'HEARING NUMBERS, SEEING SOUNDS'

CREESE (D.) *The Monochord in Ancient Greek Harmonic Science*. Pp. xvi + 409, figs. Cambridge: Cambridge University Press, 2010. Cased, £65, US$110. ISBN: 978-0-521-84324-9.
doi:10.1017/S0009840X11001016

In this volume C. addresses brilliantly a complex and crucial question for the development of ancient Greek musical studies: the history and role of the monochord (*κανών*) in Greek harmonics. The complexity of this subject is due to many factors. On the one hand, many problems derive from the fact that the monochord is, to use C.'s expression, an 'instrument without archaeology' (p. 10), and therefore its history must be reconstructed entirely on a textual basis. On the other, the fact that a significant part of the abundant extant evidence regarding the monochord, especially concerning its origins (as opposed to later technical treatises focussing on *kanoniké*, the science of canonical division), is represented by anecdotal testimonies haunted by the 'spectre' of Pythagoras (p. 81) increases the difficulty of distinguishing reliable historical information from the results of quasi-hagiographical intentions.

The crucial role of the monochord, though, is not at all diminished by its emancipation from Pythagoras' blessing. On the contrary, as C. manages to highlight very clearly, the introduction of this instrument effectively represented a turning point for research in ancient harmonic science, which had already established itself in the epistemological panorama of Greek thought and had achieved many important results without the aid of the monochord. C. attributes to 'pre-canonic' harmonics (p. 129) all accomplishments obtained before 360 B.C., of which one might mention at least the 'discovery', attributed to Hippasus, of the ratios associated with concordant intervals, later applied by Philolaus to the investigation of the structure of the universe, and Archytas' investigations into physical acoustics.

At the same time, however, the introduction of this 'ruler' for sounds (*κανών* denoted in Greek both the ruler and the monochord) was not at all unproblematic. While it acted by 'straightening' (*κανονίζειν*) the perception of sounds, transforming them into measurable quantities, at the same time it introduced a geometrical dimension of thought into a science that had been exclusively concerned with arithmetical reasoning about numerical ratios. C. presents lucidly the different theoretical problems involved with the oscillation between arithmetical and geometrical conceptual frameworks in the first section of Chapter 1, entitled 'Hearing Numbers: Arithmetic, Geometry and Canonic Division'. One example can help to clarify how these two conceptual dimensions provide opposite answers to very basic, yet essential, points: the subdivision of a tone can be defined as *adynaton* arithmetically speaking, as the resultant interval corresponds to an irrational number ($\sqrt{(9:8)}$), but the same interval can be represented as a line segment which can be easily divided in two equal parts (pp. 36–40). From this example, it is clear how mathematical harmonics requires the employment of both arithmetical and geometrical concepts, as physical distances on the monochord represent a quantifiable intermediary between sounds and numbers (p. 32).

Although arithmetical rules determine the logical boundaries so far as rational speculation is concerned, the gap between these two disciplines needed to be bridged if they were to collaborate in the same discipline. In the second section of Chapter 1, 'Seeing Sounds: Instrument, Diagrams and Tables', C. provides a brilliant analysis of the role of the monochord as a scientific instrument, arguing that its use is characterised by four concurrent aspects: (a) the instrument generates

The Classical Review vol. 61 no. 2 © The Classical Association 2011; all rights reserved

https://doi.org/10.1017/S0009840X11001016 Published online by Cambridge University Press

the phenomena which are the subject of investigation; (b) it provides a conceptual representation of the phenomena; (c) there is a clear analogy between the way in which the instrument works and the object/phenomenon; (d) the instrument can be manipulated directly, presenting a 'working' model of the phenomenon.

In other words, the monochord does not just provide a representation of the musical intervals but it actually *generates* them, and these generated intervals represent the very object of scientific interest in their own right. In this sense, the *κανών,* as C. underlines, can be conceived as an 'audible diagram' (p. 47) which gives a rational representation of sounds and at the same time reproduces them, so that they can be perceived as well as analysed by the scientist. This double dimension, both rational and perceptual, introduces a further problem for harmonic science, as its instrument has to reproduce musical phenomena with the greatest accuracy if the connections between intervals are to be perceivable as well as correct.

It does not seem surprising, then, that the monochord appears for the first time in a Euclidean text known as *Sectio canonis*, the subdivision of the *κανών*, which is analysed in Chapter 3. C. highlights how this text finds its strongest point exactly in the fact that it represents quantities by means of linear, measurable distances, and therefore introduces an unprecedented degree of rigour in harmonics. The scientific importance of the 'division' (*κατατομή*) of the monochord is confirmed by the direction followed by subsequent research, which is dealt with in Chapter 4: the main focus is on the fragments of Eratosthenes, who according to Nicomachus (*Harm.* 11.260) produced a canonic division but did not mention the *κανών* explicitly. In Chapter 5, C. looks at the historical period between Eratosthenes and Ptolemy, dealing primarily with the development of a new language of canonic theory, including the very term *κανονική*, but he also devotes a section to the importance of the practice of canonics and its epideictic role, which is effectively defined as 'thinking diagrams aloud' (p. 226). The last chapter analyses Ptolemy's *Harmonics* and the way in which it features fundamental developments on both an epistemological and a practical level: C. underlines how, on the one hand, Ptolemy devotes accurate passages to the description of the instrument's construction, while on the other he presents and demonstrates this accuracy by means of geometrical reasoning.

One last aspect of this work needs to be mentioned: although the matter treated is far from easy, C. has succeeded in approaching it in a style that is generally clear and that helps the reader to find a way through the numerous intricacies of ancient harmonics. In addition, the significant obstacle represented by the degree and quantity of technical knowledge required to understand thoroughly the questions involved is balanced by C.'s admirable ability to situate historical texts in a theoretical environment that is accurately characterised in its different aspects and options. It is also noteworthy that in this study C. employs many interesting descriptions of the monochord, which give the reader useful images with which to picture the role of this instrument in different theoretical debates (e.g. p. 2: the monochord is described as a 'black-and-white' picture of sounds; p. 228: 'straightener of the senses'; p. 259 'the abacus of harmonic science').

C.'s monograph represents an excellent contribution to the field of ancient Greek music. It is especially valuable for specialists in the subject, but it is accessible in its main aspects to readers generally interested in Greek scientific research.

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https://doi.org/10.1017/S0009840X11001016 Published online by Cambridge University Press