

Introduction

Robert Hooke (1635-1703) was a leading natural philosopher throughout the formative years of the Royal Society in the seventeenth century. He was the Society's Curator of Experiments, and performed many experiments at the weekly meetings of the new organisation. His reputation stood as high at that time as did Newton's at the approach of the eighteenth century, and indeed Hooke was a formidable rival to Newton in the latter half of the seventeenth century.

However, Hooke's achievements in science (or natural philosophy)¹ were neglected for a long time, and this persisted into the twentieth century. This is epitomized by the fact that only one biography, *Robert Hooke* (1956) by Margaret 'Espinasse, was published in the twentieth century. Of course, historians of science did not completely neglect his contributions, and in the last fifty years have published academic papers on Hooke. But their number is not comparable to those on other major scientists.

In this context, it is surprising that there should be a flood of publications on Hooke on the occasion in 2003 of the tercentenary of his death. It is true that this was foreshadowed toward the end of the last century by several works: for example, Michael Hunter & Simon Schaffer edited *Robert Hooke: New Studies* (1989), and Ellen T. Drake published *Restless Genius: Robert Hooke and his Earthly Thoughts* (1996). However, within the first three years of this century, not only were two thick biographies published, Stephen Inwood's *The Man Who Knew Too Much* (2002) and Lisa Jardine's *The Curious Life of Robert Hooke* (2003), but also an academic work by Jim Bennett *et al*, *London's Leonardo* (2003), which contains four papers on Hooke. Michael Cooper, who contributed a paper to this last work, also published his own book '*A More Beautiful City*' (2003), which focused on Hooke as surveyor and architect after the Great Fire. We shall soon have another book, of selected papers from the tercentenary memorial conference 'Hooke 2003' held at the Royal Society in July 2003 under the joint sponsorship of the Society and Gresham College.

As Cooper wrote, the works of Inwood and Jardine 'have added greatly to Margaret 'Espinasse's excellent short biography'². Jardine finely embedded Hooke's life into the social context of two successive religious and political revolutions. The

¹ In the present paper, the author uses the terms 'science' and 'natural philosophy' interchangeably, though he recognizes the importance to differentiate them in many cases in history of science.

² Cooper (2003), p. 5.

title of Inwood's biography neatly represents Hooke's versatility. He documented Hooke's multi-faceted activities through detailed analysis of Hooke's diary, *Journal Books of the Royal Society, &c.* New historical materials and facts were discovered: for example, Captain Knox's account of Hooke's death, by Inwood; Hooke's unsigned will drafted shortly before his death, by Jardine; the site of the reburial Hooke's mortal remains, by Cooper³. Thus our knowledge of Hooke's life was considerably enlarged.

But still — if the author may be permitted the liberty of cavilling at current historical achievements — we can point to a difficulty. Even after this outbreak of concentrated research, we have not moved far from the characterisation on Hooke in 1740 by John Ward: 'Had he been more steady in his pursuits, and perfected one discovery before he entered upon another, he might perhaps in some case have done greater service to the public'⁴. Hooke's vast range of activities has been regarded not as an advantage but as a disadvantage, precluding him from significant achievements⁵.

The present paper aims at challenging the viewpoint of versatility. The author does not intend to deny Hooke's versatility itself, which was well documented before and has been re-affirmed by recent works. But nevertheless, can we not identify several leading strands in Hooke's diverse activities? We can often perceive melodies in a series of scattered, seemingly unordered tones: and if that approach brings new light to our understanding of Hooke, it must be worth trying.

In pursuit of this aim, the author will circumscribe his scope within Hooke's natural philosophy, just as Cooper confined his mainly to Hooke's activity as surveyor and architect. The present paper argues that a considerable part — of course not all — of Hooke's scientific research can be understood coherently if we consider him as an astronomer, *i.e.* from a previously unexplored perspective. Though Hooke's commitment to astronomical instrumentation has been recognised, his instruments and activities have not been properly set into the historical context of the development of astronomy.

As the paper shows in the following Chapters, in the mid-seventeenth century Hooke was a leading figure in observational astronomy *in two senses*. First, he was

³ Inwood (2002), p. 438; Jardine (2003), pp. 316-317; Cooper (2003), p. 72.

⁴ John Ward, *The Lives of the Professors of Gresham College* (London, 1740), p.188. Moray made a similar observation on Hooke as early as the 1660s in a letter to Oldenburg. Moray to Oldenburg, 14 November 1665, *Oldenburg Corresp.*, 2, pp. 608-611 (p. 610); Iliffe (1995), p. 286.

⁵ Jardine was forced to end her biography on Hooke writing that 'We long to accord him the ultimate prize of proclaiming him a genius who has been unjustly overlooked,

at the forefront of a contemporary tradition of telescopic observations, the framework of which had been set by Galileo. The author names this tradition 'Galilean Observation Paradigm'. Second, Hooke contributed to the advancement of positional astronomy and precise astronomical measurements. He advocated the use of precision astronomical instruments, and he himself worked to improve them. Some of them were used at the Greenwich Observatory, which symbolised the rapid development of positional astronomy in England. It will also be shown that Hooke's astronomical research took forward the mainstream development of astronomy in England from the early half of the seventeenth century.

This paper consists of six Chapters and a Conclusion. The first Chapter is devoted to a short biography of Hooke from his birth to his debut to the Royal Society, to set the general context in which to understand Hooke's scientific research. The second Chapter begins with a statistical analysis of Hooke's research in *Philosophical Transactions*, and goes on to show the significance of telescopic observations at the Royal Society. Then the key concept of the paper, the Galilean Observation Paradigm, is defined. Chapter 3 explains how the Paradigm was introduced to England from Continental Europe during the Puritan Revolution, and adopted by the natural philosophers of Oxford and London. Chapter 4 examines Hooke's own astronomical observation in detail. He observed the stars of the solar system, as was the 'normal' science under the Galilean Observation Paradigm, but in England a new element was added to observational astronomy when William Gascoigne attached telescopic sights and eyepiece micrometers to telescopes in about 1640. Hooke used, and improved, telescopic sights and eyepiece micrometers for precision astronomical observations, as is shown in Chapter 5. They became essential tools for positional astronomy when Greenwich Observatory was established. In the final Chapter, the optical controversy between Hooke and Newton, the first encounter of the rivals, is interpreted from a new perspective. Previous research is shown to have been constrained within the history of optics, but here the controversy is reconsidered in the context of astronomy in the mid-seventeenth century. In the Conclusion, the author will propose a point of view which may provide a key to a more general re-evaluation of Hooke's natural philosophy.

perhaps we cannot, in the end, go quite that far' (Jardine, 2003, p. 321).

The basic idea which led to this paper was established in the author's Ph. D. thesis of 1995 at the University of Tokyo. Most of the research for it was undertaken in 1993-4, during a sabbatical year from the University of Tokyo to Imperial College, University of London. The author's research on Hooke was then suspended for some years while he was engaged on a project to institutionalise science and technology studies in Japan, culminating in 2003 with the successful establishment of the Japanese Society for Science and Technology Studies (JSSTS). The author then had the good fortune to obtain research funding for his Hooke studies from the Japanese Society for Promotion of Science. This gave him the opportunity to return to his original research field, and to develop the theme of his dissertation much further, absorbing the result of historical research in the last decade. This paper is therefore the fruit of the author's study of Hooke spanning more than a decade.