4

Reformers on the Necessary Knowledge

4.1 Useful Knowledge as the Only Necessary Knowledge: Benjamin Worsley in Context

G. E. Aylmer, later Charles Webster and, more recently, Thomas Leng have all made efforts to rescue Benjamin Worsley (1618–1677) from undeserved obscurity.[1] Worsley was a surgeon, a speculator, a scientist and a civil servant. In the 1640s he became a prominent member of the circle around Samuel Hartlib, who was an intelligencer and ideologue for the Protestant universal cause of knowledge and Independency. In August 1650 the Rump Parliament appointed Worsley as secretary to the new Council of Trade. This organ functioned until the end of 1651, during which time the first Navigation Act was enacted. In 1668 Worsley became a member 'of the select committee on trade, assistant to the Secretary of the Trade Council in 1670, and finally himself Secretary and Treasurer to the Council for Trade and Foreign Plantations of 1672'.[2] As a nonconformist, he resigned from his post the following year, when the Test Act of 1673 excluded Independents, Catholics and other nonconformists from civil service. He was replaced by no other than John Locke. The pith of Worsley's and Locke's fellowship may easily be described by references to the themes of nature, duty to the public, and the scientific study of economy through plantations and the laws of trade. These issues were also of intense concern to English Reformers in the mid-seventeenth century, as this chapter explores.

In several ways, Benjamin Worsley epitomized the new ethos of the Reformers – that informal group of post-Puritan and Protestant ideologues

[1] G. E. Aylmer, *The State's Servants: The Civil Service of the English Republic, 1649–1660* (Boston: Routledge & Kegan Paul, 1973), p. 270; Webster, *The Great Instauration*; Thomas Leng, *Benjamin Worsley (1618–1677). Trade, Interest and the Spirit in Revolutionary England* (Suffolk: The Royal Historical Society, The Boydell Press, 2008).

[2] Aylmer, *The State's Servants*, p. 271.

that managed to control English cultural and political life during the two decades between the Civil Wars and the Restoration and, in some respects, even beyond that point. Worsley had no personal wealth. His innumerable projects and the industrious life he led did not help him increase his fortune; he proved unable to make one and was possibly uninterested in doing so. In a eulogy of sorts, Lady Ranelagh (1615–1691), the famous sister of Robert Boyle, sent his brother a letter of condolence when Worsley, his devoted friend, and Henry Oldenburg (1618–1677), the German first Secretary of the Royal Society, died around the same time in September 1677: '[t]hey have left noe blot upon their memorys (unless their not having dyed rich may goe for one)'.[3] Worsley also lacked prominent social status and, although he claimed he had a degree from Trinity College Dublin, it appears that he completed no formal education beyond that of a seven-year apprenticeship to a barber surgeon. But Worsley was a man of many parts. Moreover, his hands-on approach was significant within the Reformer milieu, which was characterized by an 'Adamic epistemology', in Joanna Picciotto's expression, meaning that they regarded productive labour as the means of achieving the perfect combination of experience or experiment and innocence in life.[4] John T. Young relates how experiments occupied much of Worsley's time at periods, such as during his alchemical mission to the Netherlands.[5] Moreover, experiments were the door to productive knowledge. Useful knowledge thus became the only knowledge necessary[6] and represented precisely the theological content that the expression evokes.

Through the lens of his correspondence, one may often observe Worsley engaged in an activity of extracting secrets and experimental demonstrations from others for the greater good of the Reformers' cause – the service of the Lord and spiritual service – that was to be realized through

[3] 'Lady Ranelagh to Boyle 11 September 1677', in Michael Hunter, Antonio Clericuzio and Lawrence M Principe (eds.), *The Correspondence of Robert Boyle vol. 4, 1668–1677* (London: Pickering & Chatto, 2001), p. 454.

[4] Joanna Picciotto, *Labors of Innocence in Early Modern England* (Cambridge: Harvard University Press, 2010), p. 4.

[5] Young, *Faith, Medical Alchemy and Natural Philosophy*, generally Chapter 7.

[6] In a letter to his tutor, Robert Boyle stated as much: 'The other human studies I apply myself to, are natural philosophy, the mechanics and husbandry, according to the principles of our new philosophical college, that values no knowledge, but as it hath a tendency to use.' According to the editors of Boyle's correspondence this is the first mention of the Invisible College. Boyle to Isaac Marcombes, 22 October 1646, in *The Correspondence of Robert Boyle vol 1, 1636–61*, p. 42.

very concrete projects.[7] In his charmingly millenarian way, in expectation of the transformation of society, Worsley was something of a genius of creativity, industriousness and innocence. Intelligent and powerful people around him, such as Hartlib, John Dury (1596–1680), Robert Boyle, Sir Henry Vane (1613–1662) and the first Earl of Shaftesbury (1621–1683), obviously respected him.[8]

The scientific and commercial community of the Hartlib circle developed ideas for educational reformation and economic revival during the 1640s. They were first inspired by French Huguenots proposals, importantly by Pierre le Pruvost, that contemplated both the resources of the colonies, such as fishing and husbandry, and the poverty and unemployment at home. When the proposals proved to give too much control over natural resources and land to the state and to foreigners, the Reformers themselves wary of the old system of royal patents, put on their thinking hats.[9] Worsley assumed a leadership role on the question of colonial trade. The Reformers' writings show fear of the state – a feeling that private owners had to be free. However, as Kevin Dunn writes, at the same time they suffered from 'a fear of the private' that the private Corporation embodied.[10] This dichotomy led the Reformers to explore groundbreaking avenues by which to forge a relationship between private and public interest. Their approaches embody the ideal of mutual support among the communion of saints within millenarian visions of prosperity of the nations and mankind – 'mens salvation and peoples good' – without losing sight of

[7] Worsley's sojourn in the Netherlands had the aim of obtaining from the chemist Johan Glauber a process to extract gold from tin scoria that, according to the mediator in the negotiations, would serve well 'the Commonwealth of England', see Young, *Faith, Medical Alchemy and Natural Philosophy*, p. 226; Worsley's letters, e.g. to William Potter, the inventor and real money expert of the period are an attempt to learn from his ideas and thus 'making good the rich promises of God to his people', and at once to improve Potter's spirit. 'Then give me also leave to say I care not much for your demonstrations, nor doe indeed weigh them so much as I do your spirit.' Copy Extract in Scribal Hand A, Benjamin Worsley to Potter, 17 November 1658, Ref. 26/33/6A-B; Copy letter In Scribal Hand A, Benjamin Worley to Potter, 7 April 1658, 39/2/62A-63B in M. Greengrass, M. Leslie, M. Hannon (eds.), *The Hartlib Papers*, Published by The Digital Humanities Institute, University of Sheffield [available at: www.dhi.ac.uk/hartlib]

[8] This appears, among other places in Hartlib's correspondence.

[9] Webster, *The Great Instauration*, p. 227; p. 370–372; M. J. Braddick and M. Greengrass (eds.), and Introduction, *The Letters of Sir Cheney Culpeper (1641–1657)*, (Royal Historical Society Camden Series, vol. VII, 1999), p. 133; p. 227; p. 243.

[10] Kevin Dunn, 'Milton among the Monopolists: *Areopagitica*, Intellectual Property and the Hartlib Circle', in Mark Greengrass, Michael Leslie and Timothy Raylor (eds.), *Samuel Hartlib and Universal Reformation: Studies in Intellectual Communication* (Cambridge: Cambridge University Press, 1994), p. 182.

the practical aim of achieving a thriving English economy, following the example of success offered by the Dutch. The different paths to God, and 'the *unum necessarium*' – that is 'Jesus Christ' – thus emerged within a unified religious framework of natural science, technology and material wealth that justified 'the great Necessity of a generall Reformation of Common Learning'.[11] The stress among the most important writings by the Reformers lay in distribution of knowledge in the case of Hartlib, national success through international trade in that of Worsley and 'Englands prosperity' in William Potter's writings on money, to name only three of the abundant strands of thought on the issue of government current during this intellectually fertile period.[12]

The most characteristic feature of the Reformers' writings is how they viewed the path to achieving greatness, wealth, honour and truth as being no longer rooted in humanist-inspired worldviews, let alone in humanist virtue. Rather, they look at once to science and to the dramatic increase in material exchanges and wealth that trade, bureaucracy and even chemistry could bring about. They constitute a sort of hiatus in the history of natural law, but quite a fascinating one. The aim of their endeavours was still theological, the philosophy in some cases Neoplatonist, but despite the recurrence of the mantra of 'light' in their writings, their working method was authentically empirical. It revolved around the study of the material aspects of life for practical purposes. There is no longer interest in normative ideals that entitle the individual to a natural right to food from their neighbours' overly abundant harvest. The concern now lay in how to produce scientifically better and more abundant food, more professional shipping for trade, and crucially, more credit money for coping with debt and increasing trade amidst a money shortage problem in England that

[11] *The Letters of Sir Cheney Culpeper*, p. 244. 'Reformation of Schooles Designed in Two Excellent Treatises. The First whereof summarily sheweth the great Necessity of a generall Reformation of Common Learning' is the title of one of Jan Comenius's texts translated into English in 1642, Ref. 14/1/2A-B, 1642 in *The Hartlib Papers.* See also, John Amos Comenius, *Unum Necessarium*, Vernon H. Nelson (trans.) (Winston-Salem: Moravian Archives, 2008) p. 25.

[12] Samuel Hartlib, *Considerations tending to the happy accomplishment of Englands reformation in church and state: humbly presented to the piety and wisdome of the high and honourable court of parliament* (London, s.n., 1647); Benjamin Worsley, *The Advocate* (London, printed by William Du-Gard, printer to the Council of State, 1651). Early English Books Online Text Creation Partnership, 2011 http://name.umdl.umich.edu/A96937.0001.001; William Potter, *Humble Proposals to the Honorable the Councell for Trade: And all merchants and others who desire to improve their Estates* (London: pr. for Edward Husband, 1651). Early English Books Online Text Creation Partnership, 2011 http://name.umdl.umich.edu/A55526.0001.001

had been going on for more than half a century. Carl Wennerlind writes that the alchemists, with their experiments all over Europe to transmute base metals into gold, were only sent packing once an efficient credit system became operational in late seventeenth-century London.[13] What we regard today as nonsense (the endeavour to produce gold through alchemy) can also be viewed as a symptom of the urgency of the need for economic growth and of the intellectual and philosophical climate in which credit money was invented.

Together with Jan Amos Comenius (1592–1670), Hartlib was 'chief architect of parliamentary policy' during the Long Parliament and beyond until the Restoration.[14] In the 1960s Hugh Trevor-Roper argued, spectacularly, that three foreigners had been the philosophers of the Puritan Revolution: Comenius, Hartlib and Dury.[15] The first was a Bohemian and the other two were exiles from Catholic Prussia – but not fully foreign. Hartlib probably had an English mother and Dury was of Scottish origin.[16] Trevor-Roper took the view that it was Comenius, Hartlib and Dury's Baconianism combined with the expectation of the Millenium – or in methodological terms, their belief in 'useful knowledge', messianism and metaphysics – that proved to be, in the late 1630s, a source of inspiration for the English country party that was at once Puritan and Baconian.[17]

[13] Carl Wennerlind, 'Credit-Money as the Philosopher's Stone: Alchemy and the Coinage Problem in Seventeenth-Century England' 35 *History of Political Economy* (2003).

[14] Michael Hunter, Antonio Clericuzio and Lawrence M. Principe. 'Samuel Hartlib (born c. 1600–died 1662), German Educationalist, Social Reformer, Author.' *Electronic Enlightenment Biographical Dictionary*. Robert McNamee et al. (ed.) Vers. 3.0. University of Oxford. 2018. Web. 2 Dec. 2019.

[15] Hugh Trevor-Roper, 'Three Foreigners: The Philosophers of the Puritan Revolution' in *The Crisis of the Seventeenth Century* (Indianapolis: Liberty Fund). Hartlib apparently did not recognize Hobbes's peculiar talent. He described him as 'a witty brain' and seemed to have trusted others on the basis of derisive comments of his skills on mathematics. Notes by Hartlib Ref. 30/4/53A-60B; 29/5/29A-42B; 30/4/81A-85A: 81B, 83B in *The Hartlib Papers.*

[16] Dury was author of tracts dealing with subjects as suggestive as 'How to travel profitably in the law' and in '*Digitus dei* a proof that the lost Jewish nation had been found among the natives in American and of the cruelty of the Spaniards towards them' and was more generally an Irenist and architect of Protestant reunion. Peter Damian-Grint, 'Reverend John Dury (born 1596–died 1680), Scottish Churchman, Theologian.' *Electronic Enlightenment Biographical Dictionary*. Ed. Robert McNamee et al. Vers. 3.0. University of Oxford. 2018. Web. 2 Dec. 2019. The tracts are named in Hartlib's correspondence in the collection *Electronic Enlightenment Scholarly Edition of Correspondence*, ed. Robert McNamee et al. Vers. 3.0. University of Oxford. 2018. Web. 1 Dec. 2019.

[17] Trevor-Roper, 'Three Foreigners'; G. H. Turnbull, *Hartlib, Dury and Comenius: Gleanings from Hartlib's Papers* (Liverpool: University Press of Liverpool, 1947).

John T. Young, Carl Wennerlind and Lawrence Principe have studied the intellectual underpinnings of the Hartlib circle's alchemical project, thus contributing to our understanding of its broader spiritual and social endeavours. On the one hand, the Hartlib circle pursued scientific understanding of the world in all its complexity through the lenses of devout Protestant Reformers. In other words, they saw the world as the unified work of God the Creator and were, generally, wary of relativism and fearful of the sheer amount of information that the world provided. On the other, the experiments they undertook for decades, in all seriousness, to transform base metals into gold and silver aimed at generating the bullion that – shrewd economic thinkers and experienced merchants as they were – they knew England was in desperate need of.[18]

4.1.1 Jan Comenius and Sir Cheney Culpeper on Nature

The recovery of the dominion over nature would accomplish the Reformers' ideal about man's return to a state of grace. That was the true end and reward of the scientific study of nature, as famously expressed by Francis Bacon (1561–1626) and echoed by John Milton (1608–1674) in *Paradise Lost*.[19] This way of linking knowledge and dominion over nature had been, of course, the endeavour of theologians and philosophers since at least the thirteenth century. Thomas Aquinas, whose theology both Reformers and John Locke knew well, wrote about this question four centuries earlier in his *Summa theologiae*. In the Garden of Eden, Aquinas remarked, human beings did not need animals for survival, clothing or vehicle. They got their food from the tree of Paradise, they were naked without suffering of lust and other sins and the strength of their bodies made vehicles unnecessary. However, human beings needed animals 'for acquiring an experimental knowledge of their nature, signified by the fact that God put animals in their charge to give them names, which designated their nature'.[20] Dagmar Capková has noted that the new perspective with regard to theological

[18] Young, *Faith, Medical Alchemy and Natural Philosophy*; Wennerlind, 'Credit-Money as the Philosopher's Stone'; among other books by Principe, see Lawrence M. Principe, *The Secrets of Alchemy* (Chicago, London: University of Chicago Press, 2013).

[19] This is the argument of the groundbreaking study by Webster, *The Great Instauration*, 16; 59; Francis Bacon, *The Great Instauration* (New York: Start Publishing, 2012); John Milton, *Paradise Lost*, David Scott Kastan (ed.) (Indianapolis: Hackett Publishing Co., Inc, 2005) Book IV.

[20] 'Indigebant tamen eis ad experimentalem cognitionem sumendam de naturis eorum. Quod significatum est per hoc, quod Deus ad eum animalia adduxit, ut eis nomina imponeret, quae eorum naturas designant.' Aquinas, *Summa theologiae*, I, q. 96 a.1. ad 3.

tradition that the Reformers contributed was that philosophy must abandon its position of '*ancilla theologiae*' and, together with 'politics', become 'its true natural sister'.[21]

The savant Jan Comenius stayed in England between 1641 and 1642 on the invitation of some prominent members of the English Parliament. His *Naturall Philosophie* comprised an amalgam of old and current ideas. As he acknowledged, the aim of the book was to harmonize 'whatsoever truth either Aristotle hath; or Galen, the Chymicks, Campanella and Verulamis (Bacon)'.[22] The observation that 'as there is nothing in the understanding which was not first in the senses, there is nothing in the belief, which was not first in the understanding' is an important empirical and rationalist message contained in the book.[23] Comenius also described in *Naturall Philosophie* the method of learning that might be followed by future Protestant Reformers. Starting with the senses and continuing with reason and the Bible, matter was apprehended through the senses, the spirit (nature) by reason and the light by the Bible. Inspired by Luis Vives and Campanella, this was considered the right order to follow. It intended to throw away the 'Gentiles' that Aristotle embodied in different ways. On the strength of this, Comenius crafted a working definition of 'Nature' for the Reformers:

> But that all these things (created) might continue in their essence, as they were disposed by the wisdom of God, he put into everything a virtue, which they call Nature, to conserve themselves, in their essence, yea, and to multiply, whence the continuation of the creatures into this very day, and this *Moses* intimated.[24]

In *Naturall Philosophie*, the 'spirit' was not something spiritual, but rather it appeared to be that virtue called 'nature'. Nature 'spreading forth her virtue through all things' made it possible for those things to endure over time. Significantly, the aim of scientific study was to discover the divine order *entrusted* to Nature. With this understanding of nature, Comenius, who

[21] Dagmar Capková 'Comenius and His Ideals: Escape from the Labyrinth' in Mark Greengrass, Michael Leslie and Timothy Raylor (eds.), *Samuel Hartlib and Universal Reformation. Studies in Intellectual Communication* (Cambridge: Cambridge University Press, 1994), p. 90.

[22] Jan A. Comenius, 'Preface' of *Naturall philosophie reformed by divine light, or, A synopsis of physicks by J. A. Comenius* (London: Printed by Robert and William Leybourn for Thomas Pierrepont, 1651). Early English Books Online Text Creation Partnership, 2011, http://name.umdl.umich.edu/A34110.0001.001. I am using the translation of his work produced later to help its popularization as noted by Webster, *The Great Instauration*, p. 113.

[23] Comenius, 'Preface', *Naturall philosophie reformed by divine light.*

[24] Comenius, *Naturall philosophie reformed by divine light*, p. 16.

was a synthesizer rather than an original, took two important steps: First, the traditional importance of God's providential care of nature receded:

> God's omnipotencie concurring no longer immediately unto particular things, (as before) but nature it self, always spreading forth her virtue through all things, which thing derogates nothing from the Providence of God … for it comes … from his power, that such an immutable durability can be put into the universe, through such a changeable mutability of particulars, so that the World is as it were aeternall.[25]

Nature united thus the divine knowledge and matter. In common with the Reformers, Comenius understood 'Nature' as an expression of divine order in the material world, to which God had confided the future of matter – God was not involved in the particulars. In this way, theology lost its pre-eminent place in the circle of knowledge. By means of his second move, Comenius personalized and feminized 'Nature'. That was also important, since he was proposing the revival and approval of a newly conceived atomism, which required a substitute for the Aristotelian category of 'substance'.[26] The 'spirit of nature' would meet that need:

> From the same spirit is the custody of the bounds of nature; for example, that a horse grows not to the bigness of a mountain, nor stays at the smalnesse of a cat.[27]

For Sir Cheney Culpeper (1601–1663), another core member of the Hartlib circle, the true aim, end and center of nature was gold.[28] Hence to 'move the

[25] Comenius, *Naturall philosophie reformed by divine light*, p. 17. Compare with Aquinas, *Summa theologiae*, III, q. 6, art. 1, 'Reply to Objection 1. 'We may consider a twofold order between creatures and God: the first is by reason of creatures being caused by God and depending on Him as on the principle of their being; and thus on account of the infinitude of His power God touches each thing immediately, by causing and preserving it, and so it is that God is in all things by essence, presence and power.'

[26] 'Democritus erred not altogether, in making Atomes the matter of the World: but hee erred in that hee believed, that they were aeternall … by reason that he was ignorant of that which the Wisdom of God hath revealed unto us, that the Atomes were conglutinated into a mass, by the infusion of the Spirit of life, and began to be distinguished into forms, by the coming in of the light.'; 'For example, the spirit of a dog being included in its seed, when it begins to form the young, doth not form it wings or fins, or hands, &c. because it needeth not those members: but four feet, and other members, in such sort, as they are fit for that use to which they are intended.' Comenius, *Naturall philosophie reformed by divine light*, p. 30; p. 35.

[27] Comenius, *Naturall philosophie reformed by divine light*, p. 35.

[28] 'Nature hauinge (in golde) arriued at her ayme, ende, or center, of simple puritye shee there doethe, nay muste set downe, For the wisdome of God in nature is suche as that Natura nihil facit frustra; yf shee haue once attained her ende, shee there keeps an euerlastinge sabbothe; except (by an ingenuous artiste) shee bee (as it were) drawne backe from her center of reste; Now the better to discouer howe nature is put into a newe motion, it were well

spirit' of nature constituted the goal of natural philosophy (*for motus generat calorem*) in order to arouse it from its slumber and make it produce more, be more fruitful, become more open to scientific study. Culpeper was a lawyer, a private scientist and a civil servant who worked on agrarian and economic reform, natural law and chemistry and who participated in the Parliamentarians' cause to his own economic detriment. He was promoter of the cause of the Palatine, acted as advisor and donor on many of Hartlib's scientific and educational projects and was one of the fifteen members of the Commission that the Rump Parliament established to regulate and promote trade.[29] Culpeper was, with the other members of Hartlib's circle, an enemy of monopolies, of private Corporations and the King, which at once attempted to monopolize trade and conscience.[30] As a consequence of what M. J. Braddick and M. Greengrass have called his 'animist chemical universe', Culpeper deliberated at length on the need to observe the workings of nature.[31] Intriguingly, in relation to these ideas Culpeper referred mostly to the experiments carried out in the Hartlib circle at the time to produce the 'phylosophers stone' or the 'elixir' by which to convert base metals into gold. In its utmost state of purity, nature produced gold; the task of the chemist was thus not to dissolve but to observe how from the impurity 'in her dominions' nature continued 'in motions & action' until it reached the perfection of gold.

> And truly it is vpon these & the like consideration, (touched very sparingly in the bookes) that I haue insisted, nowe these many yeeres, beinge as confidently assured that these distractions & pullinge of nature to peeces,

woorthe our consideration, what are natures endes in all her motions, & (by an vniversall consente of writers) wee shall finde them to be, selfe preseruation, & selfe increase, & this, as by a continuall increase of her owne vigour, soe allsoe by castinge forthe whatsoeuer hathe the nature of enmity againste her.' *The Letters of Sir Cheney Culpeper*, p. 354.

[29] M Greengrass (2008, January 03). Culpeper, Sir Cheney (bap. 1601, d. 1663), advocate of political reform and technological innovation. *Oxford Dictionary of National Biography*. Retrieved 11 May 2020. Culpeper's estate suffered greatly from his father's opposition to his support to the Commonwealth.

[30] 'they (merchants) and all other monopolizinge Corporations of Merchantes, may perhaps finde (ere longe) imployemente inought to defende theire paste incroachements vpon the liberty of the subjectes & truly the monopoly of trade will proue as greate a greeuance (when rightly vnderstoode) as any in this kingdome whatsoeuer, nexte vnto that monopoly of Power which the [K-ing] claimes; & beleue it, nowe wee are pullinge downe of suche monopolies wee shall starte a greate many which yet ly hid in the bushes but the greate monopoly muste firste downe; & then the monopoly of trade, the monopoly of Equity, (a thinge which nowe begins to be lookt into), & the monopoly of matters of conscience & scripture (a very notable monopoly), all these & many more wee shall haue in chace & what one hownde misses another will happen in the sente of & thus will Babilon tumble, tumble, tumble tumble.' Culpeper to Hartlib, 4 March 1645/6, in *The Letters of Sir Cheney Culpeper*, pp. 269–270.

[31] M. J. Braddick and M. Greengrass, 'Introduction' in *The Letters of Sir Cheney Culpeper*, p. 144.

> may perhappes be a meanes of our gettinge those rights which natures containes, in that simple perfection wherein wee finde her in all things; but that to exalte nature to the exurebancy which is attributed to the phylosophers stone; there needes onely suche a reincrudation as the seedes of the earthe receiue after theire autumnall ripenes; And yf (insteade of these subtile mannuall operations), wee wowld more obserue the intentions, wayes & actions of nature, wee might (without cumbringe our selues about many thinges) more easily attaine that vnum necessarium, that beste parte, which is soe muche & soe vniversally desired.[32]

In its natural state of repose, nature possessed 'rights', in the sense of benefits, valuable information about natural resources and how to imitate nature in its production of them. The Reformer-scientists desired those rights of nature, and specifically gold.

But as we saw with Comenius, nature took 'nothing from the Providence of God'.[33] Hence in *Natural Philosophy*, the Czech Comenius applied his method of deciphering the Bible through scientific investigation, crucially starting with matter. In this effort 'Nature' as a virtue or spirit connected both ends – empiricism and the Bible. If this did not happen, then true knowledge and wisdom was not acquired. John T. Young quotes also a letter by Worsley to Hartlib from 1657, in which he acknowledged that true analytical and comprehensive knowledge was not acquired if 'the lawes, course & motions, of nature itself' did not produce the harmony of 'the lawes, mysteryes, Revelations & discoveryes spirituall' that always offered 'Constancy, Simplicity, Identity, Homogeneity, Unity'.[34]

4.1.2 A 'Professor of Necessities'

In 1668 an elderly Comenius dedicated a booklet entitled *Unum necessarium*, a testament of sorts published in Amsterdam, to the Prince Palatine. In this short work, Comenius wrapped the Neotestamentarian principle in a reformed philosophical doctrine of necessities.[35] He described the life of human beings as a 'perpetual frustration' of 'deep-rooted desires',

[32] Culpeper concluded the paragraph as follows: 'I doe be fore I am aware too much beate upon this subjecte, as beinge that I knowe mr. Woorslyes ingenuity will finde finally woorthe its observation' In this particular quote Culpeper appears to play with the meaning of 'the unum necessarium' suggesting ambiguously also material wealth. Culpeper to Hartlib, 14 August 1649. *The Letters of Sir Cheney Culpeper*, p. 352; pp. 354–355.

[33] Comenius, *Naturall philosophie reformed by divine light*, p. 16.

[34] Young, *Faith, Medical Alchemy and Natural Philosophy*, p. 239.

[35] Comenius, *Unum Necessarium*; Luke 10.42.

and the natural sciences – philosophy and religion – as 'huge labyrinths' from which the wise attempted to escape. Both the sacred and profane history of humankind appeared as a collection of failures on the part of individuals and societies to distinguish between the necessary and the unnecessary in the pursuit of human desires:

> but there always is this one unfortunate root underneath, that men omit NECESSITIES and think, speak and act in regard to NON-NECESSITIES. In reference to this it has been said, "We are ignorant about necessities, because we learn about non-necessities." And in imitation of this: we lack necessities because we work at collecting non-necessities. We do not concern ourselves about necessities, because we occupy ourselves with non-necessities. We do not attain necessary ends, because not sticking to the necessary means, we degenerate to what is impertinent. And so we fall short of our best vows (even if they are kept in the mind), because we are hindered from the *best* by slipping because of inferior things that are only *good*.[36]

The foolishness of Solomon came from tasting both the necessary good and the unnecessary evil, or Nimrod's extension (as the 'hunter of men') of the dominion granted by God to human beings over the fishes, the birds and the animals of the earth, to other men – which could be a veiled criticism of slavery by Comenius.[37] He detailed the practices that he considered unnecessary, such as trampling over human beings' liberty, rule by violence, and the 'Greedy' who 'ignorant of the limit of riches, heap up the goods of this life beyond necessity, and by unnecessary bother about them multiply the labors and troubles of life'.[38]

But what is it that is necessary in everything, and how can it be distinguished from the unnecessary? Or, as Comenius put it, 'how can that one necessary thing be found in such a turmoil of non-necessities?' That was the theory that the Czech wanted to articulate. The modern author of the brief 'Introduction' of *Unum Necessarium* noted that the most valuable part of the text, even comparable to Milton's *Paradise Lost*, is the last chapter.[39] With the perspective offered by the Reformers and Independents' unique philosophical project, the entire endeavour might be taken to epitomize a world that was lost with the Restoration but was yet strangely present in the work of future scientists – among them Locke's. Through

[36] Comenius, *Unum Necessarium*, p. 28. The translator notes that it was not clear whether the author was quoting and to what extent.
[37] Comenius, *Unum Necessarium*, p. 24.
[38] Comenius, *Unum Necessarium*, p. 28.
[39] C. Daniel Crews, 'Introduction' in Comenius, *Unum Necessarium*, p. 2.

this wonderfully simple text, Comenius explained the supernatural function of utilitarian science. The point was to find the 'use' of each thing for human beings – i.e. the *unum necessarium* in everything – according to 'the nature of the thing':

> The true definition of each thing must be attended to, also the end of the thing, or the purpose, and how the thing may most suitably be used for its own purpose. For if this is found, it will be that very thing which is most necessary to it.[40]

For example, the use of water, was to 'moisten us'. Hence, 'the one thing necessary for it' was to be humid, liquid and fluid. These utilitarian views were combined with astonishing simplicity with Christ's teachings as they appear in the New Testament: excessive concern with earthly things, excessive desire for power and excessive riches are hindrances. Desires ought to be limited to what is necessary. Comenius also prescribed rules for each individual, university, nation and church and for the whole world, tailored to different spheres of life, in respect of the Neotestamentarian rule of the *unum necessarium*. Interestingly, he started by pointing to the *property* of each one over her own 'body, the mind and the immortal spirit' that each individual ought to value highly 'persuaded that they are your property (your field, so to speak, garden, and paradise)'. One ought to learn to know oneself, and 'use and enjoy' (*utifrui*) oneself.[41] However, all this should be done while keeping the desires that all normal human beings have under check, without extending 'desires beyond necessity' and being content 'with the necessities that come from the hand of God'.[42] What Comenius was after, perhaps more acutely at the end of his life, was Christian poverty of spirit or detachment of material things endowed with the peculiar features of a utilitarian Protestantism. 'Therefore', wrote Comenius in his Christian Pansophy, 'the art of growing rich in God truly consists in praying and working, in economy and frugality'. He continued:

> I wish nothing else to be understood by this than the perpetual tabulation of necessary things, so that when anyone has an honest desire (for things relating to this or the future life) it may be clear what means he needs, and how these means are to be used, so as to go directly to his goal and always to arrive at it.[43]

[40] Comenius, *Unum Necessarium*, p. 33. Thus, one must 'learn to know the order of the world.' Kerstin Jergus, 'Comenius Jan Amos, 1592–1670' in M.A. Peters eds. *Encyclopedia of Educational Philosophy and Theory*, (Singapore: Springer, 2016) p. 200.

[41] Comenius, *Unum Necessarium*, p. 38.

[42] Comenius, *Unum Necessarium*, p. 41.

[43] Comenius, *Unum Necessarium*, p. 57; on the 'Pansophy' or 'overall wisdom', see Jergus, 'Comenius Jan Amos, 1592–1670'.

That was a written guide, a table, in respect of desires, not only as to which were honest, but also, as to how to satisfy them. Comenius thus transformed the deliberation about necessities into a science. He recommended that in the academies a 'professor of NECESSITIES or of FRUGALITY' would work together with the professors of medicine and theology.[44] Furthermore, in his view the cause of excesses in the government of human society lay in rulers' excesses and in the machinations of pettifogging lawyers that generated 'the labyrinths of law', leading to conflict and absence of peace. He also recalled the words of the German jurist Nicolaus Vigelius (1529–1600) with respect to 'how much damage jurisprudence' was doing to the glory of God and public welfare.[45] The problem was that people sought in the law and in legal process that which was beyond what was necessary – which was, compliance with God's tribunal in individuals' conscience.

Comenius finished the book with a pious prayer in the last chapter (chapter 10), in which he confessed to having found the *unum necessarium*, and again warned against luxuries, which he scorned.[46] His last petition to God in that chapter is as follows: 'Grant me to warn other men properly about these things, and to tell them how foolishly they act when they neglect necessities and give themselves entirely to non-necessities.'[47]

This last book by Comenius, written in simple language, evidence how rich and complex the language of necessities could be for a pious and enlightened seventeenth-century Protestant. Economic, scientific and theological themes belonged together, and the 'professor of necessities' was to communicate them in connection with each other, becoming a moral philosopher in the process. That professor was, in a word, a moral teacher of desires, or of what not to desire if it went beyond necessity, teaching that through the empirical method. Economic prosperity was not about luxury, but about industriousness, frugality and scientific knowledge about what was really necessary.

[44] As well, as a 'professor of laconic eloquence', Comenius, *Unum Necessarium*, p. 57.

[45] About the method of the German lawyer Nicolaus Vigelius see, Harold J. Berman, *Law and Revolution. II: The Impact of the Protestant Reformations on the Western Legal Tradition* (Cambridge: Harvard University Press, 2003), p. 124.

[46] He warned the Moravians, his own people, with the Bohemians, Silesians, Poles and Hungarians: "Luxury ruined the Bohemians," said a wise northern king, who hated luxury. But in a short time the same will have to be said about you, Poland, unless you swiftly come to the one thing necessary, frugality. For the beginning of sins is the haughtiness of Sodom, and an excess of bread and abundance of leisure (Ezek. 16:49)' Comenius, *Unum Necessarium*, p. 85.

[47] Comenius, *Unum Necessarium*, p. 86.

4.1.3 *Robert Boyle: Between Nature and Utilitarian Science*

Faced with the prospect of working alone in the laboratory, a young and precocious Robert Boyle wrote to Worsley in the following terms: 'I intend to court Nature as eagerly as <such a> disaccomodated Solitude will permit me.'[48] Worsley was not only Boyle's friend but also his mentor in chemistry.[49] The young Anglo-Irish Boyle contributed decisively to the making of modern chemistry by developing it as an 'independent, fundamental and philosophical' discipline. He would also become one of the artificers of the Scientific Revolution. What distinguishes Boyle from the outset from the other members of the Hartlib circle was his independence of means. The benefit of his immense wealth – he was the youngest and beloved son of the First Earl of Cork – both facilitated extraordinarily his works as a scientist and as promoter of science, and contributed to a strain of unreality in his character.[50] Young Boyle's conception of a 'Nature' of which he was enamoured in 1647 – according to his correspondence, almost literally – changed rapidly in the years that followed, with new philosophical influences of a more empiricist, quasi-Epicurian and utilitarian bent. Thus, in the unpublished *Of the Study of the Book of Nature* (probably written around 1650), which could be considered his transitional text on the path from being a moralist to becoming a natural philosopher, he summarized what might well be considered one of the core working principles of his philosophy of nature:[51]

> God has furnish't Man with such a Multiplicity of Desires; & whereas other Creatures are content with those few obvious & easily attainable Necessarys that Nature has almost every where provided for them; In Man alone every sense has numerous greedy Appetites, for the most part for Superfluitys & Daintys; that for the Satisfaction of all these various Desires, he might be olblig'd with an inquisitive Industry to range, anatomize & ransacke Nature, & by that concern'd survey come to a more exquisite knowledge of the Workes of it; & consequently to a profounder admiration of the Omniscient Author.[52]

[48] 'Boyle to (Worsley?), late February 1647', in *The Correspondence of Robert Boyle vol I 1636–1661*, p. 49.
[49] Hunter, *Boyle: Between God and Science*, p. 70.
[50] The 1st Earl of Cork was 'the richest man in Britain', Lawrence Principe, 'In Retrospect: the Sceptical Chymist', 469 *Nature* (2011) p. 30; Hunter, *Boyle: Between God and Science.*
[51] The date in Michael Hunter and Edward B. Davis 'Introductory Notes', in *Works of Robert Boyle*, vol. 13 (London: Pickering & Chatto, 2000), p. xxxvii.
[52] Boyle, 'Of the Study of the Booke of Nature', in *The Works of Robert Boyle*, v. 13, p. 156.

Boyle attributed the motive for the manipulation and exploitation of nature to the urge to satisfy the multiplicity of human desires for 'Superfluities' that, crucially opposing Comenius, went beyond 'Necessities'. Knowledge about nature and devotion to the Creator would ensue from this working with nature. In this early text, Boyle declared that only human beings' desires, many superfluous and a source of greed, forced them to plunder nature. In this sense, Boyle was announcing, a century in advance, the theory that would make Adam Smith famous. Chapter 6 analyses this important aspect of Boyle's thinking in detail. 'Since the world is a Temple, Man surely must be the Priest', wrote Boyle some pages before.[53] How can one explain this desire to ransack the very temple in which God was to be adored, given that Boyle was later justly remembered as one of the most pious and good men in England?[54] Arguably, it was the fragmentation of matter and spirit, characteristic of mid-seventeenth century empiricism that explains the 23-year-old Boyle's breathtakingly savage homily. His odd tripartite division of the main assets in a 'man's library', 'the Booke of nature, the book call'd Scripture and the booke of Conscience' makes one suspicious of the separate handling of the different 'books'.[55] For Boyle, the laws of nature, essentially the laws of motion, had nothing to do with conscience, as discussed in detail in Chapter 7 in relation to his more mature texts on nature.

One important way in which the Reformers carved out a space for 'man' and his workmanship in God's creation was through their economic plans and dreams of wealth. But in practice, the issues surrounding riches were not so easy to deal with, as evidenced by the pious Boyle's scruples. He was particularly troubled by his conscience in later life in relation to his financial transactions, about which he was extremely skilled, and his love for a 'morality of cases' was unable to sooth him in his predicament.[56] However,

[53] Boyle, 'Of the Study of the Booke of Nature', in *The Works of Robert Boyle*, v. 13, p. 151.

[54] Hunter, *Boyle: Between God and Science.*

[55] Boyle, 'Of the Study of the Booke of Nature', in *The Works of Robert Boyle*, v. 13, p. 147.

[56] Hunter, 'The Conscience of Robert Boyle'. About Boyle's financial skills, for instance, it is telling that those receiving salaries in the New England Company, mainly missionaries and teachers preaching the Gospel according to its 1662 Charter, asked to be paid in 'necessaries' and not money, since they had difficulties 'how to come by commodities at their needs'. Boyle, representing the Company, wrote ordering a different course of action. A rise of salary was decided that 'will put them to find out a means to accommodate themselves with conveniencys since they shall find soe much more commodities for their mony'. The reason was that 'the way of remitting mony' sent overseas to pay their salary would be put at 25 pounds in advance and thus 'augment the Revenew more considerably than now is'. The plan for improvement of the stock for the Company was undertaken, rather than

it appears that he was entirely untroubled in relation to his scientific work, which he described – and would restate – as plundering the work of creation in pursue of economic gain and satisfaction of 'greedy Appetites'. Moreover, this activity was necessarily preceded by an incredible amount of theoretical work towards the deconstruction of what tradition had considered a sacred understanding of nature. Boyle did, however, suffer from what appear to have been terrible crises of faith. In one of Boyle's interviews with pious men, in order to help him, the Bishop of Salisbury charitably advised him in the summer of 1691 to reject and slight them as 'mere effects of Distempers of the Body or the Brain' declaring that they 'were Mechanical Effects', arising from 'Distempers of the Animal Spirit'.[57] It is not uncommon to find these types of crises of faith occurring at some point in the lives of individuals who lead admirably charitable lives. Hence, they may cast light either on Boyle's saintly life or on the fragmentation of his reason.

4.2 All-Encompassing Human Necessities

4.2.1 Hartlib's 'Office of Publick Address'

Serving God's 'Glory and the Public' was a fundamental aim of the Reformers that found expression in many different projects.[58] Comenius proposed the foundation of a Baconian Universal College in London in *Via Lucis*, a text written during his stay in that city. Their members, dedicated to knowledge and public service, would communicate with colleagues throughout the world, thus forming an 'Invisible College'.[59] Furthermore, in 1635 Hartlib had started a membership list for a Society

the minimalist scheme of working for necessities proposed by the missionaries. 'Boyle to the Commissioners of the United Colonies in New England. 28 April 1669', in Michael Hunter and Edward B. Davis eds. *The Correspondence of Robert Boyle, vol. 4*, p. 133.

[57] See Robert Boyle, 'Appendix: The Text of the Interviews' *Robert Boyle (1627–91)* in *Scrupulosity and Science*, p. 90.

[58] From the salutation of a letter dated 30.8.1658 to Samuel Hartlib from Peter Figulus (1617–1670), a reformed priest from Bohemia and son in law of Comenius, 'Deare Sir, You refresh my bowells as many times as I see a letter written with your owne hands: I having this for a token of Gods speciall loue to the mankind & especially to the Common Cause of Protestants, if he pleases longe to continue yours & Mr Dury's life: no lesse then Mr Comen*ius* his. Hee being nowe in this his old age very variable & unstable in his resolutions. God helpe us all to serve his Glory & the Public as much as wee can!' Ref. 9/17/20A-22B, in *The Hartlib Papers*.

[59] Webster, *The Great Instauration*, p. 49; note the similarity with the Invisible College of international lawyers, Oscar Schachter, 'The Invisible College of International Lawyers' 72 *Northwestern University School of Law* (1977–78).

of Reformation and Correspondence.[60] More broadly, Comenius is largely remembered for developing the Christian philosophy he called 'Pansophy', as mentioned, which had humanist and Neoplatonists roots and sought to achieve universal harmony and provide education to solve the world's conflicts and overcome that 'labyrinth' that a human being was, promoting the universal school as a workshop of humanity, an *officina humanitatis*[61] – thus giving the *officia humanitatis* of the classics a technical and administrative expression.

Charles Webster read in the early exchange of letters (1646–1647) between Boyle and Worsley the beginning of what Boyle also termed the 'Invisible College', an actual scientific association that occurred when Bacon's writings and empirical method were incorporated into Protestant piety, or in other words the *reunion of utilitarianism and utopia*. Although Hunter debates the extent to which Boyle's 'Invisible College' amounted to anything substantial,[62] there is evidence to support the thesis, discussed further in this chapter, that distinctive ideas about commerce and exploitation of the material world as a way to God resulted from the fellowship of Worsley, Boyle and a few others. Far from belittling its importance, Joanna Piccioto suggests that the 'Invisible College' was in a way *everything*: an idea of a sacred corporate persona identified with the intellectual commons that decisively contributed to the formation of a new public sphere in seventeenth-century England.[63] Concern with the public realm was certainly one of main Hartlib's preoccupations. One may add that the 'Invisible College' represents what most visionaries of the new Protestant experimentalists had in common: industriousness, love of science and of humanity, a desire for glory for their country and sincere piety. However, as is the case of any social enterprise, at the end of the day only a handful of individuals were able to share the kind of intense communication that would enable them to be part of such a *sui generis* fellowship as the 'Invisible College'. Their own texts and pamphlets offer glimpses of the complex and rich English public sphere – military, merchants, politicians, the Church and the various social classes – that make this group of intellectual Puritans look, in context, decisively minuscule.

[60] Stephen Clucas, 'In Search of "The True Logick": Methodological Eclecticism among the "Baconian Reformers"', in Mark Greengrass, Michael Leslie and Timothy Raylor (eds.), *Samuel Hartlib and Universal Reformation: Studies in Intellectual Communication* (Cambridge: Cambridge University Press, 1994), p. 72.

[61] Capková 'Comenius and His Ideals, p. 79; Jergus, 'Comenius Jan Amos, 1592–1670'.

[62] Hunter, *Boyle: Between God and Science*, p. 67.

[63] Picciotto, *Labors of Innocence*, p. 126.

It is fascinating to observe how this method of experimenting with matter was put at the service of the actual cultural Reformation of England. Samuel Hartlib addressed a discourse to the Court of Parliament, published in 1647 as *Considerations tending to the happy accomplishment of Englands reformation in Church and State.* The gist of the address is the proposal contained in his acclaimed 'Office of Publick Address in Spirituall and Temporall Matters'.[64] However, the tract is also a masterful account of what a reformed commonwealth amounts to and how it should be applied in England, leading one to understand, indeed to explain why, despite the impracticalities involved in the whole scheme of the proposed Office, the Anglo-German Hartlib rose to inspire the men of the Long Parliament.

Hartlib was both scientifically minded and personally unambitious, an expert in trade and in the reformed religion. Despite not being personally wealthy, he acted as a disinterested and generous patron of many artists and scientists. The tract *Considerations* amounts to the strangest combination of piety, Protestantism, and trust in scientific research, putting each individuals' gifts at the service of 'the publick': the commonwealth embracing the particular situation of each citizen through bureaucracy, promotion of industriousness and prosperity. Hartlib depicted one of the goals of the commonwealth as being to establish 'superstructures of Gold, Silver, and Precious Stones' on a spiritual foundation. This idea was couched in a very pedagogical style, in which the arts of 'Trade' (embodied in the marketplace) were to be directed towards the practical organization of the commonwealth. *Considerations* reveals Hartlib to be a genius of Protestant Reformation and a very original thinker – a forerunner in intriguing ways of our present internet society with its systems of communication and exchange and, significantly, an expert in finances in terms of the specific legal-economic instruments he proposed with which to finance the Office, alongside, obviously, his proposal to deprive the official Church of its vast wealth. At the same time, Hartlib's proposals in *Considerations* make it clear why he sometimes trod a fine line between utopianism and being fair game for ridicule and satire and, as Mark Jenner has argued, in need of being able to prove that at least some of his ambitious plans were remotely feasible.[65] However, I wish to highlight here only three of

[64] Webster, *The Great Instauration*; Greengrass, Leslie and Raylor (eds.) *Samuel Hartlib and Universal Reformation.*

[65] Mark Jenner, '"Another *Epocha*"?: Hartlib, John Lanyon and the Improvement of London in the 1650s', in Mark Greengrass, Michael Leslie and Timothy Raylor (eds.), *Samuel Hartlib and Universal Reformation. Studies in Intellectual Communication* (Cambridge University Press, 1994), 343–356; see also Michael Hunter's Review of this book commenting that

the many intriguing points he made – points that, I would contend, also appear in different guises in the work of Locke. First, there is the fact that the reformed commonwealth nurtured the original micro-macrocosm analogies that Young and others mention as being typical of Hartlib's circle and the pansophic method, or in his words:[66]

> The Nationall Covenant doth bind Us for the redresse of our Evils, to settle our Church, our Civill State, and our particular Persons in a Reformed condition.[67]

Second, there is the manner in which Hartlib benefited from Comenius's principle of starting with matter, in order to establish the Erastian principle that the secular magistrate ought to be first in rank, guiding 'men' in their natural condition:

> The Advancement of this Kingdome (the Universall Kingdome of God) is the proper sphere of a Christian reformed Magistrate: First, as he is Gods Vicegerent [sic] over men, as they are in the condition of nature, and inhabitants of the world. Secondly, as hee is a Nursing Father to the Church within his dominion.[68]

Next in order after the magistrate was the communion of saints or 'Administration of Grace' that acted through love and care for the 'mutuall good in Spirituall and Temporall things' of everyone.[69]

Finally, the third principle is his description of the 'Office of Spirituall and Temporall Adresses' that Hartlib introduced as a 'Common Center of Repose', in which everyone may expect 'satisfaction for all their Lawfull desires'.[70] The 'Center' was in essence a place where all members of the commonwealth would 'come to give information of the Commodities which they have to be imparted unto others'.[71] People might need servants, have jobs to offer or seek employment. All these things were 'Usefull and profitable', convenient in 'Spirituall and Bodily Concernments'; the exchange

the projects of Hartlib's preferment 'were in fact speculative and of questionable validity, comparable to the schemes which were to evoke the satire of Swift and others in the late seventeenth and early eighteenth centuries' Michael Hunter, 28 *The British Journal for the History of Science* (1995), p. 469.

66 Young, *Faith, Medical Alchemy and Natural Philosophy*, p. 240.

67 Hartlib, *Considerations*, p. 6.

68 Hartlib, *Considerations*, p. 17.

69 That was expressed in sharing of gifts, knowledge and burdens, the entertainment of which was work of the 'faithfull Ministers of the Gospel' Hartlib, *Considerations*, p. 18.

70 Hartlib, *Considerations*, p. 36.

71 Hartlib, *Considerations*, p. 37.

of scientific research was also contemplated.[72] The process worked by registering and then sharing through the Office information about goods and other things. Hartlib proposed wildly impossible deadlines and times for registration – perhaps influenced here by his Prussian upbringing, albeit that, according to Charles Webster, Hartlib was inspired on this issue by a Frenchman, Théophraste Reanudot (1586–1653) and his *Bureau d'Adresse*.[73] The fact that his grandfather on his mother's side had been an agent of the English Baltic Company and his own father a merchant for the King of Poland, and later owner of a house of credit in Elbing, may have influenced the manner in which he employed the analogy between the Office and a great market:[74]

> If say, we consider this, we shall find what Conveniency the Use of Exchange-meetings doth bring to a Particular sort of Men who are called Merchants; the same, and farre greater will this Office bring to the whole Society of all Men, for all their Mutuall Occassions and Accommodations wherein they have need to incounter with one another so that this Office will be a Center of all mens satisfactions to gaine their Interest in each other for mutuall help.[75]

In a key sentence summarizing his project, Hartlib stated 'that this Office should bee erected properly for the Relief of Humane Necessities'.[76] Hartlib thus exploded the boundaries of a sober theological concept of supply of the needs of human nature for subsistence, with the extremely wide enumeration of services of the Office for relieving 'Humane necessities'. Certainly, human necessities were a matter of public service and it fell to 'none but to a supreme Magistrate to establish such an Office, and to Order it for the Proper Ends and Uses whereunto it should serve'.[77] Hartlib's Office emphasized ideas of love, care and citizenship of the communion of saints and of exchange of human beings' gifts and goods in the reformed commonwealth and even beyond, without necessarily transforming the notion into a question of capital, or materialism in itself, although Webster notes that its function was entirely economic.[78] Perhaps Hartlib was also thinking of something akin to a utopian society of mutual service, closer to modern ideas of social welfare than merely to

[72] Hartlib, *Considerations*, p. 40.
[73] Webster, *The Great Instauration*, p. 67.
[74] G. H. Turnbull, *Samuel Hartlib. A Sketch of His Life and His Relations to J. A. Comenius* (Oxford: Oxford University Press, 1920).
[75] Hartlib, *Considerations*, p. 40.
[76] Hartlib, *Considerations*, p. 37.
[77] However, Hartlib was of course himself applying for funding. Hartlib, *Considerations*, p. 42.
[78] Webster, *The Great Instauration*, p. 375.

charitable activities for the relief of the poor – the latter's welfare, however, was also taken into account in that they would be exempted from payment for registration. The institution was divided into an 'Office of Bodily Addresses', dealing with 'worldly Concernments', an 'Addresse of Accommodations' and an 'Addresse of *Communications*' both dealing with all 'Inward things' relating to 'the Soules of Men', by which Hartlib meant scientific rather than spiritual matters.

Webster described Hartlib's 14-year struggle, aided by his circle, to establish the Office, entailing a constant stream of new schemes, petitions to Parliament and the unsuccessful submission of proposals for funding, and how any hope of establishing the Office died with the Restoration. However, it is also clear that through his correspondence and his circle in effect Hartlib *embodied* the Office of Communication during his almost 40 years in England, from the date he arrived in Cambridge in 1625.[79] The list compiled by Webster from Hartlib's papers, of distribution of labour for a possible installation of the Office in the form of a new college at Oxford University illustrates the importance of Worsley's and Boyle's role in this project. This may have represented the point at which Boyle's 'Invisible College' project melded with the plans for the Office.[80] Here is the list:

Office of Divinity – Dury
Office of Mechanics – Boyle
Office of Agriculture and Traffick – Worsley and Culpeper
Office of Experimental Philosophy – Worsley, Coxe and Boyle
Chamber of Rarities – Caspar Godeman
Medicine – Gerard Boate, Worsley and Justin van Ascher

Worsley's role at the Oxford branch of the Office comprised the department of experimental philosophy, trade and agriculture and medicine and it shows both the esteem in which Hartlib held him, visible often in his correspondence and that of other members of the circle, and the areas in which he was thought to be an asset. Again, nothing would come of these designs. Instead, more realistic ways to serve science and the public were found. Boyle moved to Oxford at the age of 27 and later returned to London as

[79] This was done in the context of adoption of Bacon's writings and assuming as the task of his life the fostering of *Verulamian designes* in his adopted nation. Robert G. Franck, 'John Aubrey, F. R. S., John Lydall, and Science at Commonwealth Oxford', 27 *Notes and Record of the Royal Society of London*, (1973), p. 205; the network of correspondence that he directed during the Commonwealth was known also as 'the Office of Addresses' see, Sarah Hutton, *British Philosophy in the seventeenth Century* (Oxford: Oxford University Press, 2015), p. 56.

[80] Webster, *The Great Instauration*, p. 72.

an established scientist and pursued an academic career as a professional scientist in the company of other natural philosophers of the new science. John Wilkins (1614–1672), Christopher Wren (1632–1723), John Wallis (1616–1703) and William Petty (1623–1687) – who, as a professional civil servant, did not last long at the university – joined forces as members of Oxford's *eruditi* and founded the Oxford Experimental Philosophy Club around 1650 or even before, which seems to have been one of the outcomes and means for the advancement of experimental scientific activity in which the Reformers together with others participated.[81] The young John Locke's name appears in a list of the members of that exclusive Oxford club aimed at bringing about innovation in learning.[82] Locke had been elected to a Junior Studentship at Christ Church Oxford in the summer of 1652, and his membership explains the remarkable empirical research skills demonstrated in his studies of money. After all this empirical approach was the method for the study of things rather than of words.[83]

4.2.2 'A Well-Regulated Plantation'

The other obvious means by which Hartlib's aspirations in respect of his Office could be fulfilled was by pursuing a career as a civil servant. In view of the trajectory of Worsley's earlier career, Aylmer, writing in 1975, marvelled at his 'surprising appointment' to the 1650 Council of Trade, which, I think, can only be explained by reference to Worsley's connections with Hartlib's circle.[84] Aylmer also took a sceptical view of the idea that the obscure Worsley could have been 'an originator of such major legislation' as the Navigation Acts of 1651, the Enumerated Commodities Act of 1663 and the Plantations Duty Act of 1670.[85] His association with the promoter of the 'Office' and his circle, however, provides a quite realistic framework for that type of administrative legislation. Also, a clearer picture of Worsley's role in the passage of the Navigation Acts emerges from the major studies by Charles Webster on the Reformers' project, which shed light on the wider scientific, religious and political purview of the Hartlib circle, and Thomas Leng's in-depth study of Worsley's economic thinking

[81] Franck, 'John Aubrey, F. R. S.'
[82] Webster, *The Great Instauration*, p. 167; Karen Iversen Vaughn, *John Locke. Economist and Social Scientist* (Chicago: The University of Chicago Press, 1980), p. 6.
[83] Capková 'Comenius and His Ideals', p. 83.
[84] Aylmer, *The State's Servants*, p. 270.
[85] Aylmer, *The State's Servants*, p. 272.

and political career.[86] Among other projects, Worsley was involved, in the mid-1640s, in schemes for developing the productivity of the plantations, particularly those in Virginia, with the goal of resuscitating England's economy. However, as an Independent it was the appearance of the Rump Parliament that afforded him the political opportunity, to secure appointment on 1 August 1650 as secretary to the commissioners in the Council of Trade, the new body for the advancement of trade established by it.[87] He did not delay in taking action in this post. In his words, he had been 'the first sollicitour for the act for the incouragement of navigation, and put the firs fyle to it, and after writ *The Advocate* in defence of it'.[88]

Also one of the members of the above-mentioned Council of Trade from 1650 onwards, in autumn 1645 Culpeper wrote to Hartlib giving his opinion on a memorandum, probably written by Worsley, entitled 'Proffits humbly presented to this Kingdome' – a document he termed the 'Woorsteley-s-Propositions'.[89] A discussion of Culpeper and Dury's comments on them evidences the Reformers' ambiguous attitude towards wealth. While they were literally obsessed with material riches, their proposals were for the most part intended to lead to general prosperity. Their writings on trade constantly discuss material equality among the brethren, social justice, moderation and restraint in terms of 'the necessities of nature' and the state's role in meeting them. Thus, when Culpeper discussed levying new taxes he advised that they ought not to be laid 'upon nothing that serves for sobriety & necessity' and instead on 'all things that have the nature of superfluity' – in other words, 'upon all the merchandise of Babylon'. Merchants and buyers of luxurious products would accordingly carry the burden of taxation, while 'eyther poore, or (yf riche yet) soe sober as to live to, or neere the necessity of nature' would be free.[90] The question of the promotion of the Plantations became, significantly, another of those instances in which promoting the fortunes of private

[86] Thomas Leng, 'Commercial Conflict and Regulation in the Discourse of Trade in Seventeenth-Century England' 48 *The Historical Journal* (2005); the same *Benjamin Worsley (1618–1677)*; the same '"A Potent Plantation Well Armed and Policeed": Huguenots, the Hartlib Circle, and British Colonization in the 1640s', 66 *The William and Mary Quarterly*, Third Series, (2009); the same 'Shaftesbury's Aristocratic Empire' in John Spurr (ed.) *Anthony Ashley Cooper, First Earl of Shaftesbury 1621–1683* (Surrey, Burlington: Ashgate, 2011).

[87] Leng, *Benjamin Worsley (1618–1677)*, p. 13.

[88] Worsley quoted in Webster, *The Great instauration*, p. 464; pp. 462–465; Kelly, 'General Introduction: Locke on Money', p. 7.

[89] Culpeper to Hartlib, n.d. Autumn, 1645, *The Letters of Sir Cheney Culpeper*, p. 243.

[90] Culpeper to Hartlib, 7 November 1649, *The Letters of Sir Cheney Culpeper*, p. 360.

citizens should have worked hand in hand with augmenting the grandeur of England. Culpeper concurred with John Dury, the divine, that the 'Woorsteley-s-Propositions' could not be advanced 'excepte the intereste as well as the authority of a State be ingaged with it' and took the view that what Worsley proposed – a regulated plantation – was in essence what the Hugenot Pierre le Pruvost had proposed years earlier.[91]

In a letter sent that same autumn, Dury explained to Culpeper why it was not a good idea to convince Pruvost to ask for a personal patent for the Plantation project. Two years later, however, Culpeper was still asking Hartlib whether he and Dury had written effectually to 'mons. Pruvoste' about 'whether he will quitte that resolution of taking mens states & disposing of them without theire consente'.[92] Culpeper meant by this the system of land tenure involving taking leases directly from the state set out in the proposal for a state-sponsored American colony developed by Pruvost and his colleague Hugh l'Amy.[93] Webster relates that this aspect of state land leases encountered opposition among the liberal Reformers and was one of the reasons for preventing the realization of the French project. He also discloses that Pruvost and l'Amy had in fact been working on projects for settling French Protestants in Virginia to work with manufacturers of salt and silk and with olive farmers and vineyard owners since 1629. Back then, the creation of a colony named 'Carolina', in which l'Amy would had been 'Receiver general of Rents', was their sole concrete proposal. However, it came to nothing.[94]

Dury explained to Culpeper that while it was a bad idea for the state to grant land leases, the system of patents was, on both personal and practical grounds, not much of an improvement. First, it would look like 'a Monopolie in Trade', and Pruvost was adverse to it. Second, he and his friends were 'strangers' (foreigners) and 'there would bee so much oppositon of Envie & jeallousie against him' that the project would never get off the ground. Finally, no one would want to invest in a private venture like that. Instead, Dury concurred with Pruvost in arguing that the 'Authority of the state' must intervene since only in this way could the 'maintaining of that order by which all the work is to be effectuall' be achieved. Thus, Dury concluded, 'his patent would be an ordinance which the State should make for the Regulating of its owne proffit'. What would, in Dury's view, be the state's interest in the plantation? In what seem like

[91] Culpeper to Hartlib, n.d. Autumn, 1645, *The Letters of Sir Cheney Culpeper*, p. 243.
[92] Culpeper to Hartlib, 13 October 1647, *The Letters of Sir Cheney Culpeper*, p. 307.
[93] Culpeper to Hartlib, 13 October 1647, *The Letters of Sir Cheney Culpeper*, p. 308; Webster, *The Great Instauration*, pp. 371–372.
[94] Webster, *The Great Instauration*, pp. 371–372.

notions originating in Pruvost's plan, Dury pointed to the 'advantage of Employing the poore and idle people, who bring many distempers to the body of a State, because they cannot walke Reglarly and profitable'. Jobs, skills, virtue and personal reform would ensue for the mass of the people that 'bee sette a work by Land and Sea'. Further, added Dury, showing thereby that he was also well versed in trade discourse, it would give people the opportunity to

> improove their states and employ their stockes to better advantage for themselves and the public then hitherto they have done: (by which meanes the subjects become as it were the Factors, and the State by a prudentiall addresse is the Princepall tradere, and doth manage all their meanes with equalitie for their good) but the stoles and Estates of Forrainers will be drawen in, to increase the trade and make it beneficiall to the Public. The greater a stocke is, the more profit it doth yeeld.[95]

The colonies ought to be managed, in fact, like great companies. Eventually Pruvost returned to France. This led to the cosmopolitan-Protestant colour of the enterprise draining away, and it is accordingly unsurprising that the plantation ideas soon gained a nationalist hue. Although the memorandum entitled 'Proffits humbly presented to this Kingdome' is not signed, and Culpeper does not refer to it by its title, Webster, who published the text from amongst Hartlib's papers, thinks that the tract is connected to Benjamin Worsley, while also Braddick and Greengrass, who edited Culpeper's letters, note that the 'Woorsteley-s-propositions' is probably the text of 'Proffits humbly presented to this Kingdome'.[96]

Worsley's 'Proffits humbly presented to this Kingdome' anticipated some of the elements of both the Navigation Acts and *The Advocate*. However, it sketched a project that was simultaneously less detailed and much more ambitious.[97] The economic reform started with better husbandry, the use of fertilizer (the much discussed and advertised 'salt-petter' in the Hartlib circle), the improvement of the fishing industries and of production of national commodities such as wool and other clothes, and above all, rationalization of production from the rich soil of the plantations to boost the economy of the Kingdom as a whole. With a view to the future British Empire Worsley's skill in seeing the bigger economic picture is breathtaking. If England no longer needed to import her commodities from Spain, Italy, etc., but could establish

[95] Dury to Culpeper n.d. Autumn 1645, *The Letters of Sir Cheney Culpeper*, p. 235.
[96] Note by the editors in *The Letters of Sir Cheney Culpeper*, p. 243; 'Proffits' is published in Webster, *The Great Instauration*, pp. 539–546.
[97] *The Advocate* is a tract by Worsley in which he defended and explained the value of the Navigation Acts, see below.

> a well regulated plantation as wee shall cleerly and orderly describe with such lawes and constituons (*sic*) in it That the most yea all of those commodities wee now fetch from other partes, may bee had within our owne dominions and that at very inferiour rates especially those countries we will plant being also ordered and improoved according to the former manner, and government of our praescribed Husbandrie.[98]

The English nation would be thus able 'to receiving the wholl benefit both of the Commodities it selfe and monopolysing also the trading for them into their owne hands', which would afford her a strategic position that came from the perception that the nations that now produced these commodities, wines, fruits, sugar, drugs and so on 'were ours by Conquest and possession'.[99] The ensuing material benefits were indeed immense: cheap products for domestic households, better quality of commodities, increase in trade and shipping, outdoing the Hollanders, enlargement of the dominions, increased revenues and profits arising from taxes paid in the Plantations, bullion and money 'Banckt and Hoorded', leading to more discoveries, the attraction of ambassadors and artists to the country, and the deprivation of 'neighbour Kingdoms of their rich manufacturers'. In sum, as England rose the nations about her 'must necessarily as much decay and weaken'.

> For as wee sending our owne commodities every where abroad and that at gainfull rates, not standing in need of returning others for them, dayly take in without laying out, and soe stil add and improve the wealth and stock of the Kingdome.[100]

England would be feared, respected, and able to 'dictate the laws', preserve peace among the countries and 'sit as judge an Umpire of al Christian differences'. To 'wealth and honour' would be 'annexed a Reformation of lawes, and an establishment of rightousness amongst us', a 'Propagation of the Gospel', 'Reformation of Education', 'Advancement of Learning by men appointed and maintained to keeping an Universall Correspondency by erecting of Threasure Houses for the Collection of the History of Nature, for experiments both Chymicall and Mechanicall and by increasing of choice and public Libraries', 'conversion of the Jewes' was 'shortly to be expected and without a doubt at hand', and finally 'Union of reconciliation throughout all the christian at least all the Protestant Churches'.[101]

[98] Benjamin Worsley 'Proffits humbly presented to this Kingdome', in *The Great Instauration*, p. 540.
[99] Worsley 'Proffits humbly presented to this Kingdome', p. 542.
[100] Worsley 'Proffits humbly presented to this Kingdome', p. 545.
[101] Worsley 'Proffits humbly presented to this Kingdome', p. 545.

In a word, Worsley envisaged England as a combination of Messianism and the Great Instaurator.[102] And all this, one should not forget, was to be started with *one well regulated plantation*.

Leng notes Worsley's 'cynical' or 'amoral stance' in preferring 'commerce' to 'virtue' in this and other texts leading to the Navigation Acts.[103] Furthermore, Culpeper's pointed recommendation, in 1645, to 'Mr Woorstleys finall aime' that '(not this family, Cownty, Nation, but) whole mankinde' ought to benefit from the scientific study of trade, hinted at the reservations that aggressive nationalism in trade and otherwise provoked among the Protestant Reformers.[104] And yet, as transpires from his letter to Hartlib, Culpeper was impressed by this scientific promotion of the laws of trade – and how could he not be?

But rather than merely being the result of Worsley's nationalistic inclinations, or just another example of mercantilist thinking, 'Proffits humbly presented to this Kingdome' may also be read as the perfect example in early economic science of the narrow application of the empirical method to the study of wealth conscripted to a certain nation. One nation would indeed flourish, the others decay or even perish. Pure empiricism signified leaving aside the analysis – and, in effect, isolating its proposals – from moral and religious considerations about the common good, and this despite the Puritans' deeply religious and universalist aims. That the principle of 'starting with matter', if applied specifically to the production and most efficient trade of certain commodities would lead to this type of outcome, speaks, indeed of the amorality of the scientific method itself, and also of Worsley's clever way of applying it.

4.2.3 *The Knowledge of Trade*

Worsley's authorship of *The Advocate* was among his accomplishments as a civil servant. A brief but remarkably pedagogical tract on the 'Canon and Laws of Trade', *The Advocate* was a defence of the Navigation Acts that was presented in August 1651 to the Council of State and published the following year. While critics of the Acts were asking why they did not present full-throated promotion of free trade, Worsley generally defended 'the enclosed market' facilitated by them.[105] In the context of discussion as to

[102] Webster, *The Great Instauration*.
[103] Leng, *Benjamin Worsley (1618–1677)*, p. 192.
[104] Culpeper to Hartlib, n.d. Autumn 1645, *The Letters of Sir Cheney Culpeper*, p. 243; Leng, *Benjamin Worsley (1618–1677)*, p. 192.
[105] Leng, 'Commercial Conflict and Regulation in the Discourse of Trade in Seventeenth-Century England', p. 950.

how the commonwealth ought to foster trade, Worsley explained in *The Advocate* that as a private individual observes the rules of trade in order to gain prosperity, so must a nation observe the same care of *a shopkeeper*: to buy at first hand where commodities were cheaper, to fetch commodities from the immediate places of their production or growth, to send commodities to places where they were most needed, and to send all commodities to their farthest or utmost market where they would naturally tend to yield the highest price.[106] The advancement of shipping that the Navigation Acts promoted would be ideal for these activities and a means 'in som measure, to recover us'.[107] Other points made in *The Advocate*, such as noting how the Dutch were benefitting in their trade from having a bank, would have to wait four decades to be implemented. However, that was ultimately undertaken in the 1690s with the foundation of the Bank of England. As noted earlier, in 1672 Locke acted as Worsley's secretary at the Council for Trade and Foreign Plantations for one year, and then replaced him in that position.[108] The influence of Worsley's ideas as expressed in *The Advocate* and probably in a number of other texts diligently copied into Locke's notebook is evident in the latter's writings on money: the need for research and information, the analogy of how the private man (shopkeeper or farmer) and the nation should act if both wished to become richer, the centrality of foreign trade for the nation, the importance of money as the lifeblood of the economy.[109] But while Worsley advocated a low-interest rate for money, considering that 'the Easiness or Lowness of interest' in Holland benefited trade, Locke's central point when writing on money was to prove that the interest rate ought to be left at its 'natural value', as we will see in Chapter 11.[110]

Worsley devoted the bulk of *The Advocate* to explaining scientifically to the Council of State why the Dutch, whose design had been 'to laie a foundation to themselvs for ingrossing the Universal Trade, not onely of Christendom, but indeed of the greater part of the known world', had beaten out the English nation in all economic areas.[111] Their 'Care' in

[106] Worsley, *The Advocate*, p. 13.
[107] Worsley, *The Advocate*, p. 13.
[108] See about this institution in William Letwin, *The Origins of Scientific Economics. English Economic Thought 1660–1776* (London and New York: Routledge, 2003), p. 162.
[109] Worsley, *The Advocate;* Kelly, 'General Introduction: Locke on Money', p. 7; Leng, 'Commercial Conflict and Regulation in the Discourse of Trade in Seventeenth-Century England'.
[110] Worsley, *The Advocate*, p. 10.
[111] Worsley, *The Advocate*, p. 1.

big and small issues of trade policy had helped them achieve this. Thus, Worsley set out to show the 'clear waie of Governing it (trade)'.[112] A detailed account of the markets that the Dutch had conquered was presented: 'East-land', the 'Baltick Sea', Greenland, Rusia, 'East-India', the fishing coast of England, 'Spain, Canaries and the Straighs', as well as the markets for specific products, such as cloth manufacturing and – in 'East-land' and the 'Baltick Sea' – 'most necessarie Commodities' such as 'Masts, Timber, Hemp, Pitch, Tar, Copper, Iron, Salt-peter, all sorts of Grain, Pot-ashes' and the like. Moreover, he gave figures illustrating the dramatic reduction in English shipping over a short period, from 200 to 16 in the trade to East-land, whereas 'the Hollanders' employed 'no less than 600 Sail'.[113] In short, Dutch shipping was cheap, since they had become masters of the commodities employed in shipbuilding while the English had been forced to employ their services. And that was the way in which the money of the nation had gone to Holland. Moreover, the Dutch were able 'to under-sell' the English in practically all commodities that were common to the English and the Dutch. Whereas the latter were extremely careful to keep up 'the Repute' of their manufactured products, they also overbid the English in foreign commodities. The situation run 'thus in a Circle, each part of it (as wee said) strengthening another part' with the result that the nation's stock was diminishing day by day.[114] Worsley considered that the wisest path to break that vicious circle was to imitate the Dutch and carefully apply the laws of trade, described as the 'Canon or rules Belonging to Manufacturers', and whose core message was the need for focusing on the quality and increase of manufactures, at home, and in the colonies:

1. 'That although Divine Providence, in the greatness of his Wisdom, hath place natural commodities, som here, som there; yet no Manufacture or artificial commoditie, but may possibly bee had or transplanted into anie Countrie.
2. That all Manufactures (especially such as are of Necessitie) if they are of a certain goodness, They are (like Coin) of a certain value and price also; so on the contrarie. If of an uncertain goodness, They, & c.
3. That two persons selling or making commodities of a like goodness, hee shall have the preference of the Market, that will sell them the cheapest. *And so two Nations likewise.*

[112] Preface, Worsley, *The Advocate.*
[113] Worsley, *The Advocate*, p. 6.
[114] Worsley, *The Advocate*, p. 5.

4. That the cheapness of Manufactures, and artificial commodities, doth altogether depend upon the plenty and cheapness of the matter, and upon the like cheapness of price, for Handie-labor.'[115]

Worsley seemed to state by rule number 1 that while natural resources were naturally located in different areas of the globe, both the production of artificial commodities and manufacturers had no limits and could be set anywhere. Moreover, there was no impediment to the English complying with these 'few' but 'unalterable Laws in all Manufactures' in the case of wool, and the fact that they had not done it only attested to their 'want of the like Care, as our Neighbours'.[116] Manufacturers were apt to be transplanted; moreover, they were like money – they had a certain value within the wider economic picture, and well-produced commodities were more valuable than others.

Civil servants entrusted with the responsibility to administer state affairs naturally thought in terms of social welfare. The introduction to Worsley's text states as much in his narrowing down to two reasons the need for careful consideration of 'Matters of Trade'. These amounted first to the '*Safetie*, *Unanimitie*, or *Defence* of this Nation', and next

> to preserv and maintein this Countrie: calling also to minde, how many times I have heard it urged, That here is no other means to quiet or keep up the spirits of the poorer sort of people: No other to give them Imploiment, or to finde a vent and Incouragement for their Labors (when they have wrought) and consequently no other to provide against the wants and distempers of them, and of the Generalitie, but solely by Trade, and by a due Order and Regulation of it.[117]

Nevertheless, Worsley's *The Advocate* also constituted modern economic thinking in terms of the benefit of the means of production locally through very flexible establishment of manufacturers and subsequent global trade. As he had noted in 'Proffits humbly presented to this Kingdome', 'Manufacturs being halfe if not the major part of the riches of all Kingdomes', whereas history had provided abundant examples, 'raysing themselves from Nothing to a greatness solely by them.'[118]

In different terms than 'value chains' – which was developed later, following fragmentation of the unity between capital, manufacturing and labour – together with the multiplication of manufactures, this was

[115] Worsley, *The Advocate*, p. 8.
[116] Worsley, *The Advocate*, p. 8.
[117] Worsley, *The Advocate*, p. 4.
[118] Worsley 'Proffits humbly presented to this Kingdome', p. 544.

exactly what Worsley was proposing.[119] Thomas Leng has argued that political discourse in the second half of the seventeenth century was neither mercantilists in the almost caricatured way in which that concept tends to be understood, nor a government defending itself from the rest of the countries. In the context of the ideas circulating in political debate, foreign trade was not depicted as a cake of finite size in relation to which one ought to defend one's portion. Instead, Worsley, and others were also very aware of both the conflictual and enterprising nature of trade, sometimes arguing about its unlimited possibilities when managed as a matter of state.[120] The aspect of competition is visible in Worsley's invitation to outdo the Dutch – in the same way that the Dutch had outdone the English, in a polished but firm manner – and in his belief in the (quasi-natural) existence of a series of trade laws that, if applied carefully, would help England to recover and take advantage of unlimited possibilities. The regulation of trade promised both wealth and social order.

As we have seen Worsley's lasting contribution was to study trade scientifically, developing laws of trade and of manufactures. It's clear that for the English Reformers trade had become the issue on which the other political and social questions hinged. Security and preservation of the nation and employment and thus provision for the wants of the people would certainly materialize through scientific trade and scientific production, and this perspective was also accompanied by the hope that it would realize an elusive utopian goal of a new kingdom of wealth, science and faith. With their versatile skills and their determination to apply modern empirical methods the Reformers certainly contributed to the reform of knowledge in England in many respects and to the scientific and regulated development of the Empire, particularly concerning the new legislation of trade and novel thinking about it. These were regarded as being independent from classic natural law and therefore functioned outside the usual sphere of moral laws. Nevertheless, behind the Reformers' schemes, principles of distributive justice within the commonwealth were also usually at stake.

[119] Joost Pauwelyn, 'Is Globalization Finally Re-balancing? Novel Ways of Leveling the Playing Field for Labour', in George P. Politakis, Tomi Kohiyama and Thomas Lieby eds. *Law for Social Justice* (International Labor Office, 2019).

[120] Leng, 'Commercial Conflict and Regulation in the Discourse of Trade in Seventeenth-Century England'.