David Creese, *The Monochord in Ancient Greek Harmonic Science.* Cambridge: Cambridge University Press, 2010. Pp. xvi + 409, ISBN 978-0-521-84324-9, £ 65.00.

On his death bed, Pythagoras is said to have exhorted his disciples to *monochordizein*, "to use the monochord" (Aristides Quintilianus, *De musica*, 3.2). As ancient sources unanimously tell us, this simple instrument—just a single string stretched on a ruler (*kanōn*) with a movable bridge—accompanied Greek music theorists in their search for mathematical and musical beauty. It has also been argued that the structure of the monochord shaped the vocabulary of both music theory and mathematics, as well as the very way in which the Greeks conceived some arithmetic operations. However, a study of the monochord *per se* and its usage as a scientific instrument was still missing; thus David Creese's book (henceforth C.) is to be particularly welcomed.

Born out of the need to bring order to the multifarious world of musical sounds and their reciprocal relationships, harmonic science is a territory where the realms of philosophy, mathematics, acoustics and aesthetics overlap one another. The discipline lives on the edge between pure mathematical speculation on the one hand, and the necessity of taking into account the empirical perception of sounds on the other, so that it appears crucial to determine what role the monochord exactly played as a scientific tool—an issue for which C.'s research proves indispensable.

After introducing some basics about the mechanism of the monochord and the representation of music intervals in geometrical terms ("Introduction: the Geometry of Sound", pp. 1–21: a useful chapter for those who first approach the subject matter), C. tackles the first, relevant problem: the relation between the diagrams often found in ancient treatises and the actual divisions of the monochord ("Hearing Numbers, Seeing Sounds: the Role of Instruments and Diagrams in Greek Harmonic Science", pp. 22–80). One of the most novel aspects of C.'s research is his theory whereby the establishment of the basic principles of Pythagorean harmonics must have predated the usage of the monochord for scientific purposes. C. provides historical grounds for this assumption also in Chapter Two ("Mathematical Harmonics before the Monochord", pp. 81–130), where his prudent treatment of the sources leads him to conclude that the instrument may have been invented in the age of Pythagoras, but "there is no credible evidence to suggest it (p. 91)", whereas the first unequivocal occurrence of the term *kanōn* in the sense of "monochord" dates back as early as the late part of the fourth century B.C.).

In Chapter Three ("The Monochord in Context", pp. 131–177) C. outlines the prehistory of the monochord, whose systematic usage as a means of scientific demonstration is as early as the pseudo-Euclidean *Sectio canonis*—which C. inclines to ascribe to "a single hand, whether that be Euclid's or not" (p. 133), thus following Andrew Barker's studies. C. places the instrument in the context of the so-called fourth-century *epideixeis*, similar to a series of public lectures on harmonics in which theorists explained music theory and also performed on their instruments—among which we can reasonably imagine the monochord, although our sources provide very few details. In the *Sectio canonis*, however, our instrument seems to C. to be used against Aristoxenian theory: the chapter contains some illuminating pages on the conceptual background of the *Sectio* and its inheritance to Platonic and Aristotelian

epistemology, which may account, in C.'s view, for the fact that, although the monochord theoretically enables theorists to produce musical intervals of whatever size, even the irrational ones, it was used only to measure those acceptable according to Pythagorean mathematics.

Between the end of the fourth and the first centuries BC, i.e., for the better part of the Hellenistic period, the monochord seems to disappear, the only surviving canonic divisions of this period being those of Eratosthenes (to whom C. devotes Chapter Four, pp. 178–209). C.'s discussion of his tetrachordal structures, as Ptolemy reports them, is thought-provoking on many accounts: firstly, he places Eratosthenes' musical interests in their philosophical context, explaining the theorist's need to adapt the Aristoxenian linear conception of intervals to the framework of Pythagorean ratio-based theory, thus convincingly developing Andrew Barker's suggestions; secondly, he investigates the techniques Eratosthenes might have used to fit Aristoxenus' intervals to the Pythagorean way of thinking—a discussion that involves a fascinating digression on the progress of Hellenistic mathematics; finally, he points out that Eratosthenes' research does not necessarily imply that a monochord was actually used.

The lengthy Chapter Five ("Canonic Theory", pp. 210–282) abandons the chronological approach that informs the previous ones and deals with authors who flourished between the first and third centuries AD (Ptolemaïs, Panaetius the Younger, Thrasyllus, Adrastus and others), and whose work has not survived on its own but has been partially preserved by such sources as Porphyry's *Commentary* to Ptolemy and Theon. While harmonic science seems to stagnate, its vocabulary becomes permeable to some influences from geometry—a ground on which Ptolemy would build his own theoretical constructions; on the other hand, some ways of accounting for the existence of concords—e.g., Adrastus' theory of sympathetic vibration—imply the usage of more than one single string. Paradoxically, at the same time in which the monochord establishes itself as the very symbol of harmonics, it proves inadequate in bringing the discipline to a higher level and patching up the differences between the Pythagorean school and the so-called Aristoxenian one.

Such a task was to be taken by Ptolemy, whose approach to canonics is dealt with in the sixth and final chapter ("Ptolemy's Canonics", pp. 283–355). In Ptolemy's work the monochord is no longer treated as the projection of a linear scheme, as it was in the *Sectio canonis*. Its physical features—such as the additional tension of the string caused by the movable bridge, as well as the very width of the bridge itself—are taken into account. This attention paid by Ptolemy to the practicalities of using the monochord might be due, as C. convincingly suggests (p. 287), to the objections brought by Adrastus against excessive geometrical abstraction; however, another explanation for this novelty of his *Harmonics* might be, as I have also suggested elsewhere (*La scienza armonica di Claudio Tolemeo*, Messina 2002, p. 49f.), that the treatise was framed to meet the needs of practical teaching. C. opportunely shows how the great complexity of Ptolemy's thought forces him not to be content with a single-stringed instrument. His theory involves several multi-stringed tools, such as the so-called *helikōn* and two kinds of polychord instruments with eight and fifteen strings respectively.

Carefully edited and—as far as this non-native speaker can tell—charmingly written, this volume can be regarded as the most exhaustive study on the monochord ever carried out. Besides elucidating both the theoretical grounds of ancient harmonics and the practical aspects of *monochordizein*, C. has added a chapter of remarkable scholarship to the history of ancient scientific thought. The author's well-grounded and compelling reasoning helps the reader retrieve the depth of historical development into a matter that has often been handed down to us by the ancient sources in schematized and layerless pictures, as if the science of harmonics with all its paraphernalia had come, all of a sudden, out of Zeus' head. Its many merits make this book an indispensable read for anyone interested not only in ancient Greek music theory, but generally in the history of the restless hide-and-seek between the elusive beauty of nature and the stubborn attempts of men to comprehend it in the patterns of their minds.

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MASSIMO RAFFA
UNIVERSITY OF CALABRIA

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