Richard T. W. Arthur, *Leibniz on Time, Space, and Relativity*.
Oxford: Oxford University Press, 2021. xi + 404 pp.

Downloaded from http://read.dukeupress.edu/the-philosophical-review/article-pdf/132/3/495/2025773/495mcdonough.pdf by Harvard University user on 17 December 2023

In his impressive *Leibniz on Time, Space, and Relativity*, Ric Arthur manages to juggle a daunting array of tasks: tracking the chronological development of Leibniz's views over more than half a century; explicating Leibniz's groundbreaking mathematics; assembling texts—primary and secondary—in at least five languages; and, as if in passing, offering original translations and assessments of countless source materials. All this erudition is put to the service of offering detailed interpretations of Leibniz's challenging theories of time, space, and motion. Arthur's performance is a lifetime in the making, and his *Leibniz on Time, Space, and Relativity* is certain to be essential reading for those interested in the topics it covers for many years to come.

Leibniz's subtle theory of time defies easy summary. According to Arthur, Leibniz's theory of time is ultimately grounded in relations among states of substances. States of substances are representations of a world from a perspective. States that do not contradict one another occur at the same time. States that do contradict one another are successive. Among successive states, some provide reasons for others. A state that provides a reason for another state is temporally prior to that state. One thing exists before, after, or at the same time as another thing not because of the way both things are related to some special, independent third thing—namely, time—but rather because of the relations they bear to one another (and other similar things). A occurs before, after, or at the same time as B because of the relations between A and B. For Arthur's Leibniz, time itself is an abstract ordering relation that structures not only all actual temporal relations but also all possible temporal relations. It guarantees not only that my fifth birthday must precede my fiftieth but also that my fiftieth must precede my merely possible five hundredth.

Is Leibniz eliminating time? Many commentators have thought so. Leibniz was a nominalist, and nominalists typically deny that abstract objects exist. In holding that time is abstract, mustn't Leibniz also hold that time doesn't really exist? "No," says Arthur. Abstract objects, for Leibniz, have a home in the "divine mind" (61). Thus, while the abstract structure that orders all possible existing things can't itself exist in the concrete world, that doesn't mean that it doesn't exist at all. Furthermore, and perhaps even more importantly, the temporal relations holding between things in the world are not abstract. Even if time itself were not real, Arthur's Leibniz would still insist that my fifth birthday occurred before my fiftieth birthday and at roughly the same time as my older brother's seventh birthday. Even if time is abstract, temporal relations are not.

But wait, doesn't Leibniz also hold that relations are ideal? And in holding that temporal relations are ideal, isn't Leibniz suggesting that temporal relations themselves are not real? Again, Arthur thinks not. He argues that while "Leibniz denies reality to relations as entities in themselves, he does not thereby deny the reality of relational facts, such as the fact of two states of a substance occurring one after the other" (61). Suppose that Plato is older than Aristotle. For various reasons, Leibniz thinks that any relation between Plato and Aristotle can exist neither solely in Plato nor solely in Aristotle, nor in both of them jointly. Any relation between Plato and Aristotle must therefore be grounded at least partially in a mind that considers them both. Relations are, for Leibniz, ideal in precisely that sense. But "Plato is older than Aristotle" is still true even if no one considers Plato and Aristotle. That Plato is older than Aristotle is grounded in Plato's intrinsic nature and Aristotle's intrinsic nature. The older-than relation is metaphysically ideal, but relational "facts" are not. Arthur's Leibniz has a somewhat complex view concerning the foundations of time, but it would be inaccurate, Arthur thinks—and I agree—to say that Leibniz means to eliminate time.

Arthur attributes to Leibniz a similar view of space. In his famous exchange of letters with Samuel Clarke, Leibniz contrasts his mature view of space (and time) with Newton's views. In broad strokes, Clarke and Newton think of space as an immobile, unchanging backdrop. Bodies are in space by being collocated with regions of space. Bodies move through space by collocating with different regions of space at different times. In opposition to this picture, and in keeping with his own understanding of time, Leibniz suggests that existing things stand directly in spatial relations to one another. As with time, one thing is cospatial with another thing not because of the way that both are related to some special, independent third thing—namely, space—but rather because of the relations they bear to one another (and other similar things). And, again, as with time, space itself is an abstract ordering relation that structures not only all actual spatial relations at a time but also all possible spatial relations at a time. It is, Leibniz tells us, the "order of coexistence," and, like time, it is an abstract, ideal structure that resides in the divine intellect.

Leibniz wrote his letters to Clarke in the final years of his life. (One imagines him dying with pen in hand, one more argument against his great adversary still in his inkwell.) Leibniz's thinking about the nature of space, however, goes back to some of his very earliest writings. In those early writings, according to Arthur, Leibniz developed the idea that "the divine attribute of immensity is the basis of space" and that divine immensity is divided into a network of regions by the motions of bodies contained in it (123). On Arthur's telling, Leibniz was then led by his study of Hobbes to develop a new mathematics of situation, Leibniz's famed *analysis situs*. Leibniz's *analysis situs,* in turn, provided him with formal tools for characterizing space both as a changing network of regions and as a system of relative positions. It became possible to understand space as an abstract system of possible positions structuring the spatial relations between existing things. On Arthur's reading, there is thus a

Downloaded from http://read.dukeupress.edu/the-philosophical-review/article-pdf/132/3/495/2025773/495mcdonough.pdf by Harvard University user on 17 December 2023

progressive, mostly continuous line of development in Leibniz's thinking about the nature of space from the late 1670s until his death in 1716.

Arthur's progressive, mostly continuous reading of Leibniz's views on space stands in provocative contrast to past and recent work by Vincenzo de Risi. In forthcoming work, De Risi (forthcoming) argues that Leibniz's views on space can be divided into three periods: an early substantivalist view, a middle Scholastic view rooted in the idea of imaginary space, and his famous late relational view. Most intriguingly, De Risi proposes that Leibniz's relational view emerges for the first time only in the late 1680s and that it is prompted precisely by Leibniz's clandestine reading of Newton's *Principia*. On De Risi's reading, Leibniz's views on space are not an evolving refinement of a core theory but rather a series of essentially distinct theories. Leibniz's relational theory is not the almost miraculously coincidental twin of Newton's substantivalism, as it might appear to be from the Leibniz–Clark correspondence. Rather, it was crafted from the ground up by Leibniz as an alternative to the position of his great rival. Arthur and de Risi have opened up an exciting interpretative area of great consequence for early modern philosophy and science. Scholars looking for the next big thing in Leibniz studies may need to look no further.

In taking up Leibniz's views on motion, Arthur emphasizes a distinction Leibniz makes between motion conceived geometrically and motion with respect to cause. Motion conceived geometrically involves nothing more than a mere change of situation. Leibniz maintains that between any two bodies geometrical motion is relative and mutual. If our ships pass in the night, your ship moves relative to mine and mine moves relative to yours. There's no saying—it doesn't even make sense to ask—which is *really* moving. Motion with respect to cause "involves identifying the subject of motion by reference to the best explanation of the change" (321). Suppose there is a breeze and your sails are raised. The best explanation for our change of relative situation is that your boat is being driven by the wind while mine is resting in the water. In this case, the best hypothesis is that your boat is truly moving with respect to cause while mine is not. Motion with respect to cause is thus not—in contrast to geometrical motion—necessarily relative. In the case of motion with respect to cause, we can ask, and even hazard an educated guess, whether it is your boat or my boat that is *really* moving.

Arthur shows how Leibniz's distinction between geometrical and causal motion may be used to untangle some prima facie puzzles that have been raised for Leibniz's theory of motion. Take, for example, the apparent tension between Leibniz's commitment to the "equipollence of hypotheses" and his apparent endorsement of Copernicanism. In explicating the equipollence of hypotheses, Leibniz insists that "all hypotheses about the motions of any bodies whatsoever, however numerous, that are moved solely by corporeal impacts, it follows that not even an angel could discern, in mathematical rigor, which of the many bodies of this kind is at rest, and is the center of motion of the

Downloaded from http://read.dukeupress.edu/the-philosophical-review/article-pdf/132/3/495/2025773/495mcdonough.pdf by Harvard University user on 17 December 2023

others" (248–49). Copernicanism, however, suggests that we—not to mention the angels—can say that the earth and planets move and that the sun is at rest. Faced with the obvious tension between these two commitments, it is tempting simply to favor one commitment at the expense of the other. It is tempting to suppose either that Leibniz's equipollence of hypotheses is a disingenuous sop to the powers of Rome or that Leibniz's commitment to Copernicanism is faint of heart—that Leibniz, for example, is only commending Copernicanism as merely one of many possible systems.

On Arthur's reading, Leibniz's distinction between geometrical and causal motion suggests a more satisfying middle path. Leibniz does think that from a geometrical point of view, Copernicanism should be counted as merely one among many possible systems. And he really does believe that even an angel couldn't say, from a geometrical point of view, whether the planets or the sun is in motion. From a geometrical point of view, such questions don't even make sense. But they do make sense from a causal point of view, and from a causal point of view we can make better and worse hypotheses about which bodies are really moving. Leibniz can thus coherently insist that from a geometrical point of view Copernicanism is merely one among many possible systems, while still maintaining that from a causal point of view the Copernican system is our best hypothesis, that the planets really move, that the sun is really at rest. On Arthur's reading, even if Leibniz's language is conciliatory, there is nothing faint-hearted about his commitment to Copernicanism.

Leibniz On Time, Space, and Relativity is a masterpiece of scholarship. It is historically, philosophically, and technically rich. (Did I mention that it includes a series of appendixes containing formal expositions, detailed explications of Arthur's background views, and original translations? There is even a glossary of technical terms!) It is not, it should be conceded, an easy book. Although clearly written and organized, it is long and detailed. There is enough material between its covers for at least three important books, one on each of its principal subjects. Indeed, it is so chock-full of arguments, textual notes, and scholarly details that one might be tempted to suppose that it is dense in the mathematician's sense, that between any two philosophical arguments, notes, or scholarly details, one will always be able to find another argument, note, or scholarly detail. For those with a taste for virtuosic scholarship and an interest in Leibniz, early modern philosophy, or the philosophy of space and time, Arthur's masterpiece promises a dense but endless series of delights. Treat yourself.

Reference

De Risi, Vincenzo. Forthcoming. "The Genesis of Relationism: Leibniz's Early Theory of Space and Newton's Scholium." In *Oxford Studies in Early Modern Philosophy*, vol. 12, edited by Donald Rutherford. Oxford: Oxford University Press.

Downloaded from http://read.dukeupress.edu/the-philosophical-review/article-pdf/132/3/495/2025773/495mcdonough.pdf by Harvard University user on 17 December 2023

Jeffrey K. McDonough
Harvard University

Philosophical Review, Vol. 132, No. 3, 2023
DOI 10.1215/00318108-10469538

Collin Rice, *Leveraging Distortions: Explanation, Idealization, and Universality in Science.*
Cambridge, MA: MIT Press, 2021. xii + 353 pp.

Questions about idealizations in science are often framed along the lines of, How can science be so effective when it gets so much wrong? Rice's book, *Leveraging Distortions: Explanation, Idealization, and Universality in Science* offers a refinement on this framing, where we need not commit to the premise that idealizations are, in fact, wrong, that they need to be contained to the irrelevant parts of a model, or should be explained away as mere appearance. Rice takes a holist approach in which idealization is more like a process by which models as a whole are leveraged into better fit with their targets. Idealizations should not be carved out one by one on this approach; they make sense in the context of the models in which they figure, and they distort in ways that illuminate features like universal behavior in the systems being modeled. This is a refreshing approach to how idealizations work, one that does not require the common presupposition that idealizations are simply false.

By *universality*, Rice means "the stability of certain patterns or behaviors across systems that are heterogeneous in their features. Universality classes are, then, just the group of systems that will display those universal patterns or behaviors" (155). Universality enables a more abstract description of systems than what scientists may have started with, and this process of making the description of the behavior more universal serves to identify common causal structures implemented in very different physical mediums. Different descriptions of causal relata facilitate identification of more unifying patterns of behavior. Given how often philosophers think of abstraction as somehow eliminating causation, by identifying causation too strongly with microphysical details, universality is a helpful way to bring the process of abstracting description back into contact with the way in which models inevitably involve causal structure, and how that causal structure itself can be better understood by connecting classes of systems with heterogeneous physical media and similar behavior, by showing how the more abstract descriptions of causal structure are deployed in each.

Downloaded from http://read.dukeupress.edu/the-philosophical-review/article-pdf/132/3/495/2025773/495mcdonough.pdf by Harvard University user on 17 December 2023