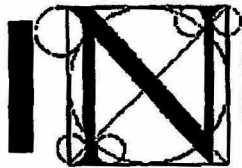


Abstract. Although the writings of the classical Greeks and their Roman and Arabic successors remain the foundation of western philosophy and science of music, as well as their sometimes problematic applications to architecture and other constructive arts, there has been a steady renewal of interest in the old science of harmonics, and it is recognized that much of the Greek theory and practice of harmonics was unquestionably derived from earlier cultures, the still shadowy predecessors of Pythagoras. Though hardly any modern writers would describe themselves as Pythagoreans, some of their ideas have important connections with the old tradition and all are symptomatic of a new era in the history of thought when mechanistic and reductionist paradigms are giving way to a holistic and organic world-view. Modern scholarship has established that most of the doctrines traditionally ascribed to Pythagoras were really the contributions of the older high civilisations, particularly of Mesopotamia and Egypt. The rise and dissemination of these perennially influential doctrines remains one of the most formidable problems for the historian of ideas. Graham Pont.



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Philosophy and Science of Music in Ancient Greece: The Predecessors of Pythagoras and their Contribution

Graham Pont ⁷

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INTRODUCTION

One of the ironies of twentieth-century thought is that the final dethronement of Pythagoras as a 'father' of western science and philosophy and the 'inventor' of music and mathematics should be accompanied by a world-wide revival of Pythagorean research and speculation. During the seventeenth century, the 'harmony of the spheres', which had remained an article of faith until the age of Shakespeare and even Louis XIV [Isherwood 1973, Ch. 1], was suddenly overwhelmed by the mighty discoveries of Kepler and Newton; but this traumatic 'Untuning of the Sky' [Hollander 1970] did not entirely obliterate the Pythagorean tradition (to which both Kepler and Newton were sympathetic).

Since the pioneering studies of Thomas Taylor (1758-1835), Antoine Fabre d'Olivet (1767-1825) and Albert von Thimus (1806-1878), there has been a steady renewal of interest in the old science of harmonics, culminating in the work of Hans Kayser (1891-1964) and his two most influential successors, Rudolf Haase and Ernest G. McClain (both of whom are living in retirement). Neo-pythagoreanism is now a conspicuous feature of post-modern philosophy and science: the revival of *musica speculativa*, part of a larger resurgence of neo-classicism, is well represented in the writings of Joscelyn Godwin [Godwin 1987, 1993, etc.]. To his extensive bibliographies could be added not only impressive results of recent mainstream research into Pythagoras and the Pythagoreans, e.g., Huffman [1993], but also the publications of several 'alternative' thinkers, including the French-American composer, music theorist, and astrologer, Dane Rudhyar, the French 'neo-astrologer' Michel Gauquelin, the English numerologist John Michell, and the English geneticist Rupert Sheldrake. Sheldrake's notion of 'morphic resonance' -- forms resonating in Nature's memory -- is a very Pythagorean-Platonic alternative to mechanistic causality. His wife, Jill Purce, is a music therapist [Purce 1974]; so both sides of the Pythagorean tradition -- the 'hard' and the 'soft' sciences -- are here reunited in the work of one family.

Though hardly any of these writers would describe themselves as Pythagoreans, their ideas have important connections with the old tradition and all are symptomatic of a new era in the history of thought when mechanistic and reductionist paradigms are giving way to a holistic and organic world-view. This emergent rationality is

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Though hardly any of these writers would describe themselves as Pythagoreans, their ideas have important connections with the old tradition and all are symptomatic of a new era in the history of thought when mechanistic and reductionist paradigms are giving way to a holistic and organic world-view. This emergent rationality is fundamentally ecological and its impact is being felt from metaphysics to everyday manners. The new paradigms of the Age of Ecology are already transforming the professions, sciences, arts, academic disciplines, and human enterprises generally -- from the minute study of bird-song and insect music to the utopian vision of planet Earth designed and managed as a single, organic *Gesamtkunstwerk* [Pont 1997].

Central to this new understanding of the world is the concept of the 'Biosphere', which is the very antithesis of Newton's mechanistic universe [Teilhard de Chardin 1955]. Thus the Pythagorean vision of the living cosmos -- or Plato's 'World Soul' -- has reappeared in new vitalist theories, including the Gaia hypothesis of James E. Lovelock [1979]. The modern world-view and its vast astronomical time-frame have changed our conception of humanity itself, if only in recognising our evolutionary affiliations with, and biological dependence on, other species in the terrestrial ecosystem. And it has also

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transformed the idea of the 'humanities': never again can they be taught as just a narrow study of the 'classical' texts or *litterae humaniores* of Greece, Rome, and the Renaissance. No longer can the ancient Greeks be contemplated, in museum-like isolation, as perfect models of everything European.

With the growth of modern archaeology, prehistory, anthropology, linguistics, and other comparative studies, the marmoreal idols of Eurocentric scholarship are now revealed in something like their original gaudy splendour -- a Joseph's coat of distinctly oriental hues. Most of the discoveries traditionally ascribed to Pythagoras were Asiatic in origin; and, in a recent survey, *Music and Musicians in Ancient Greece* [Anderson 1994], the Pythagoreans have been reduced to four passing references and Pythagoras himself is omitted altogether!

The innovations still plausibly credited to the historical Pythagoras include the coining of the terms 'philosophy' and 'theory' which, in his case, must have referred to the dogmatic teachings and pre-scientific wisdom of a guru rather than genuinely theoretical inquiries like those of Heraclitus and the Eleatics. Pythagoras was also credited with inventing the term *Kosmos*, but the idea of the beautiful world-order (above and below) must surely have been Egyptian in origin [Cf. Plato, *Laws* II, 656a-657b]. Our admiration of the Greeks is now tempered by a better understanding of their true historical circumstance and actual indebtedness to other civilisations [Cf. Bernal 1987].

Just as Whitehead saw western philosophy as 'a series of footnotes to Plato', so modern scholarship has established that most of the doctrines traditionally ascribed to Pythagoras were really the contributions of the older high civilisations, particularly of Mesopotamia and Egypt.^[1] The rise and dissemination of these perennially influential doctrines remains one of the most formidable problems for the historian of ideas.

Many of these ideas had already been explored in my General Studies courses at the University of New South Wales, particularly in 'The Philosophy of Music' (Australia's first academic course on the subject, 1974-1988) and, more recently, in shorter courses on 'Ancient Rationality' and 'Modern Rationality' (1988-1995). It was with their arguments and conclusions in mind that I undertook during 1997 my last course at the University, entitled 'The Predecessors of Pythagoras'. This aimed to examine the origins and analogies of Pythagorean traditions in Mesopotamia, Egypt, China, and India. The lectures contained little that was new and the literature survey was, unavoidably, far from exhaustive; but, even so, the course had the unintended effect of changing the lecturer's point of view - and, indeed, his whole approach to Greek philosophy and science of music.

Instead of burdening the class with the meagre texts of the early Pythagorean school and the interminable difficulties of their interpretation, lectures took a broad view of ancient history and prehistory, in an attempt to answer two very large and necessarily speculative questions: first, what might have been the origins of the famous 'analogy of the macrocosm and the microcosm'? And, second, how and when was this world-view 'mathematised'? -- that is, when was it precisely articulated with a system of musical numbers or harmonic ratios that eventually constituted the 'harmony of the spheres'? Most of the fifteen students had some background in history and philosophy of science but no prior musical knowledge was required for the course and readings had to be confined to material available in English. The only set text was *The Pythagorean Sourcebook and Library* [Guthrie 1987].

AS ABOVE SO BELOW

The division of the world into different levels (upper, middle, lower or Heaven, Earth and Hell) goes back to the prehistoric shamans who practised their magic for thousands of years before the appearance of organised religion. As F.M. Cornford [1952] and Mircea Eliade [1964] have made clear, the magical powers ascribed to Orpheus, Pythagoras, and other pre-Socratic sages (even Socrates himself) were recognisably shamanic [Cornford 1952, 107ff].^[2] These included the art of healing through music; of communicating with and taking the form of other animals, especially birds [Guthrie 1987, 71, 127]; the ability to fly and to appear in two places at once;^[3] and the Orphic control of human passions, brute animals and nature itself. Early biographers repeated stories of how Pythagoras 'chased away a pestilence, suppressed violent winds and hail, calmed storms both on rivers and on seas...' [Guthrie 1987, 70ff., 128-9].^[4] Such marvelous feats have been ascribed to shamans world-wide, including Aboriginal Australia.

Antipodean precedents to, or analogies with, the cosmology of the northern hemisphere include the dualism of the upper and lower worlds (the former being occupied, as in Christian belief, by the gods and the spirits of the departed); also common to both mythologies is a connecting *axis mundi*, presumably derived from the vertical path of shamanic commuting to Heaven and Hell. The eminent Australian anthropologist A.P. Elkin himself observed and bravely reported acts of levitation, magical healing and other paranormal feats performed by Aboriginal shamans or 'men of high degree' [Elkin 1946]. Reference was also made to the Aboriginal 'songlines', age-old ritual routes -- sometimes transcontinental -- which structured the landscape with a kind of liturgical geography or musical map,

crossing tribal and linguistic frontiers with a continuously recognisable chant which functioned like a passport.^[5] Although a long way from cosmic harmonics, the Australian songlines could plausibly be viewed as an early use of 'music' in structuring, mapping and interpreting the visible world.

While such apparently remote analogies with Greek ideas eluded the white invaders of Australia -- and are resented by some anthropologists even today ^[6] -- the following report is highly suggestive:

...Another version of the origin of the Milky Way, current in Queensland, identifies it with the deeds of *Priepriggie*, an Orpheus-like hero, as famed for his songs and dances as for his hunting. When he sang, the people danced to the rhythm until they dropped with exhaustion, and declared that if *Priepriggie* wished he could make even the stars dance. One morning when he speared a flying fox, its companions descended upon him in vengeance, carrying him up to the sky. Unable to find him, his people decided to perform his dance, hoping for his return, but without him they could not capture the rhythm. Suddenly they heard a sound of singing in the sky. As the rhythm grew louder and more pronounced, the stars, hitherto randomly dispersed, began to dance and arrange themselves in time to *Priepriggie's* song. Thus the Milky Way serves as a reminder that the tribal hero should be celebrated with traditional songs and dancing' [Haynes et al. 1996, 13-14].^[7]

Given the ancient association of choreography and cosmology,^[8] this beautiful Australian legend seems only a short step from the world of Pythagoras. In his *World History of the Dance* [1937] Curt Sachs showed how the astral dance, imitating the circular procession of the stars, is found in all the inhabited continents. Its origins too are lost in prehistory; but the circle is probably the oldest rational form known to and employed by humanity (and it is even danced by other primates). So, if mimetic dance was the original connecting principle between the upper and lower worlds, then the 'analogy of the macrocosm and microcosm' might have had very remote precedents in an age long before the invention of writing, perhaps even before speech itself.

Philosophers have rarely contemplated the beginnings of their subject in Australian prehistory; but Robert Lawlor has concluded that indigenous Australians had something like the Pythagorean table of opposites and the Hippocratic fourfold classification of phenomena into Dry/Hot, Hot/Moist, Dry/Cool and Cool/Moist [Lawlor 1991, 321ff. Cf. 31-2]. Similarly, there is evidence suggesting that the 'analogy of the macrocosm and the microcosm' -- perhaps the world's oldest cosmic system -- goes back to the myth and ritual of Australian and other paleolithic cultures, antedating the civilisations of Mesopotamia, Egypt and Greece by thousands -- perhaps tens of thousands -- of years. Europeans have always regarded Australia as being a long way from the centre of things, but during the last twenty or thirty years the discoveries of Australian archaeology and prehistory are starting to reverse that perspective.

Thus we arrived at a tentative answer to our first grand question: the 'analogy of the macrocosm and the microcosm' was the classical Greek formulation of a world-view that was prehistoric in origin. The late classical image of Urania dancing in the chorus of the Muses surely recalls the archaic astral dance which finally became the annual liturgy or song and dance of the Church, while achieving concrete form in the ziggurats of Mesopotamia and the pyramids of Egypt.

THE HARMONY OF THE SPHERES

The mathematisation of this primitive world-view obviously came much later, probably after the 'neolithic revolution' and the emergence of the first villages and towns was made possible by herding and agriculture. It was sometime during the era of *civilisation* -- the culture of cities -- that the old mimetic relationship between the larger universal system and the local human order was transformed into a precise mathematical *analogy*; that is, the heavenly order came to be seen as a harmony or attunement controlled by number and the earthly order was accordingly formed on, adjusted to, or interpreted in accordance with the same number system, which was duodecimal, not decimal. This, the oldest known mathematical cosmology, may have been suggested by the use of simple numbers in choreography, primarily the first few integers which are still used to measure rhythm today (1, 2, 3, 4, 6, 8, 9, 12). Thus the 'analogy of the macrocosm and microcosm' became the 'harmony of the spheres' when the earthly imitation of the heavenly dance was finally reinterpreted as a system of harmonic proportions shared by macrocosm and microcosm (both of which were still conceived as vital organisms).

The bold and ingenious hypothesis that the world was a harmony, a cosmos ordered on the proportions of the musical scale,^[9] must have been invented by someone -- a very sophisticated thinker, indeed; but the identity and whereabouts of that Asiatic Pythagoras are also lost in time. The evidence points first to Babylon and then, second, to Egypt ^[10] -- to the very countries where the historical Pythagoras is said to have studied and where, presumably, he acquired the science of the

monochord.



It has long been understood that the monochord, or *kanon*, played a central role in the philosophy of Pythagoras and Plato, but the early history of the instrument and its use in scientific theory and philosophical speculation are very poorly documented. Pythagoras, on his death-bed, is said to have recommended the study of the monochord to his disciples; and Plato in effect did the same -- if he really was responsible for the argument of the *Epinomis*, a kind of appendix or key to his last dialogue, the *Laws* (the imperfect text is thought to have been penned by his secretary, Philippus of Opus).

The *Epinomis* is the only writing in the entire Platonic corpus that specifically alludes to the harmonic *analogia* or tuning module of 6:8::9:12 [*Epinomis* 991a-b], but at this very point, unfortunately, the text is obscure or corrupt!

MONOCHORD MATHEMATICS

Analogia means 'equality of ratios' or 'proportion' but *the analogia* is the module or system of whole-number ratios that gives the 'divisions of the monochord', the precise points at which the vibrating string can be stopped, with a movable bridge, to sound the 'fixed' or fundamental intervals of the musical scale, the octave (2:1); the fifth (3:2); the fourth (3:4); and the major tone (8:9). The integers 6, 8, 9 and 12 are the smallest whole numbers with which the symmetrical system of interlocking ratios -- the natural framework of the ancient and modern diatonic scales -- can be expressed. Just as the Greeks admitted that their lyre was a foreign invention (brought to their land by the winged messenger Mercury or, some say, by Pythagoras), so they knew that the tuning system of Mercury's lyre, 6:8::9:12, was also imported -- presumably from Babylon, where the precise relationship between pitch, string -- length and numerical proportion could have been discovered a thousand or even two thousand years before Pythagoras (indeed almost any time during the first three or four millennia of the harp's development).

The oldest surviving book on the monochord and its divisions was written by Euclid (c.300 BC) but the instrument itself was obviously much older. Its early use and significance have been greatly illuminated by Ernest G. McClain, first with *The Myth of Invariance* [1976] and then with *The Pythagorean Plato* [1978]. Neither a classical scholar nor a mathematician, in the ordinary sense, McClain was a professor of the clarinet at Brooklyn College, New York. Endowed with a rare combination of musical and philosophical intelligence -- and a virtuoso's grasp of tuning theory and practice -- he went in search of the ancient wisdom, inspired by like-minded colleagues including Ernst Levy and Antonio T. de Nicolas. Developing insights of Robert S. Brumbaugh as well, McClain made an 'intellectual breakthrough of the utmost significance' by offering a simple musical explanation of 'crucial passages in texts of world literature -- the Rg Veda, the Egyptian Book of the Dead, the Bible, Plato -- that have defied critics of the separate concerned disciplines' [Levarie 1976, xi ff.]. McClain's method was not new in principle but his development and application of it has produced amazing results.

Taking the numbers used in or derived from monochord tuning, McClain identified their widespread employment in numerical allegories, myths, and metaphors found in some of the oldest books in the world. For example, when Plato characterised the good man as 'living 729 times more pleasantly, and the tyrant more painfully by this same interval' (*Republic* 587e), he used the number which defines the tritone (the sixth power of three; that is, 6/5 above the fundamental tone). Thus the tension between the good man and the tyrant is compared to the worst possible dissonance in the western musical system (Plato's model here, incidentally, is both musical and geometrical). Similarly, McClain decoded many other musical allegories and discovered the meaning of some incredibly large numbers in Babylonian, Egyptian, Hindu, Greek, and Hebrew texts. In *The Pythagorean Plato*, he applied the same method to Plato's numerology and produced a simple, consistent and comprehensive explanation of allegorical texts that had defeated five hundred years of classical scholarship.

Though in fact a corollary to his first book, *The Pythagorean Plato* [1978] is much more approachable for the general reader. The introduction explains the basics of tuning theory and the graphic use of the monochord string turned into a tonal circle on which any scale can be represented geometrically. Seven of Plato's numerical allegories are then analysed in detail showing, for example, how his political theory was modeled on musical theory, with the constitutions of Callipolis, Athens, Atlantis and Magnesia corresponding to four different 'temperaments' or tuning systems (including the equally tempered scale, long considered to be a modern invention).

The key to Plato's musico-political analogies is here revealed for the first time, and they were by no means an idiosyncratic jest: the Greek word *syntagma* can refer to either a political or a musical system, just as the Sanskrit *grama* can denote a village or a scale [Rudhyar 1982, 14]. In *Classical and Christian Ideas of World Harmony*, written during the 1940s, Leo Spitzer set out to explain the

compound meanings of the German *Stimmung* and discovered its relations with a whole gamut of harmonic terms resonating through the European languages [Spitzer 1963]. On purely philological grounds, Spitzer divided these terms into two groups: first, those related to 'chord' -- 'concord', 'accord', etc. -- and, second, those related to 'temperance' -- 'tempo', 'temperament', etc. The two groups correspond fairly well to the distinction between *tuning* by whole numbers and *tempering* by small adjustments (involving irrational proportions).

Spitzer was puzzled by the root-meaning of the second group, 'a section cut off' [Spitzer 1963, 82].^[11] Of uncertain origin, the variety of the 'tem-' words and their wide distribution throughout the Indo-European languages testify to the existence of a very ancient harmonic world-view or musical cosmology: words like *temenos* (sacred place), 'temple', 'time', 'template', and 'terminus' all refer to divisions of space and time based, presumably, on a common mathematics -- *which must have been musical in origin*. Thus comparative philology might yet enable the reconstruction of a 'Pythagorean' cosmology and harmonic technology much older than Pythagoras himself.

The close association of the musical and spatial sciences was independently confirmed by Árpád Szabó in *The Beginnings of Greek Mathematics* [Szabó 1978, 99ff.], which argues that all the extant terms of pre-Euclidean Greek geometry were derived from music theory or harmonics. For example, 'diastema' means an interval, spatial or musical, just as 'chord' still has a geometrical as well as a musical meaning. The geometrical representation of an interval as a line terminated by vertical strokes could equally be a picture of the monochord string.

TEMPLE HARMONIES

The Predecessors of Pythagoras now lead us into a brief survey of temple art and architecture and their connections with the science of music. Temples have always been the grandest monuments that man has built in imitation of the heavenly order. Reviewing a continuous tradition of five millennia, Joseph Campbell showed how the form of the temple has remained faithful to the old mandala of circle and square, symbols of Heaven and Earth. The Egyptian hieroglyph for a town is a circle enclosing a St Andrew's cross, with its arms pointing to the minor directions -- a perfect representation of the consecrated enclosure that was subdivided to make the four quarters of the town. Campbell pointed out that the with the rise of the hieratic city-state (c.3500-2500 BC):

...The whole city now (not simply the temple area) is conceived as an imitation on earth of the celestial order -- a sociological middle cosmos, or mesocosm, between the macrocosm of the universe and the microcosm of the individual, making visible their essential form: with the king in the center (either as sun or as moon, according to the local cult) and an organization of the walled city, in the manner of a mandala, about the central sanctum of the palace and the ziggurat; and with a mathematically structured calendar, furthermore, to regulate the seasons of the city's life according to the passages of the sun and moon among the stars; as well as a highly developed system of ritual arts, including an art of rendering audible to human ears the harmony of the visible celestial spheres. It is at this moment that the art of writing first appears in the world...[Campbell 1990, 151-2].

Campbell rightly emphasised that the same sexagesimal number system was used to represent the 'mandala of space' (the circle of 360°) and the 'mandala of time' (the almost congruent circle of the year); and he has also shown how the same sacred 'mesocosm' gradually extended from the Nile to Central America. The structure and symbolism of the Egyptian temples have been analysed by John Michell, who argues that they incorporate cosmic measures [Michell 1988], and by R.A. Schwaller de Lubicz, who concluded that the great monument at Luxor actually represents the growth of the human microcosm in extraordinary physiological detail [Schwaller de Lubicz 1977].

None of these authors, however, succeeds in elucidating the persistent tradition that 'architecture is frozen music' -- that the canons used in temple design were originally harmonic. The Renaissance enthusiasm for harmonic proportions in design has not yet been matched by a convincing history of ancient architecture as 'applied music'. But how else are we to explain Vitruvius's frequent references to music, including his comments on the different Greek tuning systems [Vitruvius 1999, V, 4]? Lacking more specific texts, we are necessarily restricted to direct measurement of existing edifices, as in Hans Kayser's suggestive analysis of the temples at Paestum [Kayser 1958], Donald Preziosi's work on the ground-plans of Minoan architecture [Preziosi 1983] and various more recent studies, including Anne Bulckens's persuasive analysis of the Parthenon and the symbolism of its harmonic proportions [Bulckens 1999].

The mathematics of temple design fall outside the mainstream of Pythagorean studies but is directly relevant to the harmony of the spheres. If the ancient priests, sages and philosophers were able to

discern musical proportions in the heavenly system, would they not have naturally encoded them in their earthly imitations -- just as their predecessors imitated the dance of the stars? A discordance between the macrocosm and the microcosm seems unthinkable but there is as yet no consensus on the ancient use of musical proportions in sacred architecture.

Of particular importance in this regard is the work of the late Abraham Seidenberg. His series of ground-breaking articles in the *Archive for History of Exact Sciences* (1962-1981) argued that the origins of arithmetic and geometry are to be found in the ritual arts: for example, the oldest precise descriptions of geometrical procedures are found in the *sulvasutras*, ancient Indian works on altar construction, a liturgical tradition that goes back to the *Rg Veda* (c.1500 B.C.) and probably much earlier. Seidenberg's work evoked little response from fellow mathematicians until it received the *imprimatur* of no other than B.L. van der Waerden [Van der Waerden 1983, 10ff.]. Though Seidenberg failed to grasp fully the ancient conception of practical music -- which embraced not only ritual but also song, dance, drama, poetry, eloquence, gesture and deportment -- his findings throw new light on the archaic association of music and the exact arts and sciences, while lending additional support to the hypothesis that the harmony of the spheres was long anticipated in the measured dance of Urania and her sister Muses.

The relationship of dance geometry and the mathematical arts is a living reality in India: in *The Square and the Circle of the Indian Arts* [1983], dance authority Kapila Vatsyayan explored the connections between sacred dance, geometric mandalas, and temple architecture, illustrating her argument with photographs of ritual dances, some possibly as old as the *Rg Veda*. All of this confirms Lewis Mumford's great historical insight: his vision of the crucial role in human evolution of 'biotechnics', the arts of brain and body that preceded and made possible the mastery of tools [Mumford 1967, 6ff., 60ff.]. Mumford argued that these biotechnics were a critical, though largely overlooked, factor in the prehistoric development of tool technology and the constructive arts. For the early Greeks, and all other preliterate cultures, the most important 'biotechnics' were the musical arts (the arts of the Muses); and this fact alone might be sufficient to explain the extraordinary value placed on musical numbers in the ancient arts and sciences. So, if architecture was indeed 'frozen music' -- the art of building regulated by cosmic measures and musical canons -- then one would expect to find the harmony of the spheres reflected in the temples of that era. Accordingly, John Michell has found cosmic numbers in the dimensions of the pyramids but they do not seem to match McClain's musical numbers! The secrets of the old temple builders remain a fascinating puzzle.

These grander issues, of course, are hardly ever addressed in ordinary musical theory, ancient or modern. The early treatises on Greek music are full of the forbidding technicalities of scales and tuning; and the modern literature is likewise replete with agonising discussions of textual problems and terminological difficulties which intimidate the general reader, repel the practical musician, and frustrate even the most determined scholar. In pursuing the predecessors of Pythagoras we avoided those complications by looking at the Greeks *from the other end*, so to speak: by viewing them, not as the founding fathers of western art and science but as the heirs of their predecessors in the older civilisations. This longer and larger perspective throws the Greek achievements into sharper focus -- however hazy the details might be. Looking to the West we can immediately discern the distant figure of Pythagoras -- or is it a chorus of Pythagoreans? -- standing at the gateway through which eastern ideas and inventions passed into Europe.

The long shadow of the Master has unjustly obscured other pioneers of Greek musical thought, such as Lasus of Hermione (late sixth century B.C.), who is traditionally credited with writing the first book *On Music*; a fragment preserves the earliest known musical use of the term 'harmonia'. [Comotti 1989, 25ff.] And, well before Pythagoras, there was another legendary citharode, Terpander, who established an influential school of music at Sparta early in the seventh century. In his final essay, "Pythagoras, Egypt, Sparta", the *Dux* of the 1997 class, Chad Bochan, identified the Spartans as the immediate predecessors of Pythagoras [12]: the Spartans were geographically the closest of the mainland Greeks to the Egyptians and perhaps the first to imitate their musical system.

This reversing of the temporal perspective also reveals that, for all the effort expended by the Greeks on rhythm and tuning theory, very little of their musical system could have been entirely original. [13] Scholars have long suspected that the diatonic scale had been imported from Asia and superimposed on the native tetrachordal system (another innovation ascribed to Pythagoras) but there was little hard evidence to go on. After centuries of literary exegesis and scholarly debate, new illumination was suddenly obtained from two highly important archeological discoveries.

ARCHAEOLOGY AND ANTHROPOLOGY OF HARMONICS

The first was the unearthing and decoding of the world's earliest known tuning manual, preserved in cuneiform writing on an Old-Babylonian (Akkadian) clay tablet from Ur, dating from the early to middle

second millennium B.C. Reading this in the light of other tablets with mathematical and musical texts, an interdisciplinary group of scholars made a conjectural interpretation of the tuning instructions, which they demonstrated on a reproduction lyre (modeled on a genuine instrument of a later period). Assuming that the strings were meant to be tuned in a diatonic system, they found that the instructions made musical sense and yielded 'specific intervals of the diatonic scale familiar to us as traditional western intervals' [Kilmer, et al. 1976]. Their brilliant demonstration of 'Sounds from Silence' is not, of course, a conclusive proof, but it is a profoundly moving experience to hear our ordinary major scale among those performed on the disc recording. If these scholars are right in surmising that the Babylonians knew the modern diatonic system, then the contribution of the Greeks to tuning theory might have been little more than lexicographical![14] This important discovery serves only to reinforce the tradition that it was the Babylonian priests who invented the harmony of the spheres.

The second discovery is the most important ever made in the archeology of music. In 1977, 124 musical instruments were found among some 7,000 burial objects in the tomb of the obscure Marquis Yi, who was buried c. 433 in Zeng, now Hubei Province, west of Nanjing, in the People's Republic of China. The instruments included 65 bronze bells, forming a well-tuned carillon of five octaves, still in playing order. To everybody's astonishment, the bells produced a very accurate, mostly chromatic scale. Cast by a technique unknown to the West, each bell can sound two clear and distinct musical notes which are much purer than those of western bells, and the sound is obtained from a resonator that is a hundred times lighter than its western equivalent! Each bell is inscribed with instructions in gold, explaining the name and function of each note in the scale: a musical Rosetta Stone, no less.

Among those who were most surprised by this find were the Chinese themselves, who were totally unprepared for the discovery of the chromatic scale in their early history, and very slow to make the bells accessible to the wider scholarly world. Almost all memory of a Chinese chromatic scale had been lost, possibly through the burning of musical books and instruments by the Emperor Qin Shiuangdi (She Huang-Ti) who reigned from 221-210 B.C. [McClain 1985, 165]. On one of the first compact disc recordings, the bells perform 'Unique Music of Great Antiquity', which is arbitrarily restricted to the traditional pentatonic scale (China Record Corporation, CCD-89/26, 1989). But the bells are capable of performing tunes in the full diatonic scale, as is shown by later recordings which feature arrangements of western classical music. How long the chromatic scale had been known in ancient China is anybody's guess, but the existence of Marquis Yi's carillon now suggests that there may have been some truth in the legend of the twelve bamboo *lǚs* (pitch-pipes sounding a twelve-note division of the octave) traditionally ascribed to the mythical 'Yellow Emperor' Huang Di. An elaborate description and analysis of these bells is to be found in Chén Cheng Yih (c.1994).

In a preliminary assessment of Marquis Yi's carillon, Ernest McClain pointed out that 'contemporary fifth century classical Greece, which we are in the habit of venerating, left no artifacts of comparable musical value' [McClain 1985, 171]. The bells confirm that 'the prevailing diatonic pattern in China as well as India, Greece, and Babylon is that of the C major scale or its inverse (Greek Dorian)', as argued by McClain in his book published the year before the discovery of these bells [McClain 1976]. Thus the bells point to a 'tonal cosmology' which anticipates that of Plato and was possibly inherited from Babylon; but, as McClain wisely counsels, the whole subject needs to be re-examined by an 'anthropology educated in the harmonical sciences of the ancient world', before any firm conclusions can be drawn on the early history of tuning theory and the dissemination of harmonic cosmology. Nonetheless, these astounding discoveries have already transformed our understanding of the ancient musical world and our appreciation of its vital continuity with, and enduring contribution to, the arts and sciences of modern civilisation.[15]

The writings of the classical Greeks and their Roman and Arabic successors remain the foundation of western philosophy and science of music, as well as their sometimes problematic applications to architecture and other constructive arts. Much of the Greek theory and practice of harmonics was unquestionably derived from earlier cultures, the still shadowy predecessors of Pythagoras. But, as we come to understand more about the achievements of those predecessors, the actual Greek contribution to musical philosophy and science will seem even more characteristically Hellenic: for here, as in most of the arts and sciences they cultivated, the Greeks created a rational theory, invented a systematic vocabulary, ordered the subject with a logical classification and infused the whole with a spirit of inquiry that still inspires us today.

NOTES

[1] An erudite and forthright critic of the Greeks was William Chappell (1809-1888): "There is no longer room to doubt that the entire Greek system was mainly derived from Egypt, Phoenicia, Babylon, or other countries of more ancient civilization than Greece" [Chappell 1874, 1]. [return to text](#)

[2] [Cornford 1952, 107ff]. Europe's last distinguished representative of this ancient tradition was probably St Francis of

Assisi, whose fits of ecstasy and sermon to the birds (c.1220) are unmistakably shamanic. So are Socrates' 'daemon' (or 'inner voice') and his trances. [return to text](#)

[3] From Abaris, his 'Hyperborean' (British?) disciple, Pythagoras obtained a golden arrow that, like the witch's broom, enabled him to fly and appear the same day in two towns separated by 'a journey of many days'. See Guthrie 1987, 90-91, 128. [return to text](#)

[4] The story of Pythagoras meditating 'the greater part of day and night' in a cave outside the city of Samos [Guthrie 1987, 62] recalls another familiar practice of the shamans. [return to text](#)

[5] Cf. Lawlor 1991, 48. It should be kept in mind that Chatwin's influential book, though based on personal experience of Aboriginal Australia, is a work of literary rather than strictly scientific anthropology. [return to text](#)

[6] Some years ago I applied for a major research grant to conduct a comparative and historical study of the Aboriginal Corroboree as the 'indigenous Australian opera'. The application was referred to the two most eminent female anthropologists in the country, one of whom gave the project a top rating for its originality and national significance; the other (who happened to have been trained by the same philosophers who taught me) utterly damned the whole idea, especially with the revelation that I had never attended a corroboree (except, that is, of the imported kind). [return to text](#)

[7] They also report a perfect example of 'As above so below': 'Central Australian tribes believed that the Milky Way divided the sky people into two tribes and hence served as a perpetual reminder that a similar division of lands should be observed by local neighbouring tribes' (*loc. cit.*). [return to text](#)

[8] See [Miller 1986], especially Foreword and Chapter 1. Cf. [Doczi 1994, Chapter 4]. [return to text](#)

[9] For a concise summary of the Pythagorean doctrine and the ancient literary evidence, see [Michaelides 1978, 129-30]. [return to text](#)

[10] Gadalla 2002, 22-3 claims the harmony of the spheres (that is, the 'planetary scale', the melodious movement of the classical 'planets', from Earth to Saturn, and including the Sun and Moon, in the proportions of a diatonic scale) as a purely Egyptian discovery. Fabre d'Olivet had long ago reached a similar conclusion. See Godwin 1993, 347ff. [return to text](#)

[11] I once speculated that the root meaning of 'section cut off' referred to the *sectio canonis* or division of the monochord but this hypothesis over-simplifies what must have been a very protracted history of human invention and social development. Following Abraham Seidenberg, I now think it more likely that the 'tem-' words originally referred to ritual or liturgical procedures of 'cutting off' or delineating sections of space and time as, for example, in the timing of festivals or the reservation of sacred enclosures. Much later the 'tem-' vocabulary was extended to musical theory, as in the terms 'temper' and 'temperament'. [return to text](#)

[12] 'In the seventh century... Sparta was the most important musical center of Greece' (Comotti 1989, 17). [return to text](#)

[13] The classical Greek music theorists concentrated their efforts on the measurement of melody and rhythm and the development of a fairly precise notation for both (see [Comotti 1989, 110-20]). Their greatest achievement (the significance of which has often been overlooked) was probably the quantitative analysis of the various tribal or regional 'modes' and the codification of their distinctive rhythms and accents. While the Greeks relied heavily on their predecessors in speculative music and tuning systems, their empirical and mathematical studies of contemporary song and dance were the beginning of comparative musicology in the West. [return to text](#)

[14] John Curtis Franklin has recently thrown new light on the influence of 'Mesopotamian diatony' on Greek music during the 'orientalising period' (c.750-650 BC). See [Franklin 2002a, 2002b]. [return to text](#)

[15] Even so, one might wonder how long it will take the recent progress in harmonic studies to affect the structure and content of academic courses in music, architecture, mathematics, aesthetics, cultural history, etc. [return to text](#)

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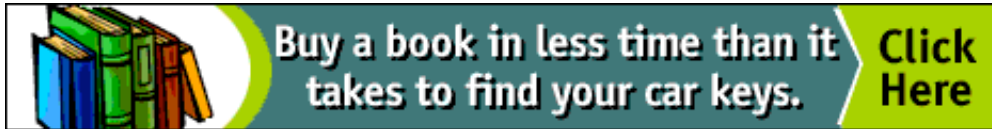
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