreiter concludes that Kepler derived a solid theoretical knowledge and practical skill from his primary schooling which continued and deepened during his theological studies in Tübingen (1589–1594).<sup>10</sup> There, he, like all his fellow students, had musical instruction. The academic ordinances prescribed singing three days a week, so that the students must “always study new motets and good songs, and thus keep the exercise of music in practice.”<sup>11</sup> Kepler also participated in performances of church music and private festivities. During those years, he encountered Glarean’s theories and befriended Lucas Osiander, son of the well-known theologian and composer of sacred music of the same name.<sup>12</sup>

**2.2** Kepler’s first job was as mathematics teacher in Graz (1594–1600), where he also taught Virgil and rhetoric. This was more than mere necessity; his abiding interest in the practice of rhetoric (and use of Virgilian images) informed his mature writings.<sup>13</sup> As Anthony Grafton has emphasized, Kepler was deeply involved in the wider concerns of humanistic scholarship.<sup>14</sup> The musical life of the school where Kepler taught was many-sided. The German organist Erasmus Widmann so favored dance styles in his sacred music that sarcastic critics wondered whether they were in a church or a beer-hall.<sup>15</sup> During Kepler’s stay, the Italian organist Annibale Perini brought Venetian musical practice to Graz. Indeed, Andrea Gabrieli

had dedicated his *Primus Liber Missarum*, (a6,1572) to Karl, the Habsburg archduke resident in Graz. Karl had close links to Venice; his wife, Maria, had a personal bond to Lasso's family and a strong interest in his music. The archducal library included works by Lasso, Willaert, de Monte, and Zacconi, among other contemporary composers.<sup>16</sup> It is not clear what part Kepler took in all this, though it seems likely he would have been aware of these musical cross-currents. His correspondence reflects above all his preoccupation with his first, seminal work, *Mysterium cosmographicum* (1596). One of his letters does mention "the excellent music that Italy abounds in" and Kepler's acquaintance with Lasso's music definitely began in Graz, if not before.<sup>17</sup> In 1599, Kepler wrote a friend that he wished that "Orlando, if he lived," could teach him how to tune a clavichord properly.<sup>18</sup> Note that Kepler singles out the great composer as the ultimate authority on tuning.

**2.3** After Kepler moved to Prague in 1600, he entered the service of the Emperor Rudolf II, famous for his patronage of occult arts. Unmarried, distancing himself ever further from political realities, Rudolf fostered "exact science next to the deepest superstition, religious freedom next to zealotry, a tendency to display the utmost pomp next to diseased manifestations of self-love and eccentricity, refined taste next to brutal sensuality."<sup>19</sup>

**2.4** In Rudolf's court, both practical and theoretical music were important, including some novel developments.<sup>20</sup> For instance, the court alchemist Michael Maier wrote fifty canons in *Atalanta fugiens* (1618) whose settings of alchemical texts would complement the manipulations of the "great art."<sup>21</sup> Such a synthesis would have deeply interested the alchemist-emperor. So also did the "perspective lute," which tried to relate musical tones to colors, or the court composer and organist Hans Leo Hassler's experiments with new automatic instruments.<sup>22</sup> As R. J. W. Evans points out, in such activities music was "practical, yet offered immediate contact with cosmic forces."<sup>23</sup> As such, the practice of music aspired to realize the Renaissance dream of mobilizing magic powers through the influence of sound.<sup>24</sup>

**2.5** Kepler did not record his precise reaction to these developments but did write to a friend a stark disclaimer: “I hate all kabbalists.”<sup>25</sup> To be sure, Kepler gave voice to mystic sentiments of his own: “For there is nothing I examine more carefully, and desire to know more than this: whether the God whom I touch (as it were) when I contemplate the whole universe, can also be found by me inside myself.”<sup>26</sup> However, Kepler noted in his *Pro suo opera Harmonices mundi apologia* (1622) that “whoever wants to nourish his mind on the mystical philosophy ... will not find in my book what he is looking for.”<sup>27</sup> He detested esotericism in all its forms, manifested in his polemic against Fludd (see [par. 1.2](#)).<sup>28</sup> Nevertheless, Kepler was deeply interested in the larger question of how the practice and theory of music might impinge on cosmic structure. His antipathy for the esoteric strain in Rudolf’s court may have reflected his anger at what he considered the bungling of his own favorite idea that music mirrors the cosmos.

**2.6** Kepler’s letters of the period turned to more practical concerns. He corresponded about problems of interval tuning in Andreas Reinhard’s *Monochordium* (1604).<sup>29</sup> Such questions also related to the “clavicymbalum universale, seu perfectum,” a keyboard instrument much admired at court, whose octaves were divided into nineteen steps.<sup>30</sup> He likely attended the services of the court chapel, in which one hundred musicians (including sixty-five singers) performed music by court composers such as Philippe de Monte, Hans Leo Hassler, and Jacob Hassler, as well as Venetian polychoral music and early monody. He could scarcely have missed the six “Geiger oder Musici” or the eighteen trumpeters and timpanists that were part of the imperial household.

**2.7** Kepler did record a fragment of the prayers sung by the “Turkish priest” who accompanied the Turkish ambassador to court. According to Dickreiter, this was “the first known ethnological investigation of this sort,” though in 1578 the Swiss theologian Jean de Léry had transcribed some Brazilian songs.<sup>31</sup> Kepler was fascinated by what he described as the priest’s “practiced and fluent manner, for he did not hesitate at all; but he used remarkable, unusual, truncated, abhorrent intervals, so that it seems that

nobody could with proper guidance from nature and voluntarily of his own accord ever regularly contemplate anything like it. I shall try to express something close to it by our musical notation” (Figure 1).<sup>32</sup> I shall return later to the significance of Kepler’s attempt to notate the exotic strains of Muslim cantillation (see par. 3.9). For now, it is an apt image of his alert curiosity about the possibilities of music in practice, not only in theory.

**2.8** Finally, the archduke Matthias seized power from his Prospero-like brother Rudolf, who died not long after, in 1612. Kepler did not remain in Prague but spent his last years in Linz (1612–1626) as a teacher, though retaining the title of Imperial Mathematician. There, he completed the *Harmonices mundi*, the apex of his theoretical activities, in a school that was reputed “the undisputed center of musical cultivation to support the renewal of faith” and that gave the highest priority to “musica practica.”<sup>33</sup> Lasso had pride of place in their library, followed by other masters of the Renaissance. Dickreiter thinks it probable that Kepler, following the customary academic regulations, would have taken an active part in the choir and also in the domestic music of the regional nobility, among whom he had many friends and patrons.<sup>34</sup>

### 3. The Influence of Practical Music on Kepler

**3.1** Thus, although Kepler claimed no skill as composer or performer, he had been surrounded with musical performance all his life and had been personally involved on many occasions. Here, more recent distinctions of professionalism are misleading. The musical experience of an amateur can be no less deep than that of a professional and, in Kepler’s time, amateurs did a great deal of serious music-making. It might even be argued playfully that his exposure to musical practice was more sustained and thorough than his knowledge of theoretical writings, which Dickreiter judges as “not really multifaceted.”<sup>35</sup>

**3.2** Beyond the traditional school readings in the quadrivium, Kepler was largely self-educated, but with the gusto that characterized his idiosyncratic genius. One thinks of him travelling in October, 1617 to save

his aged mother from prosecution as a witch, taking Vincenzo Galilei's *Dialogo della musica antica et della moderna* (1582) as reading for the journey and reading it "with the greatest pleasure" ("summa cum voluptate").<sup>36</sup> This shows that only two years before Kepler published his own treatise he needed to catch up with contemporary theory. To gauge the state of such studies at the time, Kepler was able to acquire a Greek text of Ptolemy's *Harmonia* only in 1607.<sup>37</sup> Thus, Kepler essentially reinvented and then rediscovered this important ancient source in the course of pursuing his own vision.

**3.3** Though he was engaged in reviving the ancient vision of cosmic harmony, Kepler's awareness of contemporary music informed crucial departures from the ancients. To begin with fundamental issues of interval construction, Kepler parted company with the Pythagorean tuning as transmitted by Boethius and Macrobius, who defined the major third as 81:64 and the minor third as 32:27. Instead, Kepler advocated just intonation (5:4 and 6:5, for the major and minor thirds, respectively). In justification, Kepler asserts that the Pythagoreans "were so much given over to this form of philosophizing through numbers that they did not even stand by the judgment of their ears, though it was by their evidence that they had originally gained entry to philosophy; but they marked out what was melodic and what was unmelodic, what was consonant and what was dissonant, from their numbers alone, doing violence to the natural prompting of hearing."<sup>38</sup> Though Kepler praises Ptolemy for including just intonation among his tunings, Kepler considers that Ptolemy still erred by denying that thirds and sixths were consonances, so that "the man who restored the judgment of the ears to its rightful place in words and doctrine nevertheless deserted it again."<sup>39</sup>

**3.4** To be sure, Kepler may be echoing Aristoxenus in praising practical judgment over pure theory, an old commonplace of anti-Pythagorean teachings. More recently, Gioseffo Zarlino had already given a classic and widely-known exposition of just intonation in *Le istituzioni harmoniche* (1558), which Kepler probably knew, since he refers to Zarlino elsewhere.<sup>40</sup> However, Kepler presents his own views without reference to Aristoxenus or Zarlino, using arguments based on ratios between sides of regular polygons as



well as through the long-standing practice of musicians, who needed just thirds and sixths as consonances for their polyphonic music.<sup>41</sup>

**3.5** In D. P. Walker's view, "though modern music reveals the archetypical structures of the heavens, it is not an imitation of the celestial music, nor derived from it; but both are likenesses of the same archetypes, the geometric beauties coeternal with the Creator; and modern music ... thereby even allows us to experience something of God's satisfaction in His own handiwork."<sup>42</sup> Yet here Walker may not have gone far enough, for a careful examination of Kepler's reasoning shows not merely that he treated pure mathematics and musical practice as parallels that never meet, but rather that his musical judgments informed his mathematical choices.

**3.6** As I have discussed in detail elsewhere, Kepler could have included as "consonances" such discordant ratios as 3:7 if he had included the sides of a regular heptagon following the same reasoning through which his treatment of the pentagon led to the major sixth, 3:5.<sup>43</sup> Here he relied on geometry to exclude the heptagon, which cannot be constructed with ruler and compass, unlike the pentagon. Yet just at this juncture he pauses to acknowledge that the nascent art of algebra would allow a calculation of the heptagon's side that, if accepted, would give the heptagon as much a claim to validity as the pentagon.

**3.7** In the end, he does not allow algebra equal legitimacy, for which his ultimate reason is an appeal to musical practice. Algebra would allow intervals like 3:7 that are "utterly abhorrent to the ears of all men and the usages of singing, even though it may be possible for strings to be tuned in that way, seeing that as they are inanimate they do not interpose their own judgment but follow the hand of the foolish theorist without the least resistance."<sup>44</sup> "Foolish theory" is here corrected by the touchstone of practice. To be sure, Kepler also brings forward purely mathematical arguments to justify his rejection of algebra in this case. These arguments concern the comparative intelligibility of geometric and algebraic solutions. Yet his

discussion of algebra reveals also his admiration of this new mathematical art, which he sometimes used in astronomical calculations. Musical practice resolves his doubts and guides his philosophical search.

**3.8** Kepler applies this touchstone not just to these elements but also in the highest flights of his cosmic vision. Consider first Kepler's treatment of melody in monophonic chant in Book III of *Harmonices mundi*, chapter XIII, entitled "What Naturally Tuneful and Suitable Melody Is." Here he goes beyond the theoretical commonplaces that go back to Hucbald, restricting "tuneful and suitable melody" to a few allowed intervals. Kepler attempts a rhetorical analysis that encompasses fine details of the melodic "foregrounds" of two very different melodies. He begins with the Turkish chant mentioned earlier (see [par. 2.7](#); [Figure 1](#), top), though he treats it as a kind of anti-music, "that grating [*stridulo*] style of song which the Turks and Hungarians customarily use as their signal for battle, imitating the uncouth voices of brute beasts rather than human nature." Kepler notices that the Hungarians also use such "grating" songs, which are thus not only the province of infidels or aliens but of nearby fellow-subjects of the emperor. Indeed, they are used as signals for battle, making their rudeness more intelligible. He even hazards a theory for how such songs arose: their "original author absorbed uncouth melody of this kind from an instrument which was rather unsuitably shaped, and from long familiarity with the construction of the instrument transmitted such melody to his descendants and to his whole nation." The problem is not a barbaric soul but an instrument's disproportionate body. Here again Kepler asserts that the physical shape is prior to the sound that comes from it.<sup>45</sup>

**3.9** Examined more closely, his transcription is a recognizable attempt to capture the ululation of Muslim cantillation, as of a muezzin's call to prayer. Here he confronted complex *melos* and glissandi that are an essential part of middle Eastern music. Kepler took some pains to be faithful to what he heard, though his notation and musical preconceptions were of little help. The passage begins on *g* and ends on *G*, indicating the presence of the octave even in this strange style.

**3.10** For comparison, Kepler cites the Easter sequence “Victimae paschali laudes” (Figure 1, middle). Perhaps not coincidentally, it too begins and ends on *g*, and its highest note also *g'*; Christians and Muslims both acknowledge the overarching G octave as they worship the same God. In his commentary on the Gregorian chant, Kepler notes that the Gregorian chant “rings out chiefly on the positions of *b-flat*, *d*, and *c*, exhibiting them as the skeleton of the octave, most frequently returning to *d*, and next to it *b-flat*, but from time to time reaching up to *g'* above, and to all those positions significantly, but not in that way to *a'* or to *f'*, positions which are primarily dissonant; and at length it returns to *g* and ends there.”<sup>46</sup> Kepler’s use of the term “skeleton” (used earlier by Aron, Glarean, and Zarlino) shows his effort to understand the inner construction of melody, not merely its constituent intervals. He goes so far as to write down this skeleton explicitly (Figure 1, bottom), emphasizing its triadic shape while leaving the Gregorian melody far behind. By rewriting it thus in F<sup>4</sup> clef, the reader is immediately reminded of the Turkish chant, written on the same page in the same clef (Figure 1, top), as if to show that, in skeletal form, the Turkish chant and “Victimae paschali” have some relation. Nevertheless, Kepler’s text mainly points to their differences. Where the Turkish chant jumbles dissonance and consonance, “Victimae paschali” carefully observes their skeletal relations.<sup>47</sup>

**3.11** Yet Kepler never disclaims the odd resemblance between them, at least at the skeletal level. This implicit relation remains open because Kepler continues to discuss the melodic structures of both the Turkish and the Christian chant simultaneously. Here he refers to “Euclid” for a vocabulary of melodic devices, by which he means the *Introductio harmonica* now attributed to Cleonides, a student of Aristoxenus.<sup>48</sup> Ancient writers gave the terms that Kepler takes up: *αγωγή* (literally “approach,” passage from one consonance directly to another), *τονή* (“emphasis,” dwelling on a consonance), *πεττεία* (“gaming,” a species of *αγωγή* involving playful “tiny motions”), and *πλοκή* (“twisting,” a species of *τονή* that entwines or “wanders in its passage around the *αγωγή*, as a dog does around a passerby.”).

**3.12** Having no examples of ancient Greek music, Kepler interprets these terms in light of the music he knows. In “Victimae paschali,” Kepler shows how the direct motion of ἀγωγή (as in the setting of *paschali laudes* or of *immolent*) sets off the continuous intonation (τονή) of *-demit oves Christus in-* and the “playing” alternations (πεττεία) of *-cens ... re- ... li- ... pecca-*. In contrast, the Turkish chant uses “a pure πλοκή, although not a natural one,” throughout its course, meaning the continuous twisting or twining of the melodic line.<sup>49</sup> Thus, Kepler understands the Turkish melody in terms of the same vocabulary he applies to the Gregorian chant. Throughout, he reinterprets the ancient terminology to fit the musical realities of his examples.

**3.13** He must go further still in order to encompass what he considers the moderns’ decisive innovation. As Walker notes, Kepler’s insistence on cosmic polyphony decisively separates him from the ancients, whose *musica mundana* and *musica instrumentalis* were alike monophonic.<sup>50</sup> Here, no mathematical argument enters in. Only Kepler’s profound feeling for polyphonic music inspires his search for the cosmic polyphony. Accordingly, we should carefully consider the examples of polyphony that he holds up, the most notable being Lasso’s motet “In me transierunt” (*Sacrae cantiones quinque vocem*, 1562).<sup>51</sup> Kepler cites it or draws examples from it a few times in *Harmonices mundi*, although he does mention several other motets by Lasso in passing.<sup>52</sup>

**3.14** Indeed, this particular motet was already famous in Kepler’s time, even beyond the general measure of Lasso’s renown. Werner Braun treats it as the exemplar of the Phrygian mode that is cited in the late fifteenth and sixteenth centuries.<sup>53</sup> Given the scope of his reading in contemporary German theorists and especially his extensive correspondence with the learned Leipzig Thomascantor Seth Calvisius, Kepler may well have known the rhetorical analysis that Joachim Burmeister (1564–1629) made of this motet in his *Musica αυτοσχεδιαστικη* (1601), expanded in his *Musica poetica* (1606).<sup>54</sup> That we possess no specific reference might be explained by the disappearance of some of Kepler’s letters to Calvisius in which Burmeister might well have been discussed.<sup>55</sup> However, Burmeister uses thirty-two different works by

Lasso as examples, devoting only two paragraphs to “In me transierunt”; Calvisius never uses it as an example in his *MEΛOΠOIA, sive melodiae condendae ratio* (1592), though he cites five other works by Lasso and includes it as the seventh out of eleven examples of the Phrygian mode from Lasso in his *Exercitationes musicae duae* (1600).<sup>56</sup> Indeed, other Phrygian motets by Lasso might have been even better examples.<sup>57</sup> Thus, Kepler’s choice of this particular motet reflects his particular feeling for it. His comments, few as they are, stand on their own and have a certain coherence when they are assembled in three closely successive stages.

**3.15** Immediately after his discussion of the Turkish and Gregorian chants, Kepler cites the opening gesture of “In me transierunt,” a rising minor sixth that then descends by steps (Figure 2), juxtaposed with the observation that “we rather rarely admit sixths, although they are consonances, and only minor sixths.”<sup>58</sup> Lasso’s opening illustrates this “rather rare” interval. Interestingly, Kepler writes the same, somewhat incorrect rhythm, both times he cites this incipit in his text, probably showing that he is quoting from memory.<sup>59</sup> This would indicate how familiar this motet is to him and perhaps how dear. Even his mistake is revealing; by incorrectly citing the opening *e'* as dotted, Kepler places the expressive minor sixth *e'–c''* to arrive on the downbeat in the cantus, as an appoggiatura, whereas the authentic text lacks his dot and consequently arrives on the offbeat, resolving by suspension. Thus, Kepler’s rhythmic mistake throws the expressive semitonal descent *c''–b'* into higher relief.

**3.16** In the next chapter, Kepler cites this incipit as an illustration of the “common Phrygian” mode.<sup>60</sup> Finally, in the next chapter Kepler comments in more detail on this melodic shape. Trying to clarify the significance of leaps, he adverts to the analytic terminology he had applied to the Gregorian and Turkish chants:

The force of a leap is also great, as it is like a potential *Agoge*; for it has rashness, movement, boldness, it is warlike, manly, brash, if it is frequent, especially over a diapente. Its figure, the triangle, consists of acute angles, and covers the whole circle in three lines. On the contrary, a

single ascending leap over a soft sixth, with a downward *Agoge* following, expresses the magnitude of grief, and is suitable for wailing, on account of the similarity of the note, as in Orlando's "In me transierunt."<sup>61</sup>

**3.17** Note that the felt rhetorical force of each leap is prior to its interpretation in terms of geometrical figures. Note also that, in the Lasso incipit, the "wailing" results from the minor sixth sinking a semitone, down to a fifth. Kepler does not go further into the details of the motet, recognizing ruefully that he is not adequate to the task. The inquiry into the relation between sounds and affects "is various and manifold, and very nearly infinite. Since it is too much for my muscles, it would be more correctly passed on completely to the practical men, that is, to practicing musicians, seeing that without teaching, guided solely by nature, they emerge time and again as the authors of wonderful tunes."<sup>62</sup> As Kepler acknowledges the limits of his ability, he also confirms explicitly that it is the testimony of "practicing musicians" he considers most important. Though his own harvest of insights is limited to this one small observation, it will turn out to be pregnant. Having already classified this motet into the Phrygian mode, he notes that the prominent semitone in this mode makes it "sound plaintive, broken, and in a sense lamentable."<sup>63</sup>

**3.18** Though he does not draw our attention to it, this discussion helps illuminate the climax of Kepler's work, his description of the cosmic music of the planets. At this point, he pauses to make a solemn exordium:

Now there is need, Urania, of a grander sound, while I ascend by the harmonic stair of the celestial motions to higher things, where the true archetype of the fabric of the world is laid up and preserved. Follow me, modern musicians, and attribute it to your arts, unknown to antiquity: in these last centuries, Nature, always prodigal of herself, has at last brought forth, after an incubation of twice a thousand years, you, the first true offprints of the universal whole. By your harmonizing of various voices, and through your ears, she has whispered of herself, as she is in her innermost bosom, to the human mind, most beloved daughter of God the Creator.<sup>64</sup>

His point is that the planets are “singing” a polyphonic motet *à la* Lasso and he explicitly directs us to “modern musicians” in order to hear Nature’s secret whispering.

**3.19** In this cosmic motet, Kepler identifies the particular vocal part of each planet: soprano (Mercury), alto (Earth and Venus), tenor (Mars), and bass (Saturn and Jupiter).<sup>65</sup> He also notes that the motions of each planet suit its particular vocal part: Mercury as “the treble is most free,” Earth and Venus with “very narrow distances between their motions ... as the alto which is nearly the highest is in a narrow space,” Mars as tenor “is free yet proceeds moderately,” while Saturn and Jupiter “as the bass make harmonic leaps.”<sup>66</sup> The interweaving of their six individual “songs” leads to a complex work of practical polyphony, in which Kepler anticipates “certain syncopations and cadences” and all sorts of passing dissonances as planets pass between rare moments of cosmic consonance, particularly when they reach perihelion or aphelion. Elsewhere, I explore the astronomical problem that faced Kepler, the difficulty of reaching such “cosmic cadences,” which bears on the problem of the beginning and end of the cosmos.<sup>67</sup>

**3.20** If “the planets in combination match modern figured music,”<sup>68</sup> as if emerging from the same archetype, we must return to the modern masters with renewed attention. Kepler also clarifies that he does not simply identify this celestial music with any existing composition. In part, this reflects his notable departure from the ancient conception that there is an audible music of the spheres. On the contrary, Kepler asserts that “in fact, no sounds exist in the heaven, and the motion [of the planets] is not so turbulent that a whistling is produced by friction with the heavenly light.”<sup>69</sup> His cosmic harmony reflects the relative minimum and maximum angular velocities of the planets, as measured from the sun.

**3.21** Curiously, this harmony involves certain elements that emerged when considering the Turkish chant (see [par. 3.9](#)). There, we noted that Kepler may well have been trying to notate complex glissandi that are not really expressible in discrete notation, though they are quite regular and customary parts of Turkish music. Indeed, in Western music theory the glissando as such was not explicitly used until the animal and

bird imitations in Carlo Farina's *Capriccio stravagante* (1627). However, the problem of glissando is not confined to the Turkish chant. It emerges as a central feature of the planetary music itself. Since the planets move continuously in their orbits, their distances to the Sun vary smoothly from perihelion to aphelion. As Kepler puts it, "they advance from one extreme to the opposite one not by leaps and intervals, but with a continually changing note, pervading all between (potentially infinite) in reality. I could not express that in any other way but by a continuous series of intermediate notes."<sup>70</sup>

**3.22** Accordingly, Kepler's cosmic music is really a complex interweaving of glissandi, each confined within certain limits, which Walker compares to the wailing of air-raid sirens.<sup>71</sup> Ironically, the continuous sliding Kepler found so strange and difficult to notate in the Turkish chant turned out to be an all-pervasive feature of the heavenly music. Here, the Turks and Hungarians, with their "grating," "uncouth" singing, were in touch with a dimension of musical practice that Kepler discovers in his cosmic music.

**3.23** The very soundlessness of the spheres directs him all the more insistently to the modern polyphonic masters, as if their harmonies would guide him in this strangely silent realm. In a playful marginal note, Kepler clarifies his meaning:

Shall I be committing a crime if I demand some ingenious motet from individual composers of this age for this declaration: The royal psalter and the other sacred books will be able to supply a suitable text for it. Yet take note that no more than six parts are in harmony in the heaven.... If anyone expresses more closely the heavenly music described in this work, to him Clio pledges a wreath, Urania pledges Venus as his bride.<sup>72</sup>

**3.24** Thus, Kepler invites composers to take up the challenge of writing a motet that will incorporate the harmonies that he has discovered in planetary data. Since he accepts Zarlino's system and refers only to Lasso and Artusi, never to Monteverdi, J. V. Field concludes that "Kepler was on the side of orthodoxy rather than standing up to be counted as a partisan of the avant garde."<sup>73</sup> This is confirmed by Kepler's



choice of “In me transierunt” as an exemplar, rather than one of Lasso’s rare ventures into chromatic experimentalism, such as “Prophetiae Sibyllarum.”<sup>74</sup>

**3.25** Though he does not mention any composer by name in his challenge to “the composers of this age,” Kepler’s mention of the royal psalter fits Lasso’s “In me transierunt,” which used psalm texts (Psalms 88:16 and 38:10, 17, 21), but then so did myriad other sacred works of the time. The phrase “more closely” suggests that some polyphonic music already expresses the heavenly sounds closely. Perhaps Lasso’s motet fell short of the challenge by having five voices, not the requisite six. It does contain the chords that Kepler describes as characterizing the planetary harmonies: *E mollis* and *C durus* in mm. 15, 28, 30, 31, 58 (in anachronistically modern terms, an E minor chord in first inversion and a C major chord in second inversion). By itself, this is hardly decisive, for these are common harmonies that appear in many motets. Is “In me transierunt” then merely a generic exemplar of polyphonic mastery?

**3.26** There is, I think, one telling aspect of Lasso’s motet that recommends it to Kepler as approaching the ideal, unwritten celestial motet. Recall that earlier Kepler had drawn attention to the prominent semitone in the incipit of “In me transierunt,” which characterizes its “wailing” Phrygian modality and also threads through the whole motet. To be sure, such scalar semitonal motion is common in Lasso’s motets, as it is in many other works of the time. Yet this motet has a special significance in the light of Kepler’s planetary melodies, for he identifies a special semitonal motion as the song of the earth ([Figure 3](#)). As Kepler notes in the margin at this point,

The earth sings MI FA MI, so that even from the syllable you may guess that in this home of ours MIsery and FAmine [*Miseria et FAmes*] hold sway.<sup>75</sup>

**3.27** This makes clear that Kepler reads the song of the earth not as it stands in [Figure 3](#), *g'-a'-flat-g'* (extremely rare in the practice of his times), but as MI FA MI. In hexachordal notation, “In me transierunt” begins with this exact formula, mutating from the natural to the hard hexachords: e la MI, c

sol FA, b fa MI. Indeed, if one were to begin with a semitone (as in  $e'-f'-e'$ : e la mi, f fa ut, e la mi), the solmization would be less dramatic.<sup>76</sup>

**3.28** In this sense, the opening of “In me transierunt” may be the most vivid way to realize Kepler’s song of the earth in the musical practice that he used. To Earth Kepler also assigns the Phrygian mode whose final is MI, “because its motions revolve within a semitone [16:15].” Because of all these qualities, “In me transierunt” may well have struck Kepler as a powerful treatment of the song of the earth, embedding the earthly semitone in a rich constellation of sonorities that draw the mind to imagine more vividly the full universal harmony.<sup>77</sup>

**3.29** After all, one of the greatest differences between Kepler’s harmonies and the ancients’ is that now the earth too has a voice, no longer consigned to voiceless immobility at the center of the Aristotelian cosmos. The earth moves and sings, and its song is not neutral and divinely impassive, like the ancient celestial monophony, but is redolent of human misery. Singing, the earth prays with the royal psalmist, not expressing alone its desolation but seeking the larger concourse of divine mercy. How appropriate, then, and how moving must Kepler have found Lasso’s text: “Thy wrath has swept over me; thy terrors destroy me. / My heart throbs; my strength fails me; my sorrow is ever before me. / Forsake me not, O Lord; O my God, be not far from me.” As a devout Christian, he viewed the semitone of human suffering as a crucial passage in the quest for divine grace. As such, the song of the earth needs to be understood as part of the larger scheme of suffering and redemption. The semitone in Lasso’s motet and in Kepler’s song are signs of terrestrial dissonance reconciled in celestial harmony.

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## References

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<sup>1</sup> Charles Burney, *A General History of Music from the Earliest Ages to the Present Period* (London: Author, 1776–1789; modern edition, ed. Frank Mercer, 2 vols, London: G.T. Foulis, 1935), 2:459.

<sup>2</sup> The standard modern edition is Johannes Kepler, *Gesammelte Werke*, ed. Walther von Dyck, et al., 19 vols. (Munich: C.H. Beck, 1937–), 6:302; hereafter cited as KGW. See also the fine modern translation, Johannes Kepler, *The Harmony of the World*, tr. Eric J. Aiton, et al. (Philadelphia: American Philosophical Society, 1997), 411; hereafter cited as HW. Regarding the “Third Law,” see Judith V. Field, *Kepler's Geometrical Cosmology* (Chicago: University of Chicago Press, 1988), 142–63; and Owen Gingerich, “Kepler, Galilei, and the Harmony of the World”; in *Music and Science in the Age of Galileo*, ed. Victor Coelho (Dordrecht: Kluwer, 1992), 45–63. Though he exults over the result, Kepler himself did not use the term “law.” This appellation is due to later scholars, who thereby emphasized Kepler's anticipation of crucial Newtonian results. See Curtis Wilson, *Astronomy from Kepler to Newton* (London: Variorum Reprints, 1989).

<sup>3</sup> The most comprehensive modern account is Michael Dickreiter, *Der Musiktheoretiker Johannes Kepler* (Bern and Munich: Francke Verlag, 1973), whose title emphasizes Kepler as theorist, though Dickreiter also gives extremely helpful material concerning Kepler's larger musical education, as I shall cite below (see [Section 2](#)). Regarding the details of Kepler's arguments, see the excellent treatments in Bruce Stephenson, *The Music of the Heavens: Kepler's Harmonic Astronomy* (Princeton: Princeton University Press, 1994); Field, *Kepler's Geometrical Cosmology*, 96–166; and Rhonda Martens, *Kepler's Philosophy and the New Astronomy* (Princeton: Princeton University Press, 2000), 112–41. The entry by Susi Jeans and H. Floris Cohen in the *New Grove Dictionary of Music and Musicians*, 2nd ed., s.v. “Kepler, Johannes” gives helpful

attention to Kepler's awareness of musical practice; see also H. Floris Cohen, *Quantifying Music: The Science of Music at the First Stage of the Scientific Revolution, 1580–1650* (Dordrecht: Kluwer, 1984), 13–34. Among earlier works, I am particularly indebted to Daniel Pickering Walker, "Kepler's Celestial Music," *Journal of the Warburg and Courtauld Institutes* 30 (1967): 228–50; it is included in his *Studies in Musical Science in the Late Renaissance* (Leiden: E. J. Brill, 1978), 34–62 (from which edition I will cite this work), whose approach I aim to correct and extend particularly by amplifying the Kepler-Lasso connection. See also Eric Werner, "The Last Pythagorean Musician: Johannes Kepler," in *Aspects of Medieval and Renaissance Music*, ed. Jan LaRue (New York: W. W. Norton, 1966), 867–82; Walto Harburger, *Johannes Keplers kosmische Harmonie* (Leipzig: 1925); Alexandre Koyré, *La Révolution astronomique: Copernic, Kepler, Borelli*, (Paris: Hermann, 1961); Max Caspar, *Nachbericht to the Harmonices mundi*, KGW 6:461 ff; and Gerald Holton, "Johannes Kepler's Universe," in his *Thematic Origins of Scientific Thought*, 2nd ed. (Cambridge: Harvard University Press, 1988), 69–90.

<sup>4</sup> HW 505 (KGW 6:374). For an exposition of Fludd's views, see Peter J. Ammann, "The Musical Theory and Philosophy of Robert Fludd," *Journal of the Warburg and Courtauld Institutes* 30 (1967): 198–227.

<sup>5</sup> Erwin Panofsky, *Galileo as a Critic of the Arts* (The Hague: Martinus Nijhoff, 1954). See also the excellent essay by Claude V. Palisca, "Scientific Empiricism in Musical Thought," in *Seventeenth Century Science and the Arts*, ed. Hedley Howell Rhys (Princeton: Princeton University Press, 1961), 91–137; and Stillman Drake, "Music and Philosophy in Early Modern Science," in Coelho (ed.), *Music and Science*, 3–16.

<sup>6</sup> See the exchange on Panofsky's thesis, expressed (with some revisions) in his "Galileo as a Critic of the Arts: Aesthetic Attitude and Scientific Thought," *Isis* 47 (1956): 3–15; followed by Edward Rosen, "Review of Panofsky, *Galileo as a Critic of the Arts*," *Isis* 47 (1956): 78–80; and Erwin Panofsky, "More on Galileo and the Arts," *Isis* 47 (1956): 182–5.

<sup>7</sup> See Dickreiter, 123–38.

<sup>8</sup> These are: "Wir glauben all an einen Gott" (KGW 6:162); "Nun bitten wir den heylgen Geist" (6:162); "Herr Christ, der eynig Gotts Son" (6:162); "Nun komm, der Heyden ir Heyland" (6:162); "Mit Freuden zart" (6:141); "Christ ist erstanden" (6:159); and "Victimae paschali laudes" (6:158, 15:238, 15:397), to be discussed in detail below (see [par. 3.10](#)).

<sup>9</sup> Dickreiter, 124. The school ordinance of 1582 stipulated that “Demnach das *Exercitium musicae* in Unsern Klöstern in Gebrauch, sollen der Prälat und die *Praeceptores* anordnen, daß das Gesang auf das *Contrapunctum* gericht werde, damit es dadurch um so lieblicher und verständlicher sei.” Dickreiter also lists some of the polyphonic music used in Württemberg.

<sup>10</sup> Dickreiter, 125. For a helpful study of Kepler’s whole milieu during this period, see Charlotte Methuen, *Kepler’s Tübingen: Stimulus to a Theological Mathematics* (Aldershot: Ashgate, 1998).

<sup>11</sup> Dickreiter, 126: “allwegen neue Muteten und gutte Gesang übe, und also das *exercitium Musices* in gebrauch erhalten.”

<sup>12</sup> Dickreiter (164) posits that Kepler learned of Glarean’s work from his teacher Samuel Magirus, not to be confused with Johann Magirus (cf. [ref. 53](#)).

<sup>13</sup> For a fine examination of the rhetorical dimension of these works, see Bruce Stephenson, *Kepler’s Physical Astronomy* (Princeton: Princeton University Press, 1987); and his *Music of the Heavens* (see [ref. 3](#)). I have also treated Kepler’s rhetoric (and his allusions to Virgil) in *Labyrinth: A Search for the Hidden Meaning of Science* (Cambridge: MIT Press, 2000), 87–112.

<sup>14</sup> Anthony Grafton, “Humanism and Science in Rudolphine Prague: Kepler in Context,” in *Defenders of the Text: The Traditions of Scholarship in an Age of Science, 1450–1800* (Princeton: Princeton University Press, 1991), 178–203.

<sup>15</sup> Dickreiter, 129: “mancher nicht weiß, ob er in der Kirchen oder im Wirtshaus ist.”

<sup>16</sup> Dickreiter, 129.

<sup>17</sup> Dickreiter, 130; “Velim tamen ex aliquo excellenti Musico quibus abundat Italia,” KGW 14:13. Kepler already refers to Lasso’s motets in a letter of 1599 (KGW 14:9).

<sup>18</sup> Letter to Herwart von Hohenburg of 6 August 1599, KGW 14:29. “Illud etiam, quod hic loco cognatum est, didicissem vel quaesivissem ex Orlando, si viveret, rectene tendatur Clavichordium in hunc modum.”

<sup>19</sup> Karel Chytil, *Die Kunst in Prag zur Zeit Rudolfs II* (Prague: Kunstgewerblichen Museums der Handels- und Gewerbe-Kammer, 1904), preface, quoted in Dickreiter, 131.

<sup>20</sup> Among recent studies, see Carmelo Peter Comberiati, *Late Renaissance Music at the Habsburg Court: Polyphonic Settings of the Mass Ordinary at the Court of Rudolf II, 1576–1612* (New York: Gordon and Breach, 1987); Robert Lindell, “Music and Patronage at the Court of Rudolf II,” in *Music in the German Renaissance: Sources, Styles and Contexts*, ed. John Kmetz (Cambridge: Cambridge University Press, 1994), 254–71; idem, “Stefano Rosetti at the Imperial Court” in *Musicologia humana: Studies in honor of Warren and Ursula Kirkendale* (Florence: Olschki, 1994), 157–81; and Steven Saunders, *Cross, Sword, and Lyre: Sacred Music at the Imperial Court of Ferdinand II of Habsburg (1619–1637)* (New York: Oxford University Press, 1995).

<sup>21</sup> Michael Maier, *Atalanta fugiens* (Oppenheim: Hieronymus Galler, 1618), trans. and ed. Joscelyn Godwin in *Magnum Opus Hermetic Sourceworks*, no. 22 (Grand Rapids, Mich.: Phanes Press, 1989); discussed by Franz Liessem, *Musik und Alchemie* (Tützing: H. Schneider, 1969); and Christoph Meinel, “Alchemie und Musik,” in *Die Alchemie in der europäischen Kultur- und Wissenschaftsgeschichte*, ed. Christoph Meinel (Wiesbaden: Otto Harrassowitz, 1986), 201–27. Maier is treated briefly in the context of later works that synthesize music with alchemy in David Yearsley’s valuable article, “Alchemy and Counterpoint in an Age of Reason,” *Journal of the American Musicological Society* 51 (1998): 201–43, 221. Regarding the Hassler brothers, see Hartmut Krones, “Die Beziehungen der Brüder Hassler zu Kaiser Rudolf dem II. und zu Prag,” in *Die Musik der Deutschen im Osten und ihre Wechselwirkung mit den Nachbarn: Ostseeraum-Schlesien-Böhmen/Mähren-Donauraum*, ed. Klaus Wolfgang Niemöller and Helmut Loos, 375–81 (Bonn: Schröder, 1994).

<sup>22</sup> The “perspective lute” is variously attributed to the court artist Giuseppe Arcimboldo (1530–1593) or to the magus and artificer Cornelius Drebbel; see Dickreiter, 132–3.

<sup>23</sup> Robert John Weston Evans, *Rudolf II and His World: a Study in Intellectual History, 1576–1612* (Oxford: Clarendon Press, 1973), 190–3.

<sup>24</sup> See Frances Yates, *Giordano Bruno and the Hermetic Tradition* (Chicago: University of Chicago Press, 1964), 78–83; and Gary Tomlinson, *Music in Renaissance Magic* (Chicago: University of Chicago Press, 1993), especially 45–6.

<sup>25</sup> See the standard biography by Max Caspar, *Kepler*, trans. C. Doris Hellmann (New York: Dover, 1993), 262, from Kepler’s letter to Philipp Muller after 13 September 1622, KGW 18:78–9; discussed also in my “Kepler’s Critique of Algebra,” *Mathematical Intelligencer* 22, no. 4 (2000): 54–9. For excellent treatments of Kepler’s attitude towards the occult arts, see Robert S. Westman, “Nature, Art and Psyche: Jung, Pauli, and the Kepler-Fludd Polemic”; Edward Rosen, “Kepler’s Attitude

toward Astrology and Mysticism”; Judith V. Field, “Kepler’s Rejection of Numerology”; and Brian J. Vickers, “Analogy Versus Identity: The Rejection of Occult Symbolism, 1580–1680”; all in *Occult and Scientific Mentalities in the Renaissance*, ed. Brian J. Vickers (Cambridge: Cambridge University Press, 1984), 177–229, 253–72, 273–96.

<sup>26</sup> KGW 17:80; I thank H. Floris Cohen for drawing this passage to my attention.

<sup>27</sup> KGW 6:397.

<sup>28</sup> See William H. Huffman, *Robert Fludd and the End of the Renaissance* (London: Routledge, 1988), 52–63.

<sup>29</sup> Dickreiter, 134; KGW 16:153.

<sup>30</sup> Dickreiter, 134.

<sup>31</sup> Dickreiter, 134. Regarding Jean de Léry’s *Histoire d’un voyage faict en la terre du Brésil* (1578), see the entry by Helen Myers in *New Grove Dictionary of Music and Musicians*, 2nd ed., s.v. “Ethnomusicology.” I thank Gary Tomlinson for drawing my attention to de Léry’s work, which is the earliest attempt to notate non-Western music known to me.

<sup>32</sup> HW 217 (KGW 6:158). In his treatise *De inventione et usu musicae* (1481–3), Tinctoris describes the “crude and coarse” singing of the Turkish prisoners taken by the Duke of Calabria after the siege of Lepanto (1480), though without trying to notate that singing; see Karl Weinmann. *Johannes Tinctoris (1445–1511) und sein unbekannter Traktat “De inventione et usu musicae”* (Regensburg: F. Pustet, 1917), 42–43, 45–46. I thank Sean Gallagher for informing me about this and supplying the relevant texts.

<sup>33</sup> Dickreiter, 135.

<sup>34</sup> Dickreiter, 137.

<sup>35</sup> Dickreiter, 139.

<sup>36</sup> Caspar, *Kepler*, 248; KGW 17:254. However, Kepler manuscripts in the Pulkowa library reveal that he only read three-quarters of Galilei’s book; see Dickreiter, 138.

<sup>37</sup> Caspar, *Kepler*, 266.

<sup>38</sup> HW 137 (KGW 6:99).

<sup>39</sup> HW 138 (KGW 6:99).

<sup>40</sup> HW 192 (KGW 6:139) is the unique mention of Zarlino in Kepler's text.

<sup>41</sup> Walker, 35–53.

<sup>42</sup> Walker, 39–40.

<sup>43</sup> See my “Kepler's Critique of Algebra,” 57–9.

<sup>44</sup> HW 138 (KGW 6:99)

<sup>45</sup> HW 217 (KGW 6:158).

<sup>46</sup> HW 218 (KGW 6:158). Here I have altered the translation by using the modern convention for note names in different octaves. [In *JSCM*, middle C is represented as *c'*, the octave below as *c*. —ed.]

<sup>47</sup> Note that Kepler's version of “Victimae paschali” includes the inflected tone F-sharp; this was not novel, since Gafori used such an inflection in his “Salve Regina” of 1496. See Richard Sherr, “The Performance of Chant in the Renaissance and its Interactions with Polyphony,” in *Plainsong in the Age of Polyphony*, ed. Thomas Forrest Kelly (Cambridge: Cambridge University Press, 1992), 178–208.

<sup>48</sup> See HW 218, n. 125; there is a parallel passage defining this terminology in Aristides Quintilianus, *De musica*, available in *Greek Musical Writings*, ed. Andrew Barker, 2 vols. (Cambridge: Cambridge University Press, 1989), 2:430–1. Note that some of the Greek accents and breathings are not shown here.

<sup>49</sup> HW 218 (KGW 6:158).

<sup>50</sup> Walker, 38–40. Tomlinson, 76–84, discusses the views of Guido Anselmi, who wrote that “each sphere produces not merely a single harmony but many notes and leimmas and dieses and commas as those happy spirits, at one moment with



the sounds of their own spheres or at another with those that sit near them, seem to lead in song, or follow, or press upon [one another] and strike together ..." (76). Tomlinson interprets this as a kind of harmony produced by the complex motion of each planet. Further, Ramos de Pareia associated modes, rather than only tones, with each sphere (78–84). However, neither of them contemplates an explicit polyphony between the various spheres, much less associates it with terrestrial exemplars.

<sup>51</sup> Orlando di Lasso, *Sämtliche Werke* (Leipzig : Breitkopf & Härtel, 1894–1926; reprint: New York: Broude Brothers, 1973), 9:49–52. See Jerome Roche, *Lassus* (London: Oxford University Press, 1982), 5; for the context of other motets, see Noel O'Regan, "Orlando di Lasso and Rome: Personal Contacts and Musical Influences," in *Orlando di Lasso Studies*, ed. Peter Bergquist (Cambridge: Cambridge University Press, 1999), 132–157, 145. Though Dr. Watson informs us that Mr. Sherlock Holmes spent a "memorable day" working on "a monograph which he had undertaken upon the Polyphonic Motets of Lassus," unfortunately that work never reached posterity; see Sir Arthur Conan Doyle, "The Adventure of the Bruce-Partington Plans" (1895), in *The Annotated Sherlock Holmes*, ed. William S. Baring-Gould (New York: Clarkson N. Potter, 1967), 2:449.

<sup>52</sup> "In me transierunt" is cited at HW 221, 234, 239 (KGW 6:161, 171, 174); "Ubi est Abel" and "Tristis est anima mea" are mentioned at HW 253 (KGW 6:184).

<sup>53</sup> Werner Braun, *Deutsche Musiktheorie des 15. bis 17. Jahrhunderts: Von Calvisius bis Mattheson* (Darmstadt: Wissenschaftliche Buchgesellschaft, 1994), 2:139–42, including mentions of the work by Gallus Dressler (1563/64) and Johannes Magirus (1596), not to be confused with Kepler's teacher Samuel Magirus (cf. [ref. 12](#)). See also Wolfgang Boetticher, "Orlando di Lasso als Demonstrationsobject in der Kompositionslehre des 16. und 17. Jahrhunderts" in *Bericht über den Internationalen Musikwissenschaftlichen Kongress, Bamberg, 1953*, ed. Wilfried Brennecke, et al. (Kassel: Bärenreiter, 1954), 124 ff.

<sup>54</sup> For a complete translation, see Joachim Burmeister, *Musical Poetics* (New Haven: Yale University Press, 1993), which discusses "In me transierunt" at 205–6. For the passage on "In me transierunt" see the translation and commentary by Claude V. Palisca, "Ut Oratoria Musica: The Rhetorical Basis of Musical Mannerism," in *The Meaning of Mannerism*, ed. Franklin W. Robinson and Stephen G. Nichols, Jr. (Hanover, N.H.: University Press of New England, 1972), 37–65. Concerning Burmeister in general, see Martin Ruhnke, *Joachim Burmeister: Ein Beitrag zu Musiklehre um 1600* (Kassel: Bärenreiter, 1955), 130–5, 162–5.

<sup>55</sup> See Dickreiter, 60–1 for the disappearance of Kepler’s letters to Calvisius (whose dates are listed in KGW in the appropriate chronological place). The extant letters between them in 1607–1609 are mostly devoted to detailed issues of chronology, especially their disagreement concerning the exact birth-year of Christ. See KGW 6:477, 15:469–76, 16:47–9, 16:55–9, 16:216–22, 18:455–9.

<sup>56</sup> Sethus Calvisius, *Exercitationes musicae duae* (Leipzig: I. Apelij, 1600; reprint Hildesheim: Georg Olms, 1973), 51.

<sup>57</sup> For instance, Lasso’s motet *Locutus sum* in six voices, which also begins with a prominent “mi fa mi,” but only after an initial leap of a fifth, discussed by Marie Louise Göllner, “Orlando di Lasso and Andrea Gabrieli: Two Motets and Their Masses in a Munich Choir Book from 1564–65,” in *Orlando di Lasso Studies*, 20–40 at 23–26. For the general problem of musical *exempla*, see Cristle Collins Judd, *Reading Renaissance Music Theory: Hearing with the Eyes* (Cambridge: Cambridge University Press, 2000).

<sup>58</sup> HW 221 (KGW 6:161).

<sup>59</sup> This is the observation and conclusion of both Dickreiter, 175–6, and Braun, 141. For the authentic text, see Lasso, *Sämtliche Werke*, 9:49. Kepler also misstates the final note of the incipit as a *semibrevis*, instead of a dotted *minima*.

<sup>60</sup> HW 234 (KGW 6:171). Kepler may well have known that this same example was cited by Lucas Lossius, *Erotemata musicae practicae* (Nuremberg: Gerlatseni, 1570), book I, chapter 7, among his examples of church modes, for this book was in Kepler’s school library in Linz, according to Dickreiter, 145.

<sup>61</sup> HW 239 (KGW 6:174).

<sup>62</sup> HW 238 (KGW 6:173).

<sup>63</sup> HW 243 (KGW 6:177).

<sup>64</sup> HW 441 (KGW 6:323).

<sup>65</sup> HW 449–50 (KGW 6:329).

<sup>66</sup> Dickreiter, 186, notes that Kepler's characterization of the narrow range of the alto contradicts the theory and practice of his contemporaries.

<sup>67</sup> See my "Johannes Kepler and the Song of the Earth" in a forthcoming volume edited by George Smith in the Burndy Library series.

<sup>68</sup> HW 430 (KGW 6:316). For further discussion of planetary songs, see Tomlinson, 63–100.

<sup>69</sup> HW 423 (KGW 6:311).

<sup>70</sup> HW 439 (KGW 6:322).

<sup>71</sup> Walker, 59–60.

<sup>72</sup> HW 441 (KGW 6:323).

<sup>73</sup> Field, *Kepler's Geometrical Cosmology*, 118.

<sup>74</sup> Here I disagree with Claude Palisca's view ("*Ut Oratoria Musica*," 37–41): "If Josquin represents a classical moment in the music of the sixteenth century, Lassus is the epitome of mannerism," adducing Burmeister's rhetorical analysis of "In me transierunt" to show its mannerism. For Lasso as member of "the musical avant-garde of the sixteenth century," see also Edward Lowinsky, "The Musical Avant-Garde of the Renaissance or: The Peril and Profit of Foresight," in *Art, Science, and History in the Renaissance*, ed. Charles S. Singleton (Baltimore: Johns Hopkins University Press, 1967), 113–62, at 139–44. To my ears, "In me transierunt" is not "mannerist" but "classic." *Pace* Palisca, its rhetorical stance is not so very different from Josquin's motets. See James Haar, "Classicism and Mannerism in 16th-Century Music," *International Review of the Aesthetics and Sociology of Music* 25 (1994): 1–2, 5–18. About "Prophetiae Sibyllarum," see William E. Lake, "Orlando di Lasso's Prologue to *Prophetiae Sibyllarum*: A Comparison of Analytical Approaches," *In Theory Only* 11, no. 7–8 (1991): 1–19.

<sup>75</sup> HW 440 (KGW 6:322). For an interesting extension of Kepler's idea, see Herbert Anton Kellner, "Kepler, Bach, and Gauss: The Celestial Harmony of the Earth's Motion," *Bach* [Berea, Ohio] 25 (1994):1, 46–56. Penelope Gouk asserts that "the modern tonic sol-fa system used today (*do re mi fa so la ti do*) ... was known to scholars such as John Pell through

Kepler's *Harmonices mundi* (1630) and Asted's *Encyclopaedia* (1630), but English musicians did not apparently use the method"; *Music, Science and Natural Magic in Seventeenth-Century England* (New Haven: Yale University Press, 1999), 129. However, there is no evidence of this modern system of solmization to be found anywhere in Kepler's *Harmonices*.

<sup>76</sup> Even Lasso's Prologue to "Prophetiae Sibyllarum" does not begin with such a direct use of the semitone.

<sup>77</sup> To be sure, other examples of "mi fa mi" would have worked as well, such as Josquin's "Miserere mei Deus," probably the most famous example in the sixteenth century. However, Kepler nowhere mentions Josquin, leading to the speculation that he was unacquainted with his works.

## Figures

[Figure 1](#): Johannes Kepler, *Harmonices mundi* (1619), page 61

[Figure 2](#): Kepler's citation of the incipit of "In me transierunt"

[Figure 3](#): Kepler's version of the "song of the earth"

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