

Alberto Vanzo

Experimental Philosophy and Religion in Seventeenth-Century Italy*

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1. Introduction

As is well known, several English advocates of early modern experimental philosophy posited a strong connection between religion and experimental philosophy. According to Robert Boyle, Joseph Glanvill and Thomas Sprat, by practising experimental philosophy we can shed light on God's attributes,¹ will and providence (B 11: 298–299). We can draw on the discoveries of experimental philosophers to prove the existence of God and spirits,² refute atheism, materialism, superstition and religious enthusiasm,³ and distinguish authentic miracles from fake miracles (ibid., 316). The practice of experimental philosophy leads to the worship of God⁴ and embodies the Christian virtues of humility, innocence and piety.⁵

In the light of this, early modern experimental philosophy might seem to corroborate the view that the study of nature in the seventeenth century was closely related to theology, driven by theological concerns, and pursued primarily to shed light on God. This view has been put forward by Amos Funkenstein, Stephen Gaukroger and Andrew Cunningham. According to Funkenstein (1986, 72), a 'fusion between theology and physics' took place in the seventeenth century. 'Theological and physical arguments became nearly indistinguishable' (ibid., 73). '[S]cience' and 'theology' were 'seen as one and the same occupation'.⁶ For Gaukroger (2006, 3), 'the Scientific Revolution' was 'driven, often explicitly, by religious considerations'. In the seventeenth century, 'Christianity took over natural philosophy' (Gaukroger 2006, 22), 'set the agenda for natural philosophy', 'projected

it forward' (ibid., 3) and 'establish[ed]' it 'as something in part constructed in the image of religion' (ibid., 22). Cunningham holds that natural philosophers, in the seventeenth century as in other periods, 'explored' nature 'not for itself', but only insofar as it was God's creation. They aimed to shed light on 'God's achievements, God's intentions, God's purposes, God's messages to man' (Cunningham 1988, 384).⁷ On the one hand, 'each and every variety of natural philosophy that was put forward was an argument for particular and specific views of God' (Cunningham 1991, 382). On the other hand, differences in religious outlook led natural philosophers to entertain 'somewhat differing concepts' of how God's 'nature can be seen or uncovered' (ibid., 389).⁸

In this chapter I argue that, unlike many of their English peers, practitioners and advocates of experimental philosophy in seventeenth-century Italy kept natural philosophy sharply distinct from theological and religious concerns.⁹ Negatively, the case of Italian experimental philosophers provides a counterexample to the view that either experimental philosophy or seventeenth-century natural philosophy, as a whole, were fused with theology, driven by theological concerns, or pursued primarily to shed light on God.¹⁰ Positively, the case of Italian experimental philosophers provides evidence for the claim that experimental philosophy does not bear any intrinsic connection with religion. On the contrary, as we shall see, certain features of the outlook of experimental philosophy made it easy to pursue it in isolation from theological and religious questions. Whether experimental philosophy was presented as an ally of religion or as distinct from it depends, at least in part, on matters of cultural politics, namely, which rhetorical and argumentative strategies were believed to be the most likely to ensure freedom of research and institutional support for the work of experimental philosophers.

2. Experimental Philosophy in Seventeenth-Century Italy

I understand the expression 'experimental philosophy' in a narrow sense, as referring to a

natural philosophical movement that emerged in the Royal Society in the 1660s. Seventeenth-century experimental philosophers shared at least four common features.¹¹ First, they employed a distinctive rhetoric, centred around the praise of experiment and the criticism of speculation, understood as the firm endorsement of natural philosophical systems without sufficient empirical evidence. Second, experimental philosophers had common heroes, especially Francis Bacon and Robert Boyle, as well as common foes: Aristotle, the Scholastics and, especially from the 1680s onward, Descartes, who they accused of speculating. Third, experimental philosophers shared a common methodological outlook. Negatively, they held that one should not firmly commit oneself to any substantive claims or theories on the natural world, unless they are warranted by extensive experiments and observations. Positively, they held that we should follow a two-stage process in order to make a firm commitment to substantive claims or theories. In the first stage, we should gather a large collection of empirical information by means of first-person, autoptic experiences and organize them in structured natural histories. In the second stage, we should derive theories from that information through a process of induction or deduction, whose details, however, were rarely specified.¹² Fourth, experimental philosophers shared a broad set of attitudes: a concern for the practical usefulness of natural philosophy; a special receptivity to foreign or unusual facts and opinions; an emphasis on epistemic humility, often conjoined with a plea for ingenuity, sincerity, and a readiness to learn from others; and a critical attitude towards authority, along with an emphasis on seeking the truth by oneself.

Italian authors adopted these views and attitudes surprisingly quickly.¹³ One can find them in works published as early as 1667 and 1668, Geminiano Montanari's *Physico-Mathematical Thoughts* (1667) on capillary action and Francesco Redi's *Experiments on the Generation of Insects* (1996 [1668]). Over the following decades, the outlook of experimental philosophy informed the activity of numerous researchers and several academies. It can be found, for instance, in works on crystallography (Guglielmini 1719 [1688]), geology (Scilla

2007 [1670]) and the method of practical medicine (Baglivi 1696). Practitioners and apologists of experimental philosophy were active in Bologna, Naples, Tuscany (including both Florence and Pisa), the Venetian Republic (especially Padua) and minor centres such as Brescia and Verona.¹⁴

Most Italian supporters of experimental philosophy endorsed a generic form of corpuscularism whose primary sources were Gassendi and, to a lesser extent, Descartes. They held that physical phenomena should be explained in terms of the shape, size and spatial arrangement of the particles that make up bodies, along with the motion of such particles according to the laws of nature. Proudly following Galileo, Italian authors emphasized that God wrote those laws using geometrical characters (e.g., Anon. 1665, 32–33) and they sometimes claimed that we can know the natural world only by means of mathematics (Anon. 1665, 32; Montanari 1980, 542–543). Several authors carried out qualitative studies concerning, for instance, the ‘macroscopic and behavioural features of animal species’¹⁵ that did not make recourse to mathematics¹⁶ and did not rely on corpuscular ‘hypotheses on the basic structure of phenomena’ (Baldini 1980, 427, 450). Yet even Redi, the foremost exemplar of this ‘superficial’ style of inquiry and of a politically cautious attitude that led him not to publicly endorse corpuscularism, embraced it without hesitation in a work published safely and anonymously in the Netherlands.¹⁷

The academies which Italian *novatores* convened were sometimes called academies of experimental philosophy or described as practising experimental philosophy.¹⁸ However, Italian authors did not usually call themselves experimental philosophers. They preferred the denominations of Galileans, modern philosophers and—once they started being so identified by their opponents—atomists. They used the term ‘atomism’ in a broad sense, to designate a generic form of corpuscularism that was neutral on the question of whether matter is infinitely divisible.¹⁹ Thus, according to Francesco D’Andrea (1995 [1685], 90), a Neapolitan apologist of the new philosophy, the existence or nonexistence of indivisible particles ‘has nothing to do

with the truth' of 'atomism'.

Some Italian corpuscularists did not share the outlook of experimental philosophers. Among them are Tommaso Cornelio, who founded the Neapolitan Accademia degli Investiganti, and Giovanni Alfonso Borelli, a key member of the Cimento and the author of a seminal work on biomechanics.²⁰ However, a large number of researchers did endorse both corpuscularism and experimentalism. These were not merely concurrent commitments, they were integrated components of an outlook that combined a corpuscular matter theory with an experimentalist epistemology, methodology and rhetoric.²¹ It is for this reason that a vocal opponent of the new philosophers, Giovanni Battista De Benedictis, referred to them interchangeably as 'atomists' and 'experimentalists' (Aletino 1694, 206–207). He criticized them both for reducing 'the whole science of nature' to 'mere experience' (ibid., 207) and for endorsing corpuscularist principles that lack evidence (ibid., 202).

The Neapolitan *novatores* were particularly keen to praise Descartes,²² who they occasionally presented as a forefather of experimental philosophy.²³ Yet, even they sided with experimental philosophers rather than Descartes on key epistemological and methodological questions. Most notably, Descartes (*Principles*, 2, §16, CSM 1: 229–230) held that we can establish some truths about the natural world *a priori*, for instance that there is no vacuum. By contrast, the Neapolitan *Investiganti* stressed that we can know the natural world only by relying on experience and that 'any speculations that are not confirmed by the test of the sense[s] are vain' (Anon. 1665, 27).²⁴

3. God and Natural Philosophy

As the reception of Descartes by Italian *novatores* was selective, so was their reception of the views of English experimental philosophers. Italian writers echoed their rejection of authority,²⁵ prejudices (Baglivi 1696, Part II, Ch. 5), prematurely formed systems (Baglivi 1696, Part I, Ch. 10, Sect. 2) and speculations not supported by experience (Anon. 1665, 27);

their admiration of Bacon²⁶ and Boyle²⁷ and criticisms of Aristotle and his disciples,²⁸ their praise of the senses,²⁹ experience³⁰ and observations, which provide ‘the only path’ to advance our knowledge of the natural world (Porzio 1736 [1667], 324); and their view that a new, comprehensive natural history ought to provide a ‘solid foundation for natural philosophy’.³¹ However, they did not echo their claims on the connection between experimental philosophy and religion. They did not present the practice of natural philosophy as an exercise in the cultivation of Christian virtues. They did not state that natural philosophy enables us to know the Creator, increase our devotion, or fight atheism. The natural philosophical works of Italian *novatores* did not even sketch any arguments from design, even though the inclusion of brief arguments from design at least in the prefaces would have been easy and rather conventional, especially for works of natural history.³²

I have found only two exceptions to this trend.³³ The first exception is in a manuscript written by Francesco D’Andrea, a Neapolitan apologist of the new philosophy, to reply to the attacks of the Peripatetics. D’Andrea (1995 [1685], 85) suggests that corpuscularism enables us to ‘rise from knowledge of nature to knowledge of God, its supreme author, disposing us to love and adore him’. It is telling that this suggestion is not fleshed out anywhere in this fifty-page manuscript. The suggestion does not appear in any of the numerous responses by the Italian *novatores* to the two major attacks that the Peripatetics mounted against them in the late seventeenth century.³⁴

The second exception can be found in a work by a Neapolitan physician, Leonardo Di Capua’s *Opinion on the Uncertainty of Medicine* (1681). At one point in his sixty-page critique of ancient natural philosophers (585–648), Di Capua mentions a theological argument based on corpuscular matter theory. Thales, Anaxagoras and ‘many other’ Greek philosophers borrowed from the Phoenicians the view that the division of bodies into ‘extremely tiny particles of various sizes, shapes, positions, motions and order’ entails the existence of ‘an infinite omnipotence and wisdom, that is able to order matter, dispose it in so many ways, and

communicate motion to it' (645). Having approved of this view, Di Capua goes on to criticize the ancients for believing matter to be eternal, rather than being created by God.³⁵ Di Capua does not dwell to explain *how* the existence of a divine creator of matter follows from its corpuscular composition, nor does he refer to that argument anywhere else in his 600-page long *Opinion*. This is significant because the *Opinion* is a detailed, repetitive text that tends to dwell at length on every facet of the topics discussed.

At first sight, the treatises on molluscs, spontaneous generation and microscopical observations by the Jesuit Filippo Buonanni (1681, 1691a, 1691b) appear to provide a further exception to the silence of the *novatores* on the connection between experimental philosophy and religion. Buonanni states that, by studying molluscs and tiny animals, we can come to know God's attributes (1681, 27; 1691, 34), especially his beauty, goodness, power, providence and wisdom.³⁶ This leads us to love, praise and admire God.³⁷

Buonanni's works, however, are not a real exception to the silence of Italian *novatores* on theological themes because he hardly was a true *novator*. His endorsement of experimental philosophy was superficial and highly selective. He expressed admiration for the Royal Society and praised sense experience (Buonanni 1681, 5, 15–16), but he also defended the reliance of natural philosophers on authority (Buonanni 1683, 47–51). His own reliance on Aristotle led him to make several claims that were easily falsified by experience. For instance, he held that molluscs lack a brain and a heart, insisting that not even with a microscope will one ever be able to see their hearts (Buonanni 1681, 323–324). In response, Redi detailed a wealth of observations of molluscs' hearts, which can be seen not only without microscope, but also 'without peeling one's eyes' (Redi 1684, 58). As Redi pointedly writes, Buonanni was a 'truly great man of letter who, [staying] at his desk, writes [only] what he found in the works of other authors', but 'not a philosophical experimenter, who affirms only what he has observed with his own eyes after many repeated trials' (ibid., 63).

Perhaps the most striking example of the near absence of theological claims from the

works of Italian experimentalists is Giorgio Baglivi's *De praxi medica* of 1696. This was one of the most successful medical works of the late seventeenth and early eighteenth century. By 1707, the year of Baglivi's death, it had been printed four times in three different countries³⁸ and it had been translated into English and German (Baglivi 1704, 1705). One of the reasons for the success of this book is that it outlines a method for practical medicine based on the tenets of experimental philosophy. Its over 250 pages are replete with experimentalist rhetoric. They are brimming with quotes from Bacon's and Boyle's works, with which Baglivi was familiar. Yet, Baglivi does not take up any of Bacon's or Boyle's claims on the benefits of the study of nature for theology (e.g., Bacon 1857, SEH 3: 597; OFB 4: 8–9). On the contrary, he echoes Bacon's complaint that 'Plato' greatly 'damaged natural history and its progress by including theology in his philosophy, or judging of philosophical matters by means of abstract, theological concepts' (Baglivi 1696, Part II, Ch. 2, Sect. 3).³⁹

God makes only occasional appearances in Baglivi's works. He calls the instinctive insight of the good physician a 'divine fire' (Baglivi 1696, Part II, Ch. 3, Sect. 5).⁴⁰ He states that God ordered the human body according to mathematical proportions⁴¹ and subjected the movements of living bodies to 'stable laws' (ibid., Part II, Ch. 1, Sect. 1; 1715b, 453). He once remarks in passing that those movements show how admirable God is.⁴² Rather than being merely rhetorical, the claim that God subjected bodies to 'stable laws' plays a foundational role in Baglivi's work. It underpins an argument for the view that diseases can be classified into genera and species. However, Baglivi also formulates two non-theological arguments for that claim⁴³ and he places little emphasis on it. He is far more interested in explaining how diseases can be classified than in establishing the metaphysical presuppositions for this activity, including the presupposition that God has ordered diseases into classes.

What makes Baglivi's case interesting for our purposes is the fact that it is entirely standard. God plays a marginal role not only in his works, but also in those of the other

seventeenth-century Italian authors who were partial to experimental philosophy. Peter Dear (2001a, 385) has stated that, during the nineteenth century, ‘the God of science’ becomes ‘entirely inoperative’. The same can be said of the God of experimental philosophers in seventeenth-century Italy.

4. Historical Narratives and Christian Piety

There is, however, a way in which Italian *novatores* linked natural philosophy to religion. They did not claim that experimental philosophy *per se* promotes Christian piety. However, they sometimes claimed that the new philosophers were good ‘Catholics’ with an ‘unobjectionable life’ (D’Andrea 1995 [1685], 67) and that the founding fathers of their corpuscular matter theory were pious too.

As Dmitri Levitin (2014, 2015) has shown, English experimental philosophers backed up their views on matter theory and principles by constructing historical narratives that stretched back to Democritus, the Indian Brahmins and the Persian Magi, drawing heavily on Humanist scholarship. Italian *novatores* constructed similar narratives to defend themselves from the attacks of the Aristotelians. Only one of them, the Neapolitan Giuseppe Valletta, wrote a fully-fledged history of philosophy. However, several other authors traced back the roots of corpuscular philosophy to ancient thinkers: not only Democritus and Epicurus,⁴⁴ but also Parmenides, Timaeus,⁴⁵ Plato’s dialogue *Timaeus*, and the *prisca philosophia* of the Egyptian priests, the Persian magi, the Indian Brahmins and gymnosophists. The latter were said to have taught corpuscular philosophy to Pythagoras, from whom Plato took it up.⁴⁶

These narratives highlight the piety of Pythagoras, Plato, Democritus and Epicurus, along with the greater compatibility of their doctrines than Aristotle’s doctrines with the Christian faith.⁴⁷ Sometimes, the pious Democritus was contrasted with the impious Epicurus.⁴⁸ other times, they were both baptized.⁴⁹

Three points are worth highlighting about these narratives that link the new

philosophy to religious piety. First, they were framed *ex post*, once the *novatores* came under attack, to address the charges of novelty and impiety raised by the Aristotelians. Second, the narratives were the result of historiographical and rhetorical manoeuvres that had only weak links with the actual contents of the new philosophy. Whether Democritus was pious or the gymnosophists were corpuscularists bears only a tenuous connection with whether the new philosophy furthered Christian piety. Third, English authors like Thomas Sprat claimed that the practice of experimental philosophy helps promote the Christian cause and cultivate Christian virtues. Italian authors resorted to historical narratives to defend a much weaker claim, namely, that the new philosophy and its corpuscular matter theory are acceptable to good Catholics. This is far less than what one would need to establish that a fusion of theology and physics took place among seventeenth-century Italian *novatores*, that Christianity set the agenda for their natural philosophy, or that they studied nature to shed light on God.

5. Corpuscularism, Transubstantiation and the Division of Labour

In the eyes of both the Catholic Church and the Italian *novatores*, the most serious charge against them was not that they were impious, but that their corpuscular matter theory entailed the rejection of the dogma of transubstantiation. The incompatibility of that dogma with corpuscularism had been invoked on a number of occasions, including the condemnation of John Wycliffe's doctrines in 1415, the Jesuit *Ordinatio pro studiis superioribus* of 1651, the decision to place Descartes' works in the Index in 1663,⁵⁰ and attacks of Peripatetics and Church authorities against Galileo⁵¹ and the Neapolitan corpuscularists.⁵² If the natural philosophy of the Italian *novatores* been theologically driven, one would expect some of them to defend the compatibility of their corpuscularism with transubstantiation and to at least sketch a corpuscularist account of the Eucharist. Discussing such theological topics, even

within strictly natural philosophical works, was not unusual for seventeenth-century authors. For instance, Otto von Guericke's *Experimenta Magdeburgica* on the vacuum discusses at some length the location of Heaven and Hell and the interpretation of the biblical miracle of Joshua who stopped the Sun.⁵³ As far as I have been able to establish, none of the authors who were partial to experimental philosophy sketched an account of the Eucharist, either in their published works or in their manuscripts.⁵⁴ They claimed at most that the Eucharist is a mystery of faith, that 'many things concerning the mystery of the Eucharist can hardly be understood', and that 'we do not know if there is anyone who would dare to provide a natural explanation of it' (Anon. 1995b, 129).⁵⁵ As one author wrote, the new philosophers did 'not want to engage in disputes' on transubstantiation. They said 'that it is not their job to argue about matters of faith, because ... natural philosophers should not take up the office of theologian or scholastic theologian' (Anon. 1995b, 129).⁵⁶

Italian authors justified this division of labour between theologians and natural philosophers in three ways. Giuseppe Barbari—who studied in Bologna under Montanari and published a treatise on vision—drew a sharp separation between the *domains* of natural, sensible beings and supernatural, non-sensible beings. According to Barbari, whoever acknowledges that natural philosophy relies on 'sensate experiences' will also acknowledge that a sense-based philosophy cannot shed light on 'the insensible, supernatural things that are object of faith'. These ought to be believed in virtue of the revelation, miracles, and the testimony of martyrs and 'infinitely many people' (Barbari 1678, v).

Francesco Redi and Antonio Felice Marsili justified the division of labour between theologians and natural philosophers by noting that their disciplines require different *epistemic attitudes*. Natural philosophers should reject authority and rely on autoptic experience. Instead, theological matters must be believed 'with closed eyes' (Redi 1996 [1668], 36),⁵⁷ in virtue of the authority of God and the Church. As Marsili put it, 'swearing *in verba magistri* is religion for theologians, stubbornness [...] for [natural] philosophers. It is

confusing science [*scienza*] with faith' (Marsili 1671, 311).⁵⁸

Giuseppe Valletta, a Neapolitan apologist of the new philosophy, separated theology from natural philosophy by emphasizing its *epistemic limitations*. Natural philosophy can only establish probable conclusions. These are too 'lowly and unstable foundations' for matters of faith, which should be held to be certain, not just probable. It follows that faith cannot depend on 'the principles of philosophies' (Valletta 1975 [1691–1697], 164).⁵⁹ Conveniently, this entails that good Christians can embrace the new philosophy without prejudice to their faith.

These justifications of the division of labour between theologians and natural philosophers are best seen as expressions of two complementary views. On the one hand, Italian *novatores* stressed that natural philosophy must rely on *reason*, combined with experience as Bacon (OFB 11: 20) recommended.⁶⁰ On the other hand, they adopted a fideistic outlook by denying that faith relies on reason.⁶¹ This outlook is expressed by their claims that the Eucharist is an incomprehensible mystery, that theological matters must be believed with closed eyes and that natural philosophy, which is based on reason, cannot ground truths of faith. These views differ sharply from Boyle's claims that natural religion, based solely on reason and experience, is the 'foundation' of the Christian religion (B 11: 298)⁶² and that, 'by being addicted to *Experimental Philosophy*, a Man' is 'Assisted' to be 'a *Good Christian*' (ibid., 281). By combining trust in reason within the realm of nature and distrust of reason within the realm of revelation, Italian authors drew a sharp separation between the mindset of the natural philosopher and that of the theologian.⁶³

There are two disciplines in which distinguishing between the mindsets of natural philosophers and theologians was not sufficient to keep natural philosophy apart from theological matters. This is because they dealt with subjects on which the Bible was thought to have a say. The first discipline is the study of the history of the Earth, of which the biblical flood was believed to be a chapter. Geological and paleontological discoveries lent

plausibility to the hypothesis that, instead of a single, worldwide flood, several local floods took place at different times. This was suggested, for instance, in Fabio Colonna's pioneering study of fossils, *De glossopetris dissertatio* (1616), and in Nicholas Steno's *Canis carchariae* (1667), the first work to propose that *glossopetrae* are fossilized shark teeth (Morello 2010, 194). Yet, these works did not adopt the outlook of experimental philosophy, nor did Francesco Bianchini's work on the reality of the Biblical flood (Bianchini 1697), even though Bianchini (1785) endorsed experimental and mechanical philosophy in his youth. The only seventeenth-century Italian work on paleontology or historical geology that conforms to the dictates of experimental philosophy is Agostino Scilla's *Vain Speculation Refuted by Sense*. This is one of the first studies to provide detailed empirical evidence for the organic origin of fossils. At one point, Scilla does state that the presence of fossils in the mountains is a consequence of the Biblical flood and a sign of God's power to punish people.⁶⁴ However, he does not elaborate on this theme, nor does he speculate on when and how that flood took place.⁶⁵ He also refers to multiple local floods⁶⁶ and he often refers to 'Nature' in entirely neutral terms when he had the opportunity to invoke God.⁶⁷

The second discipline that studies facts supposedly dealt with by the Bible was celestial mechanics. Any stance on issues bearing on the truth of the Ptolemaic, Copernican and Tycho's systems constrained one's interpretation of the infamous Biblical statements on the motion of the Sun and one's view on the questions of Biblical exegesis that were discussed in Galileo's Copernican letters. Several followers of experimental philosophy carried out astronomical research, including Bianchini and his teacher Montanari, whose observations of the Great Comet of 1680 are referred to in Newton's *Principia* (Newton 1999 [1726], 913–915, 927). Conveniently, neither published a treatise on celestial mechanics. Borelli, who did publish a treatise on celestial mechanics (Borelli 1666), did not adopt the outlook of experimental philosophers and he did not hesitate to establish substantive truths on the natural world *a priori*.⁶⁸

The reticence of many Italian authors to discuss questions of celestial mechanics was at least partly due to prudential considerations.⁶⁹ Geminiano Montanari refrained from engaging in a debate on Copernicanism because, as he put it in a manuscript, he was living in a place—the Papal States—where ‘one must wear a muzzle when discussing even uncontroversial topics’.⁷⁰ Similar prudential considerations might have led Italian experimentalists to avoid discussing religious or theological matters. This might lead us to suppose that they were in fact driven by theological concerns, just like many of their English counterparts. If so, they concealed this through a process of self-censorship to avoid being accused of heterodoxy and, possibly, even being tried by the Inquisition.

There is no doubt that the Inquisition was feared, self-censorship was widespread,⁷¹ and many Italian writers steered clear of controversial topics. Nevertheless, if theological concerns had been driving their natural-philosophical reflections, they could have shown it in a variety of ways. They could have arranged for their theological views to be published clandestinely, posthumously, abroad, anonymously, or under a false name. When discussing non-theological topics, Italian *novatores* resorted to each of these practices. For instance, Marcello Malpighi had his most trenchant criticisms of his opponents published posthumously (Malpighi 1697). A bitter attack on Galenist physicians by Giuseppe Gazola, who founded the academy of experimental philosophy of Verona, was published posthumously.⁷² The Neapolitan physician Sebastiano Bartoli had his broadside against Galenic physicians printed in Venice, a city that posed no obstacles to ‘the free circulation of printed works of all sorts’ (Ferrone 1995, 89; see Bartoli 1666). When Andrea Pissini was denied the permission to publish his *Naturalium doctrina* (1675) in Padua, he had it printed in Augsburg. As we saw above, Redi endorsed corpuscularism in a text published anonymously in the Netherlands. Borelli published a reply to an argument against Copernicanism under the name of his pupil Diego Zerilli (Galluzzi 1977, 103, 128).

It is very plausible that, if the seventeenth-century Italian authors who favoured

experimental philosophy had felt strongly about theology, but were afraid of being accused of heterodoxy, at least some of them would have published their views posthumously, anonymously, abroad, or under a false name. None of them did, with only one potential exception: a matter-theoretical and theological essay by Domenico Guglielmini, one of the foremost crystallographers of the seventeenth century. The essay states that God created the material world, motion and its laws; ascribed extension and impenetrability to matter; conferred form and size to the *minima*; and can split them into parts. The essay was written in the late seventeenth or early eighteenth century and it was published posthumously in 1719. It is unclear whether Guglielmini intended it to be published. At any rate, it is telling that this essay makes up only a tiny fraction of his natural-philosophical works: seven pages out of 1343.⁷³

Finally, if theological concerns had played a significant role in the works of the Italian authors who endorsed experimental philosophy, they would have had a strong incentive to elaborate on at least the theologically orthodox portions of their views. This would have helped defuse any suspicions of libertinism and it would have given additional credibility to their occasional professions of faith and willingness to submit to the Church (e.g., Marchetti 1670, 1339; Scilla 2007 [1670], 5). The fact that Italian authors did not elaborate even on theologically safe topics provides further reason to believe that they had little interest in theology.

6. Conclusion

If all this is correct, we can conclude that, *pace* Funkenstein, the seventeenth-century Italian authors who were sympathetic to experimental philosophy did not see science and theology as the same occupation, nor did they seek to fuse theology with physics. *Pace* Gaukroger, they did not present their natural philosophy as being driven by Christian themes, but as distinct

from matters of faith. And, *pace* Cunningham, they did not employ their natural philosophy as an extended argument for a specific view of God. Italian and English experimental philosophers shared the same views on how nature can be seen and uncovered, even though the former were mostly Catholics whereas the latter were mostly Protestants. This indicates that neither experimental philosophy nor seventeenth-century natural philosophy as a whole, as such, were theologically driven, and it raises the question of what explains the different attitudes of Italian and English authors on the relation between experimental philosophy and religion.

In the wake of Galileo's condemnation, several Italian *novatores* opted to eschew general questions on foundations and first principles. Some authors focused their research on small-scale questions that could be solved purely through detailed empirical inquiries.⁷⁴ Others focused on technical, mathematically demanding aspects of the new philosophy. An example is Evangelista Torricelli. He provided the inspiration for the famous experiment on Torricellian vacuum, but he refrained from participating in the debates on the interpretation of the experiment, the existence of the vacuum, or the weight of the air. He devoted much time and energy to perfecting a technique for grinding the lenses of telescopes. Yet, he never used them to confirm the Copernican theory that his teacher, Galileo, had defended, nor did he ever engage in cosmological disputes (Belloni 1975, 25–29). Torricelli adopted this attitude as early as the 1640s. In the 1660s, when experimental philosophy emerged, it offered a methodological framework that justified the choice to focus on small-scale and technical questions on the ground that overarching and foundational issues will be best addressed once a universal natural history is nearing completion. By focusing on small-scale and technical issues, researchers could avoid broader questions about the relevance of their work to theological and religious matters. They could also avoid those metaphysical questions that have implications for belief in the transubstantiation, the immortality of the soul, or how immaterial agents such as angels could act on material bodies.

Experimental philosophy did not only provide a methodological framework that encouraged work on small-scale problems in isolation from foundational issues. It also offered a set of epistemic virtues that could be easily linked to Christian virtues, and it offered data that could be used as the basis for arguments from design and claims about God's benevolence. In England, Sprat and others highlighted these aspects of experimental philosophy. This was functional to a cultural policy that aimed to ensure the success of experimental philosophy by presenting it as the natural philosophical programme most suited to 'the social and intellectual aspirations of the Restoration' (Wood 1980, 1).

Italian *novatores* were attracted to another aspect of experimental philosophy, namely, the fact that it provided a justification for pursuing technical or small-scale research in isolation from broader metaphysical and theological questions. This, too, was functional to a cultural policy. It protected the freedom of research of the *novatores* by minimizing the risk of being censored by Church authorities, losing the support of patrons,⁷⁵ and prompting disputes or smear campaigns from ecclesiastics and Peripatetics. It is not by chance that experimental research thrived in Bologna, where the *novatores* adopted this cautious attitude.⁷⁶ By contrast, the Florentine philosopher Donato Rossetti, who was eager to respond to the Peripatetics point-by-point even on foundational questions, ended up leaving Tuscany and seeking a career elsewhere.

All this indicates that experimental philosophy did not have an intrinsic relation with theological or religious views. Whether it was presented as an ally of religion or as sharply distinct from it was, to a significant extent, a matter of cultural politics. It depended on which rhetorical and argumentative strategies were believed to be most likely to enable experimental philosophers to thrive, preserve freedom of research and gain institutional support.

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¹ Glanvill 1676, 5; B 11: 295.

² Glanvill 1676, 6–13; B 11: 296.

³ Sprat 1667, 54–56; Glanvill 1676, 6–24.

⁴ Sprat 1667, 348–349; B 11: 293.

⁵ Sprat 1667, 111, 356, 366–367. For other aspects of the mindset of experimental philosophers that are in line with Christian values, see B 11: 303–306, 313–314, 322–323. Not all English experimental philosophers displayed interest in the connection between natural philosophy and religion. For instance, Robert Hooke remained largely silent on religious themes. See Chapman 2005, 24–27. On experimental philosophy and religion in seventeenth-century England, see Wood 1980, Jalobeanu 2010, Anstey 2017a and Rossiter in this volume.

⁶ Funkenstein 1986, 3. Harrison (2006, 86) agrees, although he rejects some of Cunningham's claims. See also Harrison 2005, 165–172.

⁷ See Schuster 1990, 224. According to Cunningham (2000, 264), the true aims of natural philosophers become apparent once we consider not only the technical content of their statements, but also why natural philosophy 'was practised, what larger goals its practice served, what its products meant to its practitioners and other contemporary audiences, how the products of natural philosophy were to be interpreted by its producers and their immediate audience'.

⁸ Along similar lines, Dear argues that the difference between the 'dominant forms of "science"' established in Protestant England and Catholic France 'in the second half of the seventeenth century' (Dear 1990, 683) maps onto different attitudes toward miracles (ibid., 682). Dear (2001b, 385) proposes a revised version of Cunningham's theses. Osler (1997, 102–103) quotes Cunningham approvingly, although she criticizes what she calls his essentialist attitude.

⁹ In the eighteenth century, several Italian authors posited a stronger relation between experimental philosophy and religion, partly due to the influence of the Newtonianism and of the Boyle lectures (Ferrone 1995). The claims of this chapter are intended to apply only to the texts written by those Italian authors who were partial to experimental philosophy between its emergence in the 1660s and 1700.

¹⁰ Peter Harrison, Edward Grant and Brunello Lotti have identified other instances of separation between natural philosophy and theology in the seventeenth century. As Harrison (2005, 166–172) has noted, Galileo, Bacon and Descartes all held that natural philosophy is independent from theology in several ways and should be kept apart from it. Funkenstein (1986) and Cunningham (1991) hold that Newton's natural philosophy provides confirmation for their claims on the tight relation between natural philosophy and religion. Lotti (2006, 69, 75) and Grant (2000, 288–298; 2007, 293–302) have persuasively argued against Funkenstein's and Cunningham's readings of Newton. They note that the *Principia* mention God rarely and in passing, that Newton's argument from design is unoriginal and that, according to Newton, the metaphysical tenets underlying the *Principia*, such as his conception of space, can be established and understood independently from theological considerations.

¹¹ The first three features are illustrated in Vanzo 2016, 53–54. On the fourth feature, see Philippe Hamou's chapter in this volume.

¹² For a rare attempt to flesh out this process, see Baglivi 1696, Part I, Ch. 2.

¹³ This is partly because some of those views had been held by the Linceans, Galileo and his disciples in the first half of the seventeenth century. For instance, a work by Giovanni Ciampoli (1665, 16–17) that was composed before 1644 stresses the importance of first-person experience. Other aspects of the outlook of experimental philosophers, such as the role of natural history, cannot be found in the works of Galileo and his disciples.

¹⁴ On Brescia, see Pighetti 1988, 186–187. On Verona, see Bianchini 1785. The kind of experimental philosophy that was influential in seventeenth-century Italy was the Baconian, pre-Newtonian experimental philosophy of Boyle and Hooke. Although a few Italian scholars read the *Principia* before 1700 (Ferrone 1995, 111, 283–284n58), none seems to have seriously studied Newton's philosophy and considered its theological implications before 1708 (ibid., 18, 63). Copies of Newton's *Scholium generale* first circulated in Rome in 1713, along with the works of Anthony Collins and John Toland (ibid., 75). William Derham's Boyle lectures (1713) reached Italy in 1715 and were translated into Italian in 1719 (ibid., 78).

¹⁵ Bernardi 1996, 7.

¹⁶ For instance, although Baglivi (1696, Part I, Chapter 9, sect. 7) described the human body as 'a whole' of 'motions' that 'depend on purely mathematical principles', his medical explanations did not employ mathematics.

¹⁷ Anon. 1698. On the authorship of this text, see Bernardi online,

<http://www.francescoredi.it/Database/redi/redi.nsf/b4604a8b566ce010c125684d00471e00/db89f5de884dcab0c12569fa005f0a14> (archived at <http://www.webcitation.org/6VM1oTYtQ>),

<http://www.francescoredi.it/Database/redi/redi.nsf/page/126DDC04C8A0620EC12569F300511AF2> (archived at <http://www.webcitation.org/6VM1torcv>).

¹⁸ See, e.g., the subtitle of Guglielmini 1719 [1688] and the title of Montanari 1780. The statute of the Accademia dei Fisiocritici of Siena states that 'experimental philosophy' deserves 'the name of good, true and healthy philosophy' (Accademia dei Fisiocritici 1691, 31). According to an account of its foundation, the Accademia degli Aletofili of Verona was established to spread 'the healthier experimental philosophy' (Anon. 1716, 219).

¹⁹ The expressions 'corpuscular doctrine' and 'corpuscular philosophy' were also occasionally used. See Ceva Grimaldi 1695, 90; Montanari 1980, 543.

²⁰ Cornelio held that natural philosophers should not start by carrying out experiments and observations, but by formulating axioms and hypotheses (Cornelio 1688, 78–81). Borelli relied on *a priori* arguments to show that certain

animals cannot move in given ways because they are not sufficiently simple, economical, or conducive to the achievement of natural purposes (Borelli 1680–1681, 1: 266–267).

²¹ I discuss whether experimental philosophy and corpuscularism can be consistently combined in Vanzo 2017.

²² See, e.g., Valletta 1975 [1691–1697], 55. By contrast, among the Bolognese, Guglielmini openly criticizes Descartes (Guglielmini 1719 [1688], 77; 1719 [1705], 74, 76, 83; 1719a, 468) and Marsili shows ‘a substantial lack of interest’ in his views (Piaia 2010, 239). In his account of the history of philosophy, Marsili (1671, 317) mentions Descartes only once, in passing.

²³ See a letter written in 1699 by Giacinto Gimma, a *novator* from Bari who spent time in Naples (Tremigliozi 1700, 265).

²⁴ According to Francesco D’Andrea (1995 [1673–1675?], 148), the ‘sensate philosophy’ of Neapolitan authors was ‘entirely devoted to experiences and sensate reasoning [*discorso sensato*], grounded’ on experiences. See also Porzio 1736 [1667], 324.

²⁵ E.g., Marsili 1671, 311–312; Di Capua 1681, 53; Accademia dei Fisiocritici 1691, 33; Baglivi 1696, Praefatio, sig. A3v.

²⁶ E.g., Malpighi 1980 [1698], 1135; Montanari 1980, 540.

²⁷ E.g., Porzio 1736 [1667], 334; Guglielmini 1719 [1705], 94; Montanari 1980, 544.

²⁸ E.g., Di Capua 1681, 588–634; Valletta 1975 [1691–1697], 28; Montanari 1971, 197; Montanari 1980, 549.

²⁹ Marsili asks, rhetorically: ‘who can be a philosopher without beginning from the senses and progressing on their basis [*sensatamente*]?’ (Marsili 1671, 312, as translated in Piaia 2010, 4). See also Vallisneri’s (1700, 115–117) praise of the senses.

³⁰ Montanari (1667, 5–6) writes that ‘experience alone’ has ‘the privilege of being a teacher’ in natural philosophy. According to Baglivi, the progress of ‘the good arts’ in the seventeenth century ‘is entirely due to the senses and experience’ (Baglivi 1696, Part II, Ch. 2, Sect. 1).

³¹ Marsili 1683, 24; see Guglielmini 1719 [1688], 73; Malpighi 1980 [1698], 1135. Italian authors do not associate such a natural history to the works of traditional natural historians like Ulisse Aldovrandi, but to those ‘English scholars who followed Bacon’s teachings’ (Malpighi 1980 [1698], 1135).

³² Numerous early modern authors of natural histories presented their works as fostering devotion and shedding light on God’s benevolence and providence. They drew theological implications from the order of nature and the purposeful organization of living beings. See Ogilvie 2005. The Italian natural historians who were influenced by experimental philosophy, like Francesco Redi and his disciples, did not develop those theological themes.

³³ A potential third exception might be Fraticelli 1693, a manuscript discourse by a little-known member of a minor academy which I could not access. According to the website of the Accademia dei Fisiocritici, this discourse states that experimental philosophy leads to knowledge of God. See <http://www.fisiocritici.it/archivio-storico/19-fisiocritici/201-composizioni-dottrinali-volume-i>, archived at <https://archive.is/1DIWP>.

³⁴ The first major attack took place in Pisa in 1669–1670, when the Aristotelians managed to limit the teaching of natural philosophy and medicine to commentary on Aristotle’s and Galen’s texts. See Galluzzi 1974, 1995. The second major attack was the so-called trial against the atomists (i.e. corpuscularists) that was held in Naples from 1688 to 1697. See Osbat 1975. A reply to the Pisan Aristotelians is Marchetti 1670. The seventeenth-century replies by Neapolitan *novatores* are Anon. 1995b, Ceva Grimaldi 1695, Grimaldi 1699, Torrini 1979a and Valletta 1975 [1691–1697]. Three relevant manuscripts that I could not access are two letters by Francesco D’Andrea (1695–1697, 1697–1698), summarized in Comparato 1970, 219–224, and a manuscript on the Eucharist by Donato Rossetti (1673), summarized in Gómez López 2011, 231–232n32.

³⁵ Elsewhere, too, Di Capua condemns those views of the ancients that he takes to be impious. See Di Capua 1791, 588–589 on Aristotle, 638 on Zeno of Citium, 645 on Epicurus and Democritus.

³⁶ Buonanni 1681, 20, 24; 1691a, 2, 3. For less explicit statements, see Buonanni 1691b, 6, 7.

³⁷ Buonanni 1681, 6; 1691a, 2–3, 6. Buonanni 1691b, 19–23, discusses arguments based on the Bible for and against spontaneous generation.

³⁸ Rome: Hercules, 1696; Lyon: Anisson and Posuel, 1699; Munich: Haring, 1700 and 1704.

³⁹ Baglivi’s reference is to Bacon’s *Novum organum*, OFB 11: 100–102.

⁴⁰ See Baglivi 1715 [1702], 247.

⁴¹ Baglivi 1696, Part I, Ch. 6, Sect. 2.

⁴² Baglivi 1715 [1702], 320.

⁴³ They are an empirical argument and a historical argument. See Baglivi 1696, Part I, Ch. 2, Sect. 7; Part II, Ch. 5, Sect. 1.

⁴⁴ By contrast, ‘virtually no English natural philosopher – even of the many who accepted corpuscularism – believed themselves to be a successor of Epicurus’ (Levitin 2015, 24).

⁴⁵ Valletta 1975 [1691–1697], 13.

⁴⁶ D’Andrea 1995 [1685], 72, 82.

⁴⁷ The Platonism of the Church Fathers was often mentioned in support of this view (Anon. 1995a, 132; Anon. 1995b, 114–115; Marchetti 1670, 1339). Sometimes, Aristotle’s doctrines were rejected as impious; see Ceva Grimaldi 1695. Other times, Aristotle was portrayed somewhat favourably and pitted against his disciples, e.g., in Marsili 1671.

⁴⁸ E.g., Marsili 1671, 301, 306–307.

⁴⁹ E.g., Valletta 1975 [1691–1697].

⁵⁰ This is noted in Leijenhorst and Lüthy 2002, 396.

⁵¹ Torrini 1979b, 22.

⁵² Borrelli 1995a, 23.

⁵³ Lotti (2004, 78) has noted this.

⁵⁴ A potential exception is a letter of Alessandro Marchetti to an unknown correspondent, which I could not access. It is dated 15 April 1687 and transcribed in Galluzzi's unpublished thesis (Galluzzi 1968–1969, 2: lxx–lxxiii). Marchetti was a teacher of natural philosophy in Pisa and a translator of Lucretius. He did not discuss transubstantiation in his manuscript defense of the new philosophy against the Aristotelians (Marchetti 1670). Another potentially interesting document which I could not access is an undated letter of Lorenzo Magalotti to Francesco Frosini, bishop of Pisa, on transubstantiation (Biblioteca Universitaria di Pisa, MS 988). Magalotti participated in the meetings of the Accademia del Cimento. However, he firmly committed neither to experimental philosophy nor to any other natural philosophical system, as he noted in a letter of 1681 (Magalotti 1719, 117). In avoiding the topic of transubstantiation, Italian experimentalists were following their hero, Galileo, who never addressed it. Both Descartes (*Objections and Replies*, CSM 2:173–178) and Gassendi (1658, 636–638), who were held in high esteem by the Neapolitan *novatores*, discussed transubstantiation. Among the corpuscularists who did not endorse experimental philosophy, a little-known author, Andrea Pissini (1675, 368–493), defended at some length the compatibility of corpuscularism with transubstantiation.

⁵⁵ According to Costantino Grimaldi (1699, 194), an apologist of the new philosophy, the same applies to all mysteries of faith. Although we can believe them, our reason cannot comprehend them. This is due to the disproportion between our 'limited, extremely narrow capacities and the sublime truths of faith' (136).

⁵⁶ Donato Rossetti, a corpuscularist who did not adopt the methods of experimental philosophy, made similar statements. Although he promised to explain the real presence of Christ in the Eucharist (Rossetti 1671, 'Al lettore'), the manuscript in which he addressed this problem (Rossetti 1673) states merely that it is mysterious, incomprehensible, ineffable, contrary to the ordinary course of nature, and it should not be discussed 'among physical questions' (Gómez López 2011, 231–232n32). An anonymous manuscript by an author who was partial to both experimental philosophy and corpuscularism, perhaps Francesco d'Andrea, merely lists a series of authors who discuss this issue and states that one ought not give much weight to objections concerning the Eucharist. The author compares this issue to the disputes on *scientia media*, on which the Pope had not made any official pronouncement (Anon. 1995a, 139–140).

⁵⁷ This attention to disciplinary boundaries contrasts with what, in the eyes of the new philosophers, was a capital sin of the Peripatetics: trespassing those boundaries by 'mistaking physics with metaphysics' (Marsili 1671, 312), employing the 'sooty abstractions of metaphysicians' (Scilla 2007 [1670], 11) within physics and 'subjecting everything to metaphysical sublimation' (Bartoli 1980 [1677], 1196; see Tremigliozzi 1700, 244).

⁵⁸ Unlike Redi and Marsili, Giovanni Battista Fraticelli (1692, 6) drew a parallel, rather than a contrast, between epistemic attitudes within religion and natural philosophy. He did so in a discourse on the analogies between the Accademia dei Fisiocritici and the life of its patron saint, Justin. As the Fisiocritici reject authority and seek truth in experience, so did Justin reject the authority of his teachers and sought the truth in the Bible. Taking Fraticelli to imply that Christians should reject authority and rely *sola scriptura* might be reading too much into the text. If Fraticelli, himself a churchman, meant to imply this, the implication went unnoticed by the Church authorities who granted the *imprimatur* (14).

⁵⁹ On the reliance of natural philosophy on probable truths, see e.g. Valletta 1975 [1691–1697], 99–100.

⁶⁰ See, e.g., Guglielmini 1719 [1688], 74; Baglivi 1696, Praefatio, sig. A3v.

⁶¹ As Grimaldi (1699, 123) puts it, attempting to enter the 'cabinets of Heaven through the work of human reason' is 'foolish audacity'.

⁶² See also Boyle's *Christian Virtuoso*, B 11: 295, 304.

⁶³ Two generations earlier, Galileo drew a similar separation when he claimed that the only truths of which the Bible aims to persuade humans are those that 'surpass all human reason'. See his letter to Benedetto Castelli of 21 December 1613, in Galilei 1890–1909, 5:284, trans. in Galilei 2008, 106. Galileo intended this letter to be circulated widely, as Ardissino (2011, 83) notes.

⁶⁴ Scilla 2007 [1670], 39. Scilla professes belief in the biblical flood at pp. 29, 32.

⁶⁵ He only notes that there are diverging opinions on that question (Scilla 2007 [1670], 29).

⁶⁶ Scilla 2007 [1670], 11, 19, 29.

⁶⁷ See Romano 2014, 647.

⁶⁸ See above, n. 20.

⁶⁹ In his analysis of the replies to Giovanni Battista Riccioli's anti-Copernican argument, Paolo Galluzzi (1977, 104) has highlighted 'the mood of fear and caution' of those who 'participated in the debate or followed its development'. They were especially afraid of being accused of violating the anti-Copernican decree of 1616.

⁷⁰ MS Galil. 278, fols 121r–v, as quoted in Galluzzi 1977, 123.

⁷¹ See Vasoli 1979. However, there were significant differences in the freedom of expression of researchers, depending on which State they lived in and whether they enjoyed the protection of the authorities. See Galluzzi 1977, 140–141.

⁷² See Gazola 1716. The frontispiece states that the work was published in Prague. This is likely a false place of publication, used to mask the fact that the work was published in Italy without an *imprimatur*.

⁷³ Guglielmini 1719b. One might perhaps regard Magalotti's *Letters*, which discuss religious themes (e.g., Magalotti 1719, 122–133), as a counterexample to my claim. However, Magalotti was an amateur natural philosopher, he did not firmly commit to any natural philosophical system (see above, n. 54) and he wrote the *Letters* decades after his

involvement in the Cimento Academy. He was never involved in natural philosophical research afterwards.

⁷⁴ For instance, in his work on the origin of fossils, Agostino Scilla (2007 [1670], 46) professed to eschew any subject ‘which the senses cannot easily focus on and examine’.

⁷⁵ For instance, although the Medici had not been officially reprimanded for their support of Galileo, they were keen to avoid any other *faux pas* and potential conflict with the Church. As a consequence, the *Saggi* of the Cimento did not contain any theoretical and astronomical discussions and the Medici refrained from supporting the *novatores* in the dispute on the teaching of the new philosophy at the University of Pisa.

⁷⁶ See Cavazza 1990, 50, 144–145.