



Maley, W. (2022) Knowledge exchange in the Seventeenth Century: from the Third University to the Royal Society. In: Sangster, M. and Mee, J. (eds.) *Institutions of Literature, 1700-1900: The Development of Literary Culture and Production*. Cambridge University Press: Cambridge, pp. 24-43. ISBN 9781108830201

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Deposited on 22 March 2021

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# **Knowledge Exchange in the Seventeenth Century: From the Third University to the Royal Society**

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In his proposal for a new library on the south side of St James's Park at the end of the seventeenth century, Richard Bentley declared that it 'may be so contriv'd for Capaciousness and Convenience, that every one that comes there, may have 200,000 Volumes, ready for his use and service. And Societies may be formed, that shall meet, and have Conferences there about matters of Learning'.<sup>1</sup> Bentley's innovation was in part a restitution of the Royal Library established under James I, 'stored with all sorts of good Books of That and the preceding Age, from the beginning of Printing', but now in a state of disarray:

There has been no supply of Books from abroad for the space of Sixty years last: nor any allowance for Binding; so that many valuable Manuscripts are spoil'd for want of Covers: and above a Thousand Books printed in England, and brought in Quires to the Library, as due by the Act for Printing, are all unbound and useless.<sup>2</sup>

Bentley advocated 'a radical transformation of the Royal Library into a great public institution of learning on the continental model'.<sup>3</sup> For the new building, he envisaged a structure of lasting value, drawing on domestic and foreign resources: 'The Wall that shall encompass the Library, may be cased on the inside with Marbles of ancient Inscriptions [...] either found in our own Kingdom, or easily and cheaply to be had from the *African Coast*, and *Greece*, and *Asia the Less*'.<sup>4</sup> Bentley's intention was for the new institution to become a magnet for international students: 'since the Writings of the *English Nation* have at present that great Reputation abroad [...] many Persons of all Countries learn our Language, and several travel hither for the advantage of

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<sup>1</sup> [Richard Bentley], *A Proposal for Building a Royal Library, and Establishing it by Act of Parliament* (London, [s.n.], 1697), p. 2.

<sup>2</sup> [Bentley], p. 1.

<sup>3</sup> Paul A. Nelles, 'Libraries, Books and Learning, from Bacon to the Enlightenment', in *The Cambridge History of Libraries in Britain and Ireland*, vol. 2, ed. by Giles Mandelbrote and K. A. Manley, (Cambridge: Cambridge University Press, 2006), pp. 23-35 (p. 32).

<sup>4</sup> [Bentley], p. 2.

Conversation'.<sup>5</sup> Consequently, he anticipated the building swiftly paying for itself: 'Tis our Publick Interest and Profit, to have the Gentry of Foreign Nations acquainted with *England* [...] more Money will be annually imported and spent here by such Students from abroad, than the whole Charge and Revenue of this Library will amount to.'<sup>6</sup>

This late-seventeenth-century proposal for a Royal Library in a Republic of Letters that would form a cornerstone of a restored Imperial Monarchy exemplifies the heady mix of nationalism, colonialism and commerce that characterised the emerging British state. Periodisation affords us essential frameworks and starting points but obscures the roots of those things we take to begin with our own period of study, whether they be bodies, nations, selves or, in the case of this collection, institutions. Often we are surprised by precedents for objects of study we take to be of later provenance. Our idea of modernity can be challenged in this way. For example, according to one source, the earliest periodical on record is the Roman *Acta Diurna*, dating from 623 BC.<sup>7</sup> In this chapter the aim is to push back our sense of the emergence of institutions of literature by pointing to some seventeenth-century precedents. The rediscovery and recovery of classical science had its freest rein in this period, intensified mid-century by a social and political revolution.<sup>8</sup> According to Steven Shapin, 'Seventeenth-century England witnessed the rise and institutionalization of a program devoted to systematic experimentation, accompanied by a literature explicitly describing and defending practical aspects of that program'.<sup>9</sup>

John Milton refers to institutions twice in *Of Education* (1644), first with reference to a specific 'discipline', 'the institution of Physick', and then in an allusion to the kind of practical schooling he envisages will 'supply a defect as great as that which Plato noted in the common-wealth of Sparta; whereas that City train'd up their youth most for warre, and these in their Academies and Lycaeu[m], all for the gown, this institution of breeding which I here delineate, shall be equally good both for

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<sup>5</sup> [Bentley],  
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<sup>6</sup> [Bentley], p. 2.

<sup>7</sup> F. Bayford Harrison, 'First Numbers', *Time*, 1:51 (1889), 66-82 (p. 66).

<sup>8</sup> See J. J. O'Brien, 'Commonwealth Schemes for the Advancement of Learning', *British Journal of Educational Studies*, 16:1 (1968), 30-42.

<sup>9</sup> Steven Shapin, 'The House of Experiment in Seventeenth-Century England', *Isis*, 79:3 (1988), 373-404 (p. 373).

Peace and warre'.<sup>10</sup> Milton's hybrid academy has prompted puzzlement: 'just what kind of an institution might include the study of biblical Aramaic alongside instruction in music, fortification, and wrestling?'<sup>11</sup> However, like their modern successors, seventeenth-century institutions depended on engagement and impact, on industry and empire, on internationalisation, on innovation, collaboration and interdisciplinarity, and on building the kind of external partnerships we take for granted today. Milton's *Of Education* exemplified the spirit of the age.

In this overview of the century leading up to this volume's official start date I am interested in how exactly the innovations of early modern research communities depended on, drew on, and were driven by colonial design. This is a vast subject, entailing collective biography, depth bibliography, micro-history, interdisciplinary engagement and transdisciplinary collaboration. Here I can only sketch the outlines of an argument. Taking as my starting point a little-known text by George Buck entitled *The Third Universitie* (1615), and as my endpoint the early years of the Royal Society, I explore how what began as a challenge to the universities of Oxford and Cambridge and an appeal to worldly engagement ended in an outward-facing trans-institutional sphere that drew its inspiration, founding figures and key personnel from the archipelagic and colonial contexts within which its pioneering interests developed. The seventeenth century marks a decisive shift from intellectual circles to learned societies, from armchair innovators to research hubs, and from sequestered centres of knowledge to agencies of state power. The origins of the first Royal Society lie in a range of institutions identified by Buck, including Gresham College; in later developments such as the Invisible College; and in Samuel Hartlib's Circle's pursuit of useful knowledge through an 'Office of Address'.<sup>12</sup> The relatively late establishment of the Dublin Philosophical Society by William Molyneux in 1683 conceals the extent of the Royal Society's Irish roots.<sup>13</sup> 'Avant-gardeners',

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<sup>10</sup> John Milton, *Of Education. To Master Samuel Hartlib* ([London: for Thomas Underhill? for Thomas Johnson?, 1644]), pp. 4, 6.

<sup>11</sup> Timothy Raylor, 'Milton, the Hartlib Circle, and the Education of the Aristocracy', in *The Oxford Handbook of Milton* ed. by Nicholas McDowell and Nigel Smith (Oxford: Oxford University Press, 2009), 382-406 (p. 382).

<sup>12</sup> Lauren Kassell, 'Invisible College (act. 1646-1647)', *ODNB*; Charles Webster, 'New Light on the Invisible College: The Social Relations of English Science in the Mid-Seventeenth Century', *Transactions of the Royal Historical Society*, 24 (1974), 19-42.

<sup>13</sup> See K. Theodore Hoppen, 'The Dublin Philosophical Society and the New Learning in Ireland' *Irish Historical Studies* 14:54 (1964), 99-118; T. C. Barnard, 'The Hartlib Circle and the Origins of the Dublin Philosophical Society', *Irish Historical Studies* 19:73 (1974), 56-71; W. R. Wilde, 'Memoir of

agricultural materialists, and bog-drainers active in Ireland and America from the 1580s to the 1660s were hard-wired into emerging networks of experts working across collaborative communities of scholar-practitioners.<sup>14</sup> There was no new medicine without frontiers, no advance in husbandry without fresh fields to plant, and, crucially, no knowledge exchange without satiric responses that parodied the pamphlet literature of projectors.

### **I. The Third University**

The University of London was officially established in 1836, with its two founding colleges, UCL and King's, dating from 1826 and 1829 respectively, but arguments for the de facto existence of a university in the city predated the Royal Charter by over two centuries. Buck's dedication to Edward Coke, dated 24<sup>th</sup> of August 1612, offers a vision of a civic university promoting the liberal arts:

I present here to your Lordship a view of the Academicall State, and of the Universality of the Studies, and of the liberall Arts, and Learnings taught, and professed in this Cittie of London [...] bestowed in the description of the Colledges, and collegiate houses founded in this Cittie for the professours of the Municipall, or common Law of this Land.<sup>15</sup>

Buck then lays out "A CATALOGUE, OR TABLE OF ALL THE ARTS AND SCIENCES READ, and taught in this Universitie of LONDON".<sup>16</sup> The list of 36 subjects includes Brachygraphy, 'A system of writing using abbreviations or special characters; shorthand', and Steganography, 'the practice of concealing messages or information within other non-secret text or data'. It also embraces the 'Art of Reuels',

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the Dublin Philosophical Society of 1683', *Proceedings of the Royal Irish Academy (1836-1869)*, 3 (1844), 160-176.

<sup>14</sup> For a fascinating discussion of institutional development and a nascent 'expertise' in service to the state – although the word itself is of nineteenth-century provenance – see Eric H. Ash, 'Expertise and the Early Modern State', *Osiris*, 25:1 (2010), 1-24.

<sup>15</sup> George Buck, *The third universitie of England. Or A treatise of the foundations of all the colledges, auncient schooles of priviledge, and of houses of learning, and liberall arts, within and above the most famous cittie of London* (London, 1615) p. 961. I am grateful to my colleague Bob MacLean for unravelling a complicated publication history. *The third universitie* was first published as an annex to the 1615 edition of Stow's *Annals*, edited by antiquarian Edmund Howes, Stow having died in 1605. Earlier editions of Stow's *Annals* conclude with an account of the two main universities. Howes perhaps came across Buck's account (circulating in manuscript) and decided to augment Stow with this celebration of London.

<sup>16</sup> Buck, p. 963.

because Buck, as Master of the Revels, believed his role ‘required [...] expertise in grammar, rhetoric, logic, philosophy, history, music, mathematics, and other arts’.<sup>17</sup>

Buck begins his discourse proper with a preface that sets up the question of a third university:

Having observed in divers Writers, as well forraigne as English, the Citie of London to be stiled an Universitie, and doubting of it, I tooke occasion thereby to examine upon what grounds and causes they had so stiled it, and after some search and consideration thereof, I found sufficient cause and reasons to satisfie me.<sup>18</sup>

Buck deals briskly with the objection that this third university has no papal bull to found it: ‘this is frivolous, for then had *Athens* beene no Universitie, for there the Pope had nothing to doe’. He takes issue with the perceived need for such papal authority to grant university status, arguing that ‘where the reformed Religion is professed, and established [...] the Popes power and authoritie is excluded’, adding that even if this were not the case, English monarchs had the right to establish ‘Universities, and Publique Schooles within their owne Kingdomes and Dominions’.

Buck escorts the reader around London and picks out the constituent parts of this third university work-in-progress, consisting of a remarkable array of existing institutions and activities, including ‘Schools of Theologie, and of the Arts in Westminster’, ‘the fower Innes of Court’, ‘the Innes of Chauncery’, ‘Gresham Colledge’, ‘the Colledge of Herauldes’, ‘the Art of Revels’, and ‘divers Professors of many other Arts, and Faculties residing in this University, and of Art memorative’.<sup>19</sup> Summarizing each of these institutions, Buck makes exalted claims for their combined efficacy:

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<sup>17</sup> Arthur Kincaid, ‘Buck [Buc], Sir George (bap. 1560, d. 1622), master of the revels and historian’, *ODNB*.

<sup>18</sup> Buck, p. 965.

<sup>19</sup> Buck, pp. 967-88. On the Inns of Court see John H. Baker, *The Third University of England: The Inns of Court and the Common-Law Tradition* (London: Selden Society, 1990); ‘Roman Law at the Third University of England’, *Current Legal Problems* 55:1 (2002), 123-150; and ‘The Third University 1450-1550: Law School or Finishing School’, in *The Intellectual and Cultural World of the Early Modern Inns of Court*, ed. by Jayne Elisabeth Archer, Elizabeth Goldring, and Sarah Knight (Manchester: Manchester University Press, 2011), pp. 8-27.

But not to be long in particularizing every art and every Science professed and taught in this Cittie [...] who can then deny that London is not onely the third Universitie of England, but also to be preferred before many other Universities in Europe, or in any other parte of the world knowne.<sup>20</sup>

Gresham College, which came into being in 1596-7, is a focal point of this distributed collegiate campus. Thomas Gresham, a younger son who served an apprenticeship in the Mercers' Company, and had business interests in Paris and Brussels, founded the Royal Exchange and left as his other legacy the College that bore his name. A fluent French speaker who also spoke Flemish – as well as being versed in Latin and Greek – Cambridge-educated Gresham was committed to practical knowledge of the kind only a new institution could freely encourage.<sup>21</sup> Gresham College quickly became 'a meeting place of scientists and a clearing-house for scientific information'.<sup>22</sup>

Thomas Heywood's panegyric to London University in 1632 pressed the city's claim as the site of a third university further.<sup>23</sup> Heywood's dedication 'TO THE RIGHT Worshipfull *Hugh Perry*, and *Henry Andrewes*: the two Sheriffes of the *Honourable City London, last Elected*' makes clear the colonial origins of London's newfound wealth:

your Trafficke and Commerce, (being free Merchant-adventures) testifis to the World your Noble Profession; as Trading in the *East-Indies, Turkey, Italy, Spayne, and France, &c.* to the Honour of our Nation abroad, and singular Profits redounding to the *Realme* at home. Your more private Employments heretofore, aswell in furthering Arts, as incoureging Armes, adding no common Luster to these Offices, unto which Time and your owne Demerits have at this present called you.<sup>24</sup>

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<sup>20</sup> Buck, p. 988.

<sup>21</sup> Ian Blanchard, 'Gresham, Sir Thomas (c.1518-1579)', *ODNB*.

<sup>22</sup> Francis R. Johnson, 'Gresham College: Precursor of the Royal Society', *Journal of the History of Ideas*, 1:4 (1940), 413-438 (p. 427).

<sup>23</sup> Thomas Heywood, *Londini artium & scientiarum scaturigo. Or, Londons fountaine of arts and sciences* (London: Nicholas Okes, 1632). See also J. Caitlin Finlayson, 'Thomas Heywood's Panegyric to London's "University" in *Londini Artium & Scientiarum Scaturigo: or, Londons Fountaine of Arts and Sciences* (1632)', *The London Journal*, 39:2 (2014), 102-119.

<sup>24</sup> Heywood, A3<sup>r</sup>.

Having summarised the schools and activities around the city, Heywood pauses – ‘So much for the Studies of the Braine’ – and gets down to the business of trade, for it is as ‘an open Mart’ for ‘forraigne Nations’ that London excels.<sup>25</sup> For Heywood, London’s knowledge economy is rightly a free market, rather than a closed college.

Francis Kynaston’s Covent Garden College was the next claimant to the throne of London learning. Kynaston signalled his intentions in an elaborate masque performed in 1635.<sup>26</sup> The following year *The constitutions of the Musæum Minervæ* echoed some of Buck’s arguments for a London university, opining that it would serve the purpose of ‘bringing of vertue into action, and the Theorie of liberall Arts into more frequent practise’, but Kynaston also contended that such an institutional arrangement was desirable so ‘that *England* may be as well furnished for the vertuous education, and discipline of her own Natives, as any other Nation of *Europe*’.<sup>27</sup> Here education is figured as a means of advancing native knowledge rather than creating an open market for foreigners. Arguing for Gresham College as a forerunner of the Royal Society, Francis Johnson dismissed Kynaston’s royalist venture and his ‘six professorships of Medicine, Languages, Astronomy, Geometry, Music, and Fencing’ rather too readily as an irrelevance, the outbreak of civil war having scuppered Kynaston’s plans.<sup>28</sup> But if we look at what Kynaston intended for his Covent Garden College for the Education of the Nobility, it looks more substantial and not so far removed from Milton’s fusion of commerce and conceptual knowledge.<sup>29</sup> Kynaston’s knightly museum never saw the light of day, but light was dawning elsewhere.

## II. Filthy Lucre: From Royal Exchange to Royal Society

In his famous treatise on knowledge Francis Bacon placed learning before lucre:

For many have entred into a desire of Learning and Knowledge, some upon an imbred and restlesse *Curiosity*; [...] others for *Lucre* and living; few to

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<sup>25</sup> Heywood, A4<sup>v</sup>.

<sup>26</sup> Francis Kynaston, *Corona Minervæ* (London: William Sheares, 1635).

<sup>27</sup> Francis Kynaston, *The constitutions of the Musæum Minervæ* (London: Thomas Spencer, 1636), Sig.3. On Kynaston’s contribution to courtly education see Richard Cust, ‘Charles I’s Noble Academy’, *The Seventeenth Century*, 29:4 (2014), 337-357.

<sup>28</sup> Johnson, ‘Gresham College’, p. 424.

<sup>29</sup> Kynaston, *Constitutions*, pp. 4-6. Kynaston’s was one of a series of aristocratic initiatives. Earlier, under James I, Edmund Bolton had tried to establish an ‘Academ Roial’. F. H. Thompson, ‘The Society of Antiquaries of London: Its History and Activities’, *Proceedings of the Massachusetts Historical Society*, 93 (1981), 1-16 (p. 4).



improve the gift of reason given them from God, to the benefite and use of men.<sup>30</sup>

However, the Bacon-inspired Hartlib Circle – ‘not a tight-knit group but an affiliation of like-minded participants in overlapping correspondence and patronage networks’ – embarked on its own adventures in etymology and ‘luciferous’ learning.<sup>31</sup> Following the fortunes of this pun, as Kevin Dunn observes, reveals just how invested the new science was in making money:

The Latin original of ‘Luciferous’ – *luciferum*, or ‘lucre bearing’ – is so uncommon that Hartlib’s word seems likely to have been formed on a punning analogy to ‘luciferous’, ‘light bearing’, a Baconian key word. Criticizing those who would turn prematurely to profit taking [...] Bacon writes in the Preface to the *Instauratio magna*, ‘fructifera (inquam) experimenta, non lucifera, quaesivit’. The *Oxford English Dictionary* first records ‘luciferous’ in 1648, in William Petty’s *Advice ... to Mr. Samuel Hartlib*, and the brief life of this semantic unit coincides entirely with the efforts of Petty, Hartlib, Dury and others to identify more fully the Baconian project of scientific collaboration in the public interest with economic theories that private enrichment could serve the public good.<sup>32</sup>

‘Luciferous’ – ‘Bringing gain; lucrative, profitable’ (*OED*) – captures beautifully that distinctive fusion of enlightenment and entrepreneurialism that characterised what Daniel Defoe called ‘The Projecting Age’.<sup>33</sup> This neologism, fresh-minted as Dunn says when Sir William Petty deployed it in advice addressed to Hartlib, quickly took

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<sup>30</sup> Francis Bacon, *Of the advancement and proficiencie of learning; or, The partitions of sciences* (Oxford: Leon Lichfield for Robert Young and Edward Forrest, 1640), pp. 39-40.

<sup>31</sup> Ted McCormick, ‘Food, Population, and Empire in the Hartlib Circle, 1639-1660’, *Osiris*, 35:1 (2020), 60-83 (p. 61).

<sup>32</sup> Kevin Dunn, ‘Milton Among the Monopolists: *Areopagitica*, Intellectual Property and the Hartlib Circle’, in *Samuel Hartlib and Universal Reformation: Studies in Intellectual Communication*, ed. by Mark Greengrass, Michael Leslie, and Timothy Raylor (Cambridge: Cambridge University Press, 1994), pp. 177-192 (pp. 180-181). On Hartlib’s legacy see Mark Greengrass, ‘Interfacing Samuel Hartlib’, *History Today*, 43 (1993), 45-49, and Leigh T. I. Penman, ‘*Omnium Exposita Rapinae*: The Afterlives of the Papers of Samuel Hartlib’, *Book History*, 19:1 (2016), 1-65. On Dury’s 1650 vision of the ideal library see Catherine J. Minter, ‘John Dury’s *Reformed Librarie-Keeper*: Information and its Intellectual Contexts in Seventeenth-Century England’, *Library & Information History*, 31:1 (2015), 18-34.

<sup>33</sup> Daniel Defoe, *An Essay upon Projects* (London: R. R. for Thomas Cockerill, 1697), p. 1.

hold within the emerging scientific community: ‘Schollers now disesteemed for their Poverty [...] and unable even for want of lively-hood, to perfect any thing even in their own way, would quickly help themselves, by opening Treasures, with the Key of Lucriforous Inventions’.<sup>34</sup> Petty believed in making use of people and things, as he elaborates in his advice:

The Compilers first scope in Inventions shall bee, how to apply all Materials that grow in Abundance in this Kingdome, and whereof but in considerable use and Profits are as yet made to more advantage to the Common-wealth. And also how all Impotents, whether onely blind, or onely lame, and all Children of above seven yeares old might earne their bread, and not be so long burdensome to their Parents and others.

There should be made a Preface to the Worke to teach men how to make the most of experiments and to record the successes of them whatsoever, whether according to hopes or no, all being equally Luciferous, although not equally Lucriforous.<sup>35</sup>

One can see where Swift got the idea for *A Modest Proposal*, and, as we shall discover, satires of the projecting age appeared at an early stage, almost in step with the projectors themselves.<sup>36</sup>

The word subsequently appeared in the title of a text attributed to Hartlib where a link was made between colonial ventures and an Office of Address:

Whosoever shall have relation to *Virginia*, the *Barbadoes*, *New England*, or any other Countrie inhabited with English, or shall have cause to send into any

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<sup>34</sup> William Petty, *The advice of W.P. to Mr. Samuel Hartlib for the advancement of some particular parts of learning* (London: [s.n.], 1647, i.e. 1648), p. 23. Text mispaginated; numbers given as they appear.

<sup>35</sup> Petty, p. 20. On Petty’s proposal for institutions as ‘literary work-houses’, see Walter E. Houghton, ‘The History of Trades: Its Relation to Seventeenth-Century Thought: As Seen in Bacon, Petty, Evelyn, and Boyle’, *Journal of the History of Ideas*, 2:1 (1941), 33-60 (p. 43).

<sup>36</sup> On Swift see David Alff, ‘Swift’s Solar Gourds and the Rhetoric of Projection’, *Eighteenth-Century Studies*, 47:3 (2014), 245-260; and J. M. Treadwell, ‘Jonathan Swift: The Satirist as Projector’, *Texas Studies in Literature and Language*, 17:2 (1975), 439-460. For a nuanced treatment of projecting as indebted both to public good and private greed see Mordechai Feingold, ‘Projectors and Learned Projects in Early Modern England’, *The Seventeenth Century*, 32:1 (2017), 63-79.

of those places, or would inhabit, or transplant himself into those parts, he may have all intelligence and expedients, with as much conveniency as may be.<sup>37</sup>

In an idolatrous passage vindicating the importance of lodestones, Robert Boyle exalts ‘Lucriferosness’ as a way of selling science to the state:

if we impartially consider the Lucriferosness (if I may speak in my Lord of *St Albans* Stile) of the properties of Things, and their Medical Virtues, we shall finde, That we trample upon many things, for which we should have cause to kneel, and offer God Praises, if we knew all their Qualities and Uses.<sup>38</sup>

On 18 May 1669 Isaac Newton wrote offering advice to Francis Aston before the latter travelled abroad:

Observe the products of nature in severall places especially in mines wth ye circumstances of mining & of extracting metalls and mineralls out of their oare [...] being ye most luciferous & many times lucriferos experiments [...] in Philosophy.<sup>39</sup>

Finally, Sir Hans Sloane, Irish physician, naturalist and collector, whose unique archive formed a cornerstone of the British Museum, and who, being from Ulster-Scottish settler stock, knew a thing or two about plantations, used the coinage in *A voyage to the islands* (1707):

The Blacks from the *East-Indies* are fed on Flesh and Fish at Home [...] and those from *Angola* run away from their Masters, and fancy on their deaths they

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<sup>37</sup> Samuel Hartlib, *Cornu copia, a miscellanium of lucriferos and most fructiferos experiments, observations and discoveries* (London: s.n., 1652), p. 16. See Thomas Leng, “‘A Potent Plantation Well Armed and Policed’: Huguenots, the Hartlib Circle, and British Colonization in the 1640s’, *The William and Mary Quarterly*, 66:1 (2009), 173-194; and Patrick McCabe, ‘Samuel Hartlib: A Polish Promoter of Colonial Settlement in Ireland’, *Seanchas Ardmhacha: Journal of the Armagh Diocesan Historical Society*, 19:2 (2003), 74-76.

<sup>38</sup> Robert Boyle, *Some Considerations Touching the Usefulness of Experimentall Naturall Philosophy* (Oxford: Henry Hall for Richard Davis, 1663), p. 45.

<sup>39</sup> *The Correspondence of Isaac Newton*, vol. 1. 1661-1675, ed. by H. W. Turnbull (Cambridge: Cambridge University Press, 1959), p. 10.

are going Home again, which is no lucriferous Experiment, for on hard usage they kill themselves.<sup>40</sup>

These were the economic and imperialist underpinnings of the new learning, and the Royal Society drew on the rich veins of knowledge laid out by Hartlib and others. Gresham College, part of the older distributed framework, provided the Royal Society with its first meeting place on 28 November 1660. By playing host, Gresham College ‘helped the Royal Society through its crisis years’, but suffered itself as a result as the new body shed the skin of the old.<sup>41</sup>

Christopher Hill cites Thomas Sprat’s remark in his 1667 *History of the Royal-Society* that if Gresham College ‘were beyond sea, it might well pass for a university’, while also stressing that ‘The Royal Society, the title of Sprat’s book reminds us, was the Royal Society *of London*.’<sup>42</sup> But what does ‘*of London*’ mean when the makeup of the original membership of the Royal Society covered the archipelago and when its interests lay, as Sprat insists in the same passage, ‘in things forein, & Native’?<sup>43</sup> What Michael Hunter in his *ODNB* entry on the ‘Founder members of the Royal Society’ calls ‘the foundational twelve’ included two who were Irish by birth – Robert Boyle and William Brouncker. Another, William Petty, had considerable experience in Ireland. Both Boyle and Petty were key players in the Irish wing of the Hartlib Circle. There were two Scottish members of the Royal Society: Alexander Bruce, the St Andrews-educated 2<sup>nd</sup> Earl of Kincardine, who had previously collaborated in Hamburg ‘in attempts to devise a pendulum clock that could be used at sea to determine longitude’, and Sir Robert Moray of Craigie in Perthshire, another well-travelled Scot with interests in maths, science and engineering. Jonathan Goddard was asked by Cromwell to serve as physician-in-chief to the army in Ireland and later served as physician to Cromwell in Scotland, ‘where he helped him get through a

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<sup>40</sup> Hans Sloane, *A voyage to the islands*, Vol 1 (London: B. M., 1707), p. liii. See Kay Dian Kriz, ‘Curiosities, Commodities, and Transplanted Bodies in Hans Sloane’s *Natural History of Jamaica*’, *The William and Mary Quarterly*, 57:1 (2000), 35-78; and David Buisseret, ‘Studying the Natural Sciences in Seventeenth-Century Jamaica’, *Caribbean Quarterly*, 55:3 (2009), 71-86.

<sup>41</sup> Ian Adamson, ‘The Royal Society and Gresham College 1660-1711’, *Notes and Records of the Royal Society of London*, 33:1 (1978), 1-21 (p. 15).

<sup>42</sup> Christopher Hill, *Intellectual Origins of the English Revolution* (Oxford: Clarendon Press, 1965; 1982), p. 63; emphasis in original.

<sup>43</sup> Thomas Sprat, *The history of the Royal-Society of London for the improving of natural knowledge* (London: T. R. for J. Martyn, 1667), p. 89.

serious illness'.<sup>44</sup> The Royal Society's founders thus aimed at 'the creation of a social basis for the institutionalized pursuit of natural philosophy', using the British peripheries as testing grounds for both theories and infrastructures.<sup>45</sup>

The archipelagic and Atlantic origins of the Royal Society reveal the extent to which it developed out of an internationalization agenda established in Gresham College, the Invisible College, and the Hartlib Circle, whose Irish branch was especially active, and in Hartlib's idea for an Office of Address, floated in the 1640s, based on the *bureau d'adresse* operated in Paris by Théophraste Renaudot.<sup>46</sup> Hartlib envisaged the Office of Address as 'a kind of central intelligence agency'.<sup>47</sup> Continental counterparts like Johannes Amos Comenius were initially sceptical about Hartlib's Office of Address, seeing it as less an international community of scholars than an attempt to install an English controlling interest in knowledge exchange.<sup>48</sup> The Office in its first unveiling looks like a small ads section writ large: 'a Certain Place should be designed by the Authority of the State, whereunto all Men might freely come to give Information of the Commodities which they have to be imparted unto others'.<sup>49</sup> This directory or registry of expertise, as an employment and information exchange, connected people and things, and periphery with centre, making readily available 'the kinds of information now found in a range of yearbooks and directories (including *Who's Whos*) that are the staple of ready reference sections

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<sup>44</sup> Michael Hunter, 'Founder members of the Royal Society (*act.* 1660-1663)', *ODNB*. See also by the same author 'The Social Basis and Changing Fortunes of an Early Scientific Institution: An Analysis of the Membership of the Royal Society, 1660-1685', *Notes and Records of the Royal Society of London*, 31:1 (1976), 9-114.

<sup>45</sup> P. B. Wood, 'Methodology and Apologetics: Thomas Sprat's *History of the Royal Society*', *The British Journal for the History of Science*, 13:1 (1980), 1-26 (p. 1).

<sup>46</sup> See Raymond Phineas Stearns, 'Colonial Fellows of the Royal Society of London, 1661-1788', *The William and Mary Quarterly*, 3:2 (1946), 208-268. For the later colonial history see R. W. Home, 'The Royal Society and the Empire: The Colonial and Commonwealth Fellowship. Part 1. 1731-1847', and 'Part 2. After 1847', *Notes and Records of the Royal Society of London*, 56:3 (2002), 307-332; and 57:1 (2003), 47-84.

<sup>47</sup> John James O'Brien, 'The International Educational Interests of Robert Boyle', *Comparative Education Review*, 9:2 (1965), 195-200 (p. 196). O'Brien notes that there were two Offices of Address: 'The Office of Address for Accommodations was to be set up in London to look after the welfare of the poor, whereas the Office of Address for Communications was to be set up at Oxford and would deal with religious matters, the advancement of learning, and new inventions' (p. 196).

<sup>48</sup> Vladimír Urbánek, 'J. A. Comenius and the Practice of Correspondence Networking: Between the Office of Address and the Collegium Lucis', *Gewalt sei ferne den Dingen!: Contemporary Perspectives on the Works of John Amos Comenius*, ed. by Wouter Goris, Meinert A. Meyer, and Vladimír Urbánek (Fachmedien Wiesbaden: Springer, 2016), pp. 291-308 (pp. 305-06). For Hartlib's role in promoting Comenius in London see Dorothy Stimson, 'Comenius and the Invisible College', *Isis*, 23:2 (1935), 373-388 (pp. 374-76).

<sup>49</sup> [Samuel Hartlib], *Considerations tending to the happy accomplishment of Englands reformation in church and state* ([London: s.n.], 1647), p. 37.

of every modern public library'.<sup>50</sup> As Hartlib elaborated elsewhere, the office enabled remote access to research:

if any man living remote, shall be able to discover any material thing [...] advantageous to the publick, or to himself, not being able to repair to *London*, to advance his designe [...] he may have all prevalent advantages effectually pursued to promote the execution thereof, without putting himselfe to the charge of a great journey at adventure[.]<sup>51</sup>

The Royal Society in this sense was less metropolitan than it appears, with regional hubs, international correspondence, and distance learning integral to its formation.<sup>52</sup>

The Office of Address was soon the subject of satire. In one coffee-house comedy, a customer reads out the news:

Here's an Advertisement of a Citizens Daughter of 17 handfull High, and 18 years of Age, who went without the Walls to drink Red-Cowes milk: 'tis fear'd she has stray'd among some of the neighbouring Parks. If any Male or Female Keepers of the said Chases will bring Notice of her to the Office of Address, they shall be honestly rewarded.<sup>53</sup>

The misogyny of contemporaries notwithstanding, the collaborative knowledge networks of Hartlib and others opened up a world where engagement mattered more than entitlement. The Hartlib Circle included influential women such as Katherine Jones (Lady Ranelagh), and Dorothy Moore Dury, both part of the Irish scene, as well as pioneering Dutch thinkers like Anna Maria van Schurman.<sup>54</sup> Jones, sister of Robert

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<sup>50</sup> W. Boyd Rayward, 'Some Schemes for Restructuring and Mobilising Information in Documents: A Historical Perspective', *Information Processing & Management*, 30:2 (1994), 163-175 (p. 166).

<sup>51</sup> Hartlib, *Cornu copia*, p. 15.

<sup>52</sup> For later developments aimed at challenging a perceived metropolitan monopoly on knowledge see Jon Mee and Jennifer Wilkes, 'Transpennine Enlightenment: The Literary and Philosophical Societies and Knowledge Networks in the North, 1781-1830', *Journal for Eighteenth-Century Studies*, 38:4 (2015), 599-612.

<sup>53</sup> Thomas St Serfe, *Tarugo's wiles, or, The coffee-house a comedy* (London: Henry Herringman, 1668), 25. For an excellent discussion see Jessica Reid, 'L'Écosse à l'envers: Scotland's Restoration Pamphleteer Thomas St Serfe', *Scottish Literary Review*, 12:1 (2020), 109-122 (pp. 112-114).

<sup>54</sup> See Evan Bourke, 'Female Involvement, Membership, and Centrality: A Social Network Analysis of the Hartlib Circle', *Literature Compass*, 14:4 (2017), 1-17; Ruth Connolly, 'Viscountess Ranelagh and the Authorisation of Women's Knowledge in the Hartlib Circle', in *The Intellectual Culture of Puritan Women, 1558-1680*, ed. by Johanna Harris and Elizabeth Scott-Baumann (London: Palgrave

Boyle, had her own hub connected to Hartlib's scriptorium.<sup>55</sup> Defending women's right to study, Anna Maria van Schurman, the first female student on the continent, answered the objection that 'The studies of Learning are not convenient for those that are destitute of means necessary to their studies', and thus women are excluded, by pointing out that while 'there be no Academies and Colledges, wherein they may exercise themselves [...] they may exercise themselves at home'.<sup>56</sup> Emerging distributed networks thus held out the promise of kinds of access previously denied by spatial distance and older forms of institutional gatekeeping.

### III. London to Leiden: The Fourth University?

Schurman attended lectures at Utrecht from its founding in 1636 – behind a screen so as not to distract her fellow students – but it was another Dutch university that impacted on developments across the North Sea. The Irish branch of the Hartlib circle, those Baconian protestant improvers whose various members included Arnold and Gerard Boate, Robert Boyle, Robert Child, John Durie, Myles Symner, William Petty, Robert Wood and Benjamin Worsley, had connections to Leiden University, a seedbed for the application of innovations in natural history to the Dutch colonies.<sup>57</sup> Founded in 1575 by William of Orange as a reward for withstanding the Spanish siege in 1573-4, Leiden proved a major locus of learning, almost a challenger for England's 'third university', certainly a prototype for those arguing for a university of London.<sup>58</sup> Well into the eighteenth century, it was where enterprising British students went for medical and scientific learning. Stan Mendyk says of Leiden:

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Macmillan, 2010), pp. 150-161; David Norbrook, 'Autonomy and the Republic of Letters: Michèle Le Dœuff, Anna Maria van Schurman, and the History of Women Intellectuals', *Australian Journal of French Studies*, 40:3 (2003), 275-287; and Carol Pal, 'Accidental Archive: Samuel Hartlib and the Afterlife of Female Scholars', in *Archival Afterlives: Life, Death, and Knowledge-Making in Early Modern British Scientific and Medical Archives*, ed. by Vera Keller, Anna Marie Roos and Elizabeth Yale (Leiden: Brill, 2019), pp. 120-149.

<sup>55</sup> Lynette Hunter, 'Sisters of the Royal Society: The Circle of Katherine Jones, Lady Ranelagh', in *Women, Science and Medicine 1500-1700: Mothers and Sisters of the Royal Society*, ed. by Lynette Hunter and Sarah Hutton (Thrupp, Stroud, Gloucestershire: Sutton Pub., 1997), pp. 178-197 (p. 179).

<sup>56</sup> Anna Maria van Schurman, *The learned maid; or, Whether a maid may be a scholar? A logick exercise* (London: John Redmayne, 1659), pp. 28-9.

<sup>57</sup> For a robust discussion of Bacon's ingenious secularising of nature see Mordechai Feingold, "'And Knowledge Shall Be Increased": Millenarianism and the Advancement of Learning Revisited', *The Seventeenth Century*, 28:4 (2013), 363-393. Arnold Boate published *An interrogatory relating more particularly to the husbandry and naturall history of Ireland* as an appendix to the second edition of *Samuel Hartlib his legacie* (London, 1652), making him a pioneer in posting the first 'English' research questionnaire. See Adam Fox, 'Printed Questionnaires, Research Networks, and the Discovery of the British Isles, 1650-1800', *The Historical Journal*, 53:3 (2010), 593-621 (pp. 595-6).

<sup>58</sup> See Daniela Prögler, *English Students at Leiden University, 1575-1650* (London: Routledge, 2016).

It is significant that this university, and the Dutch in general, were now beginning to attempt the systematic natural history of their equatorial colonies. Fieldwork was carried out notably in Brazil (from 1637 to 1644) and the results were published. Such early research into natural phenomena had its effect on [Gerard] Boate and his work on Ireland was of a similar type.<sup>59</sup>

Influential figures in the new learning studied medicine at Leiden: Edmund Borlase, Robert Child, Nathaniel Henshaw, William Petty, and John Durie (who wrote the dedication to Boate's *Naturall History* under Hartlib's name). The Boate brothers' Leiden connections offer insights into the workings of colonialism, the limits of archipelagic history, and the impact of Dutch intellectual culture on English colonial theory and practice. Innovation, interdisciplinarity and internationalisation exemplify the brothers' shared activities. Building on important work by Keith Hoppen, Charles Webster and Toby Barnard, Nicholas Canny and Patricia Coughlan have emphasized the colonial context of the Boates' work.<sup>60</sup> Canny opens up an Atlantic dimension that embraces figures such as Robert Child and Balthazar Gerbier, while Coughlan sheds light on the colonialist assumptions of English scientists based in Ireland. Canny, recognizing *Irelands Naturall History* as 'a work of propaganda' pushes back the origins of the interest in colonial husbandry as far as agriculturalist and entrepreneur Robert Payne and Phane Beecher in the 1580s, but we could go back further still to Barnabe Googe in the 1570s and a work on farming and planting that was later applied to Massachusetts in the seventeenth century.<sup>61</sup> If Ireland – and New England – furnishes evidence of experimentation undertaken by improvers and projectors, then the advancement of knowledge in colonial contexts was intimately intertwined with political intelligence and economic exploitation. Knowledge exchange is not only

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<sup>59</sup> S. Mendyk, 'Gerard Boate and *Irelands Naturall History*', *The Journal of the Royal Society of Antiquaries of Ireland*, 115 (1985), 5-12 (p. 5).

<sup>60</sup> Nicholas Canny, 'Migration and Opportunity: Britain, Ireland and the New World', *Irish Economic and Social History*, 12 (1985), 7-32; Patricia Coughlan, 'Natural History and Historical Nature: The Project for a Natural History of Ireland', in *Samuel Hartlib and Universal Reformation: Studies in Intellectual Communication*, ed. by Greengrass, Leslie, and Raylor, pp. 298-317.

<sup>61</sup> Canny, pp. 15, 25; Barnabe Googe, *Foure Bookes of Husbandrie* (London: Richard Watkins, 1577). Googe's pioneering work on agriculture impacted directly on Ireland and America, where experimental approaches to cultivation were more easily introduced. See William S. Powell, 'Books in the Virginia Colony before 1624', *The William and Mary Quarterly*, 5:2 (1948), 177-184 (pp. 179-80).



implicated in empire; it is advanced there.<sup>62</sup> Indeed, ‘the problems and challenges faced by Europeans in the process of exploring and understanding the New World [...] created a new context for the emergence of empirical and collaborative procedures to solve technical problems’.<sup>63</sup> There is no medicine without frontiers, no husbandry without new fields to plant, hence the popularity of books on medicine and husbandry in the colonies. As Brant Vogel notes, ‘The English “cult of improvement” had already made climate changeability a commonplace notion in lands close to home’.<sup>64</sup> Colonialism played a triple role, as site of experimentation, source of income, and birthplace of some of the most radical innovators and projectors – Robert Boyle being a notable example.

#### IV. Parodying Projectors and Patentees

According to Koji Yamamoto, ‘The terms “project” and “projector” came into circulation in response to a wave of technology transfer and economic improvements schemes that emerged in the later sixteenth century’.<sup>65</sup> This wave soon broke on the shore of satire: ‘The projector or projectress as a popular character [...] emerged between 1600 and 1630, along with the genre of character study itself’.<sup>66</sup> Parodying projectors became a pastime for playwrights and pamphleteers, which is why the Hartlib Circle, despite its own lucriferous leanings, presented its activities as part of a reforming impulse rather than being harnessed to the profit motive. In this light, John Milton’s treatment of the projector is paradoxical. Having borrowed the language of ‘card and compasse’ used by the new geographers in an extended metaphor of surveying in his depiction of Paradise in the opening gambit of *The Reason of Church-governement*, Milton goes on to decry clerical innovators: ‘So far is it from the kenne of these wretched projectors of ours that bescraull their Pamflets every day with new formes of government for our Church’.<sup>67</sup> Milton could not have had in mind

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<sup>62</sup> For the applicability of the ‘truism that science was handmaid to empire’ to an earlier period than is traditionally acknowledged see Joyce Chaplin, ‘The Natural History of British Imperialism’, *Journal of British Studies*, 42:1 (2003), 127-131 (p. 127).

<sup>63</sup> Antonio Barrera-Osorio, ‘Experts, Nature, and the Making of Atlantic Empiricism’, *Osiris*, 25:1 (2010), 129-148 (p. 130).

<sup>64</sup> Brant Vogel, ‘The Letter from Dublin: Climate Change, Colonialism, and the Royal Society in the Seventeenth Century’, *Osiris*, 26:1 (2011), 111-128 (pp. 127-8).

<sup>65</sup> Koji Yamamoto, ‘Reformation and the Distrust of the Projector in the Hartlib Circle’, *The Historical Journal*, 55:2 (2012), 375-397 (p. 379).

<sup>66</sup> Jessica Ratcliff, ‘Art to Cheat the Common-Weale: Inventors, Projectors, and Patentees in English Satire, ca. 1630-70’, *Technology and Culture*, 53: 2 (2012), 337-365 (p. 343).

<sup>67</sup> John Milton, *The Reason of Church-governement* (London: John Rothwell, 1641 [i.e. 1642]), p. 4.

Hartlib's *Considerations tending to the happy accomplishment of Englands reformation in church and state*, which would not be published for another five years, but his point proves how thin was the line between innovation and obfuscation. What Hartlib and his collaborators objected to was monopoly in all its forms, like projectors stifling innovation by securing patents. What Milton abhorred was 'the outrageous desire of filthy lucre' in the church.<sup>68</sup> The separation of church and state that Milton argued for was slow to materialise – as he acknowledged in two pamphlets published in 1659, *Considerations touching the likeliest means to remove hirelings out of the church* (1659) and *A treatise of civil power in ecclesiastical causes* – and the problem of patents persisted through to the bursting of the South Sea Bubble in 1720, when the Bubble Act called a halt to their lucriferous lure.<sup>69</sup>

Between Ben Jonson's *The Devil is an Ass* (1616) and Swift's *Modest Proposal* (1729), there was a century of satire on projectors. In one such lampoon Thomas Heywood caricatures the projector as

one whose Arse makes buttons by the Bushell at the noyse of a Parliament,  
more than the Scots do at the noyse of *English Drummes*, and hath wrought  
under hand with Seminaries and Jesuites like a Mole, to set dissention  
betweene the two Kingdomes, on purpose that hee avoyd a Parliament, and  
hath gotten a Patent or Grant of all the Blew Bonnets that are taken in the first  
battell; but meanes not to be there himselfe, but stay behind, and engrosse all  
the Carrots and Parsnips that comes to *London*, to make Dildoes for the  
Citizens wives, old maidens, and poore whores that staid behind the  
*Progressse*.<sup>70</sup>

Slight though it seems, there is an edge to these observations. In *Machiavel's Ghost* Heywood runs through all the commodities seized upon by patentees. The list includes 'The Tobacco Projectors', who

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<sup>68</sup> Milton, *Reason of Church-governement*, p. 63.

<sup>69</sup> Christine MacLeod, 'The 1690s Patents Boom: Invention or Stock-Jobbing?', *The Economic History Review*, 39:4 (1986), 549-571 (p. 571).

<sup>70</sup> Thomas Heywood, *Machiavel's Ghost. As he lately appeared to his deare Sons, the Modern Projectors* (London: J. O. for Francis Constable, 1641), C3<sup>r</sup>.

Are great foes to Plantations: [...] Most gentlemen tooke them in snuffe: nay, some had a project upon their bodies, viz. to beate them to sneezing powder, and transport them into *Ireland*. The Countrie Ale-wives curses has seased them, for 'tis thought, their Roll is rotten, and their pricke Tobacco even in the pipe putrified: so that they will bee smoaked themselves.<sup>71</sup>

Richard Brome's *Covent Garden weeded* and *The new academy* are further examples of the genre.<sup>72</sup> John Taylor's woodcut speech-bubble exchange between Tenter-Hooke and Dodger illustrates the kind of broadsheet circulating at the time:

I have brought money to fill your Chest,  
For which I am curst by most and least.

Ov'r many yeares scraping is left at a clap,  
All thou hast gotten by others mishap.<sup>73</sup>

John Wilson's comedy drama *The Projectors* (1665) has a revealing exchange about the fraudulent uses of scholarship:

*Jocose*. I know thou hast been bred a Schollar, and thy invention not ill: – But canst thou Cant?

*Driver*. How think you Sir, – Suppose I should tell him I had studied the *Emporeuticks*, *Lemnicks*, *Camnicks*, and *Plegnicks*, could demonstrate the *Minimum quod sit*, of *Homocreicious*, and *Heterocrasious*; and stripping *Materia Prima* to her smock, discover the most private recesses, and occult qualities, of *Ignicadrillica*, *Metallorgonica*, *Euricatactica*, and *Hydropanta pressoria*, Do you believe (I say) he would be able to understand more of it, than I do my self, which is just nothing? If you call this Canting, let me alone with him.

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<sup>71</sup> Heywood, *Machiavel's Ghost*, D1<sup>r</sup>

<sup>72</sup> Richard Brome, *Five new playes* (London: A. Crook and H. Brome, 1659).

<sup>73</sup> John Taylor, *The complaint of M. Tenter-hooke the projector, and Sir Thomas Dodger the patentee* (London: Elizabeth Purslowe for Francis Coles, 1641).

*Jocose*. Excellent! – Then to subdivide ‘um into as undemonstrable (yet seemingly probable) Projects, – We shall make such sport!<sup>74</sup>

However, there was a serious side to this sport, a side to which writers such as Defoe and Swift were attuned: war and the pursuit of Empire.

## V. Studying War

The link between knowledge, war and empire cannot be overestimated, and in the early modern period scholars applied themselves to military strategy as a source of funding and employment.<sup>75</sup> Josias Bodley, son of merchant-turned-publisher John Bodley, after studying in Geneva and Oxford, served in Ireland as a surveyor from 1598.<sup>76</sup> Expert in mapmaking and military fortification, on a trip home to England in 1602 he ‘donated a quadrant, an astronomical sphere, and other brass instruments, all signs of his mathematical and engineering skills, to the Bodleian Library in Oxford’, newly founded by his older brother Thomas, a fitting gift from one enterprising son to another.

Daniel Defoe’s *An Essay Upon Projects* (1697) takes aim at innovators with an eye to a quick profit and identifies the influence of the nascent military-industrial complex in knowledge exchange. Defoe declares his to be the age of projects: ‘Necessity, which is allow’d to be the Mother of Invention, has so violently agitated the Wits of men at this time, that it seems not at all improper, by way of distinction, to call it, The Projecting Age’.<sup>77</sup> Defoe spells out exactly what the mother of invention gives birth to:

The Art of War, which I take to be the highest Perfection of Human Knowledge, is a sufficient Proof of what I say, especially in conducting Armies, and in offensive Engines; *witness* the new ways of Mines, Fougades, Entrenchments, Attacks, Elodgments, and a long *Et Cetera* of New Inventions which want Names, practised in Sieges and Encampments; *witness* the new sorts of Bombs and unheard-of Mortars, of Seven to Ten Ton Weight, with

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<sup>74</sup> John Wilson, *The Projectors: A Comedy* (London: John Playfere and William Crook, 1665), p. 6.

<sup>75</sup> Lisa Jardine and Anthony Grafton, “‘Studied for action’: How Gabriel Harvey Read his Livy”, *Past and Present*, 129 (1990), 30-78.

<sup>76</sup> J. J. N. McGurk, ‘Bodley, Sir Josias (c.1550-1617)’, *ODNB*.

<sup>77</sup> Defoe, *An Essay upon Projects*, p. 1.

which our Fleets standing two or three Miles off at Sea, can imitate God Almighty himself, and rain *Fire and Brimstone* out of Heaven, as it were, upon Towns built on the firm Land; *witness also* our new-invented *Child of Hell*, the Machine, which carries Thunder, Lightning, and Earthquakes in its Bowels, and tears up the most impregnable Fortifications.<sup>78</sup>

Defoe adds another layer of irony: the money-grubbing merchants now supporting the arms industry are those whose mistakes led to so much loss in the late war with France, so that the mother of invention gives birth not just to the child of hell but to ‘Abortions of the Brain’.<sup>79</sup> Defoe links innovation with poverty and inequality, as well as with military conflict:

an incredible number of the best Merchants in the Kingdom sunk under the Load [...] These, prompted by Necessity, rack their Wits for New Contrivances, New Inventions, New Trades, Stocks, Projects, and any thing to retrieve the desperate Credit of their Fortunes.<sup>80</sup>

Knowledge is not only implicated in empire; it is advanced there.<sup>81</sup> There are two chapters on bogs in Gerard Boate’s *Naturall History*, including one on the ‘Originall of the Bogs in Ireland; and the manner of Draining them practiced there by the English inhabitants’.<sup>82</sup> Ireland’s wetness was an issue for colonists, especially those interested in how cultivation and deforestation could affect the weather.

There is no bog without flies. Mathematician John Wallis, writing to Robert Boyle in 1669, one Fellow of the Royal Society to another, quoted from ‘a long oration of satirical invectives against Cromwell, fanaticks and the new philosophy’ by Robert South, Prebendary of Westminster, canon of Christ Church, and Public Orator of the University of Oxford including the choice line: ‘They can admire nothing

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<sup>78</sup> Defoe, pp. 3-4.

<sup>79</sup> Defoe, p. 4. On the ‘morally ambivalent figure of the “projector”’ see Vera Keller and Ted McCormick, ‘Towards a History of Projects’, *Early Science and Medicine*, 21:5 (2016), 423-444.

<sup>80</sup> Defoe, pp. 5-6.

<sup>81</sup> On the Royal Society and Empire see John Gascoigne, ‘The Royal Society, Natural History and the Peoples of the “New World(s)”, 1660-1800’, *The British Journal for the History of Science*, 42:4 (2009), 539-562, and Raymond Phineas Stearns, ‘Colonial Fellows of the Royal Society of London, 1661-1788’, *The William and Mary Quarterly*, 3:2 (1946), 208-268.

<sup>82</sup> Gerard Boate, *Irelands naturall history* (London: John Wright, 1652), pp. 112-117.

except fleas, flies and themselves'.<sup>83</sup> Elsewhere, South remarked: 'The Church is a Royal Society for settling old things, and not for finding out new'.<sup>84</sup> What can we make of fleas and flies? Margaret Cavendish, the first woman to attend a meeting of the Royal Society – on 30 May 1667 – saw several experiments conducted there.<sup>85</sup> In her pioneering prose fantasy, *The Blazing World* (1666), Cavendish has her Bear-Men seek to impress the empress with their microscopes, magnifying fleas and lice:

But after the Emperess had seen the shapes of these monstrous Creatures, she desir'd to know whether their Microscopes could hinder their biting, or at least shew some means how to avoid them? To which they answered, That such Arts were mechanical and below the noble study of Microscopical observations.<sup>86</sup>

So much for science, at least as practiced by Bear-Men. However, while researching the Boates in Cambridge in the summer of 2016, I came across a copy of that university's *Research Horizons*. It contained a fascinating article entitled 'Think Small', about research into 'the hunting behaviours of various flying insects [primarily dragonflies and killer flies] to determine how their visual systems influence their attack strategy, and what sorts of trade-offs they have to make in order to be successful'.<sup>87</sup> This research was funded by the US Air Force. It seems a long way from drains to drones, or from bogs to bombs, but the targeted removal of native populations is common to both. It's all about empire, empiricism and impact.<sup>88</sup> It is indeed 'lucriferous' – the word may have died but the drive lives on, fuelled as ever by filthy lucre.<sup>89</sup> Institutions are less independent than they might imagine, with the

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<sup>83</sup> Gerald Weissmann, 'Academic Boycotts and the Invisible College', *The FASEB Journal*, 21 (2007), 3017-3020 (p. 3017); R. H. Syfret, 'Some Early Reactions to the Royal Society', *Notes and Records of the Royal Society of London*, 7:2 (1950), 207-258 (pp. 240-241).

<sup>84</sup> Syfret, p. 242.

<sup>85</sup> Samuel I. Mintz, 'The Duchess of Newcastle's Visit to the Royal Society', *The Journal of English and Germanic Philology*, 51:2 (1952), 168-176.

<sup>86</sup> Margaret Cavendish, Duchess of Newcastle, *The description of a new world, called the blazing world* (London: A. Maxwell, 1666), pp. 31-2.

<sup>87</sup> Paloma Gonzalez-Bellido, Guillaume Hennequin and Simon Laughlin, 'Think Small', *Research Horizons: Pioneering research from the University of Cambridge*, 29 (2016), 24-25 (p. 25).

<sup>88</sup> For an intriguing sidelight on institutional input into a notorious seventeenth-century colonial venture see C. P. Finlayson, 'Edinburgh University and the Darien Scheme', *The Scottish Historical Review*, 34:118 (1955), 97-102.

<sup>89</sup> See Marion Hersh, 'Ethics, Scientists, Engineers and the Military', in *Ethical Engineering for International Development and Environmental Sustainability* ed. by Marion Hersh (London: Springer, 2015), pp. 325-360.

state – domestic and foreign – exerting its influence. We remain suspended between Buck and Defoe.