The influence of Greek musical thought on early Western musical theory

Music theory is ever changing. Like any academic discipline, Western musical theory has evolved over many centuries to become what it is today. We can trace the roots of modern music theory back to the Ancient Greeks. Greek "music theory" shares little in common with the subject which comes to the mind of 21st Century Westerners, yet the two are inseparably linked. Westerners tend to comprehend the relationship between medieval and modern theory, finding Greek theory to be abstract and fundamentally unrelated. However, it is Greek theory which dominates early medieval musical thought. Scholars were still studying - and basing their work upon - the works of Greek philosopher Pythagoras some 1000 years after they were written. It was not until nearly 1500 years after Pythagoras' abstract treatment of music that the transformation of musical science to musical art occurred. This transformation may seem to sever the relationship between Greek and medieval theory, but this is not the case. Greek theory remained important throughout the early medieval period. Rather than naively treating music as art instead of science, medieval theorists applied the scientific methods of their Greek predecessors to explain the art of their 'modern' music. Thus, Greek theory left its mark upon Western theory for centuries to come.

The primary thesis of Ancient Greek musical theory was that music represented the mathematical study of numbers in ratios. Much of this theory was advanced by Pythagoras of Samos (c. 580 – c. 500 BC) - a Greek philosopher living in the 6th Century B.C. Though no writings of his exist, he is credited with many mathematical, and musical, innovations: the classification of numbers as odd and even; prime numbers; triangle and square numbers and, of course, the Pythagorean theorem, to name

but a few.[1] To him, music and mathematics were inseparable; music was the harmonious reflection of number and thus represented the "ultimate reality".[2]

Pythagoras and his followers were known to be especially interested in the ratios constructed of the first four positive integers – namely, 1:2, 1:3 and 1:4. The Greeks and, indeed, modern Western musical theorists considered these ratios, when sounded, to have a consonant quality. The diagram in Figure 1 show how these intervals were studied acoustically by Pythagoras.

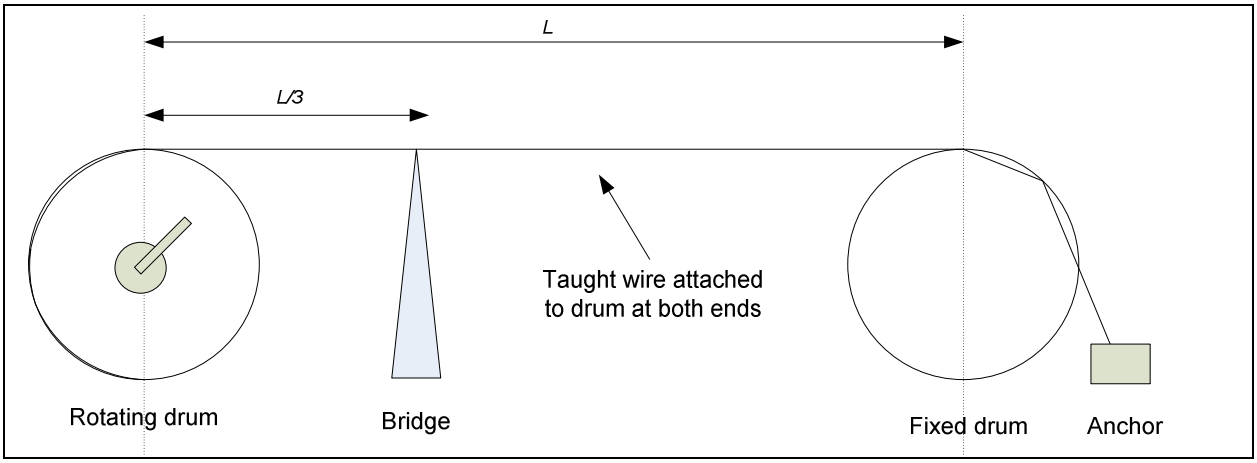

Figure 1: *Diagram of equipment similar to that used by Pythagoras to measure intervals produced by certain ratios. In the diagram above, the string is split in the ratio 1:2, so an interval of an octave is heard.*

When performing the experiment outlined in Figure 1, we must bear in mind that the fundamental tone is heard at all times. As we see, a ratio of 1:2 adds a note an octave higher than the fundamental frequency of the string. 1:3 creates a note an octave and a fifth higher than the fundamental, and 1:4 creates a note two octaves higher. The simplicity and elegance with which consonant intervals could be

[1] Don Allen, "Pythagoras and the Pythagoreans", <http://www.math.tamu.edu/~don.allen/history/pythag/pythag.html>. Accessed 10 March 2007.
[2] Thomas Christensen (ed.), *The Cambridge History of Western Music Theory* (Cambridge: Cambridge University Press, 2002), p. 114

written as ratios led the Pythagoreans to believe that the study of ratios was the fundamental way in which music should be studied. [3]

Music as the study of ratios is a recurring theme seen throughout the following millennium. The most notable example of the continued interest in Pythagorean theory is *Harmonics*, a major work by Claudius Ptolemy (c. 90 – c. 168 AD) in the 2nd Century AD. In Harmonics, Ptolemy, a Roman of Greek ancestry, put many of the propositions of Greek musical theorists to the test. Ptolemy investigated what he considered to be the most promising insights from any early-Greek theorists and aimed to construct from these a fair and balanced summary more suited to the job of musical classification and less biased by the politics of philosophy that affected Ancient Greek philosophers. [4] Through scientific experimentation, Ptolemy demonstrated the theories of his ancestors. In order to do so, Ptolemy designed and built his own instruments to study various ratios and the intervals they sounded. These varied from simple strings stretched out and clamped at different positions (as shown in Figure 1, previously) to more complex contraptions to measure ratios of more complex (often irrational) numbers.

Ptolemy's work bridges a gap between mathematical musical theories and their 'real-world' demonstration in a scientific manner that, for the first time, acknowledged the importance of perception in order to understand theory. Ptolemy is one of the earliest theorists to juxtapose reason and perception rather than view them as competitors for the scientist's allegiance. Ptolemy realized that the two were inseparable and believed that, in order to understand music theory, musical perception must be acknowledged. He summarized this view in *Harmonics*: "Hearing is concerned with the matter and the *pathos*, reason with the form and the cause".[5] Ptolemy understood that some theories could be

[3] Manuel Pedro Ferreira, "Proportions in Ancient and Medieval Music", *Mathematics and Music* (Germany: Springer-Verlag Berlin Heidelberg, 2002), p. 2
[4] Andrew Barker, *Scientific Methods in Ptolemy's* Harmonics (Cambridge: Cambridge University Press, 2001), p. 14
[5] *Ibid.*, p. 15

best understood by direct perception of them, whilst other, less perceivable, theories required application of the brain in a purely mathematical form. This view, although seemingly a rebellion against standard Greek thought, was actually no more than an extension of it. Ptolemy's work applied new ideas to old without questioning the traditionally abstract and theoretical study of music that had been in place for over six hundred years before his time.

We can see that Greek musical philosophy was still a dominating force in the 1st Century AD. It can be argued that this is due merely to the fact that the period between the fall of the Greek empire and Ptolemy's *Harmonics* was not long enough for there to have been any major changes in Western musical philosophy. However, this thesis is false since the same pattern of Western theory expanding upon Ancient Greek philosophy can be seen up until the late 9th Century AD. The lack of progress in this period can be attributed to Roman philosophers, and their study of *musica*. The Roman study of *musica* – the Latin word for "music theory" - was effectively an extension of the technical subject formulated by the Ancient Greeks. Like its forbearer, *musica* was isolated from the artistic tradition of musical performance. *Musica* tended to be studied by the wealthy in order to expand their conversational repertoire – the ability to enumerate famous Greek theorists and show a shallow understanding of the Greek tonal system was a sign of class.[6]

A major contribution to Western theory that the Romans were responsible for was the notion of music as thing of beauty. Much of Roman music theory is influenced by spirituality and relates both spirituality and beauty to music, often through the application of Pythagorean musical theorems. Marcus Tullius Cicero's (106 – 43 BC) master work, *The Republic*, drew clear lines between the three, and contains a romantic account of a soul's ascent to knowledge. In this section, Cicero's soul is curious about the nature of the beautiful sounds it hears upon being lifted into the cosmos. His soul is told that

[6] Christensen (ed.), *The Cambridge History of Western Music Theory* (Cambridge: Cambridge University Press, 2002), p. 136

the harmony is due to the motion of the spheres that are spaced according to musical ratios.[7] This philosophy is mirrored by St. Augustine of Hippo (354 – 430 AD). Music, to Augustine, represented the manifestation of beauty. Furthermore, Augustine believed strongly in the Pythagorean tradition. He combined these two thoughts in his book, *On Music*, in which he uses number and ratios as a way to lead the reader away from the corporeal world of sound. He argues that the ratios encountered in music can lead the soul to appreciate harmony (in an abstract sense), and then can lead to philosophical knowledge and finally to the knowledge of God.[8] Finally, Martianus Capella (5th Century AD), a pagan writer of the Late Antiquity, believed that the cosmos itself was set out according to the principles of musical harmony. Capella was responsible for associating divine intellect with musical theory. Such ideas were based upon, and in turn gave credence to Pythagorean views of music.

Roman writers, influenced by the rise of Christianity in the West linked Ancient Greek musical theory with a deeper, more spiritual reasoning. This link resonated well with future scholars during the highly religious first millennium, AD. While, as we have seen, many Roman scholars were responsible for advancing contemporary musical theories, these theories did not fundamentally alter Western musical theory as a whole. Instead, these theories built upon the existing abstract Greek study of music by linking spirituality with abstract mathematical reasoning. This trend continued into the Middle Ages as the manuscripts of the ancient, "enlightened" Greek civilization were studied in detail.

Anicius Manlius Severinus Boethius (480 – 525 AD), the most prolific and influential writer of the early Middle Ages, was responsible for solidifying many earlier Roman and Greek theories and forming the predominant musical theory that would last for some 300 years. By doing so, Boethius holds more responsibility than any other early medieval music theorist for forcing Greek (and Roman extensions of Greek) theory upon the field. Boethius' most important contribution was his *Fundamentals of Music* in

[7] *Ibid.*, pp. 139-140
[8] *Ibid.,* p. 141

which he juxtaposed arguments for both the sensual experience and reasoned truth that defined music in these early times. Following in Ptolemy's footsteps, Boethius demonstrated by experiment the veracity of ratios to the sense of hearing. He did this by stretching a string and moving a bridge underneath it to split the string into certain ratios – a method we have seen time and time again in the experiments of earlier musical theorists. [9]

For all of Boethius' solidification of Western music theory, his works still lacked direct reference to the musical repertoire of the time. Indeed, there is no mention - nor analysis - of any piece of contemporary music in any of his works. This leads us to believe that Boethius was heavily influenced by past theories - the elegance and simplicity of the Pythagorean view of music as the measure of ratios was so well established that he could not see past it. Greek and Roman musical theories suppressed Boethius' ability to advance music past the point of abstract reasoning.

Under the pressure imposed by widely accepted musical thought, music theory remained generally unaltered for the next 300 years. It was not until after the Carolingian Renaissance swept Europe in the 8th Century AD that we see the next steps towards our modern musical theory. The unification of Europe under Charlemagne during these times led to an unprecedented circulation of manuscripts between the kingdoms. Boethius' *Fundamentals of Music* and Capella's *Marriage of Mercury and Philogy* were copied and circulated extensively. Thus Carolingian music theory was, at first, strictly grounded in the Pythagorean tradition. However, the death of Charlemagne and the dissolution of his kingdoms would be the catalyst for a massive reevaluation of musical theory.[10]

As the political unity of Europe waned during the 9th Century, the culture that had been revived under the Carolingians retreated to the monasteries – the most stable centers of intellectual thought during this time. The scholars at these monasteries were naturally drawn by the Roman theory of music

[9] *Ibid.,* p. 146
[10] *Ibid.*, p. 150

being something divine. However, these scholars were also heavily influenced by the liturgical chant that they sung every day. It was the monastic scholars who were responsible for illustrating Boethius' (and by transitivity, Pythagoras') theory of ratios with examples from Gregorian chant. Pythagorean use of ratios in intervallic analysis was inextricably linked to musical practice as scholars explained intervals in chant with the use of Pythagorean analysis. The modern tradition of applying musical theory to analyze musical pieces had begun.[11]

Before concluding that the monastic scholars were first to demonstrate the concrete link between musical theory and practice, it is vital to investigate a rival school to that of the Pythagoreans that dates back to the 5th Century, BC. This tradition, known as the Aristoxenian tradition, stood opposed to certain teachings of the Pythagoreans. They have come up until now because their influence upon Western musical theory seems minimal up to this point. The tradition is important because Aristoxenus of Tarentum's (4th Century BC) major work, *Harmonic Elements*, outlined many musical principles that are similar to those that were proposed by the scholars of the 9th Century. Aristoxenus, himself taught by Pythagoreans, believed in music as a scientific practice but also believed strongly in a connection between musical theory and practice. Aristoxenus' major contributions include the definition of notes, intervals (as bounded by two different notes), genera of tetrachords (enharmonic, chromatic and diatonic), scales and the process of modulation between keys. These words are familiar to modern scholars of Western theory, but it is important to bear in mind that the words have changed meaning significantly since their conception. In the end, the Pythagorean school enjoyed so much support that Aristoxenus' classification of musical elements was to fall by the wayside. The Pythagorean school became the archetypal 'Greek musical theory' – as suggested by the influences of the theorists we have studied this far. It is interesting to note that the work done by the monastic scholars, though

[11] *Ibid.*, p. 150

apparently unrelated to that of Aristoxenus, often uses similar technical terms – albeit to often mean quite different things. [12]

Regino of Prüm (? – 915 AD) made the first important steps in creating a medieval music theory different from that of centuries past. Regino was responsible for organizing virtually all earlier musical theory and rationalizing the systematic study of chant. Regino categorized music as natural music (i.e. music sung by the human voice) and artificial music (i.e. instrumental music). He went on to argue that four tones defined the tonal structure of chant: the *protus, deutrus, tritus* and *tetradus* - it should come as no surprise to learn that these terms had been coined by the Pythagoreans a thousand years earlier to describe the tonal centers governing the 'modes' of Greek music.

But Regino's work was to be overshadowed by the most important text to emerge from this time - the *Musica enchiriadis*. This was the first work on music theory to use musical example as the primary proof of theoretical hypothesis. The content of the treatise is fundamentally different from anything to have come before it: the quantitative details that plagued earlier theories are absent and there is no reference to ratios or any other objective measurement of intervals. Instead, *Musica enchiriadis* introduces pitches as "qualities", the intervals between which are defined by their individual characters. The primary tetrachord described as the building block of music is essentially different from that of the ancient Greek tradition. The *enchiriadis* tetrachord corresponds to our modern D, E, F, and G notes. Furthermore, *Musica enchiriadis* introduces the first recorded notion of polyphony – an idea key to our modern musical theory. *Musica enchiriadis* signaled the birth of a new way of thinking about music – a way that would become standard for the West over the centuries.[13]

Up until the 9th Century AD, Greek musical theory dominated Western music. For centuries, scholars continued treating music as an abstract science as the Pythagoreans had in ancient times.

[12] *Ibid.*, p. 125
[13] *Ibid*., pp. 151-153

Music was primarily explained in terms of integer ratios for 1500 years, as scientists and philosophers alike investigated its cause and reason. This study was unchanged for so long because of the massive impact of Ancient Greek civilization upon most aspects of Western culture. Ancient Greece's empire covered much of Western Europe and, as such, its philosophies spread far and wide. The Roman Empire spread even further and held Greek theory in high regard, thus the theory was preserved into the first millennium and beyond. Early Middle Ages writers, such as Boethius, were responsible for restating Greek thought, and the circulation of their manuscripts around the 9th Century appeared to solidify Greek theory as the *de facto* theory in the west. However, the fall of Charlemagne's kingdom in the 10th Century forced many artistic and academic practices, such as music theory, to take sanctuary in the monasteries as Europe's political unity waned. It was in this environment of musical practice in the monasteries that a new musical theory, based –but not dependent – upon Pythagorean intervallic theory, arose to explain patterns seen in every-day musical performances. Finally, Europe had its own musical theory to explain its own creative musical process.