Before Science and Religion: Learning from Medieval Physics

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Abstract

Scientists today are surprised when confronted by the sophistication of natural philosophy of the 13th century. Although clearly of a former age and holding very different perceptions of material structure, its mathematical and imaginative exploration of nature is striking. It also finds a natural theological and contemplative framing; because of this it can work as a resource for contemporary projects constructing a 'theology of science', and constructing different approaches to the relation of science and religion. Taking the work of the English polymath Robert Grosseteste from the 1220s as an example, I exemplify these claims in more detail through three aspects of medieval physics: (1) a teleological narrative for science, (2) a fresh apprehension of scientific imagination, and (3) a Christological and incarnational metaphysics.

Keywords:

MEDIEVAL; PRE-MODERN SCIENCE; THEOLOGY OF SCIENCE; GROSSETESTE

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1. Introduction: Reading Medieval Science Today

The commonly accepted narrative that 'science and religion' suffer 'conflict' or 'warfare' is deeply flawed. As Peter Harrison (Harrison 2015) has incisively demonstrated, the meanings of both 'science' and 'religion' have shifted throughout history. Furthermore, alternative theological framings of the past (such as Francis Bacon's theological motivation for experimental science) have demonstrably advanced rather than resisted, scientific advances. However, the questions surrounding science and theology have stubbornly confined themselves largely to the field of apologetics. The assumption, for example, that one can delineate categorical relationships between them is, since Barbour's scheme (Barbour 1998), almost hard-wired into the discourse. The task facing a faithful science community therefore requires considerable imagination to think into a different paradigm. Such conceptual leaps can be assisted by drawing on radically different viewpoints, removed in culture and time from our own, yet drawing at depth on a shared theological narrative. I have attempted to outline before, for example, how a 'theology of science' might be developed from the Wisdom tradition, and in particular the anguished relational material in the *Book of Job* (McLeish 2014). This ancient text is as far removed in its thought-world from our own times as it is possible to find such writing, yet speaks from within a Semitic monotheism of covenant relationship, where sin spoils and where there are no easy solutions, where vindication can be sought but is not cheaply won, and where a natural world in apparent chaos demands human understanding. There is distance, but also resonance with our own predicament and the questions facing us.

The present work attempts to do the same from the perspective of high medieval natural philosophy. The spirit of the idea might be paralleled with that of Barbara Tuchman, who in *A Distant Mirror* (Tuchman 1978) showed how the upheavals of the European 14th

century might assist in understanding the conflicts of our own age. We find advantage through a focus on a major writer of the period – in this case the 13th century English polymath Robert Grosseteste, who wrote extensively on light, colour, sound, astronomy, optics and mathematics in the period 1210-1230, including a period as Master to the Oxford Franciscans, and before becoming Bishop of Lincoln in 1235.

The first-order questions posed by the great natural philosophers of this period were as concerned with the reasons, the meanings of 'doing science' as they were with the questions themselves. What does the God-given task of understanding nature achieve? Where does it fit within the vocations of human beings? When this level of question is on the table, fundamental issues of purpose or teleology are inescapable – in stark contrast to our contemporary intellectual scientific world, in which they are hardly ever raised. Other, second-order, questions emerge from theological and biblical sources: which are the more fruitful avenues of investigation that might lead to an understanding of nature? Is there a theological mandate to search for order in the material world, and to re-imagine it? What is the role of mathematics in describing the world, if any? Might an investigation of nature call on experimental manipulations as well as observation? What constitutes a complete understanding of a phenomenon? These are questions of vital importance to science itself, yet cannot be answered within scientific methodologies, nor within the narrow social framing of science in our own century. The high middle ages remind us that at great turning points in science, we need to go beyond its disciplinary boundaries for resources to re-frame its direction of travel (Kuhn 1962). This is timely today when the ever-present need for sources for the scientific imagination is very little discussed in a method-based scientific education.

For these reasons, it is not such a strange idea to ask what we might learn, or at least what questions we might ask, by visiting the emerging scientific world of Robert Grosseteste and his contemporaries. In the following I will examine three ways in which this 'scientific distant mirror' can nourish the task to reframe science and religion in our own times. These are: (1) a teleological narrative for science, (2) a fresh apprehension of scientific imagination, and (3) a Christological and incarnational metaphysics.

2 A Teleological Narrative for Science

Perhaps the most striking contrast between Grosseteste's intellectual world and ours can be found in their differing framing teleologies. Cultural narratives are able to generate shared purpose, or equally, to proclaim purposelessness (Dupuy 2010). There are both simple and more sophisticated strands within Grosseteste's motivations to engage in natural science. On a delightfully straightforward level, at one point in his commentaries on the Psalms, he reflects that, if the Bible chooses to convey truth to its readers through the illustrations of natural objects (trees, clouds, falling leaves *etc.*) then it behoves us to discover as much as we are able concerning them, simply in order that we might better understand the scriptures (Gasper 2016). By practising contemplation of nature beyond the mere appearance of things, students are accustomed to look for deeper meaning, a skill that they need to cultivate in preparation for spiritual interpretation of scripture. An application of this very direct thinking appears in an explanatory note accompanying his translation of John Damascene's *De Fide Orthodoxa* (Southern 1986). Two chapters in the earliest manuscripts at his disposal concerned scientific topics that ostensibly had no contact with the theological substance of the work as a whole.

Earlier editors had sometimes omitted them for that reason. But Grosseteste reinstates both, explaining that (Southern 1986: 200):

> These two chapters, namely the 24th about seas and the 25th about winds, are omitted in some Greek manuscripts; perhaps because they did not seem to contain a theological subject. But according to truly wise men, every notice of truth is useful in the explanation and understanding of theology.

Although he is perfectly able to distinguish between theology and science as, for example in the first part of book I of his *Hexaemeron,* he takes the two as mutually dependent (Gasper 2016). He maintains a clear distinction between theological and scientific writing, but within an implicit and deep connectivity of his whole project. So although we find no explicit theological introductions or conclusions to the scientific works, this is because their theological context is assumed.

For a detailed exposition of that context we need to turn to the philosophical works. In Grosseteste's *Commentary on the Posterior Analytics* (of Aristotle) he places a more sophisticated philosophy of science within the overarching Christian narrative of Creation, Fall and Redemption. Employing a common medieval metaphor for the effect of the Fall on the higher intellectual and spiritual powers (in descending hierarchy those of understanding, memory, imagination) as a 'lulling to sleep' by the weight of fallen flesh, he maintains that the lower faculties, including critically the senses, are less affected by fallen human nature than the higher (Crombie 1953). Human understanding, (*aspectus*) always inseparable from human emotions and loves (the *affectus* – the disposition to be affected), is now reduced and dulled through the inward turning of the latter. However, there is an avenue of hope that the once-fallen higher faculties might be re-awakened: engaging the *affectus*, through the still-operable

lower senses, in the created external things of nature allows it to be turned outward once more, and met by a remainder (*vestigium*) of other, outer *light.* So a process of re-illumination can begin once more with the lowest faculties and successively re-enlighten the higher (Rossi 1981 p.405):

> Since sense perception, the weakest[1] of all human powers, apprehending only corruptible individual things, survives, imagination stands, memory stands, and finally understanding, which is the noblest of human powers capable of apprehending the incorruptible, universal, first essences, stands!

Human engagement with the external world through both the senses and the emotions, becomes a participation in the *theological* project of salvation. Furthermore, this is possible because such a relationship with the created world is also the nexus at which dimmed human searching is met by divine illumination. As a central example, the 'physics of light' grounded in the cosmogony of Grosseteste's *De Luce* informs a 'metaphysics of light' as a vehicle to become a 'theology of light' (Grosseteste, 2011). The *De Impressionibus Elementorum* (*The Impressions of the Elements*) makes explicit the theological action of light that remains implicit in the *De Luce* – light (following the epistle of James 1:19) is a symbol of the perfect gift that descends from the Father of Lights. The implied restorative process that begins with an alertness to nature through our senses becomes another of Grosseteste's 'critical Aristotelian' moves (Crombie 1953). With Aristotle he insists that all knowledge of particulars and universals comes through the senses, but against Aristotle he allows this, and in fact makes it necessary, to be met with divine illumination.

This double move even suggests a theological motivation for novel combination of experiment and mathematics implied in his scientific works – in every case it is at the meeting-

[1] We recall Paul's categories in 1 Cor 1v7

point of observed phenomena and mathematical reasoning that understanding is born. The teleological employment of scientific investigation as an instrument of human participation in a reversal of the effects of sin in the fall, is an idea that itself reawakens in the early modern period, especially (but by no means exclusively) in Francis Bacon (Harrison 2007). The *Novum Organum*, a philosophical and theological foundation for the ascendant experimental philosophy of the 17th century, by no means abandons all the scholastic work of its medieval predecessors, however strident Bacon's claims may be that it does so. Its justification of experimental method as avoiding the worst excesses of fallen imagination and reason, build on medieval articulations.

A richer teleology of science for today, that goes beyond the pure factual acquisition in education, and the instrumentalism of economics in research, is of vital urgency. Although Grosseteste's far deeper and more humanly resonant framings of natural philosophy are of their own time, they are not untranslatable into our own. Remarkably, the contemplative and palliative potential of *physics* has been articulated very recently by one of the UK's leading (and better theologically informed) science journalists (Radford 2019). There is more to say, and to experiment with, here, including the educational advantage of developing a holistic body-and-mind approach to experimental dexterity and exploration.

3 A Contemplation of Visual Scientific Imagination - *Sollertia*

William Blake inveighed against the natural philosophy of Newton and Bacon as reason devoid of imagination (his is the first explicit record of such an opposition I have found). In the Romantic period, Keats and Poe would do likewise. I have attempted elsewhere to describe the

silent stories of imagination that must drive the task of science (McLeish 2019), as any working research scientist knows. Einstein, among others affirmed that 'imagination is more important than knowledge; imagination encircles the world' (Vierek 1929: 117). 'Imagination', however, may extend in visual, textual, abstract, and other modes (McLeish 2019), each possessing a theological ground (Funkenstein 1986). The dominant imaginative mode in science is still the visual, itself another inheritance from medieval natural philosophy. In this section we continue to draw on Grosseteste to illustrate a detailed account of the visual imagination.

We might expect, since light is for Grosseteste both the supreme physical and theological form, that sight would be his preferred metaphor for a meeting between sense and revelation. And so it proves to be. As the higher senses become sharpened by their infusion of illumination through the lower, so a higher penetrating power – *sollertia* – awakens (Grosseteste borrows the use of the word from the translation by James of Venice of Aristotle's *Posterior Analytics* – in Greek this is *agchinoia*, which might also be rendered 'acumen'). In the *Commentary on the Posterior Analytics* Grosseteste writes (Rossi 1981:281):

> Sollertia, then, is a penetrative power by which the vision of the mind does not rest on the surface of the thing seen, but penetrates it until it reaches a thing naturally linked to itself In the same way as corporal vision, falling on a coloured object, does not rest there, but penetrates into the internal connectivity and integrity of the coloured object, from which connectivity its colour emerges, and again penetrates this connectivity until it reaches the elementary qualities from which the connectivity proceeds.

This is his great articulation of the restorative effect of the divinely-assisted contemplation of nature, but it is also a striking description of the experience of science in any age. Any contemporary scientist would recognise such an enhanced form of seeing, by which not only

the outer appearances of things, but their inner logic and workings are also perceived, as the prime metaphor for scientific understanding. "Ah - I see it now!" is not an arbitrary exclamation. This exposition on *sollertia* fills out in more detail the scale of restored human understanding. The penetrative power of mental sight as a multi-layered connectivity with the object understood is preceded by a similarly-patterned connectivity of the 'corporeal vision' with the inner integrity of the object perceived.

Grosseteste does not have to invent the idea of an extended sense of vision in regard to the human relationship with nature, however. It occurs both in the Church Fathers and in biblical Wisdom literature with which he is familiar. In Gregory of Nyssa's *On the Soul and the Resurrection,* Gregory's sister (and 'Teacher') Macrina defends the real activity of the soul (or 'mind') during a moving debate as she lies dying. She chooses the example of the phases of the moon to make her case: we do not assume that the appearance of a waxing and waning object is sufficient to describe the reality, but understand that the Moon is a sphere passing through successively different angles of illumination by sunlight as seen from the Earth. It is mind that performs this task – 'the mind that sees' – beyond the surface of phenomena, or in Macrina's words (Schaff and Wace 1893:460):

> You see what the eye does teach; and yet it would never of itself have afforded this insight, without something that looks through the eyes and uses the data of the senses as mere guides to penetrate from the apparent to the unseen. It is needless to add the methods of geometry that lead us step by step through visible delineations to truths that lie out of sight, and countless other instances which all prove that apprehension is the work of an intellectual essence deeply seated in our nature, acting through the operation of our bodily senses.

The closely parallel biblical source is the Hymn to Wisdom of Job 28. Grosseteste refers to this poetic search for Wisdom, humorously described in the Hymn, in developing a discussion of theology itself in the opening of the *Hexaemeron*. McEvoy points out that in this context he is distinguishing theology from the sciences by emphasising the place of divine revelation – it possesses a necessary totality that the 'wise of the world' are not able to discover, but that must be received by faith (McEvoy 2000:91f.). Yet, as we have already seen, he derives theological motivation for his work in the liberal arts in general, and cannot have been unmoved by the reason given at the close of the Hymn, that God himself knows the way to wisdom (Clines 2006:893):

> But God understands the way to it; it is he who knows its place.
> For he looked to the ends of the earth, and beheld everything under the heavens,
> So as to assign a weight to the wind, and determine the waters by measure.

Here once more is the special, enhanced way of 'seeing' that recruits other aspects of mind than perception alone, including quantitative reasoning, to the task of beholding all of creation. Furthermore, although the Hymn concludes with this description of divine beholding, no alert reader could miss the structural sense in which this conclusion balances its opening verses, equally powerfully descriptive of the unique view of the Earth from below afforded to the eyes of human miners dangling by ropes in their deep-cut shafts. Not even the sharp-eyed falcon can claim their vision of the earth 'from beneath, transformed by fire'. It is not only God who has access to the deep perception of creation which is the Way to Wisdom – the invitation is extended to humans as well (see also Fiddes 2014).

Grosseteste draws on both biblical and patristic material to develop a cultural (and in his case, necessarily theological) narrative of science. However, the central place within his thought

that he accords to his own metaphysics of light gives him material to expand and develop *sollertia* as a running teleological metaphor. He is explicit in his demonstration that sense perceptions can awake the higher senses into a grasp of underlying reality when mathematics and geometry are also summoned to the task of deeper seeing. Finally, all this is set within an overarching biblical narrative of Creation, Fall and Redemption in which humankind is invited to participate in the process of recreation.

4 A Christological and Incarnational Metaphysics

There is another purpose evident in Grosseteste's thought behind the re-engagement of the human mind with the inner structures of the cosmos, beyond a post-lapsarian invitation to re-awaken fallen minds. This second strand is important to him, for one of his great theological questions concerns an alternative history – one in which there is no Fall from grace. In the *De cessatione legalium* (*On the Cessation of the Law*) he asks famously 'Would God have Become Man had Man not Fallen?' (Hilderbrand 2012:155). The question of the incarnation in such an unfallen world has corollaries – in particular would we be doing 'science' in such a world? Is there, in other words, a motivation for natural philosophy that goes beyond the restoration of a mind intended to perceive nature clearly, but now clouded and dulled? Although the text does not address this question directly, it points in very strong directions that parallel Grosseteste's conclusion that there would indeed have been an incarnation of God in an unfallen world, and that his relationship with human and non-human creation maintains a directional narrative even without its disastrous first turn.

In this, his chief Christological work, Grosseteste's continuous theme is unity. He points out, once again driven by the prime unifying principle of light, that the human body communicates with all corporeal natures (*communicat in natura*) because of the way light is incorporated into all elements by its reflection from the heavenly bodies. He extends his light metaphysics of matter to living beings: all of the rational soul of humans, the sensitive souls of animals and the vegetative souls of plants share both the same indwelling of constitutive light, and thereby, the composition of the elements. Through these insights he entertains a very early conception of the material way in which humankind is, literally, earthed into creation.

A related account of such material connectedness across the cosmos is found towards the end of the *De Luce*, and is worth quoting in full (Grosseteste, 2011:244):

> And it is clear that every higher body in respect of the luminosity begotten from it is the species and perfection of the following body. And just as unity is potentially every following number, so the first body by the multiplication of its luminosity is every following body. Earth, in contrast, is all higher bodies by the collection in it of the higher luminosities. Thus, the poets call it "Pan" (that is, "All") and it is named Cybele as if cubele from the cube (that is, from solidity); because it is the most compressed and dense of all bodies, it is Cybele and mother of all the gods, for although all higher luminosities are brought together [in earth], they have not come forth in it through their operations, but it is possible that the luminosity of any celestial sphere you please be drawn out from earth into act and operation, and so from earth, as if from a kind of mother, any god will be procreated.

A modern version of this sentiment was made famous by the scientist and communicator Carl Sagan (Sagan 2002:189), drawing a material communication between human and cosmic

materiality not from light, but from the atomic generative properties of stars: 'The nitrogen in our DNA, the calcium in our teeth, the iron in our blood, the carbon in our apple pies were made in the interiors of collapsing stars. We are made of star-stuff'.

For both writers there are real, material reasons that connect us to even the most distant objects in the universe. The difference is in the material detail: Grosseteste deduces them from the structuring properties of light, Sagan from the unique environments within the cores of stars, where alone heavy elements can be manufactured. In spite of the efforts of thinking such as this, deeply poetic in the connective and emotive force of its idea, the relational cultural context that it suggests for science has not taken root.

The greatest unity of all, of which this material unity is a consequence, is that of Christ with both church and world. His strongest reason for advocating an incarnation irrespective of the Fall is that (Hilderbrand 2012:156) 'It is not consistent with reason that the universe, because it is the most perfect and most beautiful, participate only in the weakest kind of unity'. Although Christian narrative theology is usually taken to invoke a linear concept of time, Grosseteste identifies an element of the circular (first woman is born of man without generation, last man is born of woman without generation) that resonates with the Pauline passage on Christ and creation to the Colossians. The perspective into material and natural structure described in the Hymn to Wisdom of Job 28 is in that tradition both a divine and human one – or rather it takes the human perspective onto creation into the divine one. For this to be true, the incarnate and loving gaze onto creation described at its temporal origin becomes true at all times. One can enter logically, if not temporally, the circle of creation, incarnation and re-creation at any point. From this point of view, the circular temporal structure of the world and the external, potentially detached perspective on it becomes similar

to that of a Stoic worldview, except that it is Christ in Creation who says 'Yes!' to 'the universe in its totality', not humans.

Chris Tilling has recently described this strange temporality in which time 'bends' or 'spirals' around Christ (Tilling 2018). Just as a 21st century physicist is surprised by resonances of thought in reading 13th century descriptions of the mind's sight in teasing out the play of light uniting with matter that gives rise to colour, while being delighted by the difference in thought-world, so the contortions of a circular, or ever-present, time that are theologically-motivated are not so very strange in the century after we first learned that both time and space were geometrical, woven together and, in the presence of any mass or energy, curved.

A theology of science must be relational, soteriological and Christological. It must respect the narrative freedoms and constraints of God, humans and material creation. It must dissolve the epistemological divisions and hierarchies of the late modern world. Above all it must situate science as a God-gifted vocation and ability that lies at the heart of what it means to be a created human, spatially within a material creation and temporally between incarnation and new creation. The medieval thinking we have encountered in this short survey through the eyes of one of that period's greatest thinkers points to all these. It is a distant mirror that can only partially reflect the vision we need for our own times, but it does remind us of stark alternatives to our own cultural assumptions, and will surely assist in rendering them more transparent.

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