The aided eye

Philip Ball examines two studies on how optical instruments taught science to see.

In the seventeenth century, scientists learnt how to see, discovering the astronomically large and the invisibly small. Both the telescope and the microscope had been invented, independently, by the first decades of the century, and Europe's intelligentsia were astonished, amused and unnerved by what was revealed.

In *Eye of the Beholder*, historian Laura Snyder describes the insights derived from the microscope by Dutch cloth merchant Antoni van Leeuwenhoek, who, using self-made microscopes with a resolution as fine as one micrometre, found teeming life in drops of rainwater. In *Galileo's Telescope*, historians of science Massimo Bucciantini, Michele Camerota and Franco Giudice offer a new account of how Galileo Galilei introduced the world to the telescope's power to unravel the heavens. They track the genesis and influence of Galileo's 1610 booklet *Sidereus nuncius* (*Starry messenger*). Both of these detailed studies show how sensational it was to discover worlds not perceivable to the naked eye.

Snyder also explores the parallels between the interests of Leeuwenhoek and those of the artist Johannes Vermeer. Both men of Delft, they put lenses to work for different purposes — Leeuwenhoek to satisfy an insatiable curiosity, Vermeer to extend his ability to perceive and record the world, for example with a camera obscura. Did they share knowledge as acquaintances, even friends? Leeuwenhoek was executor of Vermeer's estate; although this may have been the civic duty of an eminent merchant, Snyder points out that the few other times Leeuwenhoek took such a role, he had links with the deceased.

It has been suggested that the scholar in two of Vermeer's paintings from the 1660s — with map and dividers in *The Geographer* and with a globe in *The Astronomer* — was Leeuwenhoek. Known portraits of him are from a later date, so the resemblance is hard to judge, and Snyder is unable to settle the matter. She can only speculate about whether Vermeer inspired Leeuwenhoek to use lenses for more than assessing the value of fabrics.

Nonetheless, Snyder beautifully evokes the ambience of late-seventeenth-century Delft, “where an obliging butcher would sell Leeuwenhoek cows' eyes, the testicles of hares, and other required specimens”. She is revelatory

The Astronomer (1668) may depict Antoni van Leeuwenhoek.

about Vermeer's aims and methods, helping to explain what is so mesmerizing about his work. That sent me scampering to examine the “specular highlights” of the bread in *The Milkmaid*, produced with refined layering of pigments. “What Vermeer was painting was the way the eye actually sees, not the way the mind thinks it sees,” she writes.

That distinction underlies both books, and encapsulates the contention over what observation meant. It is sometimes assumed that the introduction of new instruments was unproblematic to all but the bigoted and ignorant. In fact, the first telescopes and microscopes failed to reveal much. You needed to “get your eye in” before you could interpret what you saw.

Diarist Samuel Pepys admitted “great difficulty before we could [see] any thing” in the microscope he bought after reading natural philosopher Henry Power's description in 1664. Even Robert Hooke, asked by the Royal Society to verify Leeuwenhoek's claims,

Eye of the Beholder: Johannes Vermeer, Antoni van Leeuwenhoek, and the Reinvention of Seeing

LAURA J. SNYDER
W. W. Norton: 2015.

Galileo's Telescope: A European Story

MASSIMO BUCCANTINI, MICHELE CAMEROTA & FRANCO GIUDICE, TRANSLATED BY CATHERINE BOLTON
Harvard Univ. Press: 2015.

found it difficult to use the merchant's favoured single-lens microscopes, which give better magnification than the compound microscopes that Hooke had used for his *Micrographia* (1665). And Galileo wondered, when Saturn shifted and its rings became less clear, whether his instrument was deceiving him. There was debate over whether such devices could be trusted. Optics had a disreputable association with magic: the Neapolitan Giambattista della Porta, who had perpetuated the link in his 1558 book *Natural Magic*, initially dismissed Galileo's claims (while taking credit for inventing the telescope): “I have seen the secret use of the eyeglass and it's a load of balls.”

Both Leeuwenhoek and Galileo were secretive and possessive about their devices. Galileo mastered lens-grinding to improve on Dutch instruments (he relied on verbal descriptions). But he was determined to keep his own telescopes from rivals: entreaties from Johannes Kepler, with whom he was on

good terms, went unheeded. And there was scant understanding of how the instruments worked. Galileo said airily in *Sidereus nuncius* that he had perfected the device “on the basis of the science of refraction”, yet it was Kepler who first gave a fair account of the principles, in his 1611 *Dioptrice*.

Galileo's Telescope restricts itself to the period when Galileo became famous for descriptions of the surface of the Moon, the Milky Way “powdered with stars” (as writer John Milton described it), and the moons of Jupiter — which he called the Medicean stars to flatter Cosimo II de' Medici, his patron. The challenge this complexity posed to traditional cosmology foreshadowed theological storms to come. As the authors put it: “If the sky was subject to generation and corruption, could it continue to be the home of angels and saints?”

Galileo's Telescope is not a light read: more context amid the richly researched detail would have helped, and there is little on how Galileo's personality shaped his debates. But both books project a sense of how new ways of seeing, far from merely providing new tools, were — and are — complicated extensions of the way we understand our experience. ■

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