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Shaping Worldviews: Contextualizing Roman Science

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Daryn Lehoux's comprehensive and thoughtful work, *What did the Romans Know? An Inquiry into Science and Worldmaking* (2012) emphasizes just how difficult the task of studying a world so foreign to our own can be for the historian. In addressing the question raised in his title, Lehoux describes the social, political, and religious context in which scientific ideas were developed in the Roman world between the first century BCE and the second century CE. With a sound understanding of Roman natural philosophy and a touch of humor, Lehoux's work investigates ideas fundamental to the history and philosophy of science.

While the Romans are at the heart of this study, the questions examined by Lehoux extend beyond the geographical and chronological parameters of the book, making it a welcome contribution to the history of science. It is only by stepping out of our modern way of seeing the world, Lehoux argues, that we can begin to understand how the ancients approached, comprehended, and rationalized the world around them. Roman science – complete with divination, astrology, and numerology – appears strange, but Lehoux contends that while these concepts are foreign, "their difficulty lies not in their weirdness but in the ancient claims as to how good the evidence for them is" (Lehoux 2012, 14). The importance of understanding the context in which scientific ideas flourish is imperative for all historians of science, and Lehoux demonstrates that ideas about the physical world around us, which modern readers might take for granted, cannot be assumed about the ancient scientist.

Lehoux's work is marked by judicious use of evidence and a careful analysis of his subject. Organizing his ideas thematically, he begins by addressing the relationship between nature and laws in chapters two and three. Lehoux explores the Romans' understanding of the role of gods in the physical world and the interrelation between judicial laws and nature. Taking Cicero as a case study, Lehoux demonstrates how Cicero's view of the natural world influenced his understanding of law: Cicero argues that just social interactions between people are natural and that these types of interactions form the basis for civil law (Lehoux 2012, 31). Alternatively, the Romans' understanding of law influenced the way they viewed the natural world. Lehoux uses as another example Ptolemy's findings on planetary stations – the point at which a planet, beginning or ending a retrograde pass, appears to stop in the sky – to illustrate a law ascribed to the natural world. This demonstrates that laws of nature do not make their first appearance in early modern science as is often assumed, but that they can be found in ancient science. In chapter four, "Epistemology and Judicial Rhetoric," Lehoux explores the concept of the observer as a judicial witness. Viewing the scientific observer in this light raised questions for Roman natural philosophers about the credibility of the witness, who counts as a witness, and the use of the reader as a witness.

While the first three chapters, all of which feature the relationship between nature and law, are closely linked, in chapter five, "The Embeddedness of Seeing," the author turns his attention to the visual theories proposed by Galen and Ptolemy. Lehoux explores how both authors – Ptolemy from a mathematical perspective and Galen from a medical perspective – used the same principle in their visual theories: namely, that things similar to each other are able to influence each other, a concept that Lehoux refers to as the law of "like affects like." This principle is assumed by both authors, but never justified. Lehoux argues that this law, "like affects like," is an example of a preconceived idea about the world that did not require explanation. In formulating ideas about the natural world, the Romans wove together observations and assumptions about how the natural world works, but what they saw when they looked at the world and what they understood about the world are not the same as what the modern reader sees and understands.

Lehoux's most poignant ideas come through in his discussion of garlic and magnets in chapter six, "The Trouble with Taxa," which he states was the kernel for this project. It is in this chapter that the claim that the Romans had different facts than what we have today, an idea that he alludes to in the introduction, resonates most clearly for the reader. According to Plutarch, Ptolemy, and others, rubbing a magnet with garlic neutralized its power of magnetism. Lehoux explains that this idea, completely baffling to modern readers, was treated as a fact in the Roman world. Neither Plutarch nor Pliny needed to test such a theory, in the same way that most modern readers will not feel the need to test whether garlic will have any impact on magnets. We take for granted that garlic has no effect on a magnet, in the same way that many Romans took for granted that garlic *does* have a disabling effect on a magnet. (As an aside, in the midst of reading chapter six, I found myself in my kitchen rubbing garlic on refrigerator magnets – for the record, I observed the magnets to behave the same before and after their garlic encounter.) While there are several examples that buttress Lehoux's argument that Roman science developed in a distant world, complete with its own governing rules, underlying truths, and facts, this example is the most effective at demonstrating the strangeness of Roman science to the modern reader.

Models and theories not only offer explanations, but they also influence the way we view the world. In chapters seven and eight Lehoux explores how allowing different entities – a divine being, astrology, or sympathy – into an explanation changes how the world works, what we observe, and how we understand it. Additionally, he examines the belief that a working theory that adequately explains observed phenomenon can also explain confounding observations in an unrelated branch of science. These symmetrical explanations, as Lehoux calls them, illustrate the ancients' view of a world that worked according to underlying principles that transcended specific fields.

While Lehoux's thematic approach is effective, the nuances of the different theories and the processes of constructing theories are sometimes lost. The principles, observations, and modes of explanation are unique to each historical actor; moreover they are not stagnant but regularly changing. Consequently the historian must understand the subtle details of the individual theories and how they change. A single example might serve to illustrate the point: one of Ptolemy's arguments in the *Almagest* for the circular motion of the heavens is that the sizes and distances of the stars do not appear to vary over the course of a revolution of the celestial sphere. He argues that the distances of the stars from the Earth must therefore be constant.[1] Ptolemy says:

> For the apparent increase in their sizes at the horizons is caused, not by a decrease in their distances, but by the exhalations of moisture surrounding the earth being interposed between the place from which we observe and the heavenly bodies, just as objects placed in water appear bigger than they are, and the lower they sink, the bigger they appear. (Ptolemy 1998, 39)

Ptolemy is referring to the occurrence of the Sun and Moon appearing larger when viewed at the horizon. He contends that this phenomenon, which is often referred to as the Moon illusion, is due to the median through which we view the Sun or Moon: namely, the air and the moisture in it. It is clear that he does not think the Moon is closer to the Earth when we view it near the horizon and further from the Earth when we view it near the zenith. Instead, he says that the Moon appears to increase in size when viewed near the horizon due to (what seems to be) refraction. While this explanation at first seems sensible to Ptolemy, he later provides a different account of the observation: that the angular diameter of the Moon is same when measured at the horizon and zenith.

In the *Optics*, Ptolemy attributes this phenomenon to a psychological effect. In Book III of the *Optics*, he accounts for the Moon illusion:

> Generally speaking, in fact, when a visual ray falls upon visible objects in a way other than is inherent to it by nature and custom, it perceives less clearly all the characteristics belonging to them. So too, its perception of the distances it apprehends will be diminished. This seems to be the reason why, among celestial objects that subtend equal visual angles, those that lie near the zenith appear smaller, whereas those that lie near the horizon are seen in another way that accords with custom. Things that are high up seem smaller than usual and are seen with difficulty. (Ptolemy 1996, 151)

Ptolemy explains that celestial bodies that subtend equal angles, and are consequently the same size, appear bigger when viewed near the horizon due to the way the visual rays from the eye fall on the object. The Moon would be the same size when viewed near the zenith or the horizon; however, the observer would think the Moon appears to be larger nearer to the horizon. Ptolemy argues that the eye must gaze up to see the object, and the visual ray falls upon the object in a way to which it is not accustomed. When the same celestial object is viewed near the horizon then the visual ray makes contact with the object in a way that is "inherent to it by nature and custom" (Ptolemy 1996, 151).

The different explanations of the Moon illusion in the *Almagest* and the *Optics* demonstrate Ptolemy's evolving theories on optics as applied to astronomy. At first he explains an inexplicable phenomenon, that the Moon appears larger when viewed near the horizon, using refraction. Later he revised his account, presumably after observing that the Moon in fact appears to be the same size when viewed near the horizon or zenith, and he replaced his theories this time relying on a different theory to explain the phenomena, or in this case, the lack thereof. Consequently, both what the observer saw and how those observations were explained were shifting for Ptolemy. We can see from this example that there was not one Roman mindset to understand. Rather, each author had a different approach to explaining the world, and these approaches were often evolving. Lehoux acknowledges this and he does not endeavor to explain the scientific theories of all of the characters he examines; in fact he says that he will only examine the most significant of the interconnections, so in some ways this critique may be unfair (Lehoux 2012, 2). Nevertheless, the reader needs to be attuned to the fact that there is not a single web of knowledge, but many *webs* of knowledge, and that historical actors make sense of the world in very different, and constantly shifting, ways.

In the final chapters of the book Lehoux changes the lens he uses to examine the ancient world by situating Roman science within philosophy of science debates on realism. He raises two main questions: (1) Can a historian be a realist and offer a fair portrayal of ancient science? And, (2) How does the criteria for realism hold up against ancient scientific theories? Concerning the first question, Lehoux analyzes how the historian can offer a fair consideration of ancient science, but at the same time believe that our modern scientific theories are approximately true. This idea is closely tied to the second question, which asks how the philosopher of science should approach ancient science. Lehoux examines a Hippocratric work, *On Ancient Medicine*, in which the author states that the accuracy of current medical theories demonstrates that they are "rightly and truly uncovered, and not the product of accident" (Lehoux 2012, 205).[2] This idea is similar to Hillary Putnam's famous miracle argument: "The positive argument for realism is that it is the only philosophy that doesn't make the success of science a miracle" (Putnam 1975, 73; see Lehoux 2012, 204). The similarity of these ideas, one an observation by a Roman author and the other a weighty argument in the philosophy of science, leads Lehoux into an exploration of what separates modern views that our science is approximately true from the Romans' confidence in the truth of their own theories. He shows that some of the theories proposed by authors such as Galen and Ptolemy fare surprisingly well against criteria of what constitutes a scientific theory that is viable, mature, and approximately true. In the end, Lehoux sketches out a broad strategy for the historian/realist where modern scientific models are viewed with a pragmatic theory of truth and a coherence-based epistemology. That is to say that only the parts of our theories that are verifiable, testable, and cohere should be considered to be true, or approximately true. While Lehoux's discussion of the place of Roman science in modern philosophical debates represents a departure from the themes covered in the rest of the book, the last two chapters nevertheless offer much food for thought for historians and philosophers alike.

Science does not take place in a vacuum. Underlying ideas, many of which may be so deeply rooted that they are unknown to the scientists, play an essential role in the development of theories. The historian's role is not to condemn ancient ideas as silly or naïve, but to make sense of those ideas with the larger social, political, and religious context in mind. Lehoux examines the title question, "What did the Romans know?" from almost every angle, revealing a Roman world more intricate and intellectually complex than is often assumed. His fresh writing style holds the reader's attention and his peppering of modern references keeps the reader on her toes. This is a thought-provoking work and one that explores many critical questions for the historian and philosopher of ancient science.

Notes

1. According to Ptolemy: "To sum up, if one assumes any motion whatever, except spherical, for the heavenly bodies, it necessarily follows that their distances, measured from the earth upwards, must vary, wherever and however one supposes the earth itself to be situated. Hence the sizes and mutual distances of the stars must appear to vary for the same observers during the course of each revolution, since at one time they must be at greater distance, at another at a lesser. Yet we see that no such variation occurs" (Ptolemy 1998, 39).

2. Lehoux includes both the original Greek text and an English translation.

Works Cited

Lehoux, Daryn. 2012. *What Did the Romans Know? An Inquiry into Science and Worldmaking.* Chicago: University of Chicago Press.

Ptolemy. 1996. *Ptolemy's Theory of Visual Perception: An English Translation of the Optics With Introduction and Commentary*. Trans. and commentary by Mark A Smith. Philadelphia: American Philosophical Society.

——. 1998. *Ptolemy's* Almagest. Trans. by G. J. Toomer. Foreword by Owen Gingerich. Princeton, NJ: Princeton University Press.

Putnam, Hilary. 1975. *Mathematics, Matter, and Method*. Cambridge: Cambridge University Press.