pects of Ellul's sociological analysis. Tonstad claims that to deny demonic reality used to be a sign of intellectual maturity and a refined mind; but the reality of the Holocaust, the Gulags and a century of genocides casts a long shadow over this myth about the progress of modern humanity. He therefore repeatedly stresses the need to understand the Christian God who, at the end of history, overcomes the demonic reality of Satan and his followers by the non-violent power of peace, goodness and love. This idea has almost vanished from the modern Christian theological tradition, and Tonstad makes an effort to demonstrate its crucial importance for a balanced understanding of evil and suffering within the horizons of the cosmic conflict between good and evil again.

Darko Pirija

Geoffrey Gorham, Benjamin Hill, Edward Slowik, C. Kenneth Waters (eds.)

The Language of Nature

Reassessing the Mathematization of Natural Philosophy in the Seventeenth Century

The University of Minnesota Press, Minneapolis 2016

More often than not, the natural world can be quite perplexing. Even the things we today take for self-evident, need not have been such for our ancestors. Try to remember the disbelief you felt when you first encountered the fact that all bodies fall at the same rate, regardless of their mass. Surely, that cannot be so, a young mind thinks, an anvil is bound to strike the ground much faster than a tiny feather. Yet, experiments conducted in vacuum keep proving these intuitions wrong to this day. At least our young minds were in good company, as many ancient natural philosophers believed the same, and they could offer extensive and consistent explanations to support their claim. After all, the task of a natural philosopher was to make rational sense of the seemingly chaotic nature. And to do that, they had to rely on the powers and discipline of their minds, because the physical world and the senses can be treacherous and deceptive. A long time ago, the best way to become a *physicist* (so to speak) was to read a book – Aristotle's *Physics*.

It took quite some time for us to become comfortable with the idea that the best source of knowledge about nature was nature itself. The uncovering of mathematical principles of nature is often cited as the turning point. We no longer needed to rely on clever teachers from the past to provide us with answers to our questions, we could simply ask nature, and it would gladly give us the answer, provided that we understood its language. Hence Galileo's famous adage about the book of nature being written in the language of mathematics.

This is the language that is spoken of in the book *The Language of Nature: Reassessing the Mathematization of Natural Philosophy in the Seventeenth Century*. The book is comprised of twelve distinct essays collected by editors Geoffrey Gorham, Benjamin Hill, Edward Slowik and C. Kenneth Waters, and published in 2016 by University of Minnesota Press as a part of Minnesota Studies in the Philosophy of Science series. Contributors of this book are professors of various universities and colleges from the United States, Canada, France, Romania and the Netherlands, most of them specializing either in modern philosophy, philosophy and history of science and epistemology. Their essays are rallied around a common topic, namely, the so-called *mathematization thesis*, an idea that the ever-greater use of mathematics as a constitutive element of natural philosophy during the seventeenth-century played a pivotal role in the emergence of modern science. The soundness of this idea is probed from various standpoints: some essays are engaging with historical figures such as Galileo and Leibniz, while others focus on the development of important ideas like laws of motion. All of the texts are seriously researched and equipped with sizeable lists of references, yet topically distinct enough to avoid repetition and to offer a plethora of information. The historiographical approach that all these essays share makes them very enjoyable to read and every single one of them can be considered as much a compelling story as a scholarly article.

The subject matter contained in this book can best be described as an advanced commentary on a previously established understanding of a prominent historical milestone. Thus, this book is not a primer, a beginner's companion or an introduction to the early history of modern science, it is instead geared towards experts and enthusiasts who are already well-acquainted with the mathematization thesis.

Both beginning students and expert researchers will, however, appreciate the copious lists of sources that come after every essay. Still, the more one is familiar with the history and philosophy of science, the more use and enjoyment they will be able to glean from these pages.

This is not to say that the book is inaccessible to the layman reader – quite the contrary. Gorham, Hill and Slowik offer a comprehensive introduction that covers the essential information about the mathematization thesis, explaining both its central concepts as well as the historiographical function it served, initially framing it as the transformation of scientific concepts and methods brought about by the application of mathematical ideas. Worthy of note is their inventory of three main foci of contention about the mathematization thesis during the seventeenth century: the issue of instrumentalism versus realism (due to growing acceptance that mathematics is not just an approximative tool, but a true description of physical nature), the manifold types of mathematization (different paradigms) and the perspective of the social context of mathematization (a noticeable increase in the intellectual authority of mathematicians of the time). Although the writers of the introduction grant that the mathematization thesis is elegant, useful, unifying and simple, they nevertheless point out its limitations:

> "Recent historical work and historiographical trends, however, have put considerable pressure on the mathematization thesis, and in many cases have begun to undercut its power and plausibility as a narrative of the scientific revolution. It has always been recognized that there were outliers to the mathematization story. (...) And it has always been recognized that within certain domains of natural philosophy (medicine, biology and psychology, for example) very little mathematization was successful or even attempted. (...) The rise of contextualist history of science and philosophy has also begun to highlight the many additional factors propelling the scientific revolution (...). Add to this the growing trend to deny that this emergence is revolutionary, as opposed to gradual or halting, and there seems to be no place for the mathematization thesis in current history of science." (Geoffrey Gorham, Benjamin Hill, Edward Slowik, "Introduction", in: Geoffrey Gorham *et al*. (eds.), *The Language of Nature: Reassessing the Mathematization of Natural Philosophy in the Seventeenth Century*, The University of Minnesota Press, Minneapolis 2016, p. 15.)

It should be noted, however, that for all the mentions of "reassessing" and "reevaluating" of established paradigms found in this book, most essays are relatively tame with regards to the conclusions they offer. They are not as much redefining our understanding of the mathematization thesis as they are offering a more in-depth look into a topic that can sometimes be taken for granted. In most cases, the essays of this book give a higher resolution image of a complex historical mosaic, so to speak. The only essay that can be called "revolutionary" inasmuch as it explicitly attempts to upend the usual understanding of the history of science is that of Roger Ariew.

Ariew's text "The Mathematization of Nature in Descartes and the First Cartesians" directly challenges the widely-accepted version of the mathematization thesis that is found in seminal works of Koyré, Dijksterhuis and Burtt, the one which states that the scientific understanding of space has undergone a radical paradigm shift by way of geometrization, whereby an abstract notion wholly supplants experiential space. This shift is often used as a blanket justification for general devaluation of experience, something that Ariew believes is most erroneous, as it fails to account for the fact that mathematization had different meanings for different thinkers. Cartesian philosophers (Rohault, Le Grande, Régis) offered a suitable proving grounds for this thesis. In their teachings, Ariew found a multitude of ways mathematics was linked with science, none of which could be used as an argument for doing away with experiential knowledge. In that vein, one finds:

> "[T]hat natural philosophy can develop a method similar to that of mathematics; that propositions in natural philosophy can be as certain as those of mathematics; that mathematics can be of use in sharpening one's mind for the practice of philosophy; that mathematics has a mode of exposition that is particularly persuasive; that philosophy can be based on the same clear and distinct ideas as those on which mathematics are based. But we do not find the view that the method of philosophy is reducible to the method of mathematics or that philosophy is founded in mathematics." (Roger Ariew, "The Mathematization of Nature in Descartes and the First Cartesians", in: G. Gorham *et al*. (eds.), *The Language of Nature*, p. 128.)

Other texts tacitly accept that the mathematization thesis holds some ground in the scientific practices of the seventeenth century, and from there mostly argue about the scope of its applicability. A number of them attempt to demonstrate the limited scope of the project of mathematization, either by indicating areas in which it failed outright or by uncovering anachronistic elements in interpretations of successful instances of mathematization. Justin Smith's text "Leibniz's Harlequinade" sketches the limits of mathematization in medical sciences, while Eileen Reeves' text "Color by Numbers" attempts the same in the field of early colour theory.

Some contributors chose to take on some of the more dubious details of the mathematization thesis and offer new and more coherent perspectives that still remain faithful to the original idea. Dana Jalobeanu tries to show

that Francis Bacon's purported dislike of the mathematical method is only a shallow reading of this philosopher, and Lesley B. Cormack insists that practical, applied mathematics cannot be ignored in the historical development of modern science. Finally, Kurt Smith commits to perhaps the most challenging adaptation of all. His text "Leibniz on Order, Harmony, and the Notion of Substance" goes against the usual grain of interpreting Leibniz as a philosopher who subordinated mathematical method to metaphysical principles, and underlines aspects in which Leibnizian metaphysics made good use of mathematics.

This cursory glance of available topics and approaches covered merely a half of the texts that can be found among the pages of this book, and those that we omitted from this review should not be considered any less relevant than those mentioned. They engage with other interesting issues, ranging from mathematical methodology to mathematical realism, offering valuable philosophical analysis and ample historiographical information. However varied the immediate topics of these essays are, and irrespective of how sympathetic their authors are towards the mathematization thesis, an overarching sentiment still emerges, a conclusion that answers the challenge that was initially articulated by the editors. Much like the case of the idea of a monolithic scientific method, the idea of monolithic mathematization at the dawn of modern science is deconstructed into numerous variegated instances that are neither in complete accord with one another nor completely divergent from one another. Mathematics is still seen as being at the root of our science; it is, however, shown that this root has more branches than was previously understood. Thus, while this collection of essays is perhaps not as bold or daring as its title would at first suggest, it is nevertheless interesting, useful and, above all else, true to its promises.

Goran Rujević

Duncan Pritchard

Epistemic Angst

Radical Skepticism and the Groundlessness of Our Believing

Princeton University Press, Princeton 2016

We ordinarily take ourselves to know many things about the external world. However, radical scepticism, the thesis that propositional knowledge of the external world is impossible, poses a significant threat to contemporary epistemology. Epistemologists have developed various proposals to tackle this threat. Duncan Pritchard, a leading epistemologist, makes his unique contribution. His proposal is significant in three aspects.

First, radical scepticism has two influential arguments, i.e., the closureRK-based and the underdeterminationRK-based sceptical arguments. They are logically independent but equally devastating, and thereby a satisfactory treatment of scepticism should be able to counter them at the same time. However, many anti-sceptical proposals fail to do so. Pritchard's project is unique in this respect.

Second, the sceptical challenge can be easily evaded if one adopts externalist theories of knowledge. However, externalism would concede that we do not have rationally grounded knowledge and that what we have is merely animal knowledge. In a word, the externalist strategy makes a big concession to the sceptic. While internalists aspire to save rationally grounded knowledge, it is easier said than done. Pritchard's book provides an internalist anti-sceptical proposal in which the possibility of rationally grounded knowledge is secured.

Third, the sceptical challenge is posed as if it is a paradox residing in the fundamental tenets of epistemological theories. Hence, it is not enough that we simply rebut the sceptical arguments. To relieve our intellectual worry, we need to diagnose the sceptical problem. A diagnostic anti-sceptical proposal may include the following inquiry. What is the source of scepticism? Is the source innocent or problematic? Where do we go wrong when we take the sceptical paradox as plausible? Pritchard's diagnostic story helps us to resist the sceptical lure.

In his new book *Epistemic Angst*, Pritchard offers a novel approach to solving the sceptical problem.

In the first part Pritchard formulates two forms of sceptical arguments, i.e., the closureRK-