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## **The Bible, Protestantism and the Rise of Natural Science: A Response to Harrison's Thesis**

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*Harrison has proposed that the rise of modern science required as its most important condition the decline of religious nature symbolism (allegory) across early modern Western culture because it diverted attention away from nature to God. He identifies the main cause of this decline as the rejection of religious nature symbolism by the Protestant reformers. They rejected symbolic interpretation of Scripture texts because it made the meaning of the text indeterminate. We offer six reasons for doubting the proposed role of the Protestant Reformation and suggest other possible causes for the rise of modern science. There is another reading of Harrison's thesis. For Harrison the rejection of symbolism in Scripture interpretation removes a veil from nature and its particular order the exploration of which still requires other causes. According to what we call the analogy thesis the rejection of religious nature symbolism removed a source of ambiguity and led to the use of precision in the language of biblical scholarship. By analogy of the two books this actively encouraged precise unequivocal language and attention to empirical detail in the study of nature. We argue that disagreements over Scripture interpretation render this thesis implausible as well.*

**Keywords:** nature, allegory, symbolism, Middle Ages, interpretation of Scripture, natural science, ambiguity, Protestant Reformation, natural philosophy, Jesuit science

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### **Introduction**

In his book *The Bible, Protestantism and the Rise of Natural Science* Harrison has proposed that during the Middle Ages and the Early Modern Period symbolic, that is, allegorical approaches to nature<sup>1</sup> diverted attention from nature

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1 Harrison refers to the rejection of nature symbolism as the rejection of allegory. By this he does not mean a literary allegory which is a category in the language of words also referred to as verbal allegory or figure of speech. In a literary allegory a word refers to an imaginary thing, event or person – it is part of the literal sense. For instance, the Song of Songs taken as a literary allegory is about an imaginary human couple symbolising the relationship between Christ and the church. But the allegorical interpretation of Scripture Harrison is referring to is to do with factual allegory. This is a category in the language of things belonging in the symbolic view of the world. In a factual allegory a real corporeal thing, event or person refers to or symbolises another thing either concrete or abstract, either secular or spiritual. For instance, the Song of Songs taken as a factual allegory would be about a real couple such as king Solomon and his favourite wife symbolising Christ and the church. Nature symbolism is factual allegory applied to nature.

for its own sake to nature as a source of knowledge of God, that this was one of the main obstacles to the development of what we now call the natural sciences, that such symbolic approaches declined across European society after the Protestant Reformation, and that this decline was the result of a rejection of symbolism by the Protestant Reformers. According to Harrison, Protestant ways of reading Scripture brought down the medieval allegorical, that is, symbolic view of nature, making room for the causal-mechanical world-concepts of the seventeenth century and the rise of modern science.<sup>2</sup> The Protestants presented themselves polemically as rejecting allegory and as practising their own exegetical style as distinct from their Roman colleagues and their medieval predecessors.<sup>3</sup> In this paper we question the proposed role of Scripture interpretation in the rise of science, by which Harrison means natural philosophy (astronomy and physics) and natural history (the study of plants and animals).<sup>4</sup> We first introduce Harrison's argument, then offer six reasons to doubt the role of the Protestant Reformation and conclude with a discussion of an alternate reading of Harrison's thesis.

### Harrison's hypothesis

To explain Harrison's argument we offer a brief description of nature symbolism. The symbolic mode of thought had been familiar to ancient Christianity because it was found in the Scriptures as well as outside of them. In the symbolic mode of thought two things, events or persons are linked because they share essential properties: Jerusalem on earth symbolises the heavenly Jerusalem because they share the property of being the kingdom of God. Likewise, the Lamb symbolises the Christ – they have sacrifice as a common property (Isa. 53:7; Jn 1:36). Biblical symbols were absorbed in the analogy of being of the Neoplatonism of ancient and early medieval Christianity. As a result, a word in Scripture can refer unequivocally to a material object (literal sense). But from a Neoplatonic symbolic perspective an object in Scripture refers to another object which may represent a spiritual or a non-spiritual reality (allegorical or symbolic sense). Thus a word in Scripture had at least two meanings – a literal meaning as well as an allegorical or spiritual one. The Church Fathers distinguished several different kinds of spiritual meaning in the text of Scripture corresponding to different kinds of spiritual realities. This eventu-

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2 Harrison, P. *The Bible, Protestantism, and the Rise of Natural Science*, Cambridge: Cambridge University Press (1998), pp. 28-29, 31-32, 41-43, 92, 110-111, 114-115.

3 Greene-McCreight, K.E. *Ad Litteram: How Augustine, Calvin and Barth Read the 'Plain Sense' of Genesis 1-3*, New York: Peter Lang (1999), p. 98; see also Thompson, J. L. 'Calvin's exegetical legacy: his reception and transmission of text and tradition', in Foxgrover, D. (ed.) *The Legacy of John Calvin*. Grand Rapids, MI: CRC Product Services (2000), pp. 31-53, p. 35; Blacketer, R. A. 'Smooth stones, teachable hearts: Calvin's allegorical interpretation of Deuteronomy 10: 1-2', *Calvin Theological Journal* (1999) 34: 36-63, see p. 40.

4 Harrison *op. cit.*, (2), pp. 4, 53.

ally resulted in the so-called *quadriga*, the principle that each word or text in Scripture has a fourfold meaning: the literal sense and three spiritual senses.

	What you believe in	allegorical = symbolical meaning: Christ, church
Jerusalem (spiritual reality)	What you hope for	anagogical meaning: kingdom of God
-	What you ought to do	tropological, moral meaning: justice
Jerusalem (historical, material city)		literal-historical meaning literal-natural meaning
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Jerusalem (word)		

**FIGURE ONE: MEDIEVAL FOURFOLD SENSE OF SCRIPTURE (QUADRIGA)**

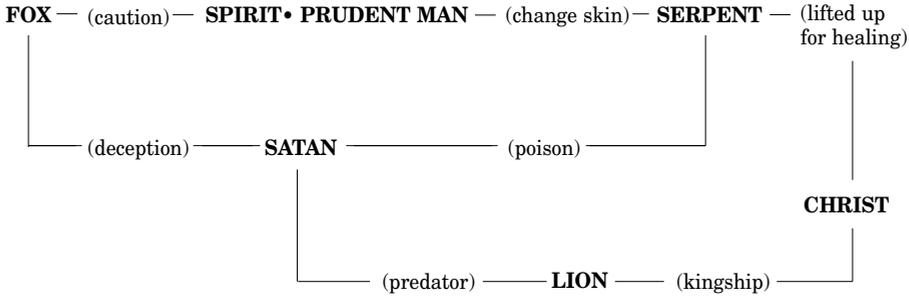
*The word Jerusalem is understood literally as the city of the Jews (literal-historical sense). Spiritually, Jerusalem is understood as the church of Christ (allegorical sense), as the heavenly city (anagogical sense), and as the individual soul (tropological sense). The four senses apply to both Scripture and nature because Scripture as well as nature is interpreted in terms of vertical similitudes between material and spiritual realities.*

For instance, the literal sense of the word Jerusalem refers to what exists in nature and history: the city of the Jews. The spiritual sense refers to three spiritual realities: what you believe in – Jerusalem as a symbol of the church (allegorical sense), what you hope for – Jerusalem as a symbol of the kingdom of God (anagogical sense), and what you ought to do – Jerusalem as a city where justice is found (tropological or moral sense).<sup>5</sup> The four senses apply to both Scripture and nature because Scripture as well as nature is interpreted in terms of vertical similitudes between material and spiritual realities. As will become obvious, the analogy of being in turn inspired speculation. Not only did it accommodate pre-Christian symbols such as the phoenix symbolising the risen Christ, but it also inspired the imaginative production of a host of symbolisms not found in Scripture.

To the vertical Neoplatonic symbolisms were added horizontal ones with the discovery of Aristotle. The result was a network of symbolic relations.

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<sup>5</sup> Since each of the three non-literal senses is concerned with the spiritual meaning of things a simple distinction between literal and spiritual sense is frequently used in the literature and we will follow this usage as much as possible.



**FIGURE TWO: NETWORK OF SYMBOLIC RELATIONS**

*Words in parentheses refer to the essential attribute shared by the connected entities.*

People believed that things in nature and culture, as well as events and persons, exist in a web of symbolic relations. For instance, the fox symbolises the spiritually prudent man because they share the property of caution. The prudent man in turn is symbolised by the serpent in that both purify themselves by fasting before replacing their old ‘skin’ with a new one – a symbolic reference to the biblical symbol of changing clothes that represents conversion to Christianity. But the serpent also symbolises Satan because they attack and harm sinners. Satan in turn is symbolised by the fox because both excel in deception. The serpent, however, also symbolises the Christ for ‘as Moses lifted up the serpent in the wilderness, so must the Son of man be lifted up, that whoever believes in him may have eternal life’ (Jn 3: 14-15, Num. 21: 9, RSV). Finally, the Christ is symbolised by the lion because they share the property of kingship. But the lion also symbolises Satan because both are predators. In this way a network of meaning relations was woven. A word referred to a single thing, Harrison points out, but the latter referred to many other things thereby giving multiple meanings to the word and rendering its meaning indeterminate.<sup>6</sup>

Harrison’s argument begins with two observations about the symbolic world-view of the Middle Ages. First, in the earlier Platonic version of this view all things created point to the Creator. Harrison sees this as an obstacle on the way to modern science presumably because it diverts attention away from nature.<sup>7</sup> This turns the decline of nature symbolism into an important condi-

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6 Other examples of animal and plant symbolism and polysemy in Crowther-Heyck, K. ‘Wonderful secrets of nature: natural knowledge and religious piety in reformation Germany’, *Isis* (2003) 94, 253-273; on ambiguity: Harrison *op. cit.*, (2), pp. 4, 28, 111, 113; Chenu, M.-D. *Nature, Man, and Society in the Twelfth Century: Essays on New Theological Perspectives in the Latin West*, Taylor, J. & Little, L.K. (trans. & eds.) Chicago: The University of Chicago Press (1968), p. 136.

7 Harrison *op. cit.*, (2), pp. 31, 32.

tion for the development of science. Secondly, in the later Aristotelian transformation of the Platonic view, all things also point to each other in a horizontal network of meaning relations between things.<sup>8</sup> Thus, while a word refers unambiguously to a thing, the meaning of the word is rendered indeterminate by all the other objects to which the thing refers. Harrison writes,

Multiple meanings emerge from allegorical readings of texts because the things to which the words literally refer have themselves further multiple references...The multiplicity of meanings which arises out of allegorical readings is thus a function of the reader's view of the nature of objects.<sup>9</sup>

The Protestant reformers were not the first to face the problem of indeterminacy of meaning of texts. What was new about them, according to Harrison, is that they addressed it by rejecting allegorical interpretation, that is by rejecting the symbolism of things, events and persons.<sup>10</sup> A decline in nature symbolism across European society followed as a result. The loss of the religious symbolism of nature made it possible for natural philosophers and natural historians to focus on nature for its own sake rather than for the sake of knowing God. This made room for a different conception of the order of nature in which things were related causally and mechanically – relations that could be described logically and mathematically.<sup>11</sup>

The rejection of nature symbolism by the Protestant reformers was a side effect of their emphasis on literal interpretation of Scripture.<sup>12</sup> This literal meaning, Harrison indicates, was the quadrigal literal sense: 'the principle adopted by the reformers – that only the literal sense of Scripture was of use in matters of theological disputation – had been a long-standing rule in the Roman Church'.<sup>13</sup> We would refer to this as the literal-historical or the literal-natural sense of a text. He also makes the weaker claim that the Protestant reformers pursued determinacy of meaning primarily though not exclusively by means of literal interpretation.<sup>14</sup> This implies that non-literal meanings – Harrison mentions parables – were sometimes accepted provided they were determinate. Harrison proposes that the rejection of allegorical interpretation of Scripture that underwrites both the strong and the weak claims is the most important condition for the rise of modern science.<sup>15</sup> In what follows we offer six reasons for doubting the proposed role of the Protestant Reformation.

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8 *ibid.*, pp. 41-42, 43.

9 Harrison *op. cit.*, (2), pp. 28-29, 114; see also pp. 4, 113, 123; Chenu *op. cit.*, (6), p. 136.

10 Harrison *op. cit.*, (2), pp. 110-111.

11 *ibid.*, pp. 4, 53, 114-115.

12 *ibid.*, pp. 5-8, 107, 113, 266 (assessed as most important), 113, 114, 116-117, 122, 205, 208 (pursuing literal meaning), 122, 129, 185 (rejecting allegory).

13 *ibid.*, pp. 110-111.

14 *ibid.*, pp. 111, 113.

15 *ibid.*, pp. 5-8, 107, 113, 266.

## The role of the Protestant Reformation

### ***If symbolism was not the problem for Protestant Scripture interpreters, what was?***

According to Harrison indeterminacy of meaning of Scripture texts (textual ambiguity) is due to the ambiguity of the symbols used in the text and this was the problem faced by the Protestant reformers. Symbols are ambiguous by nature.<sup>16</sup> And symbolism was universal in medieval society. Harrison infers that symbols are the dominant source of textual ambiguity for the Protestant reformers. The problem with this argument is that there are other sources of ambiguity of Scripture texts such as speculation and linguistic ambiguity. Thus from the occurrence of ambiguity one cannot infer that symbolism is the problem. Moreover, the network of symbols is ambiguous only when considered out of context. We show that in fact the textual ambiguity addressed by the Protestant reformers was not due to the symbolism of things, events and persons in the religious contexts in which it functioned, and that they did not reject allegorical interpretation provided the underlying symbolism was divinely authorised.

During the Middle Ages everyone heard sermons preached by clerics who used symbols. The ship as symbol of the church was common in sermons from the eleventh to the fourteenth century.<sup>17</sup> Likewise, the castle as symbol of the church was frequently encountered from the eleventh to the fifteenth century.<sup>18</sup> Their meaning was so familiar that it needed no explanation. Despite their inherent ambiguity these symbols had unequivocal meaning stable through time because it was fixed by sermon manuals that compiled symbols and their meanings.<sup>19</sup> This also applies to works in the tradition of the so-called *Physiologus* and the bestiaries<sup>20</sup> which were used in monasteries and cathedral schools to teach preachers.<sup>21</sup> Some animals have a single meaning. The phoenix, for instance, is a symbol of the death and resurrection of Christ.<sup>22</sup> The meaning of other animals such as the lion and the serpent has been considered ambiguous because each has several meanings described. But in all the edi-

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16 Chenu *op. cit.*, (6), pp. 118, 136.

17 Owst, G. R. *Literature and Pulpit in Medieval England: a Neglected Chapter in the History of English Letters and of the English People*, 2nd edn, Oxford: Basil Blackwell (1961), pp. 68-70.

18 Owst *op. cit.*, (17), pp. 77-85.

19 For a sixteenth-century example, see the stork: Crowther-Heyck *op. cit.*, (6), pp. 266-267.

20 For an introduction to the *Physiologus* and the bestiaries see: Baxter, R. *Bestiaries and their Users in the Middle Ages*, London: Sutton Publishing (1998); Harrison *op. cit.*, (2), pp. 23-26, 67-68; Harrison, P., 'The Bible and the emergence of modern science', *Science & Christian Belief* (2006) 18, 115-132.

21 White, B. 'Medieval animal lore', *Anglia* (1954) 72, 21-30, see p. 26; Owst *op. cit.*, (17), pp. 188, 197-204; Clark, W. B., McMunn, M. T. (eds.) *Beasts and Birds of the Middle Ages: The Bestiary and its Legacy*, Philadelphia: University of Pennsylvania Press (1989), pp. 3, 6; Baxter *op. cit.*, (20), pp. 62, 188, 190, 209.

tions of the *Physiologus* and the bestiaries the meaning of each of the more than ten animals symbolising the Christ is explained, often in a section designated for that purpose and entitled *Significacio*.<sup>23</sup> To perceive any ambiguity resulting from changing links between symbol and meaning one would have had to compare different editions of the *Physiologus* and the bestiaries. This would have required travel or access to a library containing several editions as well as a scholarly motive for comparing animal symbolism. Such a motive may have existed in the scholastic context of the universities, but would have been unlikely to arise in a monastic one. Read from the contemplative perspective of the monastics for the purpose of religious edification, the spiritual meaning of symbols was fixed. We conclude that symbolic ambiguity was not the problem addressed by the Protestant reformers. Thus, they did not need to reject symbolism. Indeed they incorporated symbolism into their understanding of the literal sense of Scripture.

### **Late medieval transformation of the literal sense of Scripture**

The medieval practice of fourfold exegesis underwent a revaluation that was more complex than a rejection of all but the literal-historical meaning of texts. Religious reformers before, during and after the Protestant Reformation shared a desire to understand divine truth and eliminate arbitrariness from the interpretation of Scripture. This passion drove the gradual recovery of the importance of the intentions of the divine author. There was a move from reader-oriented interpretation which was seen as a source of speculation to author-oriented interpretation which was restrained by a desire to understand authorial intent. We note three consequences. Firstly, allegorical interpretation of texts in which the symbolism is imposed by the reader was slowly replaced with interpretation of allegorical texts in which the symbolism originates with the divine author. This reduced the overall frequency of allegorical interpretation provided the intentions of the author could be established. Secondly, the focus on the divine author also meant that the symbolic meaning of things was respected if it was intended by God. Only unauthorised symbolism was rejected. This is compatible with Harrison's weaker claim that determinacy of meaning was the goal of the Protestant reformers. But we note that this goal did not require the rejection of authorised symbolism. Harrison misses this point because he does not develop the role of authorial intent.<sup>24</sup> Thirdly, while literal meaning became more prominent its boundaries moved. What had been regarded as the spiritual sense was gradually subsumed under a new literal

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22 Mermier, G. R. 'The Phoenix: its nature and its place in the tradition of the *Physiologus*', in Clark, W. B., McMunn, M. T. (eds.) *Beasts and Birds of the Middle Ages: The Bestiary and Its Legacy*, Philadelphia: University of Pennsylvania Press (1989), pp. 69-85.

23 For instance, Armistead, M. A. *The Middle English Physiologus: A Critical Translation and Commentary*. MA thesis, Virginian Polytechnic Institute and University, Blacksburg, VA (2001).

24 Harrison *op. cit.*, (2), pp. 113-114.

sense.<sup>25</sup> For instance, Andrew of St Victor (c.1110-1175) applies Nathan's prophecy about the future of the house of David to the reign of his son Solomon.<sup>26</sup> But Nicholas of Lyra (c.1270-1349) extends this application of Nathan's prophecy to the Christ. Lyra explains that 'if we understand the prophetic meaning as something intended by the speaker himself, then the meaning belongs to the literal sense'. The literal meaning of the text now includes the spiritual meaning which is constituted by the symbolic reference of Solomon to the Christ. A similar distinction between two literal meanings was developed by the Spanish bishop Paul of Burgos (c.1351-1435). The gradual absorption of spiritual meanings within a new single literal meaning parallels the return to authorial intent and may be seen as its effect. The Protestant reformers completed this development by subsuming the three spiritual meanings of the medieval *quadriga* under the new literal meaning. Thus, historically the strong claim that the allegorical sense was rejected by the Protestant reformers and only the literal meaning of the *quadriga* retained is incorrect.<sup>27</sup> Rather, divinely sanctioned symbolism became part of the literal sense. The Protestant reformers could not have rejected allegory because this would have entailed the rejection of all symbolic relations and anthropomorphic descriptions of God in Scripture, without which Christian theology could not exist. But they did reject reader-imposed allegorical interpretation. The reason for this was expressed by the Geneva-born biblical scholar Jean Le Clerc (1657-1736): 'Allegory... wholly depends upon the Fancy of the Interpreter.'<sup>28</sup> Finally, considering that the new literal sense gained profile before the Protestant Reformation, its effect cannot be exclusive for the Protestant Reformation.

### **Fifteenth-century globalisation and its consequences**

There are reasons unrelated to Protestant Scripture interpretation confirming

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25 Whitman, J. 'Present perspectives: antiquity to the late Middle Ages', p. 56, in Whitman, J. (ed.), *Interpretation and Allegory: Antiquity to the Modern Period*, Boston: Brill (2000), pp.33-57 with additional references; Steinmetz, D.C. 'Luther and the ascent of Jacob's ladder', p. 148, in Steinmetz, D. C. *Luther in Context*, 2nd edn, Grand Rapids: Baker Academic (2002), pp. 143-155. Steinmetz, D. C. 'Luther and Calvin on the banks of the Jabbok', in Steinmetz *Luther in Context*, pp. 156-167; Goering, J. 'An introduction to medieval Christian biblical interpretation', in McAuliffe, J. D., Walfish, B. D. & Goering, J. W. (eds.) *With Reverence for the Word: Medieval Scriptural Exegesis in Judaism, Christianity, and Islam*, New York: Oxford University Press (2003), p. 200; van der Meer, J. M., Oosterhoff, R. 'God, Scripture and the Rise of Modern Science (1200 – 1700): notes in the margin of Harrison's hypothesis,' in van der Meer, J. M., Mandelbrote, S. H. (eds.) *Interpreting Nature and Scripture in the Abrahamic Religions: History of a Dialogue*, Leiden: Brill (2008).

26 For the prophecy see 1 Chron.17: 11-14 and 2 Sam. 7: 12-16.

27 Steinmetz, D.C. 'Divided by a common past: the reshaping of the Christian exegetical tradition in the sixteenth century', *Journal of Medieval and Early Modern Studies* (1997) 27, 245- 264; Steinmetz 'Luther and the ascent of Jacob's ladder', *op. cit.*, (25), pp. 143-155; Steinmetz 'Luther and Calvin on the banks of the Jabbok', *op. cit.*, (25), pp. 156-167; Steinmetz, D. C. 'John Calvin as an interpreter of the Bible', in McKim, D. K. (ed.) *Calvin and the Bible*, Cambridge: Cambridge University Press (2006), pp. 282-291, p. 285.

28 Le Clerc 1696, 143f., cited from Harrison *op. cit.*, (2), p. 109, n171.

that Protestantism was not a major force in the rise of modern science. Exploratory voyages undertaken before the Protestant Reformation during the late fifteenth and sixteenth centuries contributed to the promotion of astronomy and natural history by introducing new stars, plants and animals to Europe. Columbus launched his early voyages from Portugal in 1492 and 1493. He returned with descriptions of alligators, manatees, iguanas, macaws, and various rats. His later voyages of 1498 and 1502 produced reports of more unknown animals. Macaws and capuchin monkeys quickly became favourite pets in Europe. Eventually new animals from all continents flooded Europe as a result of expeditions in the first two decades of the sixteenth century. 'By mid-century a host of other native South American species were known. None of these animals existed in the Old World.'<sup>29</sup> As the late Professor Hooykaas pointed out, Francis Bacon recognised the value of these discoveries in redirecting attention from the authority of bookish knowledge to nature itself. Hooykaas as well as Harrison also emphasised that there were more requirements to be fulfilled for the development of science.<sup>30</sup> Nevertheless we may conclude that modern science could start without the help of the Protestant Reformation because the expeditions predated the Protestant Reformation or happened so soon after that their effects on natural history could not be attributed to Protestant influence.<sup>31</sup>

### ***Ecclesiastical suppression and the rise of science***

The notion that the development of science was suppressed in Roman as opposed to Protestant territory has also been used to suggest that the Protestant Reformation was responsible for the rise of modern science. One reason for suppression is seen in the decision of the Council of Trent to maintain the medieval fourfold sense of Scripture and thus also the symbolism that Harrison holds responsible for blocking science in Roman countries. This suppression is seen as compounded by the enforcement of theological orthodoxy and of the authority of Scripture and tradition in those countries.<sup>32</sup> While we cannot trace the effects of these three influences separately, the facts do not support a correlation between Roman Catholicism and a suppression of science.

Portugal was a country unaffected by the Protestant Reformation. Nevertheless, the encouragement science had received from global explorations

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29 Young, D. A. *The Biblical Flood: A Case Study of the Church's Response to Extrabiblical Evidence*, Grand Rapids: Eerdmans / Carlisle: The Paternoster Press (1995), pp. 36-38.

30 Bacon, F. *Instauratio Magna*, praef., in Spedding, J., Ellis, R. L. & Heath, D. D. (eds.) *The Works of Francis Bacon*, London (1857-1874), vol. 1, p. 133 cited in Hooykaas, R. 'The Portuguese discoveries and the rise of modern science', *Boletim da Academia Internacional da Cultura Portuguesa*, (1966) 2, 88-107, reprinted in Hooykaas, R. *Selected Studies in History of Science: Acta Universitatis Conimbrigenis*, University of Coimbra (1983), pp. 579-598; Harrison *op. cit.*, (2), p. 8.

31 Hooykaas *op. cit.*, (30).

32 Harrison *op. cit.*, (2), pp. 111-113.

before the Protestant Reformation continued afterwards. Further, as Ashworth has shown, when unhindered by institutional concerns the Roman Catholic faith allowed for a great deal of leeway in natural philosophy. There were side effects of the reaction against the Protestant Reformation. The institutional apparatus of the Counter-Reformation was intended to enforce theological orthodoxy, but it was extended to enforce a wide range of ecclesiastical opinion on matters in natural philosophy including, but not limited to Copernicanism.<sup>33</sup> The enforcement of theological orthodoxy was patchy. This does not justify the generalisation that science suffered irretrievable damage under Roman Catholic institutions.

The Society of Jesus is one institution with a positive effect. Jesuits in Protestant and Roman Catholic countries contributed to both mathematics and science.<sup>34</sup> For instance, in the seventeenth century the Aristotelian idea of the universal experience was the unquestioned standard of empirical adequacy. The question was how reports of singular events could be integrated into philosophical practice in the study of nature if they had no philosophical standing. Jesuit mathematical scientists introduced the novelty of historical reports of specific, usually contrived, experiences. These reports gave the writer the competence to speak and to be trusted in making universal claims based on single events. It is morally much harder to disagree with a specific experienced factual claim than to question a piece of reasoning. While this approach was intended to legitimise interpretations of nature, it was perceived as odd because events had never been able, by their nature, to suffice as guarantors of universal propositions – as Spinoza pointed out to Boyle. Following the Jesuit Clavius, Newton addressed this problem by merging the universality of mathematical knowledge with physics. He did this by arguing that mechanical movement underlies the construction of geometrical shapes. He could claim, for instance, that if you know the properties of one triangle you have certain and universal knowledge of all triangles. The universality of mechanics as a science then follows from the fact that a triangle can always be drawn by mechanical means. This allowed Newton to justify the universality of mechanics with that of mathematics. The new approach was adopted by the Royal Society. ‘The importance of the arguments [of the Jesuits to defend Aristotelian science] lies in the enormous role of Jesuit scholarship in the mixed mathematical sciences

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33 Young *op. cit.*, (29), pp. 36-38; Ashworth W. B., Jr. ‘Catholicism and early modern science’, in Lindberg, D. C., Numbers, R. L. (eds.) *God and Nature: Historical Essays on the Encounter between Christianity and Science*, Berkeley: University of California Press (1986), pp. 136-166; Blackwell, R. J. *Galileo, Bellarmine, and the Bible*, Notre Dame: University of Notre Dame Press (1991), pp. 135-164; Shea, W. R. ‘Galileo and the church’, in Lindberg and Numbers *op. cit.*, (33), pp. 114-135.

34 See for instance: Dear, P. *Discipline and Experience: The Mathematical Way in the Scientific Revolution*, Chicago: University of Chicago Press (1995); Feingold, M. (ed.) *Jesuit Science and the Republic of Letters*, Cambridge, MA: The MIT Press (2003); Hellyer, M. *Catholic Physics: Jesuit Natural Philosophy in Early Modern Germany*, Notre Dame, IN: University of Notre Dame Press (2005); Rimmert, V. ‘“Our mathematicians have learned and verified this”: Jesuits, biblical exegesis and the mathematical sciences in the late sixteenth and early seventeenth centuries’, in van der Meer and Mandelbrote, *op. cit.*, (25).

through this period; even non-Catholics, as well as Catholics who had not been trained in the Jesuits' extensive educational system, studied Jesuit philosophical writings as the most accomplished and up-to-date available.<sup>35</sup>

In the mid seventeenth century, religious suppression and experimentation were two opposing influences on the rise of modern science, and they were found on either side of the great divide. Protestant theologians in the Dutch Republic and Roman Catholic theologians in Louvain and Paris tried to suppress Cartesianism, without success.<sup>36</sup> Experimentation was pursued by Roman Catholics such as Athanasius Kircher or Galileo as well as by the Protestants such as Newton. In hindsight there may have been differences in experimental style, but these were invisible at the time.<sup>37</sup> The problem for Harrison's thesis is that the Protestants tried to suppress the science that threatened their theology while the Catholics engaged in experimentation in theologically safe zones.

Finally, there is the aftermath of the Copernican debates and the alleged suppression of natural philosophy due to enforced theological orthodoxy under Roman Catholicism. But even in Spain religious suppression was only one among other influences that account for the seventeenth-century decline of natural philosophy. When the country emerges from scientific backwardness recovery is differentiated according to subject. In chemistry, medicine and biology no suppression is detectable. Physics and astronomy suffered suppression only when they engaged in issues which were perceived to have theological implications such as atomism, Copernicanism and non-Aristotelian physics.<sup>38</sup> As elsewhere this suppression may have applied only under specific conditions such as realism in astronomy. In sum, the rise of science under Roman Catholicism suggests that science could develop without the help of the Protestant Reformation.

### **Reception of the Protestant Reformation**

Yet, the Protestant Reformation may have promoted modern science. Disagreements over the interpretation of Scripture texts caused some natural philosophers to resort to nature as a less controversial source of the knowledge of God. First, the Protestant reformers failed to agree amongst themselves on the interpretation of Scripture texts concerning important theological issues.

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35 Dear *op. cit.*, (34) pp. 6-7, 219-220.

36 Ariew, R. 'Descartes and the Jesuits: doubt, novelty, and the Eucharist', in Feingold *op. cit.*, (34), pp. 157-194 pp. 161, 170-182.

37 Ariew, R. *op. cit.*, (36), pp. 157-194; Findlen, P. 'The Janus faces of science in the seventeenth century: Athanasius Kircher and Isaac Newton', in Osler, M. J. (ed.) *Rethinking the Scientific Revolution*, Cambridge: Cambridge University Press (2000), pp. 221-246.

38 Navarro, V. 'Tradition and scientific change in early modern Spain: the role of the Jesuits', in Feingold *op. cit.*, (34), pp. 331-387, pp. 331, 352-354.

They also could not reach consensus with the Roman Catholics while both could argue from the Fathers equally well. This was not surprising because there was no consensus among the patristic writers either. '[G]ood exegesis produced, as Catholic critics warned it might, competing theologies.'<sup>39</sup> In the fourteenth century, appeal to tradition often failed to determine authorial intent because the saints disagreed.<sup>40</sup> That is why in the sixteenth century Calvin used comparison of a text with other texts as well as with the larger context as strategies to establish authorial intent. While Calvin's strategies excluded extra-scriptural symbolisms from Scripture interpretation, they did not always eliminate multiple meanings within the confines of Scripture. For instance, the approach used by Augustine to justify an allegorical interpretation of the story of the burning bush produced competing readings in Lyra and again in Calvin.<sup>41</sup>

Protestants diverged between as well as within European nations and even within different national schools of thought. Europewide, there were the controversies about the Lord's Supper, notably among Luther, Calvin and Zwingli. Later, the central theme of the Protestant Reformation, namely the inability to bring about one's own spiritual salvation gave rise to the controversy between Remonstrants and Contra-Remonstrants. There were widespread attempts to restore the prelapsarian state.<sup>42</sup> Arminians and Socinians used the same basic scriptural principle as the Reformed Orthodox, but came to very different conclusions.<sup>43</sup>

Nationwide, British Protestants split into conformists and nonconformists over questions of how to govern the state after the English Civil War (1642-1649). In the Dutch Republic, leading Calvinists such as Gisbertus Voetius (1589-1676) and Balthasar Bekker (1634-1698) were divided over the Cartesian question in part because they assigned different roles to reason and revelation.<sup>44</sup> Disagreement about Copernicanism also depended in part on matters of Scripture interpretation. For instance, Philip Lansbergen (1561-1632), Gisbertus Voetius (1589-1676), Johannes Coccejus (1603-1669), Christopher Wittichius (1625-1687), Balthassar Bekker (1634-1698) and Bernhardinus de Moor (1709-1780) all accepted that some Scripture texts required a non-literal

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39 Steinmetz 'Divided by a common past...' *op. cit.*, (27), pp. 245-264; on interpretive disagreement within the Wittenberg reformation, see McGrath, A. E. *The Intellectual Origins of the European Reformation*, Oxford: Blackwell (1987), p. 166.

40 Minnis, A. J. "Authorial intention" and "literal sense" in the exegetical theories of Richard Fitzralph and John Wyclif: An essay in the medieval history of biblical hermeneutics', *Proceedings of the Royal Irish Academy* (1975) 75 (C1), 1-31, see p. 24.

41 Hansen, G. N. *John Calvin and the Non-literal Interpretation of Scripture*, Ph.D. dissertation, Princeton Theological Seminary (1998), pp. 238-248.

42 Harrison *op. cit.*, (2), p. 226.

43 Trueman C. R. 'Calvin and Calvinism', in McKim, D. K. (ed.) *The Cambridge Companion to John Calvin*. Cambridge: Cambridge University Press (2004), pp. 225- 244, see pp. 225, 230.

44 van Asselt, W. J., Pleizier, T. T. J., Rouwendal, P. L., Wisse, P. M. *Inleiding in de Gereformeerde Scholastiek*, Zoetermeer: Boekencentrum (1998), pp. 123-124.

interpretation because they were accommodated to a limited human understanding. Voetius would characterise a text as accommodated only on scriptural-theological grounds while the others also accepted this characterisation on scientific grounds. Accordingly, Voetius rejected Copernicanism because it contradicted Scripture. Other Calvinists accepted Copernicanism, but for different reasons. For instance, Philip Lansbergen and Bernhardinus de Moor argued Copernicanism could be true astronomically because the Bible presents things from the perspective of unreflected observation. Coccejus was open to non-literal interpretation because he acknowledged historical progression in divine revelation with its associated typological, that is, non-literal interpretation of texts in the Old Testament. Wittichius appealed to authorial intent – the Bible is a book of faith, not a source of science. Voetius did not have these options because to him the Word of God was timeless, universal and self-explanatory.<sup>45</sup> Thus disagreement on Scripture interpretation within Calvinism becomes intelligible in light of different views of the nature and authority of Scripture as well as about the scope of the principle of accommodation and the conditions under which it can be applied. Failure to reach agreement in the Germanic realm have been attributed to the hermeneutic of Melancthon. It features a factionalism that is associated with ‘any theory which presumes that “theologies” can be proved both biblical and true through logical devices, that there is not a deeper epistemic mystery in interpretation that calls for greater subservience to tradition and ancient consensus’.<sup>46</sup> This hermeneutic fails to see that multiple meanings arise not only in the language of things, but also in the language of words.<sup>47</sup>

Due to the plurality of interpretations of Scripture, the Protestant Reformation had a mixed reception. Natural philosophers among others from the sixteenth to the eighteenth century understood that disagreement about the meaning of Scripture texts was to blame for theological divisiveness. In Germany, Kepler (1571-1630) experienced it in connection with the Lord’s Supper.<sup>48</sup> Copernicans in Protestant and Roman Europe knew about interpretative disagreements related to the motions of the planetary system.<sup>49</sup> In the Dutch

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45 Vermij, R. *The Calvinist Copernicans: The Reception of the New Astronomy in the Dutch Republic, 1575-1750*, Amsterdam: Koninklijke Nederlandse Akademie van Wetenschappen (2002), pp. 247-251; Goudriaan, A. *Reformed Orthodoxy and Philosophy, 1625-1750: Gisbertus Voetius, Petrus van Mastricht, and Anthonius Driessen*, Leiden: Brill (2006), pp. 133-141; Jorink, E. ‘Reading the book of nature in the seventeenth-century Dutch Republic’, in van Berkel, K. & Vanderjagt, A. (eds.) *The Book of Nature in Early Modern and Modern History*, Leuven: Peeters (2006), pp. 45-68, see pp. 58, 60; for more examples see Vermij, R. ‘The debate on the motion of the earth in the Dutch Republic in the 1650s’, in van der Meer and Mandelbrote *op. cit.*, (25).

46 Schneider, J. R. *Philip Melancthon’s Rhetorical Construal of Biblical Authority: Oratio Sacra*, Lewiston: The Edwin Mellen Press (1990), p. 108.

47 For contemporary examples, see Whitman *op. cit.*, (25), pp. 262-263.

48 Hübner, J. *Die Theologie Johannes Keplers zwischen Orthodoxie und Naturwissenschaft*, Tübingen: J.C.B. Mohr (Paul Siebeck) (1975).

49 Howell, K. J. *God’s Two Books: Copernican Cosmology and Biblical Interpretation in Early Modern Science*, Notre Dame: University of Notre Dame Press (2002).

Republic, Descartes became familiar with literal and metaphorical interpretations of the creation story in the book of Genesis as he was developing his vortex theory of the origin of the planetary system.<sup>50</sup> In England, Newton kept his theological studies private to avoid controversy about his anti-Trinitarian interpretations.<sup>51</sup> Francis Mercury van Helmont (1614-1698), a natural philosopher, located the plurality of interpretations that produced the religious controversies after the Protestant Reformation precisely at the point where the reformers had hoped to discipline it, namely at the corruption of language.<sup>52</sup> The failure of the Protestant reformers to impose determinacy of meaning on the interpretation of Scripture was widely perceived among natural philosophers and, thereby, becomes a reason for their flight to nature as the clearer divine revelation.

These natural philosophers, however, did not see symbolism as the source of the theological disagreements. In the seventeenth century ordinary verbal language rather than symbolism was widely seen as the source of confusion, inhibiting thought. Galileo, arguing that scriptural language about nature conformed to ordinary spoken use, also wrote that passages of Scripture 'may have some different meaning beneath their words,' but 'Nature, on the other hand, is inexorable and immutable.'<sup>53</sup> He drove this point home by offering two different literal interpretations of Joshua showing 'that the very notion of literal interpretation is problematic, for verbal language is ambiguous by its very nature'.<sup>54</sup> Robert Hooke (1635-1702), another natural philosopher with an interest in language, claimed that the aim of the natural philosopher is to read the Book of Nature, but this exercise is not to be performed with verbal skills.<sup>55</sup> A century later Pluche wrote that in the book of nature 'we neither find Errors nor different Opinions, nor Controversy, nor Prejudice, not Contentions'.<sup>56</sup> Clearly, nature came to be seen as a less ambiguous source of knowledge of God than Scripture.<sup>57</sup> Even some theologians agreed with this assessment by the

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50 Van Ruler, J. A. *The Crisis of Causality: Voetius and Descartes on God, Nature and Change*, Leiden: Brill (1995), pp. 255-257.

51 Snobelen, S. D. "God of gods, and Lord of lords': the theology of Isaac Newton's General Scholium to the Principia', in Brooke, J. H., Osler, M. J. & van der Meer, J. M. (eds.) *Science in Theistic Contexts: Cognitive Dimensions, Osiris* (2001) 16, 169-208; Snobelen, S. D. "Not in the language of astronomers': Isaac Newton, scripture and the hermeneutics of accommodation', in van der Meer and Mandelbrote *op. cit.*, (25).

52 Coudert, A. 'Some theories of a natural language from the Renaissance to the seventeenth century', in Heinekamp, A., Mettler, D. (eds.) *Magia Naturalis und die Entstehung der Modernen Naturwissenschaften*, Wiesbaden: Franz Steiner Verlag (1978), pp. 56-118, see pp. 57-58.

53 Galileo 'Letter to the grand duchess Christina,' in Drake (trans.) *Discoveries and Opinions*, p. 183; cf. pp. 187, 199.

54 Palmerino, C. R. 'The mathematical characters of Galileo's book of nature', in van Berkel and Vanderjagt *op. cit.*, (45) pp. 27-44, see p. 32.

55 Hooke, R. *Discourse of Earthquakes*, in Brown, T. M. (ed.) *The Posthumous Works of Robert Hooke*, London (1971), p. 338.

56 Pluche, N. A. *Spectacle de la Nature: or Nature Display'd*, 5th edn revised and corrected, 7 vols. London (1770) III, p. 115.

57 De Grazia, M. 'The secularization of language in the seventeenth century', *Journal of the History of Ideas* (1980) 41, 319-329.

natural philosophers. For instance, John Sparrow argued in the introduction to one of Boehme's works that the language of nature 'doth show in every ones Mother tongue the Greatest Mysteries' while the meaning of scripture is 'vayed by Doubtfull Interpretations, Expositions, Inferences and Conclusions'.<sup>58</sup>

In conclusion, the Protestant reformers located the source of disagreements over Scripture interpretation in speculation. They sought to reduce it by rejecting reader-imposed allegorical interpretation among others, not by rejecting symbolism as such. Natural philosophers saw linguistic ambiguity as the reason for disagreements over Scripture interpretation. They looked towards the book of nature as a less ambiguous source for the knowledge of God because it was not written in a verbal language. This encouraged modern science.

### ***Literal interpretation of Scripture sometimes blocked science***

Moreover, even if the new literal or determinate sense had encouraged agreement on matters of text interpretation, this would not have guaranteed a similar effect on science. A literal turn in Scripture interpretation can affect science in constructive and destructive ways. For instance, the use of literally interpreted Scripture texts as a source of information about nature by Bellarmine (1542-1621) moved him not only to part with various Aristotelian elements in his natural philosophy, but also to reject the theory of Copernicus as corresponding to physical reality.<sup>59</sup> Indeed the Jesuits Bellarmine and Riccioli (1598-1671) are known for their opposition to Copernicanism based on a literal interpretation of Scripture texts.<sup>60</sup> Thus a literal turn in the interpretation of Scripture can hamper development of scientific theories and explanations.

### ***Reformation of natural philosophy sometimes meant a return to nature symbolism***

Furthermore, the very idea of reformation moved natural philosophers towards rather than away from a symbolic view of nature. These scholars included Protestants such as Robert Bostocke and Francis Bacon in England as well as

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58 Boehme *The Second Booke: concerning The Three Principles of the Divine Essence* London (1648), Sig. A3r; Mandelbrote, S. H. book review of *The Bible, Protestantism, and the Rise of Natural Science*, *Journal of Theological Studies* (2001) 52, 429-433. Sir Kenelm Digby, a theologian and a natural philosopher, based his attempts to heal the religious divide on natural philosophy: Janacek, B. 'Catholic natural philosophy: alchemy and the revivification of Sir Kenelm Digby', in Osler, M. J. (ed.) *Rethinking the Scientific Revolution*, Cambridge: Cambridge University Press (2000), pp. 89-118, see pp. 116-117.

59 Blackwell *op. cit.*, (33), pp. 30-45.

60 Grant, E. 'The partial transformation of medieval cosmology by Jesuits in the sixteenth and seventeenth centuries', in Feingold *op. cit.*, (34), pp. 127-155; Dinis, A. 'Giovanni Battista Riccioli and the science of his time', in Feingold *op. cit.*, (34), pp. 195-224.

the Calvinist Paracelsian Oswald Croll in Germany.<sup>61</sup> Significantly, Lambertus Danaeus (1530-1595) and Hieronymous Zanchius (1516-1590), who are among the first Calvinist scholars to define the reformers' standpoint in natural philosophy, did not refer to the reformed literal sense of Scripture but instead to the Church fathers Basil, Ambrose, and Cyril.<sup>62</sup> Likewise, natural philosophers such as Kepler and Newton presented themselves as returning to the sources. Kepler saw himself as 'the Luther of astrology.'<sup>63</sup> Newton expressed the need for reformation in both Scripture exegesis and natural philosophy.<sup>64</sup> As theology had to be reformed by eliminating Greek and medieval corruptions of Scripture and by returning to its sources in Abraham and Moses so natural philosophy had to be purified. For natural philosophy to return to its sources meant a return to the secret knowledge of symbolic relations among things and words as revealed to Adam, transmitted through Moses to Plato, and recovered in Mosaic philosophy and Christian cabbalism.<sup>65</sup> In this way both the Protestant and Roman wings of religious reformation promoted rather than discouraged the symbolic view of the natural world. This is an effect directly opposed to the one suggested by Harrison that – on his assumption that symbolic meaning is indeterminate irrespective of context – implies that a revival of the symbolic view of nature would have discouraged the development of natural science.

## Conclusions

Harrison has proposed that the rise of modern science required as its most important condition the decline of religious nature symbolism across early modern Western culture because it diverted attention away from nature to God

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61 McKnight, S. A. 'The wisdom of the ancients and Francis Bacon's *New Atlantis*', in Debus, A. G., Walton, M. T. (eds.) *Reading the Book of Nature: The Other Side of the Scientific Revolution*, Sixteenth Century Journal Publishers (1998), pp. 91-109; Bono, J. J. *The Word of God and the Languages of Man: Interpreting Nature in Early Modern Science and Medicine*, Madison, WI: The University of Wisconsin Press (1995), pp. 95, 140-166.

62 Van Ruler *op. cit.*, (50), pp. 71-84.

63 Webster, C. *From Paracelsus to Newton*, Cambridge: Cambridge University Press (1982), p. 4.

64 SCRIPTURE EXEGESIS: Newton, I., in Turnbull, H. W., Scott, J. F., Hall, R. A., & Tilling, L. (eds.) *The Correspondence of Isaac Newton*, Cambridge: Cambridge University Press (1959-1977) III, 138f.; Newton, I. 'Paradoxical questions concerning the morals and actions of Athanasius and his followers', in McLachlan, H. (ed.) *Sir Isaac Newton's Theological Manuscripts*, Liverpool: Liverpool University Press (1950), pp. 60-118; Manuel, F. E. *The Religion of Isaac Newton*, Oxford: Clarendon Press (1974), pp. 65-67; Markley, R. *Fallen Languages: Crises of Representation in Newtonian England, 1660-1740*, Ithaca: Cornell University Press (1993), pp. 145-147; Westfall, R. *The Life of Isaac Newton*, Cambridge: Cambridge University Press (1994), pp. 122-125. NATURAL PHILOSOPHY: Manuel *op. cit.*, (64), p. 23; McGuire, J. E., Rattansi, P. M. 'Newton and the pipes of Pan,' *Notes and Records of the Royal Society of London*, 21: 108-143 (1966). BOTH NATURE AND SCRIPTURE: Dobbs, B. J. T. *The Janus Faces of Genius: The Role of Alchemy in Newton's Thought*, Cambridge: Cambridge University Press (1991), p. 150.

65 Walton, M. T. 'Genesis and chemistry in the sixteenth century', in Debus and Walton *op. cit.*, (61), pp. 1-14, see pp. 7-12.

and from a causal to a symbolic approach to the order of nature. He identifies as the main cause of this decline the rejection of symbolism by the Protestant reformers. They presumably saw symbolism as the source of the indeterminacy of meaning of Scripture texts they were trying to reduce.

We agree that the problem Protestant reformers faced with Scripture interpretation was indeterminacy of meaning. But, we do not locate the source of this problem in symbolism. This is because the meaning of animal symbols was stable over centuries due to their fixation in the religious contexts in which they were encountered in the late Middle Ages. Thus, indeterminacy of meaning was not a reason to reject symbols. Indeed the Protestant reformers as well as their late medieval predecessors did not reject symbolic meaning provided it was divinely authorised. Authorised symbolism was included in the literal sense of the text which was understood as the sense intended by the divine author. However, they did reject symbolism when it was contributed by Scripture interpreters, but then what they were rejecting was not symbolism as such, but speculation. Therefore, things, events and persons in this world did not cease to function as symbols, but there was less speculation about their religious meaning. Thus, if nature symbolism was not rejected, then neither its rejection nor the Protestant reformers who presumably rejected it could have been the most important cause of the rise of modern science. Moreover, even if it had been rejected in favour of the quadriliteral sense the latter would have blocked science in some cases.

There are four additional but unrelated reasons why the Protestant Reformation cannot be responsible for the rise of modern science. Firstly, there is no correlation between Roman Catholicism and a suppression of science. Secondly, the introduction of new animals from other continents undermined nature symbolism by showing that there were animals without symbolic meaning. This undermined the metaphysical essentialism according to which each natural object has another object as its meaning based on a shared essential attribute. Assigning symbolic meaning to the new animals would have destroyed symbolism as well by showing that symbolic meaning was conventional rather than essential. Thirdly, these discoveries also stimulated science by redirecting attention from ancient written authorities whose failure to treat the newly discovered animals made them untrustworthy to the animals themselves. This rise of science preceded the Protestant Reformation or followed soon after showing that modern science could start without the Protestant Reformation. This is consistent with the fact that science emerged in Roman countries also after the Protestant Reformation. Fourthly, in some cases the very idea of reformation, that is, of returning to the sources meant a return to nature symbolism rather than its rejection and this effect is opposite to the one proposed by Harrison for the Protestant Reformation.

While we reject Harrison's strong claim that the Protestant reformers got science started by rejecting allegory, would it be possible to rescue his weaker claim that they pursued determinacy of meaning primarily though not exclu-

sively by means of literal interpretation. Since this implies that non-literal meanings – Harrison mentions parables – were sometimes accepted provided they were determinate, could symbols be included as well? Since their inclusion would entail that symbols can have determinate meaning it would contradict Harrison's assumption that the meaning of symbols is indeterminate. And if he were to drop that assumption he would have lost the ground for his thesis. So this is clearly not possible. But could Harrison's weaker claim be rescued on our assumption that symbols can have determinate meaning? That is, could the new literal sense which includes symbols with determinate meaning have encouraged modern science? We do not think so because the inclusion of symbolism in the new literal sense conflicts with Harrison's requirement that the veil of nature symbolism be removed before nature can be explored for its own sake.

We do believe that the Protestant Reformation contributed a cause to the rise of science. That cause lies in the disagreements over Scripture interpretation. These divisions caused natural philosophers to prefer nature over Scripture as an unambiguous revelation of God. Only in that negative sense did developments in Scripture interpretation stimulate the development of science. But the natural philosophers saw the problem with Scripture interpretation in linguistic ambiguity rather than nature symbolism. Interpretive disagreement issuing from the ambiguity of language would have affected the verbal language of Scripture as well as of nature. That is why natural philosophers made many attempts to replace verbal language with artificial language and eventually ended up with logic and mathematics.

Harrison has sometimes been interpreted as proposing another thesis. For instance, Steven Matthews asserts: 'with the Protestant movement towards a more rigorous literal interpretation of the Scriptures came a parallel emphasis on the rigorous and literal reading of nature.'<sup>66</sup> Likewise Menachem Fisch: 'By insisting that the Bible's message resided in the plain, literal meaning of the text, the reformers were forced to empty the biblical text of all manner of symbolical, metaphorical and allegorical meaning. And by analogy, so was nature. By virtue of its new understanding of the two books metaphor, argues Harrison, Protestantism was responsible for rendering nature, for the first time, purely *factual*.' This interpretation will be addressed as the 'analogy thesis'.

Under both theses, the problem of the Protestant reformers is identified as the indeterminacy of meaning of the Scripture text, this problem is located in the ambiguity of symbols, and symbolism in Scripture is said to be rejected

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66 Matthews, S. 'Reading the Two Books with Francis Bacon: Interpreting God's Will and Power,' p. 61, in Killeen, K., Forshaw, P. J. (eds.) *The Word and the World: Biblical Exegesis and Early Modern Science*, Houndmills, Basingstoke, Hampshire, UK and New York, USA: Palgrave Macmillan (2007), pp. 61-77; Fisch, M. 'Science and the Jewish Covenants of Learning Part 1', *The Global Spiral*, 2002.07.30 cited June 24, 2008: [www.metanexus.net](http://www.metanexus.net); Fisch, M. 'Judaism and the Religious Crisis of Modern Science', in van der Meer and Mandelbrote *op. cit.*, (25).

leaving only the literal sense of the text intact. But the theses differ in their effect. For Harrison the rejection of symbolism in Scripture interpretation removes a veil from nature and its order, but the rise of science still requires other causes. He does not claim that the literal sense of Scripture directly causes the development of science. In contrast, according to the analogy thesis the literal sense of the text of Scripture directly inspires a literal reading of the text of nature. The analogy involves empirical attention for both texts, the use of precise language in biblical scholarship and natural philosophy which in the latter became the language of causes and mathematics. We believe the analogous effects are a fair alternative or even addition to the causal effect in Harrison's thesis because reading the two books was a unified activity. He argues that the ambiguity of symbols produces the indeterminacy of words the Protestant reformers are struggling to contain. This is what suggests that the rejection of symbolism by the Protestant reformers inspired an analogous rejection of symbolism in the interpretation of the book of nature as compared to the rejection extending causally across Western society.

	Protestant Reformers	Natural Philosophers
The Problem	Ambiguity of Symbols Produces Indeterminacy of Meaning of the Text of Scripture	Religious Symbolism of Nature Diverts Attention from Nature to God  Attention Diverted from Causal to Symbolic Relations between Things
Causal Thesis	Rejection of Symbols Removes Indeterminacy of Meaning of the Text of Scripture	Rejection of Symbols by Protestant Reformers Spreads Across Culture and Allows Attention for Nature and its Order for their own Sake

*FIGURE THREE: CAUSAL THESIS (HARRISON 1998)*

	Protestant Reformers	Natural Philosophers
The Problem	Ambiguity of Symbols Produces Indeterminacy of Meaning of the Text of Scripture	Ambiguity of Symbols Produces Indeterminacy of Meaning of the Text of Nature
Analogy Thesis	Rejection of Symbols Removes Indeterminacy of Meaning of the Text of Scripture and Emphasises the Literal Sense	Rejection of Symbols Removes Indeterminacy of Meaning of the Text of Nature and Emphasises the Factual and Causal Sense

*FIGURE FOUR: ANALOGY THESIS*

The question is what feature(s) of Protestant Scripture interpretation could have inspired a literal interpretation of nature in the sense of causal explanation and logical inference. The new literal sense could have inspired by analogy an unambiguous interpretation of nature because in the context of Scripture the meaning of symbols was fixed by divine authority. And it could have done so starting before the Protestant Reformation because the Protestant reformers adopted the new literal sense from their medieval predecessors. Further, a habit of avoiding speculation and pursuing clarity in reading the book of Scripture could have inspired the same attitudes in reading the book of nature, manifesting themselves in a precise and literal, that is, a causal reading of nature by analogy because the interpretation of the two books was a single unified endeavour.

However, these possibilities would have been neutralised by disagreements over Scripture interpretation due to linguistic ambiguity. These caused natural philosophers to prefer nature over Scripture as an unambiguous source of the knowledge of God. Only in that negative sense did developments in Scripture interpretation affect the development of science. But interpretive disagreement would have affected the verbal language of Scripture as well as of nature. This is why there were many attempts to develop what we would call an artificial language for use in the study of nature. The proposals ranged from a more rigorous verbal language, to a verbal language organised mathematically, to a purely mathematical language and, eventually, led to work on symbolic logic. Such languages were believed to be organised on the same principles as those of nature.

Underlying the idea that ambiguity needs to diminish if science is to increase is the assumption that ambiguity stops science. But the same creative imagination that can destroy science by means of unguided speculation can promote it when guided by expert speculation. The role of metaphor in expert speculation was discovered in the twentieth century. Chenu as well as Harrison himself associate the so-called 'discovery of nature' in the twelfth and thirteenth centuries with the emergence of a range of new metaphors for nature.<sup>67</sup> In hindsight we can recognise this as an instance of a pattern in which creative metaphoric language is associated with periods of unusual development of science. Therefore, the suggestion that scientific language became literal and that this was a condition for the development of the natural sciences is too simple. One might argue rather that literal language would have stopped science.

Finally, we do believe that an approach to nature and Scripture that avoids speculation, pursues unambiguous language and focuses on the realities at hand – the text and natural phenomena – could have been the common cause of the two reformations in the study of nature and Scripture, respectively. Such a common cause is not associated with the Protestant Reformation and could

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67 Chenu *op. cit.*, (6), pp. 5-7; Harrison *op. cit.*, (2), pp. 41-42.

not have been perceived as a source of disagreement. This makes it necessary to take leave of the analogy thesis as well and suggest the common cause thesis as a third option. An account of the origin of the common cause is beyond the limits of this paper.

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