

Boethius on Pythagorean Music

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BOETHIUS' five books on music are not a translation of a work by Pythagoras, who left no writings. But they are based on a strong tradition and on the work of later members of the Pythagorean school; from his education by his father-in-law Symmachus and in Athens Boethius was well acquainted with these, and it is evident from his writings that he was firmly convinced of the system's validity. The treatise is particularly striking for its success in combining religion, physiology, astronomy, physics and mathematics, and for its systematic technical analysis of the complicated theory. Boethius is said to have made musical instruments himself, as well as scientific models.

He wrote nearly a thousand years after the Pythagorean theories had been formulated. The sect had been stamped out in the fifth century B.C., but its ideas and discoveries had permeated all Greece. In the five books on Music Boethius emphasizes that the harmony he is describing is that discovered and elaborated by Pythagoras. It is concerned principally with the lyre, which had been in existence, at least in its primitive form, for an unknown length of time before the Greek philosopher lived in the sixth century B.C. and whose origin and development were interwoven with legend.

Before the time of Orpheus, Boethius tells us, it had four strings forming the tetrachord (whose discovery was attributed to Mercury) covering the range of a diapason interval, an interval of five tones and two lesser semitones. These strings bore the names of Saturn, Jupiter, Mars and Venus. They were related to each other by intervals in proportions which comprised all the prime consonances he treats in his grammar of music. Summarizing the account given by Nicomachus of Gerasa, he says that this arrangement was in imitation of Mundane (or Universal) music, which was constituted of the four elements of which all things, even the gods, were made. These were fire, air, water and earth, compounded from the four qualities hot, cold, wet and dry. Galen, summarizing the philosophical arguments of his day, explains that cold must always be mixed with either wet or dry, heat with damp or dryness. So Venus was thought, says John Laurentius,¹ to be warm and humid, and Mars to be of fire mixed with air.

The Egyptian origin of the tetrachord is suggested by its attribution to Mercury, known in Egypt as Thoth, and also by the statement of Boethius that this four-stringed instrument kept that form until the time of Orpheus, the mythical bard and founder of a religion whose rites derived from Egypt and from which Pythagoreanism borrowed many of its tenets. Pythagoras is said by Iamblichus to have lived for eighteen years in Egypt, and though this is questioned by many, he is believed to have spent some time there. After the

¹ Known as John the Lydian, a Byzantine antiquary of the fifth century A.D.

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time of Orpheus a fifth string was added by Cherebus, King of the Lydians, a sixth by Hyagis, said to be the father of Marsyas the inventor of the double-reeded pipe, and a seventh by Terpander of Lesbos, who lived about 700 B.C. Later musicians added others until the lyre reached its full complement.

An interesting point about the tetrachord of Mercury is that the four strings are arranged in the order of the length of the sidereal years of the planets to which they are attributed, and the same is true of the seven-stringed instrument, the heptachord perfected by Terpander, if the Earth is substituted for the Sun in its order. This suggests that the system of harmony which Pythagoras discovered or analysed was based on astronomical calculations and not a fanciful attribution of the sounds to certain deities. It also strengthens the probability of its origin in Egypt, where there was a seven-stringed lyre typifying the planetary system in use.

The heptachord extended the interval between the outermost strings of the lyre to twice diatonic or two octaves. Its symbolism, which represented the solar system, was not confined to music, but spread gradually through the whole cultural life of the Greeks and then of the Romans. John Laurentius describes its embodiment in the Roman Circus, called Euripus. There was a pyramid in the centre of the stadium, representing the Sun. Above this there were three altars, to Saturn, Jupiter and Mars, and below were another three to Venus, Mercury and the Moon; this arrangement is evidently based on the same planetary order as the heptachord.

By Boethius' time (again according to John the Lydian) each of the seven musical modes was attributed to a particular planet and was believed to be the rhythm of its movement. The Dorian governed Saturn, the Phrygian Jupiter, the Lydian Mars, "and the rest move with the others according to Pythagoras". Each planet also gave out a single note: Mercury α , Venus ϵ , Sol η , Saturn ι , Mars $\omicron$, Moon υ , Jupiter ω . This is a less poetic idea than that of Plato, who describes a siren seated on each planet singing its one pure note, but one which was more compatible with the current acoustical theory of sound as having its origin in movement. Plato's grasp of the physics of sound was less firm than that of some of his rather later compatriots. Boethius gives an account of Nicomachus' correction of Plato's explanation of the reception of sound by the ear that shows a much better understanding of its nature.

So the heptachord was not an instrument haphazardly constructed and then turned into a poetical analogy of the universe but an attempt at a mechanistic reproduction of the planetary movements. Although the planetary notes could never be heard (either because their sound faded before it reached us or because a continuous sound was not noticeably audible), their relation to each other, the rules which governed their movements and conjunctions, were faithfully imitated.

THE LYRE AND THE THEORY OF TEMPERAMENTS

This basic symbolism of the lyre is a clue to the therapeutic use of music by Pythagoras and later members of the sect, and perhaps to that of the spells and

incantations used by the Egyptian priests in medicine long before him. Boethius describes Pythagoras' treatment of a young man intoxicated by the sound of pipes playing the Phrygian mode: he recommended the pipers to play spondees, by which the patient was calmed and cured. Lasserre² points out that this anecdote is related elsewhere of Damon of Athens, a later Pythagorean (first half of the fifth century B.C.). Since the spondaic was one of the ancient ritual chants or nomes accompanying sacrifices—the Song of Libation, which was in the Phrygian mode—he suggests that the music of the piping before the intervention of Pythagoras must have been in the Hypophrygian, a mode that was reputed to enrage and intoxicate. Boethius makes no mention, in his detailed treatment of the modes, of their emotional content but arranges them in order of tension. But in a letter to him from Theodoric, the King, writing as a pupil to his teacher, cites the following allocation of moods to modes: Dorian, modesty and purity; Phrygian, combative; Aeolian, tranquil and sleepy. The Ionian sharpens the intellect and stimulates the desire of heavenly things, and the Lydian soothes the anxious soul.³

Boethius also mentions the use by Pythagoreans of certain modes to induce sleep, and of others to purge "the stupor and confusion of sleep" when they woke up. "Knowing this undoubtedly, that the whole structure of our minds and bodies may be combined by fitting music. For as the disposition of the body maintains itself, even so the pulse is moved by the motions of the heart." He goes on to affirm that "it is impossible to doubt that the state of our souls and bodies is seen to be composed in a certain way in the same proportions in which later argument will show harmonious modulations to be joined and coupled together", so that if the body could be persuaded to move in accordance with rhythms based on the movements of the planets, it could be made to bring the various parts and organs supposedly governed by these bodies into a harmony like that of the spheres. The idea that each organ was governed by a particular god, which became general in astrology, was perhaps derived from the Egyptian habit of interring the viscera of the dead with their mummified bodies in Canopic jars representing the four children of Horus. The liver was put into a jar with a human head, the lungs in one with the head of an ape, the stomach in a jackal-headed and the intestines in a falcon-headed one.⁴ The four children of Horus were four genii born of Horus and Isis, each under the protection of a different goddess, and thought by J. H. Breasted to be of solar origin.

The strings and notes of music were related to the movements of the heavenly bodies and related, likewise, by the nature of these bodies to the four elements of which all things, including the human body, were composed. And "when rhythms and melodies reach down through them (the ears) to the spirit, it is unquestionable that they should affect and mould the mind and be themselves in the like rhythm". And since anyone can be turned from a peaceful state of mind to fury and wrath by the sound of the tuba used in war, "there is no

² F. Lasserre: *Plutarque De la Musique* (Urs Graf-Verlag, Olten and Lausanne, 1954).

³ Cassiodorus: *Letters*, Book II (1886).

⁴ G. Elliot Smith and W. D. Dawson: *Egyptian Mummies* (Allen and Unwin, 1924).

doubt that the more modest mode can fether intemperate cupidity and the wrath of the disturbed mind".

This amounts to a claim that the pulse-rate could be influenced and, as it were, brought into resonance by musical rhythm, and the study of the pulse, of which Galen was a profound scholar, was an important part of the medicine based on the theory of temperaments or proper admixture of the elements of the body, which derived from Pythagoras or perhaps from his follower Empedocles. Galen⁵ describes the theory of his day, by which the pulse-beat was classified in rhythms appropriate to health or sickness, fulness or weakness, and the various ages and conditions of men. His definition of rhythm is this: "Rhythm is the proportion of parts of time which have a certain respect to the pulse among themselves. Otherwise it may be defined thus: rhythm is the quality of the times in which the arteries expand to that in which they contract". Galen knew the heart to be the origin of the pulse and believed its movement, which drives the pulse, to derive from respiration, and respiration to be controlled by the brain. He also believed in the influence of the planets on the course of diseases.

Hence the importance of music to the Greeks not only in the education of the mind but also in the control of the body. Boethius quotes Plato's opinion that music was best and most influential when "simple and masculine, not effeminate or wild or complex"—that is, as it was in Sparta in the days before Timothy of Miletus added an eleventh string to the lyre and so besotted the Spartan youths by the use of chromatic music that they were reluctant to study any other subject. He firmly endorses the Pythagorean belief that it had a direct effect, uncensored by upper levels of consciousness, on the muscular rhythm of the body, and that in this lies its power both for improvement and disturbance.

It is possible that the Greeks and, before them, the Egyptians were more sensitive than we are to the power of music and rhythm. Herodotus says that the Egyptians of his day (fifth century B.C.) eschewed all forms of music, because they believed it made men effeminate. And the earliest genus of music used by the Greeks appears to have been the enharmonic type, which consists of ditones and quarter-tones, the latter very small intervals. Less than five hundred years after the great musical theorist Aristoxenus (*fl.* c. 320 B.C.), Ptolemy reproached him because he used an interval which the later writer maintained was too small for the hearing to detect. Three hundred years later than Ptolemy, Boethius declares that the smallest interval the hearing can cope with is the comma, the difference between a lesser and a greater semitone. It would be interesting to know what is the smallest interval we can detect today.

Modern medicine, which has discovered so much about the human body that tends to support a mechanistic view of its working, is inclining more and more to adopt mechanical principles in its repair and rehabilitation. The Pythagorean system had the same tendency, but with an important difference: instead of using man-made machines as a comparison, it used a working-model

of the universe designed so that its components were in harmony with man's astronomical and hence, perhaps, electrical and magnetic environment. It held that man the microcosm was an image of the macrocosm. Where the machines and instruments of today exist in a philosophic vacuum, claiming independence of the environment, this system conceived of man as an integral part of a universal whole and believed that the faults in his soul and body could be repaired by having the harmonious rhythm of the heavens imposed upon them. Boethius himself must have believed this, for the passages in which he argues in its favour are some of the most eloquent in his book.

THEORY OF SOUND AND HEARING

Some of the ideas on the physics of sound which Boethius explains are not to be found in his accounts of Plato or Aristoxenus and are close to our own theories. Some of them are so close that the metaphors he uses are still quoted in textbooks on physics or harmony in use today. One of these is the classic comparison of a wave of sound with the wave caused in water by a stone dropped into a pond.

He is insistent that all sound has its origin in motion, and that sound-waves are produced and propagated by the percussion of this movement on air. He uses Aristoxenus' terms *dense* and *rare* (for the proportions of breadth of interval) to describe variations in the speed of the originating movement, and hence in the speed of sound. He knew that the speed of these vibrations governed the depth or shrillness of the sound, and that this was not due, as earlier writers had thought, only to the thickness or even the length of the string, but chiefly to the tension at which it was held. It would seem from his correction of Ptolemy and Aristoxenus that this was a conclusion of his own, though Lasserre says that a fragment quoted by Theon of Smyrna maintains that Lasos of Hermione (*fl.* 520 B.C.) and pupils of the Pythagorean Hippasus analysed the speed and slowness of the vibrations which produced the consonances of the flute. If they did so, later theorists before Boethius do not seem to have followed it up, and there is no indication of how it was done. For this reason, because sound is produced only by strings or air in motion, he calls music the study of relative numbers, distinguishing it among the four mathematical disciplines from arithmetic, which is the study of multitudes, astronomy (of mobile magnitudes) and geometry, which deals with immobile magnitudes. These are the four branches of mathematics which made up the quadrivium of mediaeval studies. The tetrachord of Mercury, with its combination of dimensions, strings and stars, was the foundation of this scholastic edifice.

Boethius seems to have known little about the anatomy of the ear and nothing about the part played by its diaphragm in reproducing the sound-waves impinging on it, and offers no personal opinion on this. From the ideas of Plato and Nicomachus which he quotes it would seem that they conceived of the ear as a kind of conch shell, which echoed back the sounds it received to the brain, and that they had not examined its structure. Galen was certainly used to anatomical dissection and had written on it, but he was interested in the dynamism of the whole body and not in the fine analysis of particular organs.

⁵ *Definitiones Medicae in Medicorum Graecorum Opera quae extant*. Ed. Kühn. Vol. XIX (Leipzig, 1830).

His knowledge was acquired from and applied to the wounds and training of gladiators, athletes and soldiers, as much as from study and experiment.

In his appreciation of the respective parts played in hearing by the senses and the reason, Boethius compromises between Aristoxenus, "allowing everything to the judgement of the ears", and those among the Pythagoreans—Archytas and others—who said "this was the intention of harmony, that they should follow all things agreeably to reason". The senses must be corrected by reason, because not only is their range limited by the loudness or weakness of certain sounds, but also they vary between individuals and with the age and physical condition of a man. On the other hand, the senses are the originators of the impressions conducted to the brain, and stimulate it by their perception of the "form" of things. The conception of form is important; Boethius defines it thus in his essay *On Unity and One*: "Therefore Form existing in matter is what perfects and keeps the essence of anything". Also: "Form is as it were light, by which as if by light one perceives a thing; thus by Form knowledge and science of a thing is obtained, not by matter". And again: "To be is the existence of Form in matter". The sense approximates, reason distinguishes, but "if nothing could be heard, no argument concerning sounds would exist at all"—a rather controversial remark when the connection of this harmony with the inaudible music of the spheres is considered. If there had been no sound, the Platonists would surely have had to invent it.

In the long run Boethius gives priority to reason, and so logically he sets the "musicologist", as we might call his true musician, above the players of instruments, who are all called by the names of their respective instruments. But it should be remembered that in the society of his day professional musicians were either slaves or stood very low in the social scale. The upper classes listened and criticized and constructed aesthetic theories, but rarely practised.

Aristotle speaks equally scornfully of the idea of teaching cookery to children in school. In a society which makes use of slaves, professionalism must always be despised because it can be acquired only at the expense of wholeness—the idea of the "all-rounder" who keeps all his faculties in good trim and is a well-balanced man, a man of good temperament. In our own day, with so many machines at our disposal, we are perhaps nearer the possibility of attaining that ideal than men have been in any free society, without the moral opprobrium of having climbed there on other people's backs. But, if this is to come about, the machines must be of the right pattern: it is the model that matters, not the purpose.

Boethius includes poets among the instrumentalists, since they are brought "rather by a certain natural instinct to song, and not by speculation and reason", and makes his musician, who is the ideal cultured man, a critic of poetry also. He places the reading of heroic poems midway between the uninterrupted speech of the orator and the rhythm of song. "He is a musician" he says "in whom the faculty is present, according to speculation and reason, and the appropriate purpose of the music, of judging concerning modes and rhythms, the kinds of songs, and (numerical) combinations, and all that which we have to go into later, and the songs of poets."