
The Mechanical Hypothesis in Ancient Greek Natural Philosophy by
Sylvia Berryman

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In 1972, P. M. Fraser wrote that mechanics was the ‘Cinderella’ of Greek Hellenistic science [1972, 425]. I doubt that many scholars would subscribe to that today. In recent years, ancient mechanics has experienced a historiographical shift. On the one hand, treatises once dismissed as ‘technical’, such as the pseudo-Aristotelian *Mechanica* or Philo of Byzantium’s *Belopoeica*, are no longer relegated to the margins of scholarly investigation. Indeed, the validity of the very category of ‘marginal’ text has come under scrutiny. On the other hand, the role of machines—the products and at the same time the subjects of study of ancient mechanics—is being re-evaluated. For example, in contrast to the traditional dogma of economic *bloccage*, recent trends in the history of ancient economy, particularly in the Roman period, have emphasized the role played by mechanical artifacts in the growth of production and urbanization.¹ At the intersection of these two strands of scholarship, Sylvia Berryman is well aware of developments in the latter but operates within the former area of scholarship, which is essentially context-aware history of ideas. She writes:

Although the deployment and exploitation of technology might loom large in the eyes of economic historians, the *philosophical* reception of technological devices is a different matter. [41]

The two principal questions discussed in her book are

¹ See, e.g., [Wilson 2002](#).

whether mechanical theory was applied to nature, and whether mechanical practice played a heuristic role in guiding investigation of the natural world. [22]

Berryman answers both questions in the positive and thus advances two main claims. One is that there was a mechanical hypothesis in antiquity, which is distinguished from what is known as the teleological view of the world and which is at the same time not to be assimilated to materialism or atomism. The mechanical hypothesis was a third way, so to speak, which acquires clearer connotations as the book goes along. Berryman's second main claim is that the mechanical theories and mechanical devices developed from the Hellenistic period onwards stimulated many Greek thinkers, who engaged with the very specific issues raised by mechanics in order to understand the natural world better.

In order for the two claims to be sustainable, a few mistaken notions need to be dealt with and some ground needs to be cleared. Consequently, Berryman begins by sorting out the terms of the discussion and reviewing the various senses in which 'mechanics' and 'mechanical' are used in the scholarship. This is all the more necessary, since references to ancient mechanics (or to the modern as opposed to the ancient 'mechanical' world picture) have long been common in analyses of the Scientific Revolution. Berryman wants to make clear that historians of science of the early modern period often refer to a picture of ancient mechanics which does not correspond to what we find in the ancient sources but is a later construct. The book's appendix is specifically dedicated to this question.

In fact, the initial part of the volume is, almost by necessity, devoted to negative argumentation, a *pars destruens*, as it were. Berryman goes through some well-trodden territory, mostly demonstrating that common interpretations of mechanics are arbitrary or at best limited. Despite paying some dividends in terms of insights into the historiography of ancient mechanics, the first few chapters felt to me like a preamble to the following chapters, where (I thought) the real meat of the book was.

In this first part, although eschewing further discussion of the epistemic status of analogy among other things, Berryman usefully distinguishes between analogies to artifacts and mechanical analogies: 'not every artifact analogy would count as specifically "mechanical"'

[31: cf. 37]. She establishes, convincingly in my view, that mechanics as a discipline really only emerged in the fourth century BC and that mechanical devices preceded both the theories that tried to explain them and the classificatory attempts to divide and subdivide branches within the field of mechanics. Berryman also articulates with clarity the interpretation of ancient mechanics, now steadily gaining scholarly consensus, according to which «παρά φύσιν» is to be read *not* as being ‘against nature’ but rather ‘beyond’ or ‘above’ it [44–48].

With chapters 4 and 5 we finally get into the swing of things. They explore mechanics within mechanical treatises and devote particular attention to the interplay of theory and practice. We begin with the Aristotelian *Mechanica* and continue with Ctesibius (through the medium of later sources), Archimedes, Philo of Byzantium, Vitruvius, Hero of Alexandria, and Pappus of Alexandria. Many questions emerge that are remarkable for their significance to natural philosophy: for instance, the analysis of compound motion. How can one break down a movement resulting from more than one force into its causal components, while at the same time keeping the analysis within a conceptual framework organized along the distinction between motion that is either ‘natural’ or ‘beyond natural’? And is compound motion really a composite of forces moving in different directions or does the greatest force determine the eventual effect? Again, the nature of elasticity and resilience emerges, particularly in the context of discussions about the best material for catapult springs. What makes a bundle of sinews return to its shape after they have been forcefully twisted out of it?

There are interesting insights into the role of equilibrium. The conception of balance is shown to be crucial to Hero’s mechanics. Of Archimedes’ balance, Berryman writes:

[Archimedes’ technique] avoids the problem of measuring an awkward quantity—an area, in this case—by setting it equal to a known quantity in the context of a balance, the archetypal device for establishing equality. . . .The balance is used to give intuitive content to the notion of ‘setting equal’ two quantities that cannot, strictly, be weighed. [123]

Thus, she draws a neat connection between strands of research that have both been identified as crucial to Archimedes’ activities.

Models of the heavens are given their own subsection; and pneumatics, its own chapter [ch. 5]. Elasticity, to be understood in the context of pneumatics and pneumatic devices, is at the heart of Berryman's interpretation of Hero's theory of matter. Chapter 6, of a more substantial size than most of the others, analyzes philosophical texts that take on board insights provided by mechanics. This is probably the central chapter, in terms of argumentation—Berryman finally applies most of what she has said so far to philosophical texts and delivers the promise of the book's title. It is true, as she says [179], that the chapter traverses a long time span, including late ancient Christian and non-Christian authors, and by necessity extrapolates passages from wider treatises and discussions; but I also thought that the result was coherent and that it will indeed stimulate further consideration of the question.

The chapter is organized thematically, and chronologically within each subsection. The themes include the already-mentioned question of elasticity and recoil, as well as the limits of indefinite proportionality; this latter forms part of the account of how weights can be moved and under what conditions. By showing that indefinite proportionality is problematic, mechanics exposes the difficulties involved in applying mathematics to physical, real-life situations and prompts and deepens philosophical reflections, in authors like Simplicius, on this complex relationship. It is almost an understatement for Berryman to write:

[T]he evidence shows that late antique natural philosophers acknowledged and engaged with some implications of the weightlifting branch of mechanics for natural philosophy. [191]

In chapter 6, Berryman also further explores the intersections of mechanics and medicine, and mechanics and astronomy. Both are not completely novel ground but she finds some interesting things to say, highlighting for instance how Galen's explanation of the function of the parts of the body is related to his understanding of the limits of mechanical explanation [205–209]. Or again, she argues that the mechanical hypothesis provided fuel for a specifically Christian reading of design in the universe, both macro- and micro-cosmos. It is only in this, the last, chapter, that Berryman ventures an overarching definition of mechanics:

My proposal—and it is speculative—is that the unifying factor [of the field of mechanics] was simply the perception that certain devices have in common that they *do* something. [201]

Berryman's minimalist definition is, in my view, all more convincing, coming as it does after a thorough review of the evidence. The book's conclusion is exemplary, in that it actually does what it says on the box, as it were, in summarizing lucidly and thoroughly what the book says.

I have to admit that I found Berryman's style arduous at times, especially in the initial chapters; but I also thought that the book picked up speed and elegance as it went along. Her style of argumentation is very measured. Unlike what seems to be the norm in academic writing nowadays, she is happy to advance moderate claims and is rather modest in affirming the breadth and significance of what she is saying. While at times I would have liked to see her push the envelope a bit more, it was refreshing to read such an unboastful piece of scholarship for a change.

If I had to summarize the argument of Sylvia Berryman's book in one sentence, I would say that her claim is: ancient mechanics mattered. She makes a well-argued case that it mattered in antiquity and that it ought to give us food for philosophical thought today.

BIBLIOGRAPHY

Fraser, P. M. 1972. *Ptolemaic Alexandria*. Oxford.

Wilson, A. 2002. 'Machines, Power and the Ancient Economy'. *Journal of Roman Studies* 92:1–32.