The Keplerian Hindemith

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Introduction

Scope of This Paper

Paul Hindemith was a twentieth century man who held many nineteenth century Romantic ideals. He embraced many of the romantic philosophical views of the previous century and this is evidenced in Hindemith's fascination with Johannes Kepler. I intend to show the influence of Kepler's life and ideas upon Paul Hindemith's philosophical and musical lives, as it reveals itself in the symphony 'Die Harmonie der Welt'.

In order to discover Kepler's influence on Hindemith, it will be necessary to provide some background information dealing with the harmony of the spheres, Kepler's harmonic concept of the universe, and Hindemith's cosmological concept of music.

The Harmony of the Spheres

The Harmony of the Spheres had its historical origins in the Greek tradition. The philosopher and mathematician Pythagoras considered the world and devised an explanation of its underlying order. The Pythagorean concept held that there existed a relationship between the abstract worlds of numbers and music that coincided with the physical world of the cosmos. Aristotle, if not the Pythagoreans themselves, labeled this term the 'music of the spheres'.[1]

The chain of great thinkers maintained this idea. It was passed down from Pythagoras to such Greeks as Plato, Aristotle, and Ptolemy. Especially due to their admiration of the former two, the early Christians kept the concept alive.[2] Of these, a medieval music theorist provided the most complete understanding of the Pythagorean system, at least

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1 James, Jamie, The Music of the Spheres: Music , Science, and the Natural Order of the Universe (New York: Grove Press, 1993), 38.
2 James, Jamie, The Music of the Spheres: Music , Science, and the Natural Order of the Universe (New York: Grove Press, 1993)., 69.

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from a musical perspective. This was Boethius (ca. 480-ca. 524), whose theoretical treatise *De institutione musica* (*Principles of Music*) became the most widespread music theory text of the middle ages.[3] Indeed, the reach of Boethius' influence has extended well past the Middle Ages and in to modern times.

St. Augustine had further influence on Hindemith's concept of the harmony of the spheres. In reference to Augustine's work *De Musica libri sex,* Hindemith writes, "Musical order… is not an end in itself. It is an image of a higher order….".[4] Augustine had extended the concept beyond the immediate physical world to include the spiritual and emotional planes by asserting that musical impressions were not simply reactions to external stimuli, but are the result of physical, physiological, and mental interaction. Music affects "both our corporeal and mental" natures and thereby serve to order our physical bodies and emotional states.[5] For Augustine, as it had been with Pythagoras before, "pure music is number made audible."[6]

This idea was augmented in the theories of Boethius, which divide music into three parts: *musica mundana*, *musica humana*, and *musica instrumentalis*. *Musica instrumentalis* (music of the instruments, including voice) is that music which is for and by instruments. This is the music that we know. It is performed by *cantores*, which are vocalists and instrumentalists. *Musici* were music theorists, considered to be true artists and, indeed, scientists. *Musica humana* (music of the body and of the soul) is the music of one's 'inner soul'. For Augustine, it is that which orders (or disorders) one's passions and emotions. Hindemith's own definition was, "[It] is the principle which unifies the immateriality of our faculty of reasoning with our corporeal existence … and which brings about the harmonious coherence of our body's members and their smooth and well-tuned synchronization." *Musica mundana* (harmony of the universe) is the music of

3 The Norton/Grove Concise Encyclopedia of Music, 1988 ed., s.v. "Boethius."
4 Paul Hindemith, A Composer's World: Horizons and Limitations (Cambridge, Mass.: Harvard University Press, 1969), 5.
5 Ibid., 4.
6 Jamie James, The Music of the Spheres: Music , Science, and the Natural Order of the Universe (New York: Grove Press, 1993), 73.

the cosmos; it is the method of ordering the planets' motion and, through Ptolemy's astrological method set out in the *Tetrabiblios*, affects our own *musica humana*. Hindemith elaborated and clarified Boethius' explanation by stating, " [It] governs the heavens, time, and earth. It causes the planets to revolve in their orbits; it moves the celestial spheres. Without such organizing harmony how would the cohesion of the entire universe be possible?" This was the development of the 'music of the spheres'. Its effect was far reaching, especially in the analysis of the lives and works of Johannes Kepler and Paul Hindemith.[7]

Kepler's Solar System

Kepler's greatest achievements dealt with explaining the juxtaposition of the planets.
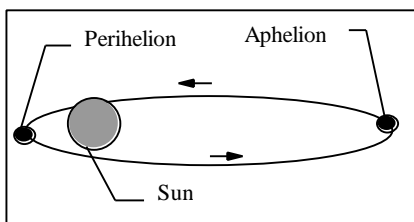

Figure 1: Kepler's Discovery

Previously, the solar system had been considered to be a geocentric one in which all of the planets (of which only six were known) traveled in circular orbits around the earth. Earlier, Copernicus had shattered the idea of a geocentric solar system by proving that it is in fact heliocentric; the planets move around the sun. There was still a problem with the calculations, however, and Kepler solved it. He showed that the planets move in elliptical orbits around the sun, and that this elliptical shape is due to the effect of each planet on all of the other planets. The mass of each planet has a direct effect on the orbit of every other planet. This is known as Kepler's First Law of Planetary Motion.[8]

There are two points on an elliptical orbit are worth noting, the aphelion and the perihelion. The aphelion is the point that is farthest from the sun, and the perihelion is the point that is closest. These are illustrated in Figure 1. These points, when taken

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7 Jamie James, <u>The Music of the Spheres: Music, Science, and the Natural Order of the Universe</u> (New York: Grove Press, 1993), 74; Paul Hindemith, <u>A Composer's World: Horizons and Limitations</u> (Cambridge, Mass.: Harvard University Press, 1969), 4-5, 8; <u>The New Harvard Dictionary of Music</u>, 1986 ed., s.v. "Musica".
8 Paul A. Tipler, ed., <u>Physics for Scientists and Engineers</u> (New York: Worth Publishers, 1991), 297.

together, form the greatest distance between any two points along the planet's orbit. The resulting harmonic intervals due to the extreme motions of aphelion and perihelion are shown in Figure 2. These are Kepler's Scales of Aphelions and Perihelions.[9]
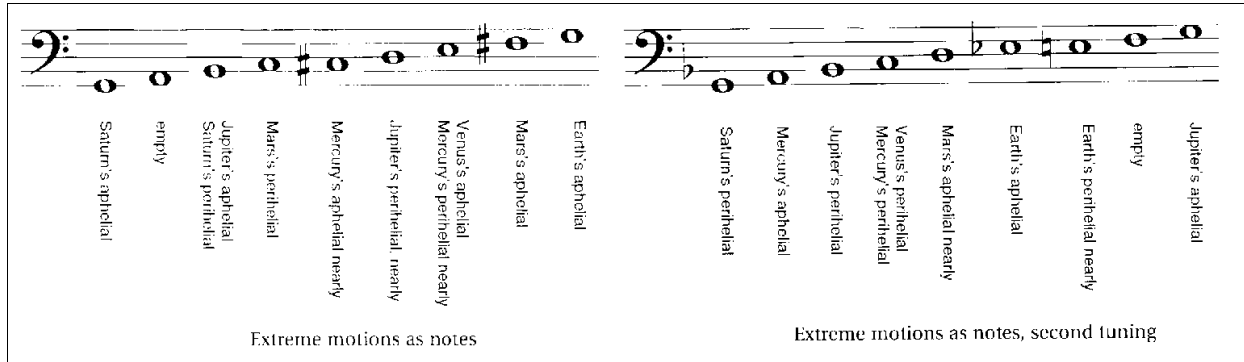

Figure 2: The Aphelion and Perihelion Scales of Kepler; reprinted from Bruce Stephenson, <u>The Music of the Heavens: Kepler's Harmonic Astronomy</u>, (Princeton: Princeton University Press, 1994),57.

The definition of these points and their respective distances form a major portion of Kepler's early work. Additionally, Kepler devised a universal scheme that set the five major solids 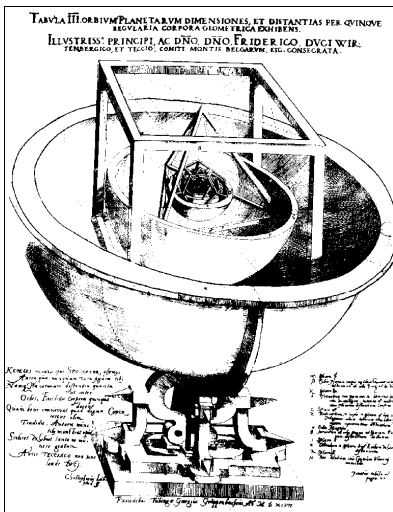as 'layers', separating the six known planets. This scheme is set out in the *Mysterium cosmographicum*, and is shown in Figure 3.[10] Only five such solids exist, for mathematical reasons. Similarly, it can be reasoned that only five consonant intervals exist in music. To do so, an assumption must be made that the intervals of the tonic to major third (M3) and a minor sixth (m6) to the octave/tonic are aurally equivalent. This same equivalence applies to the intervals of the tonic to the minor third (m3) and the major sixth (M6) to the octave/tonic. The five consonant intervals relative to the tonic, then, are the

Figure 3: Kepler's Universe; reprinted from Johannes Kepler, <u>Mysterium cosmographicum</u> [The Secret of the Universe], trans. A.M. Duncan (New York: Abaris Books, 1981), i.

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[9] Bruce Stephenson, <u>The Music of the Heavens: Kepler's Harmonic Astronomy</u>, (Princeton: Princeton University Press, 1994),145-165.

[10] Paul A. Tipler, ed., <u>Physics for Scientists and Engineers</u> (New York: Worth Publishers, 1991), 297; Johannes Kepler, <u>Mysterium cosmographicum</u> [The Secret of the Universe], trans. A.M. Duncan (New York: Abaris Books, 1981), 131-149.

minor third/major sixth (m3/M6), the major third minor sixth (M3/m6), the perfect fourth (P4), the perfect fifth (P5), and the perfect octave (P8). This concept fits in neatly with Hindemith's own views.

Hindemith's Musical Theories

Hindemith devised his own approach to music theory, one that was based heavily on his belief in a universal harmony. Its basis is the harmonic series; a natural phenomenon that dictates
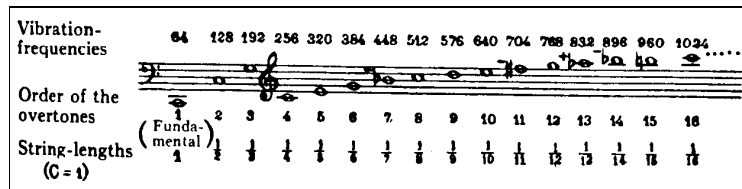

Figure 4: The Overtone Series; reprinted from Paul Hindemith, The Craft of Musical Composition, vol. I, Theory , 4th ed., trans. Arthur Mendel, (New York: Schott Music, 1942), 17.

certain harmonic overtones will result from a fundamental tone. In Hindemith's theory, tones closer to the fundamental tone, the tonic, are more consonant than tones that are further away. The harmonic series is illustrated in Figure 4. Hindemith's compositional method does tend to become quite complex, but this basis remains nevertheless.

The Influence from an Historical Perspective

Similarities in Their Lives

It is extraordinary to view the lives of Johannes Kepler and Paul Hindemith in tandem. A startling fact is evident from the outset - the birth and death dates of each lie within one day of each other (Kepler: b. 27 December 1571, d. 15 November 1630. Hindemith: b. 16 November 1895, d. 28 December 1963.). Even queerer is the fact that their birthplaces of and places of death all lie within a distance of eighty miles. The parallels are much deeper, however. Both men received their schooling from adolescence into their early twenties (from approximately age twelve through age twenty-two). Both men entered their respective fields and married in their late twenties. Both published early works within their field at this same time in their lives (Kepler - *Mysterium cosmographicum*, Hindemith - *Das Marienlieben*). By middle age, each of

the men had achieved recognition for excellence within their field and published a *philosophical* stance to their profession (Kepler - *Harmonice mundi*, Hindemith - *A Composer's World*). Finally, both were greatly affected by the political turmoil of their day and were exiled from their faith (Kepler was excommunicated from the church) or from their country (Hindemith left Germany due to the Nazi occupation).[11] While the correlation may be rather general in nature and could be attributed to a number of individuals, they could in no way be attributed to all individuals, or even most individuals. That is to say, part of Kepler's attraction for Hindemith lies in his being such a similar person.

The Attraction of Kepler

Given these parallels in their lives, it is no wonder that Hindemith found in Kepler a kindred spirit. Though for some reason Hindemith disclaimed any extreme or radical admiration of Kepler, his high esteem shows through in the libretto of his opera *Die Harmonie der Welt*.[12] In the final act, the spheres praise Kepler, singing,

> That man Kepler should be a model for us:
> He tried to assimilate his life into the Harmony,
> . . . .
> And their [Kepler and Susanna] willingness to serve these aims,
> Uplifted them far above mankind.[13]

Hindemith saw in Kepler a man of values and principles, steadfast in his beliefs; beliefs that were similar to his own. An example lies in Kepler's musical description of the solar system. [14] Hindemith used a very similar description, in reverse, to explain his concept of music. "The leading tones may have little harmonic impetus toward the tonic, but then they surrender spatially, i.e., melodically (the half-tone step) with all the

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[11] James P. D'Angelo. "Tonality and Its Symbolic Associations in Paul Hindemith's Opera <u>Die Harmonie der Welt</u>" (Ph.D. diss., New York University, 1983), 32.

[12] Ibid., 34.

[13] Ibid., 34.

[14] Johannes Kepler, <u>Mysterium cosmographicum</u> [The Secret of the Universe], trans. A.M. Duncan (New York: Abaris Books, 1981), 131-149; D. P. Walker, "Kepler's Celestial Music," <u>The Journal of the Wartburg and Courtauld Institute</u>, 36:4 (1964): 228-250, quoted in James P. D'Angelo. "Tonality and Its

more compliance to its attraction, just as the planets Mercury and Venus feel the sun's power in closest proximity, without, however, equaling the mass and power of the greater planets."[15] Further, he states in *Craft I* that, "… music and the cosmos are inseparably merged."[16] So, it can be seen that Hindemith related to Kepler both as a man of integrity and intelligence (maintaining his scientific beliefs even to the point of excommunication), and as a fellow believer in the cosmic musical order.

The Influence from a Musical Perspective

The influence of Johannes Kepler upon Paul Hindemith did not simply reveal itself in the latter's philosophical perspective but in his musical output as well. Hindemith composed both a symphony and an opera based on the life of Kepler. In order to see this influence Kepler affected, I will examine portions of the symphony *Die Harmonie der Welt*. Additionally, I will draw upon James D'Angelo's dissertation, "Tonality and Its Symbolic Associations in Paul Hindemith's Opera <u>Die Harmonie der Welt</u>" in order to show a correlation between the opera and the symphony from which the opera's music came.

Three Periods, One Work

The realization of Hindemith's tribute to Kepler had its genesis in the 1930's. However, Hindemith decided to escape the political climate within Germany and discontinued his work on it while an opera based on the German painter Grünewald (c. 1475-1528) was completed (*Mathis der Maler*). Work on the Kepler opera would not resume until the late 1940's. When it finally did resume, Hindemith found himself too busy to devote the time he felt was necessary to undertake the work. He had started a

Symbolic Associations in Paul Hindemith's Opera <u>Die Harmonie der Welt</u>" (Ph.D. diss., New York University, 1983), 21.

[15] Paul Hindemith, <u>The Craft of Musical Composition,</u> vol. III, <u>Three-Part Writing</u>, quoted in James P. D'Angelo. "Tonality and Its Symbolic Associations in Paul Hindemith's Opera <u>Die Harmonie der Welt</u>" (Ph.D. diss., New York University, 1983), 29.

[16] Paul Hindemith, <u>The Craft of Musical Composition,</u> vol. I, <u>Theory</u> , 4th ed., trans. Arthur Mendel, (New York: Schott Music, 1942), 12-13.

libretto, but was constantly distracted by his teaching position at Zürich as well as by conducting responsibilities and the completion of more pressing compositions. Musical ideas were begging for expression, however, and Hindemith decided to give these ideas fruition in the form of the symphony *Die Harmonie der Welt.*[17]
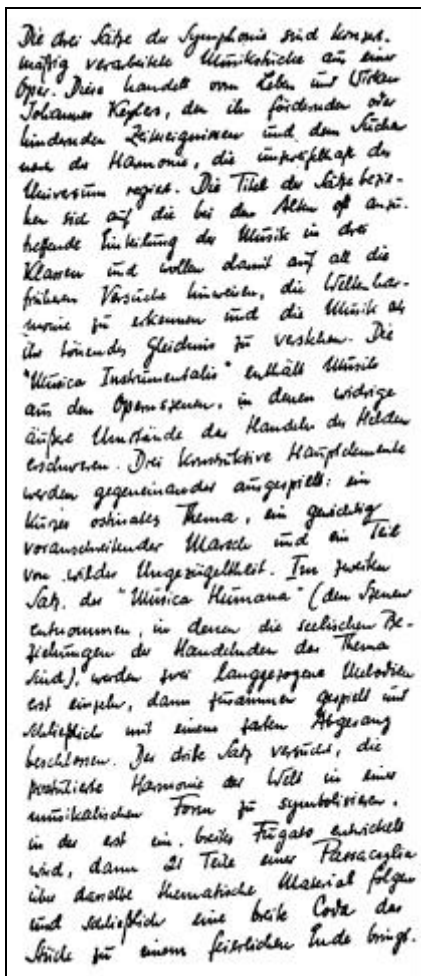
Symphonie: Die Harmonie der Welt

Figure 5: Hindemith Explains His Symphony reprinted from Friedrich Blume, ed., <u>Die Musik in Geschiste und Gegenwart</u> (Basel: Im Bärenreiter-verlag Kassel, 1957), s.v. "Hindemith," by Ebehard Preußner.

Hindemith's plan for his symphony included three movements, each taking a title from Boethius' musical divisions: *musica instrumentalis*, *musica humana*, and *musica mundana*. The work itself received its title from the German translation of Kepler's treatise, *De harmonice mundi*, which is translates into German as *Die Harmonie der Welt* (The Harmony of the World). The three movements are temporally spaced in approximately the same manner, with the last movement lasting about three minutes longer than the preceding two.[18] Hindemith elaborated on the plan in the program notes during the premier in 1951, having apparently completed the opera (finished in 1957) in his head! He says, "The three movements... are pieces from an opera and have been reworked for concert presentation.... The titles refer to the division of music into three classes that we often encounter in the writings of the ancients..."[19] Hindemith goes on to

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[17] David Neumeyer, <u>The Music of Paul Hindemith</u> (New Haven: Yale University Press, 1986), 243.
[18] Ibid., 244; Jamie James, <u>The Music of the Spheres: Music , Science, and the Natural Order of the Universe</u> (New York: Grove Press, 1993), 140-141.
[19] Friedrich Blume, ed., <u>Die Musik in Geschiste und Gegenwart</u> (Basel: Im Bärenreiter-verlag Kassel, 1957), s.v. "Hindemith," by Ebehard Preußner.

explain that his symphony features opposing themes and tonalities (see Figure 5).[20]

The embodiment of opposing distances was Kepler's claim to fame; he discovered the fact that the planets did not have a circular orbit, but an elliptical orbit. The perihelion,

Example 1: Tritone arch theme - mvmt. 1, meas. 12-13

being closest to the sun, is represented musically by Hindemith as the semitone, and the aphelion, being furthest away, as the tritone. As with Kepler's genius regarding cosmic juxtaposition, the key to the genius of the symphony is recognizing the importance of differing juxtapositions. The tonality of the main theme in *Musica instrumentalis* shifts between E and A#, establishing the important tritone relationship which occurs throughout the symphony and the opera alike. This holds true in this opening section as different orchestrations of the theme are played against each other. The theme is enlarged at B and elaborated upon. The dominating tonality is that of E, if only because it is the first to reach the ear. Again, this is true for the symphony at large.

Hindemith scholar James D'Angelo expounds on the meaning of the tritone relationship:

> The most prevalent interplay of tonalities are those a tritone apart, that is the most distant intervallic relationships in series I.
>
> . . . .
>
> The movement between tonalities a tritone apart stands separate from Hindemith's usual scheme of modulations because in addition to its powerful symbolic meaning [of Kepler's discoveries, Kepler's distanced familial and social relationships, and the harmonic series]…, [it] represents both a temporary exchange of tonal reference points and a permanent effected modulation. Hindemith's presentation of tonalities a tritone apart has two essential forms:
>
> 1. Tonality X juxtaposed with Tonality Y.
>
> 2. Tonality X succeeded by Tonality Y.
>
> In the first instance, the two tonalities are interwoven whereby either tonal center predominates or both centers compete for rulership.[21]

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[20] Friedrich Blume, ed., <u>Die Musik in Geschiste und Gegenwart</u> (Basel: Im Bärenreiter-verlag Kassel, 1957), s.v. "Hindemith," by Ebehard Preußner.

[21] James P. D'Angelo. "Tonality and Its Symbolic Associations in Paul Hindemith's Opera <u>Die Harmonie der Welt</u>" (Ph.D. diss., New York University, 1983), 83.

The second section is that of a march in which the succession tonalities may be seen. On a microscopic level, it is seen in the 'march' theme (Examples 1, 2). On a larger level, it is seen in successive entrances of the theme (Example 3).
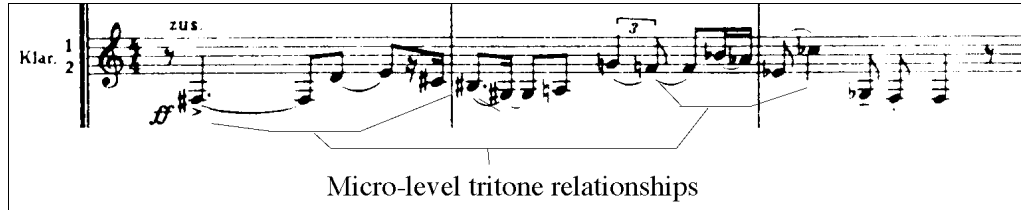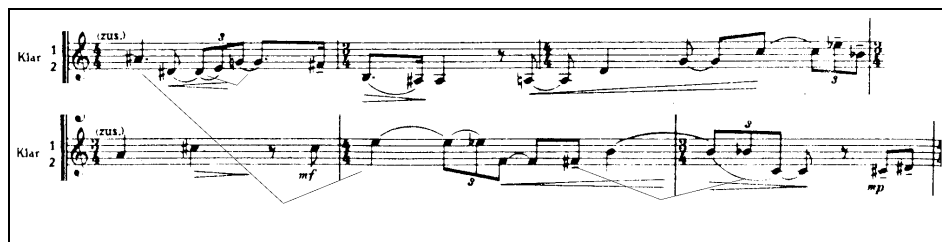

Example 2: Micro-level tritone relationships - mvmt. 1, meas. 34-36
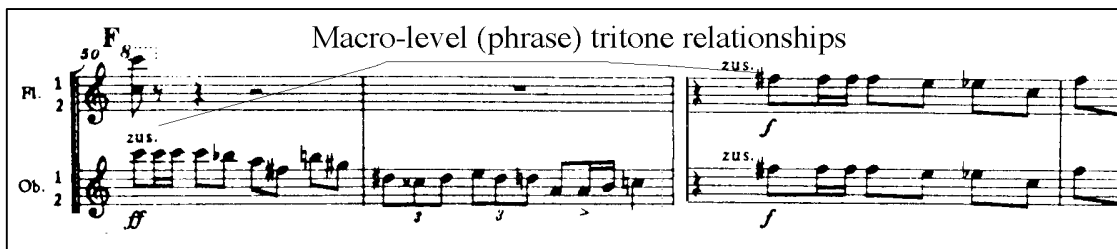
Example 3: Macro-level tritone relationships - mvmt. 1, meas. 50,55

The clarinet introduces the opening theme in *Musica humana*. This theme is itself divided along two lines - the first is in the G# tonality and the second is the tonality of D (Example 4, meas. 5). This illustrates the tritone relationship yet once again. Symbolically, this movement illustrates the complex weavings which *musica humana* must create to properly maintain the functions of the body.

Example 4: Successive Tritone Relationships; mvmt. 2, meas. 1-8

Musica mundana differs thematically from the other two movements, but nevertheless exhibits the tritone as a prime organizational factor. There is one pervasive theme through out this final movement (Example 5). A portion of it is given at the introduction,

Example 5: Main theme - mvmt. 3, meas. 1-4

and it is fully represented when the pasacaglia begins in measure 48 (Example 6). The pasacaglia is based solely on the juxtaposition of this theme between instruments. The theme incorporates a small 'tonal arch' from E to Bb and back to E. The only shift from

Example 6: The tritone relationship as an 'arch-tonality' within a phrase - mvmt. 3, meas. 48-57

this 'elliptical tonality' (E vs. Bb) occurs at a free section from measure 140-158, where the pasacaglia then begins again. A chaotic section occurs toward the very end, and the theme is lost for the only time in the piece (meas. 222-249), but it is resurrected for a final triumphant ending. The symbolism here is clear; there is an underlying, universal theme, and though it may seem clouded, it will nonetheless rise again in its power and truth.

These same important tritone relationships are used to propel the libretto of Hindemith's opera as well. The bulk of James D'Angelo's work on the subject is spent analyzing the relationship and its symbolism within Kepler's professional, social, and

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familial lives, and upon the human race itself. The tritone is used to symbolize a myriad of diametrically opposing relationships that occurred within Kepler's life.

Kepler did indeed hold a special place within Hindemith's life. His devotion of thirteen years towards a tribute to Kepler is clear evidence of this. Further, the meticulous manner that Hindemith used in composing both the symphony and the opera, more so than some of his other works of the time, shows his great devotion to Kepler's memory. Lastly, it has been shown that Hindemith used the tritone as an organizational basis for both his symphony and his opera in the same manner that Kepler built his musical universal theory from the great distances between the aphelion and perihelion.

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