

# Triumph of the medieval mind

Modern science began several hundred years earlier than we have come to imagine. It got going in the twelfth century — and with it, the long-standing rift between reason and faith.

## Philip Ball

The popular caricature locates the origins of modern science in the natural philosophies of ancient Greece and the rediscovery of their spirit during the Renaissance and the Enlightenment. It passes decorously over the intervening period, deemed to be a hotbed of superstition. In fact, the notion of a Universe governed by laws accessible to human reason — the precondition for science — emerged in Western Europe largely during the twelfth century, several hundred years earlier than we have come to imagine.

“The eleventh-century Christians,” says historian Georges Duby, “still felt utterly crushed by mystery, overwhelmed by the unknown world their eyes could not see.”<sup>1</sup> By 1300, the foundations of a scientific world view were in place. The architects of this new philosophy attempted to reconcile their perspective with the pervasive religious sentiment of the Middle Ages. But in so doing they opened the schism between faith and reason that has since widened to a chasm.

From around 1120, an influx of classical texts revitalized European thought. These had been translated previously into Arabic within the Islamic world, and were now

rendered in Latin by energetic scholars working at the volatile boundaries of Christendom and Islam. Most of these books were scientific texts by writers such as Euclid, Aristotle, Archimedes and Ptolemy.

There was more to the ‘twelfth-century renaissance’<sup>2</sup> than the recycling of ancient learning. Islamic scholars such as Averroës, Al-Khwarizmi and Avicenna made original contributions of their own in subjects ranging from mathematics to medicine. So too did some of the medieval Europeans often depicted now as mere translators. Strangely, although Christian Europe showed little prejudice against learning from Muslims, it was reluctant to accept new ideas from its own people. The very antiquity of old knowledge was thought to make it more reliable.

One of the most active translators, the Englishman Adelard of Bath, was a startlingly original and perceptive thinker. Rueing how difficult it was to get his ideas accepted, he wrote: “Our generation ... refuses to accept anything that seems to come from the moderns. Thus when I have a new idea, if I wish to publish it I attribute it to someone else.”<sup>3</sup> This is why so many of the works of natural philosophy from antiquity to the Renaissance have apocryphal attribution: a book apparently by Pliny or Aristotle

was more likely to be read. The progressive thinkers of the early Middle Ages hid their new wine in old flasks, so that others would take them seriously.

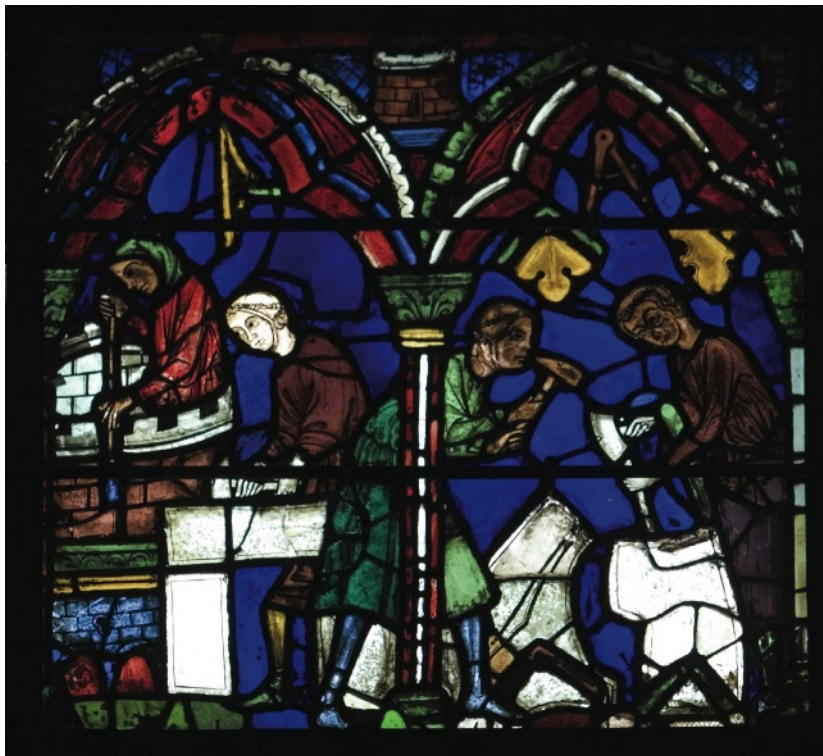
The translations guided scholars towards a mode of inquiry governed by scepticism and reason rather than by the search for validation in the Bible or St Augustine. In his book *Sic et Non*, the combative Frenchman Peter Abelard pointed out that the writings of the Church Fathers were not always consistent. These inconsistencies, he urged, should be reconciled using logic. *Sic et Non* is something of a sceptic’s manual: “We seek through doubt,” Abelard wrote, “and by seeking we perceive the truth.”<sup>1</sup>

## Natural questions

A rationalist position was also nurtured at the cathedral school of Chartres (see ‘Rationality in stone’, page 818). From around the 1120s, this school acquired several chancellors with a deep interest in natural philosophy. These included Bernard of Chartres and his brother (or possibly pupil) Thierry, arguably one of the true founders of Western science. The Chartres scholars were platonists: they believed that the mundane world is underpinned by a transcendental realm governed by order and geometry. Thierry attempted to show how platonic ‘physics’ could be used to comprehend the world systematically, and even to interpret the biblical creation in Genesis.

Another Chartres scholar and teacher, William of Conches, got into trouble for pushing the rational agenda even harder. His *Philosophia Mundi* provided twelfth-century Europe with its first comprehensive treatise on the physical world. He argued that natural phenomena arise from forces that, although created by God, act under their own agency. William insisted, echoing Plato, that the divine system of nature is coherent and consistent, and therefore comprehensible: if we ask questions of nature, we can expect to get answers, and to be able to understand them.

That is a necessary belief for one even to imagine conducting science. If everything is subject to the whim of God, there is no guarantee that a phenomenon will happen tomorrow as it does today, therefore there is then no point in seeking any consistency in nature. But William of Conches could not countenance a Creator who was constantly intervening in the world. He saw the Universe as a divinely wrought mechanism: God simply set the wheels in motion. It is in the twelfth century that the



Empirical skills combined with the new philosophy to create the high Gothic style.

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With God as ultimate architect, the workings of the Universe were now open to rational study.

first references to the Universe as *machina* begin to appear.

Some conservative theologians denounced this attempt to develop a Christian platonic natural philosophy. They felt that taking too strong an interest in nature as a physical entity was tantamount to second-guessing God's plans. As everything was surely determined moment to moment by the will of God, it was futile and impious, they believed, to seek anything akin to what we now regard as physical law. The quest for laws of nature was also condemned because it seemed to limit God's omnipotence. As the eleventh-century Italian cleric Peter Damian insisted, one could not know anything for certain, as God could alter it all in an instant.

William of Conches didn't try to deny God's absolute power; he argued that it wasn't the issue. "Certainly God could make a calf out of the trunk of a tree, as country bumpkins might say, but did he ever do so? Therefore show some reason why a thing is so, or cease to hold that it is so."<sup>3</sup> Adelard of Bath, another Chartres student, agreed: "I

do not detract from God. Everything that is, is from him, and because of him. But [nature] is not confused and without system, and so far as human knowledge has progressed it should be given a hearing. Only when it fails utterly should there be recourse to God."

Adelard's book *Quaestiones Naturales* reveals a mind full of curiosity about the world. Why do some animals see better at night? Why don't babies walk as soon as they are born? Why can sound pass through walls? In addressing these questions, he offers perhaps the most elegant and dignified defence of science ever written: "If we turned our backs on the amazing rational beauty of the universe we live in, we should indeed deserve to be driven therefrom, like a guest unappreciative of the house into which he has been received."<sup>4</sup>

These things were said by deeply devout men in an age that could not contemplate a world without God. How narrow and theologically immature they make the dogmas of contemporary religious

fundamentalists seem by comparison.

The twelfth-century trust in reason and interest in nature for its own sake flourished in the following century. This was particularly so in the aristotelianism of Thomas Aquinas, Robert Grosseteste and Roger Bacon. Their emphasis on attention to detail and careful observation signals the beginnings of an experimental approach — something that was unlikely to emerge from the abstract platonism of Chartres. Crudely speaking, Plato focused on the generalities, Aristotle on the particulars.

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### The backlash begins

But the golden age of rationalism in the early thirteenth century instigated a theological backlash, a kind of medieval Counter-Reformation. This culminated in the papal declaration of 1277 condemning many propositions in Aristotle's works. It was a metaphysical power struggle: was the world ruled by God's whims or Aristotle's laws? Could God contradict Aristotle? The battle was also more prosaic: did the universities' theology faculties have more authority than the arts faculties?

The Condemnation of 1277 forced some scholars to compromise on the inellegant 'dual truth' we are still struggling to expunge. 'Scientific truth' was right about the world, but they had to concede that theological truth, with its mysteries and miracles, could overrule it. Nevertheless, the efforts of scholars such as Aquinas eventually legitimized logic and natural philosophy on religious grounds almost to a counterproductive extent. Indeed, by the Renaissance it became almost a heresy to challenge Aristotle.

Opposition to medieval rationalism was motivated in part by valid concerns about the dangers of bringing science into scripture. When, for example, William of Conches was denounced for seeking physical explanations for the creation of Eve from one of Adam's ribs, conservatives were right to voice dismay at this apparent transformation of the Bible into a work of science. Read as a kind of moral mythology, holy books may have some social value. Deeming them sources of natural facts must lead to the absurdities of today's creationism.

By making God a natural phenomenon, the medieval rationalists turned Him into an explicatory contingency for which there has since seemed ever less need. By degrees, such secular learning was found to have so much explanatory power that it rivalled, rather than rationalized, theology itself. The consequent rift between faith and reason has now left traditional religions so compromised they are susceptible to displacement by more naive and dogmatic varieties.

The emergence of Western science as

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# Rationality in stone

The twelfth-century renaissance gave rise to the artistic style now known as Gothic. In architecture this is characterized by hierarchical, orderly structures based on symmetry and proportion. Vaults and spires soar to unprecedented heights, yet the masonry, linked into a web of delicately balanced forces, seems almost weightless, flooded with light from immense coloured windows.

Some historians — most influentially Erwin Panofsky in the 1940s<sup>4</sup> — have suspected a link between this style and the emerging belief in cosmic order. If a medieval church was in some sense a representation of heaven on Earth, they argue, then changes in church design must have something to tell us about how the Middle Ages conceptualized the cosmos. If the world was “God’s discourse to man”, in Umberto Eco’s words, then cathedrals “actualized a synthetic vision of man, of his history, of his relation to the universe”.

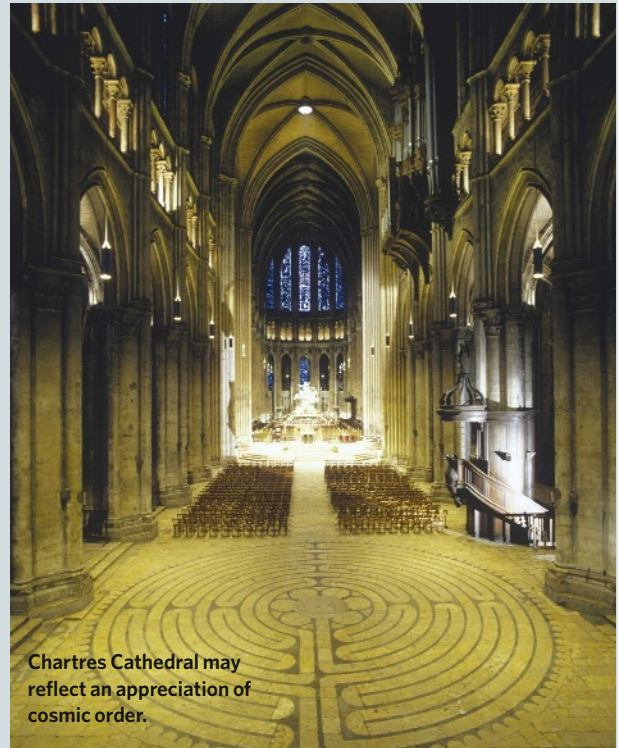
Panofsky proposed that the nascent French universities and academies in and around Paris influenced the Gothic architecture that originated here. Both architects and scholars, he said, used division and subdivision “to make the orderliness and logic of their thought palpably explicit”<sup>4</sup>. In the 1950s, historian Otto von Simson gave Panofsky’s argument greater force when he

scrutinized the role of geometry in the relationship between the intellectual and architectural worlds.

Von Simson argues that the first Gothic “marks and reflects an epoch in the history of Christian thought, the change from the mystical to the rational approach to truth”<sup>5</sup>. Historian of technology Lynn White agrees: “The transition from Romanesque to Gothic charts the passage from an age indifferent to the investigation of nature to one deeply concerned with it.”

Today many historians consider Panofsky’s argument to have been overstated, even misplaced. Some identify socioeconomic conditions as the principal force behind Gothic church building. Others say that geometry in architecture amounted to little more than convenient rules of thumb, lacking mathematical foundation. The truth probably lies somewhere in between.

A link between building and theology was sometimes explicit. To the scholars of Chartres, God was the great *architectus*, who used geometrical schemes to construct the Universe. Some medieval writers distinguished between the ‘theoretical’ geometry of the cathedral schools and universities, governed by mathematical proof, and the ‘practical’ geometry that could be used mechanically for constructing



Chartres Cathedral may reflect an appreciation of cosmic order.

pillars and vaults. Builders probably had little need of mathematical understanding: they could draw and interpret plans encoded in sequences of operations that could be learnt by rote and passed on orally.

A fifteenth-century builders’ handbook gives prescriptions for how to construct regular polygons, or to find the centre of a circle from an arc, with compass and ruler, with no indication that the writer knew of, or felt the need for, Euclid’s proofs.

Yet classical geometry and pythagorean symbolism do sometimes emerge in masonry. For example, medieval sculptors

often used a lens-shaped figure called the *vesica piscis* to frame Christ seated in majesty. The shape is found in *Ars geometriae et arithmeticae* by the early sixth-century Roman writer Boethius as the overlap between two equal circles whose circumferences pass through one another’s centres. Boethius explains that this construction, which can be made with a pair of compasses, may be used to make the most ‘perfect’ of triangles, the equilateral. So the shape would have been used to frame the figure of Christ not simply because it was pleasing and convenient but for its symbolic connotations. P.B.



Classical philosopher Pythagoras is honoured in stone on Chartres Cathedral.

a branch of humanism should thus be properly located in the high Middle Ages, not, as is traditional, in the Renaissance. It was in the twelfth and thirteenth centuries that the Universe ceased to be a forest of symbols designed by God for humankind’s spiritual edification, and became instead a source of intrinsic intellectual value and fascination, governed by logic. One can see this even in the shifting religious imagery of the sculpted flora of the Gothic churches from stylized forms to identifiable plant species. Art, theology, philosophy, social structures — all felt the influence of this altered perspective as we began to find our true place in the world. ■

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