

ASTRID SCHÜRMAN, *Griechische Mechanik und antike Gesellschaft. Studien zur staatlichen Förderung einer technischen Wissenschaft*. Boethius: Texte und Abhandlungen zur Geschichte der Mathematik und der Naturwissenschaften, Band 27. Franz Steiner Verlag, Stuttgart 1991. 348 Seiten.

In this well researched study the author defends various interrelated theses. Firstly, she argues that it was scientists like Ktesibios, Philon and Heron who invented and developed a set of devices and tools which subsequently were widely used in society: military equipment (artillery, poliorcetic devices); water-raising devices used in agriculture, mining and by fire-brigades; oil- and winepresses, weight-lifting devices (cranes vel sim.) used in harbors and in the construction business; waterclocks, geodesical devices, measuring devices (e.g. the odometer) and a set of so-called αὐτόματα used to delight the visitors in the theatre, the lookers-on of certain processions and symposion-freaks. Secondly, the argument is that this research was deliberately promoted by governments, especially the Ptolemies with their 'Institute for Advanced Studies' in Alexandria (Mouseion); other urban Mouseia may have stimulated such research similarly. Thirdly, the author contends that the engineers and their sponsors consciously aimed at alleviating heavy physical labor, improving the labor situation in everyday life, facilitating the satisfaction of daily needs and boosting production and productivity.

The author tries to substantiate her claims by a careful analysis of what Ktesibios, Philon and Heron tell us about their achievements and aims, and by a more or less systematic comparison of the devices described by them and those which archaeology has unearthed for us so far. For government involvement

she heavily relies on the above-mentioned Mouseion, subsidized by the Ptolemies, and on little and isolated scraps of evidence concerning specific rulers who are known to have been φιλότεχνου βασιλείς. This is acceptable up to a point; a couple of Ptolemaic kings and isolated autocrats like Dionysios of Syracuse and Nero should not be taken too lightly as representative of what one could call 'the government'. Some Roman emperors may have been technology-freaks but many others were not; and what about the innumerable local urban elite-governments in the cities of the Hellenistic-Roman world? I would not *a priori* argue that they all shared the anti-banausic bias of Roman senators but this is a far cry from stating that they consciously fostered technological research and applications.

The author is undoubtedly right in emphasizing that the writers on μηχανική τέχνη were convinced of the great use to be derived from their work by the common people. She quotes relevant passages from their works which substantiate their claims (cf. pp. 2 and 57/59). However, claims and pretensions are not necessarily the same as achievements. The author perhaps does not distinguish sharply enough between the two, when she suggests that the self-consciousness of the ancient technologists derives from their contributions to the „Verbesserung der Existenzbedingungen ihrer Mitmenschen“ (p. 59). For this inference to be true we need evidence for the consistent use in everyday life of devices built and described by the mechanical specialists. Apart from this, the latter's claim that the μηχανική τέχνη is useful for many important things in life, is coupled with the statement that it is held in great esteem by the philosophers and a compulsory item for all their students. I doubt whether the credibility of the claim benefits from this combination. Pappos' idea that the μηχανικός should be at home both in theoretical disciplines and in a number of manual crafts sounds modern and sympathetic but I do not believe that this point of view was shared by the 'philosophers'; here we seem to be in the realm of wishful thinking rather than of reality. If we check what the ἐγκύκλιος παιδεία comprised in the various philosophical schools and schemes, the mechanical arts are absent in most cases; and in the few cases in which they are present, we seem to have an *oratio pro domo*, as in the case of Vitruvius, rather than a reflection of what really went on in those disciplines. As a result, the 'social' claim of the μηχανικοί raises some suspicion; and the reasons given by Philon and Heron for the writing of a work on pneumatics is hardly consonant with their message about the impact of their work on daily life. Philon wrote for a friend who needed a textbook for his study of pneumatic devices (p. 39), whereas Heron wrote for „future mathematicians“. This smells of an intellectual in-crowd and of the study rather than of a deliberate attempt to improve everyday life.

Ultimately, however, the proof of the pudding is in the eating: what evidence do we have to support the thesis that the devices invented and described by the μηχανικοί actually were used in society at large? Here the author scores a few points but not many. The Archimedian screw is a case in point. Archimedes invented the thing and there is a source which confirms that it was widely used. The so-called „Druckkolbenpumpe“ of Ktesibios is another. Philon improved it but it was not until the first century A. D. that thanks to a further contribution by Heron the pump seems to have been used in mines and by firebrigades in „zumindest einige[n] größere[n] Städte[n] des griechischen Ostens in der Kaiserzeit“ (p. 110). The author (p. 108) herself candidly admits that for a long time after Ktesibios the device remained in an experimental stage and, if used at all, was used „als Trickpumpe für Überraschungen bei Symposien“: hardly a contribution to the „Verbesserung der Existenzbedingungen ihrer Mitmenschen“.

Without going into detail one may observe that in the field of ballistics, poliorcetic devices, water-raising devices and water-mills, there seems to be more evidence for architects and talented craftsmen having developed certain tools and machines during long years of persistent experimentation than for Mouseion engineers having invented (or just improved) and introduced them in everyday life. As to wine- and oil-presses it is interesting to see how the most advanced type, the so-called screw-press, known from Heron's description, lost the battle against the „Hebel“-press (p. 295) which was used long before Heron described it and consequently cannot have been invented by him. As to cranes, the author gives a detailed account of Heron's and Vitruvius' descriptions of various types but one is left with the impression that the two authors in question simply described devices which had already been used widely in earlier centuries, rather than invented these themselves.

The author offers good sections on the various devices used during symposia and religious ceremonies which, however, were economically rather insignificant and in many cases simply served to underline the power and wealth of those who used them. She is also good on water-clocks, geodesical instruments and the so-called hodometer, but again may well somewhat overestimate their impact on society. I doubt whether Heron's διόπτρα really ousted the traditional Roman *groma*, widely used by Roman *agrimensores* (cf. pp. 280, with note 32, and 289); and the hodometer probably remained a nice sort of mechanical toy which served, as the author herself admits, as „Demonstrationsobjekt“ (p. 286). Roman road-builders are not known to have used it.

Whether preindustrial tools and machines were designed by intellectuals (state-subsidized or otherwise) or, in a long process of trial and error, by talented and persistent (master-)craftsmen is a question

which obtrudes itself not only for the Graeco-Roman world but also for later preindustrial Europe. Regretfully the author has not tried to find inspiration in comparative research in this field. It may have tempered her confidence about the leading role of Mouseion-researchers somewhat.

Oegstgeest

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