

The Oxford

Oxford's medieval philosophers deserve greater recognition, says Mark Thakkar



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observing, however, that Bradwardine and Swineshead were both originally Balliol men. Balliol's founding statutes restricted its scholars to studies in the faculty of Arts, so that those who wished to study in the higher faculties of Theology and Law were obliged to leave after taking their MA. Merton, by contrast, was founded with the specific aim of fostering study in the faculty of Theology.

Then, as now, Oxford was a centre of academic excellence. Indeed, if Paris was the capital of scholasticism, Oxford was its second city. But the life of the mind was pursued in a manner quite unlike that of today: the best work in philosophy was produced by men who went on to enjoy high-profile careers in politics or the Church. This led the powerful patron and wealthy bibliophile Bishop Richard de Bury to complain of being 'deprived of the bodily companionship of some of these shining lights when, justice looking down from heaven, the ecclesiastical preferments and dignities that they deserved fell to their portion.'

Bradwardine provides the most striking illustration of this phenomenon. His career was initially that of an Oxford academic, which brought with it administrative responsibilities; in 1328, for instance, as a University proctor, he successfully defended our disciplinary autonomy from the Church. He left Merton in 1335 to join de Bury's household in Durham, but two years later he was appointed Chancellor of St Paul's, and subsequently became chaplain to Edward III. His period of royal service culminated in the French expedition of 1346, where he witnessed the Battle of Crécy; he was later appointed to negotiate peace with Philip VI. He was consecrated Archbishop of Canterbury in 1349, just over a month before succumbing to the Black Death.

Nowadays, Bradwardine is known primarily for his views on free will and

OXFORD has such a long intellectual history that even the episodes that made it illustrious are liable to be forgotten. One such took place in the second quarter of the fourteenth century, when a group of Oxonians developed a battery of new techniques for dealing with philosophical problems, the strikingly mathematical nature of their approach earning them the epithet of 'calculators.'

These scholars busied themselves with quantitative analyses of qualities such as

heat, colour, density and light. But their experiments were those of the imagination; practical experiments would have been of little help in any case without suitable measuring instruments. Indeed, some of the calculators' works, although ostensibly dealing with the natural world, may best be seen as advanced exercises in logic.

They have been dubbed 'the Merton School', because several of them – including the most notable, Thomas Bradwardine, William Heytesbury and Richard Swineshead – were Fellows of Merton. I cannot resist

ABOVE: *Oxford mathematician Richard of Wallingford (1292–1336), a contemporary of the Merton calculators, though any evidence of a connection is lost*

calculators

predestination, which earned him a mention alongside Augustine and Boethius in *The Canterbury Tales*. But for centuries he was famed for his *Treatise on Proportions* (1328), which, among other things, sought to establish the relationship between the force applied to an object, the resistance to its motion and its resulting velocity.

Some remarks of Aristotle's suggested that velocity was proportional to force and inversely proportional to resistance, so that doubling the force would double the velocity, while doubling the resistance would halve the velocity. But, as Bradwardine objected, this fails to predict a velocity of zero when the resistance matches or exceeds the force, as when one struggles with a stiff door.

Bradwardine proposed a new formulation which focused on changes in velocity: in order to double the velocity we must square the ratio of the force to the resistance; in order to triple the velocity we must cube this ratio; and so on. In modern notation we might express Aristotle's theory as $V \propto F/R$ and Bradwardine's as $V \propto \log F/R$; mathematically inclined readers can confirm that the latter does indeed give a zero velocity when $F = R$. Bradwardine's law was extremely influential, and widely accepted throughout Europe until the late sixteenth century.

Bradwardine's younger contemporary, Heytesbury, played an active role in life at Merton, where he was a bursar in the late 1330s. We have his record of an arduous journey to administer the college properties in Northumberland; it took him eight days to get to Ponteland, averaging more than 30 miles per day. In his later life he also had one or two stints as Chancellor of Oxford, and as a churchman he held a number of benefices in Kent.

In his *Rules for Solving Sophismata* (1335), Heytesbury was the first to articu-

late one of the calculators' most famous results: the mean-speed theorem, also known as the Merton rule. The theorem says that if a moving object accelerates at a uniform rate for a certain time, it covers the same distance as it would by moving for the same time at its mean speed. This means, for instance, that a lorry travelling at 30 mph will be caught up by a car accelerating smoothly from a standstill as soon as the car reaches 60 mph. Unlike Bradwardine's law, which falls foul of the physical facts, the Merton rule is a mathematically demonstrable truth, and is thought to have indirectly influenced Galileo's treatment of free fall.

The last and the greatest of the calculators was Richard Swineshead, known simply as 'the Calculator'. The sixteenth-century polymath Girolamo Cardano placed him in the top ten intellects of all time, alongside Archimedes, Aristotle and Euclid, while according to Robert Burton, writing *The Anatomy of Melancholy* some 75 years later, he 'well nigh exceeded the bounds of human genius'. Sadly, by the turn of the



WARDEN AND FELLOWS OF MERTON COLLEGE/TOMAS PHOTOS

eighteenth century Leibniz could complain that Swineshead's works were little known and hard to find, and these days his name is familiar only to students of medieval philosophy.



WARDEN AND FELLOWS OF MERTON COLLEGE/PHOTO: JULIA WAIWORTH

TOP: 17th-century depiction of Merton's medieval buildings, from the memorial to mathematician Henry Savile

RIGHT: Opening of Bradwardine's *Treatise on Proportions* (Venice, 1505)

Swineshead's magnum opus, and perhaps the crowning achievement of the group as a whole, was a series of treatises known as the *Book of Calculations* (c.1350). These dealt in exhausting detail with problems of quantitative physics, including more than 50 variations on Bradwardine's law. While supposedly wrestling with such subtle problems, Swineshead took part in a brawl over the election of the Provost of Oriel as Chancellor of Oxford, and was subsequently ordered by the Crown to return several items seized from the University Chest. It seems he favoured the Mertonian candidate, John Wyliot, who was installed when the Provost died a month later.

Oxford scholastic philosophy is thought to have declined in brilliance after 1350. It is tempting to see this as an immediate consequence of the Black Death, but the plague actually claimed the lives of comparatively few Oxonians. The real blow probably

came instead from its devastating effect on primary education, which meant that students from the 1360s onwards were not sufficiently well prepared to cope with work as advanced and sophisticated as that of the calculators. (Oxford, with its overwhelmingly English demographic, suffered more in this respect than the cosmopolitan university of Paris.)

Subsequently the abstruse nature of the calculators' writings earned them ridicule from some quarters. While the Italian universities enthusiastically adopted an Oxonian approach, the humanists of the Renaissance heaped scorn on what they called *quisquiliae suiciticae*, 'Swinehead's rubbish'. One particularly vicious critic complained that 'the scholastics hit upon cavillations of the most stupid subtlety and called them calculations', and asked: 'What science can there be in subjects so remote and divorced from all intelligence and common sense?'

Swineshead ... was subsequently ordered to return several items seized from the University Chest

From the student's point of view, however, the analytical facility developed by such technical study would have proved useful for careers in an increasingly monetised society. It is notable that even today Oxford bills its Mathematics and Philosophy joint degree as involving 'two of the most fundamental and widely applicable intellectual skills'.

Moreover, with hindsight we can see that the calculators made an important advance by treating qualities such as heat and force as quantifiable at all, even if only theoretically. Although the problems they set themselves stemmed from imaginary situations rather than actual experiments, they nonetheless 'introduced mathematics into scholastic philosophy', as Leibniz put it. This influential move facilitated the full-scale application of mathematics to the real world that characterised the Scientific Revolution and culminated triumphantly in Newton's laws of motion.

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