Book Review for HOPOS

Klaas van Berkel. *Isaac Beeckman on Matter and Motion.* The Johns Hopkins University Press, 2013, viii + 265 pp, $35.96 (pbk), ISBN 13: 978-1-4214-0936-8.

Isaac Beeckman (1588-1637) is a fascinating figure in the history of modern thought. This unsung hero of the Dutch Enlightenment was perhaps the first thinker to outline the program of the mechanical philosophy, aptly described by Van Berkel as follows: "nature consists of nothing but matter in motion, and all phenomena can be explained by combinations of material particles that behave according to specific laws of motion" (6). Moreover, for Beeckman, all action is by contact, so that gravitational and magnetic attraction must be rejected: "attraction, in my judgment, is not according to nature, since all action is by contact" (94). Accordingly he clearly and consistently rejected the magnetic virtues of Gilbert, the planetary intelligences of Kepler, the plastic principles of Severinus and Libavius, and the idea of God as a world soul. Beeckman was an atomist, his atoms being (at least initially) infinitely hard corpuscles of various geometrical shapes and sizes, like those of Hartsoeker, Huygens and Newton some decades later. He gave micro-corpuscular explanations of light, magnetism, gravitation, cohesion, and, in advance of Torricelli, he explained that "Water that is sucked up by a pump is not drawn by the force of the vacuum, but rather pushed up by the pressure of the air" (92). In the theory of motion he originated the principle of inertia, (later co-opted, modified and made famous by Descartes and then Newton). He stressed the importance of applying mathematics to understand phenomena, giving several elegant demonstrations of its application—for instance, to explain why the Colossus of Rhodes would be better able to withstand the wind than a human body because of its greater ratio of volume to surface area (78). Beeckman, moreover, was an artisan, and his scientific hypotheses were not mere speculations, but based in his experience. Thus his case is of critical relevance to the question of the origins of rational mechanics and its relationship with artisanal and mechanical practice.

There are multiple challenges here: to explain how this modest schoolteacher, working in isolation, managed to set the program for the mechanical philosophy that later thinkers were to follow, not only in its broad fundamentals, but also in many of its particulars; and how he did this without the supposed ground-breaking changes in metaphysics and epistemology that Descartes claimed were necessary for the task; to explain how and to what extent he influenced later thinkers, particularly Descartes and Gassendi (and, given this influence, to explain how Beeckman's seminal contributions have not become better known); and, finally, to explain the implications of this story for the historiography of modern science.

All of this is achieved in exemplary fashion by Klaas van Berkel in this fascinating book. He draws extensively on Beeckman's celebrated notebooks, written in Latin and Dutch. Although Beeckman's surviving brother Abraham published a selection from them in 1644, these notebooks were thought to have been lost until they were rediscovered lying intact in the Provincial Library in Middelburg by Cornelis de Waard in 1905. He subsequently published them in 4 volumes between 1939 and 1953 as *Journal tenu par Isaac Beeckman de 1604 à 1637 publié avec une introduction et des notes par C. de Waard*. They cover topics in mechanics, musical theory, medicine, logic, chemistry and astronomy, all in the form of isolated reflections and observations, like Newton's *Certain Philosophical Questions*, or Darwin's "commonplace book". Sections of them have since been studied in depth by various scholars, but they have not until now received a treatment in their entirety.

In the first three chapters of his book Van Berkel gives us an engagingly intimate portrait of Dutch life in the early seventeenth century. He charts Beeckman's career from candlemaker to Latin teacher, craftsman, and expert consultant on civic projects involving fluid flow, to a respected contributor in the republic of letters, to his final years as a retiring principal of a Latin school in Dordrecht absorbed in the solitary undertaking of lens grinding, after giving up his plan to write a treatise on mathematical philosophy. The loss of confidence characterizing that last transition followed Descartes' vicious and demeaning attack on his work and character in 1630, despite his earlier admiration and acknowledged debt to Beeckman stemming from their collaboration in 1618. But it is unlikely that this incident was the only cause of Beeckman's withdrawal. In 1629 he also suffered the loss of his brother and close confidant Jacob to the plague of tuberculosis afflicting Holland and Zeeland. Also, by 1632 five of the seven children his wife Cateline bore him had died in their infancy, and in 1634 pupils from his school including two of his nephews were lost in a shipwreck trying to flee the plague. In 1637, after months of decline, Beeckman himself succumbed to tuberculosis at the age of only 48.

Beeckman's temperament was in any case quite the opposite of Descartes'. His modesty and tolerance are particularly evident in the way he negotiated around some of the religious and political issues of the time, sticking up for friends and acquaintances who were Remonstrants (Dutch Protestants who had adopted several Arminian tenets in opposition to orthodox Calvinism). This was at a time when the leader of the Remonstrants, Oldenbarnevelt, had been tried and executed after Prince Maurice of Nassau had seized power and initiated purges of Remonstrants from all political positions. Beeckman himself was a Counter-Remonstrant, or orthodox Calvinist, believing that matter was utterly unable to act on its own, and denying human free will as contrary to divine predestination. This did not prevent him from adopting atomism like the Remonstrant student David van Goorle, or from advocating a combination of Copernicanism and mechanical philosophy of the kind that would later earn the wrath of Descartes' Calvinist opponent, Gisbert Voetius.

Van Berkel discusses Beeckman's natural philosophy in two informative chapters, one on his matter theory, and one on his contributions to the theory of motion. Beeckman's matter theory is dominated by his commitment to atomism. Atomism was in fact quite prevalent in Europe in the late sixteenth and early seventeenth century as Epicureanism began to establish itself as a focus for opposition to Scholasticism, especially in England, buttressed by currents of thought in alchemy and medicine. A number of Beeckman's contemporaries—among them Sébastien Basson, David van Goorle, Daniel Sennert and the young Robert Boyle—had followed Julius Caesar Scaliger in reinterpreting Aristotelian natural minima as really existing atoms, smallest and naturally indestructible units of each natural kind of thing, possessing such properties as chemical affinity and force or appetition. In contrast, however, Beeckman had adopted a more austere Platonic atomism, stripping atoms of all such occult qualities and endowing them only with (geometric) figure, size and mobility. To begin with, he conceived them also as infinitely hard and inflexible, thus anticipating the atoms of such later stars of the mechanical philosophy as Hartsoeker, Huygens and Newton. Later, anticipating Leibniz, he realized that absolutely hard, incompressible bodies were incompatible with the phenomenon of rebound presupposed in his laws of collision, and replaced them with bodies that are inherently elastic (128). The differing geometric shapes of his atoms were the basis of the way they could combine into larger indivisibles, which he called "*homogenea physica*", which could then be the species-specific *primordia* from which chemicals and organisms are composed (90-91). This allowed Beeckman to claim that once God had created these principles, they "could not but form a specific being" (90), in accordance with the idea of all the forms of living creatures having been created by God in the first days after Creation, and with his giving them the power to "go forth and multiply". His *primordia* , moreover, anticipate the *molecules* introduced by Gassendi in 1637 and reappearing in nineteenth century chemistry, although there is something similar in the atomism of Basson. Nevertheless, there seems little doubt that it was his encounter with Beeckman in 1629 that set Gassendi on the path to the atomist philosophy for which he later became famous, since before he met Beeckman he had only been developing Epicurus' ethical theory in opposition to Aristotelianism (58).

It was Gassendi, of course, who later provided experimental corroboration of the principle of inertia in his *Letters on Motion* published in 1642. Although he had never read Beeckman's *Journal*, the latter had given him a copy of his 1618 *Thesis* in which the principle is stated, and they had discussed it together in 1629 when they met. Gassendi freely acknowledged Beeckman's originality, unlike Descartes. The latter's arrogance and vituperativeness towards his erstwhile friend and fellow "mathematico-physicist" has puzzled commentators. By 1630, Descartes had made huge strides in mathematics, as well as its application to optical and mechanical problems, and was about to publish his *Monde* or *Treatise on Light*, containing his three laws of nature. But as Van Berkel observes, he could not tolerate it becoming known that someone using alternative methods had reached similar conclusions, or had had any influence on the development of his own views. "This would damage seriously the image Descartes wanted to create of himself as someone who single-handedly transformed the system of philosophy. Thus, he used a combination of intimidation and contempt to prevent that from happening" (65). For Beeckman had not only taught Descartes his principle that "*Whatever is once moved moves always in the same way until it is impeded by something extrinsic*"; he had stripped the concept of impetus of its connotation of an occult cause of continuing motion, reducing it to a measure of the continuance itself, the product of velocity and quantity of matter (*corporeitas*), a product Descartes would call the *quantity of motion*; he had given examples of laws of collision based on the conservation of this product; he had made the crucial breakthrough of no longer requiring motion to be explained, insisting that "only a *change* in motion requires an explanation" (106); and he had articulated the crucial premise that all change of motion is effected by collisions, with all of this implying that in a vacuum a body will continue moving with the same speed. None of this belittles Descartes' own seminal contributions. Among other things, he corrected Beeckman's erroneous application of his inertial principle to circular motion, restricting it to instantaneous, linear motion; he reduced force to an inclination to motion or *conatus* acting at an instant; and he founded the conservation of quantity of motion (about which Beeckman was rather vague) on the need for God to conserve motion in the universe at every instant by the same force and action (and in the same total quantity) as was necessary for him to create it in the instant of Creation. But Descartes was happy for everyone to think that the whole approach to mechanical philosophy he had learned from Beeckman, as well as some of its core principles, was instead the result of his own genius.

This raises the question of the origins of Beeckman's own principles, and the sources of his mechanical philosophy, to which Van Berkel turns his attention in chapter 6. He finds reason to be skeptical of the view that Beeckman's own experiences as a craftsman translated *directly* into the formulation of a mechanical philosophy—both because of Beeckman's own reservations, and because many of the magical and neo-Platonic philosophers also appealed to mechanical concepts (140). Perhaps, then, the way Beeckman formulated his mechanical philosophy owed a debt to his Calvinist views, as suggested by Max Weber, Robert Merton and Roger Hookyas. Van Berkel gives qualified assent, suggesting that Beeckman's Calvinist belief in "the absolute gulf separating God and mankind, and […] the distance between the active God and the passive world, created the very space for explaining nature in its own terms and deriving the phenomena of nature from natural causes" (142). This is consistent with his belief that God created the simple geometric forms of matter in the first in such a way that all the consequent phenomena of nature "could not not be produced" (143), with his rejection of all plastic, magnetic and formative powers in nature (146), and with his insistence that God's continual action is necessary to uphold the constant activity of the colliding corpuscles of the natural world (142). Notably, however, all these themes also found a sympathetic reception in his Catholic sympathisers, Descartes, Mersenne and Gassendi.

But what most significantly influenced the shaping of Beeckman's philosophy, Van Berkel contends, was his debt to the philosophy of Petrus Ramus. Ramism, especially as he had learned it first-hand from Rudolf Snell, emphasized a certain approach to learning that freed it from the shackles of the fixed Aristotelian categories, and encouraged independent thought based on finding categories and dichotomies appropriate to the subject matter at hand. It also put a high premium on visualizability over purely verbal and abstract principles, a signal feature of Beeckman's work. In his final chapter, Van Berkel explores the relation of the picturability prized by Beeckman with the realist art of contemporary Dutch painters, connecting it also to the rising importance of material things in the emerging capitalist economy of the Dutch republic.

This is an exceedingly rich book, written in a modest and straightforward style befitting of its subject. It works on all levels: it is an engaging and poignant biography of an honourable man worthy of admiration; it is also fascinating for what it tells us about the origins of modern science; and, in doing this so even-handedly, provides a model for how history of science should be done. It should be mandatory reading for anyone interested in the origins of modern science, for students of early modern philosophy who wish to know more about its relation to the science, politics, religion and art of the period, and for anyone concerned about issues in the historiography of science.