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Medicine, Metals and Empire: The Survival of a Chymical Projector in Early Eighteenth-Century London

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ABSTRACT: It is well known that Newtonian philosophers such as Johan T. Desaguliers defined their authority in contradistinction to the 'projector', a promoter of allegedly impractical and fraudulent schemes. Partly due to the lack of evidence, however, we knew relatively little about these eighteenth-century projectors, especially those operating outside learned networks without claims to gentility, disinterest or theoretical sophistication. This paper begins to remedy this lacuna through a case of a 'chymical' projector, Moses Stringer (fl. 1693-1714). Instead of aspiring to respectability, this London chymist survived by vigorously promoting new projects, thereby accelerating, rather than attenuating, the course of action that rendered him dubious in the first place. The article follows his (often abortive) exploitation of medicine, metals and empire, and thereby illuminates the shady end of the enlightened world of public science.

> I am not very fond of lying under the *Scandal* of a bare *Projector* ... [but] I can easily give grains of allowance for your *Suspicions*, because I know very well what *Miscarriages* there have been by People *Ignorant* of what they *pretend* to.[1]

Thus Thomas Savery, a Fellow of the Royal Society, complained of 'projectors' when promoting his engine for draining mines. Another natural philosopher, Johan T. Desaguliers, agreed. 'Projectors contrive new Machines (new to them, tho' perhaps describ'd in old Books, formerly practised and then difus'd and

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[1] Thomas Savery, *The miners friend; or, an engine to raise water by fire*, 1702, p. 2. The place of publication for pre-1800 materials is London unless otherwise stated.

forgot)' and thereby 'draw in Persons more ignorant than themselves to contribute towards this (suppos'd advantageous) Undertaking'. Such promoters would hold sway, as he put it elsewhere, 'especially if the Project has the Sanction of an Act of Parliament' or a patent to protect the supposed invention. '[T]hen the Bubble becomes compleate, and ends in Ruin.'[2] Natural philosophers frequently described projectors as embodying the opposite of their own ideals: they were unreliable promoters of knowledge, pretending competence but advancing their own private advantage at others' expense. This article scrutinises the substance of such complaints, re-examining the projector's infamy which sits at the heart of our understanding of public science in the age of Enlightenment.

It is well established that the market for scientific instruments and coffeehouse lectures had grown significantly by the early eighteenth century.[3] Account books of wealthy gentlemen, such as Sir George Savile, recorded sums paid for items such as a 'microscope with all the Apparatus', £4 4s, or paid to 'Mr Hawk[es]by for a Course of Astronomy', £5 5s.[4] Pivotal studies, especially by Larry Stewart, have suggested that experimental philosophers, versed in Newtonian mechanics and preoccupied with experiments, facilitated the industrial application of natural philosophy precisely by policing over dubious 'projectors' who promoted impractical schemes.[5] Natural philosophers

[2] Johan T. Desaguliers, *A course of experimental philosophy, vol. 1*, Second ed. corrected, 1745, p. 138; idem, *A course of experimental philosophy, vol. 2*, 1744, p. viii.

[3] Mary Margaret Robischon, 'Scientific Instrument Makers in London during the Seventeenth and Eighteenth Centuries, Ph. D thesis, University of Michigan, 1983; Alexi Baker, 'The Business of Life: the Socioeconomics of the "Scientific" Instrument Trade in Early Modern London', in F-E. Eliassen & K. Szende (eds.), *Generations in Towns: Succession and Success in Pre-Industrial Urban Societies*, Newcastle: Cambridge Scholar Publishing, 2009, pp. 169–191. For European contexts, see Mario Biagioli, 'From Print to Patents: Living on Instruments in Early Modern Europe', *History of Science*, (2006) 44, pp. 139-86.

[4] Nottinghamshire Archives, DD/SR/211/178, George Savile's Books of Accounts, 1715-1721, the book of 1720, pp. 48, 50.

[5] Larry Stewart, *The Rise of Public Science: Rhetoric, Technology, and Natural Philosophy in Newtonian Britain*, Cambridge, Cambridge University Press [hereafter CUP], 1992, pp. 29, 126, 282, 286, 326, 335, 390, 393; Margaret C. Jacob and Larry Stewart, *Practical Matter: Newton's Science in the Service of Industry and Empire, 1687-1851*, Cambridge, MA, Harvard U[niversity] P[ress], 2004, pp. 67-8, 83; Liliane Pérez, 'Technology, Curiosity and Utility in France and in England in the Eighteenth Century', in

such as Desaguliers, Francis Hauksbee and William Whiston lived in what Defoe called the 'Projecting Age', a period that saw the emergence of the stock market, and along with it, the boom of patents for inventions and technological enterprises of dubious credibility.[6] The story of projection in this period has been one of widespread knavery and incompetence calling for intellectual policing. As Stewart puts it, 'an epidemic of projectors and promoters was the best argument for the propagation of the Newtonian natural philosophy.'[7]

While policing the unreliable, purveyors of natural philosophy also highlighted their own virtue and competence. Influential studies by Steven Shapin and Simon Schaffer have examined how Fellows of the Royal Society, especially Robert Boyle, sought to lend credibility to their experiments by highlighting their Christian civility and gentlemanly disinterest, a lofty distance from politics and pecuniary labour.[8] It is also well known that savants and natural philosophers claimed to possess expert competence by highlighting their capacity to grasp fundamental laws and general principles underlying practical experience of getting things done.[9]

Bernadette Bensaude-Vincent and Christine Blondel, Aldershot: Ashgate, 2008, pp. 25-42, at pp. 34, 38.

[6] Christine MacLeod, 'The 1690s Patents Boom: Invention or Stock-Jobbing?', *Economic History Review* (1986) 2nd ser. 39, pp. 549-571. On 'projecting' in the early eighteenth century, see Paul Slack, *The Invention of Improvement: Information and Material Progress in Seventeenth-Century England* (Oxford, Oxford University Press [hereafter OUP], 2015), ch. 6. See also Maximillian E. Novak (ed.), *The Age of Projects*, Toronto: University of Toronto Press, 2008, especially chapters by Kimberly Latta, Alison F. O'Bryne, Sarah Kareem and Larry Stewart.

[7] Stewart, *Public Science*, op. cit. (5), pp. 283, 286 (at p. 286). See also Simon Schaffer, 'The Show that Never Ends: Perpetual Motion in the Early Eighteenth Century', *BJHS*, (1995) 28, pp. 157-189, esp. p. 185.

[8] Steven Shapin and Simon Schaffer, *Leviathan and the Air-pump: Hobbes, Boyle, and the Experimental Life*, Princeton, NJ: Princeton University Press, 1985; Steven Shapin, *A Social History of Truth: Civility and Science in Seventeenth-Century England*, Chicago: University of Chicago Press, 1994; Steven Shapin 'The Man of Science', in Katherine Park and Lorraine Daston (eds.), *The Cambridge History of Science, vol. 3: Early Modern Science*, CUP, 2006, pp. 179-91; Steven Shapin, 'The Image of the Man of Science', in Roy Porter (ed.), *The Cambridge History of Science, vol. 4: Eighteenth-Century Science*, Cambridge: CUP, 2003, pp. 159-83.

[9] Stephen Johnston, 'Making mathematical practice: gentlemen, practitioners and artisans in Elizabethan England', Ph. D thesis, University of Cambridge, 1994; Eric H. Ash, *Power, Knowledge, and Expertise in Elizabethan England*, Baltimore: Johns Hopkins UP, 2004.

But did policing by able natural philosophers incapacitate the projector of lower repute? If not, how did he survive? Projectors do feature frequently in studies of eighteenth-century public science, but do so most often as the shadowy 'other'. That natural philosophers could be derided alongside baser sorts of 'projectors' is often acknowledged.[10] Yet when it comes to the questions of projectors' survival, scholarly accounts tend to echo those of eighteenth-century philosophers: the projectors scraped by through shady operations, outright bribery, and the hurried execution of impractical, over-confident, schemes. 'The projectors of the early eighteenth century … were held in low regard precisely because they had duped so many prominent individuals'.[11] Case Billingsley, the promoter of a longitude scheme and marine insurance companies, is depicted as one driven by 'constant search for the "big-score"'.[12] Serious mismanagement and outright deceptions were surely all too often perpetrated. Recent studies suggest, however, that those who claimed to have discovered the method for determining longitude at sea – often disparaged as projectors – included merchants, inventors, foreign savants, and government officials, and that some of them certainly had technical skills and understanding required for the subject.[13] These works suggest that depicting projectors as incompetent, or worse fraudulent, 'projectors' might be to endorse contemporary biases.

Recent accounts have focused on projectors who achieved celebrity or notoriety or both, many of them operating in the upper echelons of society. Billingsley, for example, was able to approach Walpole through an MP of his acquaintance; another promoter of a longitude scheme, Emanuel Swedenborg, was the son of a Swedish theology professor.[14] I wish to complement such

[10] Stewart, op. cit. (5), pp. 260-61. See also Koji Yamamoto, 'Reformation and the Distrust of the Projector in the Hartlib Circle', *Historical Journal* (2012) 55, pp. 375-397.

[11] Stewart, op. cit. (5), pp. 261 (quotation), 271, 301.

[12] Jeffrey R. Wigelsworth, *Selling Science in the Age of Newton*, Aldershot: Ashgate, 2010, p. 136.

[13] Schaffer, 'Swedenborg's Lunars', *Annals of Science*, (2014) 71, pp. 2-26; Richard Dunn and Rebekah Higgitt, *Ships, Clocks & Stars: The Quest for Longitude*, Glasgow: Collins, 2014, ch. 2.

[14] Stewart, op. cit. (5), p. 305; Schaffer, op. cit. (13), p. 3.

accounts by examining the survival of Moses Stringer, a humble projector with limited expertise in what early moderns called 'chymistry', a category that sat uneasily across alchemy, metallurgy and medicine.[15] As we shall see, his economic circumstance was too humble to maintain gentlemanly disinterest, his social and intellectual standing too low to develop contacts with the Royal Society, Royal College of Physicians, or their fellows. If anything, he was closer the Fleet Prison, to which he was committed more than once (the reason for a committal in 1708, for example, was the total debts of £94 owed to four partners).[16] Stringer nevertheless survived and rose to brief prominence by exploiting three areas of knowledge and profit: medicine, metals and empire.

The case of such a humble projector, peripheral to learned networks, and standing on the verge of insolvency, is particularly valuable; for, one might expect that such a man would have been less competent, more desperate and hence perhaps more fraudulent. At least that was how some contemporaries mocked him in print: 'Dr. Stringer', whose 'Secrets in Medicine ... out-does Dr. *Faustus* himself, who was not only a Physician, but a Conjurer'.[17] Although no evidence suggests Stringer's involvement in alchemy, another satire counted him among 'Knavish Chimists' and '*Alchimical Quacks*' who lured innocent families by the 'pretended *Transmutation of other Mettals into Gold and Silver*, by their Powder of Projection'.[18]

True to contemporary jibes, we shall find Stringer being accused of cheating. Taking a closer look at his wide-ranging activities will, however, is to do more than a fact-finding exercise against contemporary depictions. For, the case enables us to start exploring the kind of promotional strategy available even to an actor with limited learning and expertise. The satirical reference to

[15] William R. Newman, 'From Alchemy to "Chymistry"', in Katharine Park and Lorraine Daston (eds.), *Cambridge History of Science Volume 3: Early Modern Science*, Cambridge: CUP, 2006, pp. 497-517.

[16] The National Archives [hereafter abbreviated as TNA], PRIS 1/2, fols. 3, 174, 315 (at fol. 3). It is most likely that the debt was repaid shortly after the committal.

[17] Edward Ward, *Mars stript of his armour: or, the army display'd in all its true colours*, 1709, p. 96.

[18] Nathaniel Wanley, *The history of man; or, the wonders of humane nature*, 1704, p. 105.

the alchemical 'projection' and transmutation of base metals into precious ones is revealing in this regard, as it uncannily encapsulates the chymist's modus operandi. As Carl Wennerlind and Ted McCormick have shown, alchemical transmutation provided powerful frameworks for conceptualising credit, banking proposals, Irish policy and much more.[19] The case of Stringer suggests that alchemical projection may have served as a template for action at the intersection between knowledge, economy and empire more broadly. That is, the chymist survived not by acquiring institutional membership, or by assuming gentility or disinterest, but by 'projecting' in and outside his laboratory, consistently seeking to turn whatever resources available to him into power and profits (as the alchemist did their base metals). In the process, Stringer exploited his casual training in Oxford, melted mineral ores, sold their medical virtues as drugs, coopted opportunities afforded by England's imperial expansion, and even revived dormant corporate privileges. By juxtaposing his wide-ranging activities with those of his better-known contemporaries, we can reveal surprising overlaps, as well as obvious differences, between them. The article thereby illuminates the shady end of the enlightened world of public science. Before delving into Stringer's Oxford training, the next section begins with the strange climax of his career.

Life and Afterlife of a Chymist

In 1709 things were moving on rapidly within the two ancient chartered corporations, of the Mines Royal and the Mineral and Battery Works, of the City of London. For more than two decades, the companies had been little

[19] Carl Wennerlind, *Casualties of Credit: The English Financial Revolution, 1620-1720*, Cambridge, MA: Harvard UP, 2011; Ted McCormick, *William Petty and the Ambitions of Political Arithmetic*, New York: OUP, 2009. For transmutation in Petty's idea, see also Sue Dale, 'Sir William Petty's "Ten Tooles": A Programme for the Transformation of England and Ireland during the Reign of James II', Ph. D thesis, Birkbeck, 2014, chaps. 4-7.

more than dormant, mostly meeting only once a year for re-electing officials.[20] A secretary of the Mineral Battery Works took away the seal and records of these companies, and died in about 1705 without returning them. The companies returned to life when some of the records were found and returned in early 1709. During the next two years, fifty-five meetings were held for the Battery Works alone. Numerous resolutions were made, and the companies were thereby amalgamated. Through this deluge of transactions arose a new governor and the self-styled 'Mineral Master General': Moses Stringer.

Little is known about Stringer's modest origins and early years. He probably started his career in the Midlands, somewhere close to Loughborough where his father lived. In July 1692, he obtained an episcopal license in Chester to practise medicine.[21] Although he never matriculated, Stringer also spent some time at the University of Oxford in the early 1690s.[22] By the time he died in 1714, Stringer had much of which to boast. He had engaged in mining, metallurgy, naval medicine, poor relief, and colonial settlement. He had demonstrated 'choicest Secrets and Experiments' to the young Peter the Great upon his London visit in 1698, and apparently provided his elixirs to the Queen Anne – the high points of his laborious life.[23]

Thanks to his wide range of activities, Stringer has appeared in studies of the copper industry, of the two chartered companies mentioned above, of the history of Trinidad and Tobago, and of Russian history.[24]In histories of

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[20] D. Seaborne Davies, 'The records of the Mines Royal and the Mineral and Battery Works', *Economic History Review* (1936) 6, pp. 209-13. As for the Mineral and Battery Works, for examples, meetings were held more than once after 1688 only in 1702 (twice) and in 1704 (four times). See British Library [hereafter BL], Loan 16(2).

[21] Moses Stringer, *Variety of choice experiments made of two incomparable medicines*, 1700, p. 8 [hereafter cited as *Variety*, 1700 as further editions with similar titles survive]. For his license, see P.J. Wallis and R. V. Wallis, *Eighteenth-century medics*, 2nd ed., Newcastle-upon-Tyne: Project for Historical Bibliography, 1988, p. 577.

[22] *Alumni Oxonienses 1500-1714*, Oxford: Parker, 1891, pp. 1422-52; *An exact alphabetical catalogue of all that have taken the degree of Doctor of Physick in our two universities, from the year 1659 to this present year 1695*, 1696.

[23] John H. Appleby, 'Moses Stringer (fl. 1695-1713): Iatrochemist and mineral master general', *Ambix* (1987) 34, pp. 31-45 [hereafter cited as Appleby].

[24] Leo Loewenson, 'People Peter the Great met in England: Moses Stringer, Chymist and Physician', *Slavonic and East European Review* (1959) 37, pp. 459-68; Eric Williams, *History of the people of Trinidad and Tobago*, New York: Frederick Praeger, 1964, p. 52;

medicine and metallurgy, Stringer has been portrayed amongst 'quacks', as an unreliable 'projector' with little skill or business acumen.[25] Viewing him as a quack is perhaps not surprising given that he was an 'irregular' practitioner below the ranks of the Royal College of Physicians.[26] In contrast, some more recent accounts have sought to rehabilitate his reputation. Stringer's medicinal 'salt of lemon', for example, has been hailed in the history of naval medicine as one of the earliest uses of citrus fruits for alleviating scurvy.[27] In an important reappraisal of Stringer's life and writing, John Appleby has treated him as a Paracelsian-Helmontian chymist. Presenting a range of printed and manuscript sources, Appleby has concluded that, 'far from being an empiric, Stringer was exceptionally knowledgeable and proficient in a wide field of theoretical and practical disciplines: chemistry, medicine, mineralogy, metallurgy and natural philosophy'.[28] If assessing him from modern disciplinary perspectives has provided fragmented, sometimes negative, assessments of his versatile career, then rescuing him from the charge of quackery and projecting has led to a rather celebratory account.[29] As in the wider scholarly literature, then, pejorative assessments have subtly shaped scholarly interpretations.

Reappraising the chymist in his own terms would surely be more productive than imposing modern disciplinary angles. Yet viewing him either as a mere quack or a reliable natural philosopher has made it extremely difficult to understand the most striking moment of his career: his brief rise to prominence in the two mining companies from 1709 until his death in 1714. A

William Rees, *Industry before the Industrial Revolution*, 2 vols., Cardiff: University of Wales Press, 1968, vol. 2, pp. 657-66.

[25] C.J.S. Thompson, *The Quacks of Old London*, London: Brentano, 1928, pp. 248-51; John Morton, 'The Rise of the Modern Copper and Brass Industry in Britain, 1690 - 1750', Ph. D thesis, University of Birmingham, 1985, ch. 2, p. 42, [hereafter cited as 'Morton Thesis'].

[26] See the lists of College membership published annually under the same title, *The catalogue of the fellows and other members of the Royal College of Physicians, London*, 1695.

[27] J.J. Keevil, *Medicine and the Navy, 1200-1900, Vol, II, 1649-1714* (London: Livingstone, 1958), p. 253.

[28] Appleby, p. 43.

[29] See also John Appleby, 'Stringer, Moses', in *Oxford Dictionary of National Biography*, 61 vols., Oxford: OUP, 2004, vol. 53, p. 89.

shareholder of the two companies since 1693, this chymist of a relatively humble origin became in 1709 'our absolute Mineral Master General forever', vested with 'whole and sole Executive Power of the Said Societys in as full and ample Manner'.[30] Under his leadership the united societies asserted their monopolistic power 'over fifty Branches of Profits', not only for the production and processing of gold and silver, but also for the digging and processing of 'All *Minerals*, *Earths* and *Metals*, *Salts* and whatsoever is subterraneous'.[31] This included tin, copper, lead and salt, and related manufactured goods like pin, copper vessels, and sheeted lead – all seemingly beyond the original scope of the charters given to the two corporations. As will be seen below, private entrepreneurs concerned with these sectors were now requested to pay arrears of rents allegedly owed to the united societies. The attempt ultimately failed due to evasions, a lack of governmental support, and Stringer's eventual insolvency and his untimely death. In the meanwhile, however, 'invaders' and 'interlopers' were threatened with legal action and with having their works 'destroyed' and tools confiscated.[32]

This aggressive attempt at reviving a corporate monopoly has been either passed over by historians, or else seen as an indication of Stringer's business enthusiasm, or as 'an amazing capacity for self-delusion on Stringer's part' – a product of the fancy and enthusiasm that Defoe and others mocked so relentlessly.[33] A closer look, however, suggests that Stringer's peculiar rise in the mining corporations was the culmination of his desperate projects to generate profits out of medicine, metals and empire. The remainder of this article thus goes beyond pejorative images and follows Stringer's footsteps to tease out how his various pursuits informed one another, across different spheres of knowledge and geography. Stuart McCook has recently proposed 'the deceptively simple method of *following* something, as it moves around the

[30] BL, Loan 16(2), fol. 227.

[31] BL, Loan 16(2), fol. 226v; M[ose] S[tringer], *Opera mineralia explicata: or, the mineral kingdom, within the dominions of Great Britain, display'd*, 1713, p. 255 [hereafter cited as *Opera*].

[32] BL, Loan 16(2), fols. 228v, 231v; 'Morton Thesis', p. 41.

[33] Rees, op. cit. (24), vol. 2, p. 660; Appleby, p. 40; 'Morton thesis', p. 42 (quotation).

world ... and doing a contextually rich analysis of what happens as it moves.'[34] Adopting this approach, we shall now follow Stringer's engagement with medicine and metallurgy, explore how that brought him into contact with the emerging British empire, and reveal what happened to his knowledge claims in the process.

Chymist in the Making: Stringer's Oxford

By the time Stringer went to Oxford in the 1690s, chymistry and experimental science in Oxford was in visible decline. The chymical philosophy of Paracelsus, further developed by van Helmont (1580-1644), had been introduced to Oxford from the mid-seventeenth century onwards by Peter Stahl (d. 1675) and Boyle (1627-1691). Yet, luminaries like Stahl, John Wilkins (1614-1672) and Thomas Willis (1621-75) had died some time ago; others like Boyle and Robert Hooke (1635-1703) had long since left Oxford.[35] The Ashmolean Museum had been established in 1683 but did not provide a systematic training in new science partly because the founder Elias Ashmole (1617-1692) died without fulfilling his promise to endow a chair in chemistry. Robert Plot (1640-1696) did teach chemistry at the Ashmolean, but his civil (not statutory) 'professorship' terminated in 1689 and soon left Oxford. His successor Edward Hannes (1664-1710) was still a young medical student; he too left the position around 1695, with the position terminated at that point.[36]

[34] Stuart McCook, 'Introduction [to Focus: Global Currents in National Histories of Science]', *Isis* (2013) 104, p. 776 (my italic).

[35] Mordechai Feingold, 'The Mathematical Sciences and New Philosophies', in Nicholas Tyacke (ed.), *The History of the University of Oxford, Volume VI: Seventeenth-Century Oxford*, Oxford, OUP, 1997, p. 442 [hereafter cited as Feingold]. This section owes much to this excellent chapter.

[36] Feingold, p. 439; Carol Brookes, 'Experimental Chemistry in Oxford 1648-c.1700: its Techniques, Theories and Personnel', unpublished MA thesis, Oxford, 1985, pp. 25-6.

However briefly, Stringer seems to have learnt '*Physick* and *Chimistry*' from Benjamin Woodroffe, a student of Stahl.[37] Although no direct evidence of Stringer's education in Oxford has been found, we know enough about the evolution of chymical practices in and outside Oxford that informed the kind of training that would have been available.[38] By the end of the seventeenth century, the complex worldview of earlier Paracelsians had changed dramatically. Earlier fascinations with the re-reading of the Creation as a chemical process, or with theories of sympathy and antipathy, were replaced by more mechanistic worldviews; the dream of the infinite production of gold had lost much of its credibility by the early eighteenth century.[39] Through Paracelsian practitioners like Stahl, skills initially developed in alchemy and metallurgy, such as the melting of metals, and the separation and amalgamation of compounds, were introduced to medicine. Such techniques were applied also to metallurgy, to extract medicinal 'liquors' or powders out of mineral and organic compounds.[40] Thus, like those inspired by the heterogeneous Paracelsian-Helmontian tradition such as Johann Moriaen, Johann Rudolf Glauber and Johan Joachim Becher before him, Stringer also pursued the 'Metallick parts of Chyimstry in Minerall Knowledge and Practices', while also producing chemical medicines from them.[41]

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[37] BL, Harley 5931, item no. 116, Moses Stringer, *Old-age and the gout: in a letter to the learned Dr. Woodrofe*, 1707 [hereafter cited as *Old-age*], p. 1; R.T. Gunther, *Early Science in Oxford, Part I - Chemistry*, Oxford: Oxford Science Laboratories, 1921, p. 23.

[38] Edward Lhuyd was the Keeper of the Ashmolean between 1691 and 1709. But no letters to and from Stringer or Woodroffe has been found in Lhuyd Correspondence at Bodleian Library, MSS Ashmole 1817a (O-S), 1817b (T-W).

[39] Allen G. Debus, *The Chemical Philosophy: Paracelsian Science and Medicine in the Sixteenth and Seventeenth Centuries*, 2 vols., New York: Science History Publications, 1977, vol. 1, esp. pp. 84-9, 96-103. For subsequent developments, see William R. Newman and Lawrence M. Principe, *Alchemy Tried in the Fire: Starkey, Boyle, and the Fate of Helmontian Chymistry*, Chicago: University of Chicago Press, 2002. While Stringer hinted that his cures approached the universal medicine, we find no evidence to indicate that he was seeking to transmute base metals into silver or gold.

[40] Harold J. Cook, 'Medicine', in Katharine Park and Lorraine Daston (eds.), *Cambridge History of Science, vol. 3, Early Modern Science*, Cambridge, CUP, 2006, pp. 407-434 (esp. pp. 421-3).

[41] BL, Loan 16(2), fol. 248v. See also Appleby, p. 31. For Moriaen, Glauber and Becher, see John T. Young, *Faith, Medical Alchemy and Natural Philosophy: Johan Moriaen, Reformed Intelligencer, and the Hartlib Circle*, Aldershot: Ashgate, 1998; Pamela

As the Oxford mathematician John Wallis (1616-1703) recalled in about 1700, a series of informal instructions had been available in Oxford after Boyle invited Stahl there in 1659. These exploited 'a convenient *Laboratory*' built by the university, 'well furnished with furnaces and utensils for that purpose'. In it '6, 8, or more' students would agree plans with an instructor and 'go through a whole *course of chymistry* ... with one company after another from time to time'.[42] The Ashmolean built upon this tradition, as described by Edward Chamberlayne. In addition to a fine laboratory, the museum boasted a collection of natural rarities and a 'Store-room for Chymical preparations', a cellar where chemical ingredients could be purchased 'at easie rates'. In the same museum, Plot was said to have offered a one-month 'Chymical course' concerning

> all Natural Bodies, relating to, and made use of in Chymicall preparations, particularly, as to the Countries, and places where they are produced, and found, their Natures, their Qualities and Virtues, their effects, by what Marks and Characteristicks they are distinguished one from another[.][43]

Note the emphasis placed upon basic, practical, details like place of origin of particular minerals and their virtues. What Stringer attended was probably one of these courses with a stronger emphasis on hands-on practices than on theoretical sophistication. Stringer's instructor, Woodroffe, also displayed a similar, practical, orientation. In Woodroffe's proposed curriculum for Worcester College, a chymical lecturer was to give four sessions on principles and twelve on experimental chemistry.[44] As Wallis attested, such instructions were made available until well into the early eighteenth century, even after

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H. Smith, *The Business of Alchemy: Science and Culture in the Holy Roman Empire*, Princeton, NJ: Princeton UP, 1994.

[42] T.W. Jackson (ed.), 'Dr Wallis' Letter against Mr Maidwell, 1700', in *Collectania, First Series*, Oxford: Oxford Historical Society, 1885, p. 316.

[43] Edward Chamberlayne, *Angliae Notitia*, 1684, pp. 327-8. See also R.F. Ovenell, *The Ashmolean Museum, 1683-1894*, Oxford: Clarendon Press, 1986, ch. 2.

[44] Feingold, p. 428, fn. 196.

Plot's tenure terminated.[45] The case at hand thus reveals the career and competence of a humble chymical practitioner who received extra-curricular instructions at a low point in Oxford's history as a centre of experimental learning.

Beyond self-fashioning

Thanks probably to his training at Oxford, Stringer was admitted to the Mines Royal and to the Mineral and Battery Works in 1693 as someone 'being Esteemed Ingenious & p[ro]pence to Chymistry & minerall Studies'.[46] Due to the intermission of regular teaching of chemistry at Oxford in about 1695, Stringer may have even offered ad-hoc chymistry lessons in colleges or in apothecary shops that were equipped with furnaces.[47] Three years later, in 1698, he described himself as 'The famous Mr *Stringer* the Chymsit (who made the Extraordinary Separation of Metals, and the Artificial Gem, before his Imperial Majesty the *Czar of Moscovy*'. Just a decade later he was referring to himself as 'Dr Moses Stringer who had been 14 years past Professor of Chymistry in the University of Oxford'.[48] No evidence of the university appointment has been found, yet some evidence does seem to support the impression of relative success. In January 1702, Stringer testified to the Chancery Court that he had spent nearly £1,000 for 'Erecting a Laboratory and a Foundary & in setting up Severall large Furnaces & Refineryes For the working & refineing of Mettals'.[49] This manuscript evidence has persuaded Appleby of Stringer's relative affluence and technical competence.[50] Note,

[45] Jakson, op. cit. (42), p. 316.

[46] BL, Loan 16(3), fol. 93, 16 June 1693 (Mines Royal admission, quotation); BL, Loan 16(2), fol. 207v, 7 Dec. 1693 (Mineral Battery Works admission).

[47] Stringer, *Variety*, 1700, p. 16. Licensed by the University, Oxford apothecaries were closely involved in chymistry, with their shops numbering about 20 by the 1660s. See Brookes, op. cit (36), pp. 12, 30 (a map showing their locations).

[48] *Relation*; BL, MS Loan 16(2), fol. 220v.

[49] TNA, C 5/632/110.

[50] Appleby, 'Stringer', p. 38.

however, that this speaks of Stringer's own estimation. A closer inspection of his material circumstances provides a less sanguine picture, to which we now turn.

Stringer began his career as a chymist on the move. In 1697, we find Stringer based in 'his *Refinerys* in the *High Peak* in *Derbyshire*'.[51] There he was providing cures to the sick and wounded, while melting metals for industrial purposes. Evidence suggests that he did not have a fixed address for another few years. We thus find him providing cures in Buxton, Chester, Leicester and London among other places.[52] When he performed the experiments for the Russian emperor at Deptford in March 1698, Stringer announced that he 'now is come to live in *York-Build*[*ing*]*s* in the *Strand*'; he was still there January next year when he signed the mining proposal addressed to parliament.[53] He did not stay there for long. Less than nine months later, in September 1699, we find him in one 'Mr Smith's a painter in Kerlson Court in Drury Lane'. His mining proposal of earlier in the year had neither won parliamentary support nor a prospect of profitable employment. Thus, from Drury Lane, Stringer wrote to the Duke of Hamilton in Scotland about his potential 'dispatch' to Edinburgh so that he would be 'able of My selfe to doe the service I intend for your Scotch Nation'.[54]

This newly discovered manuscript helps us to reassess Stringer's declared investment of £1,000 into his 'laboratory'. As Stringer told Hamilton, one Mr Godde was 'to raise the £200 ... towards ere[cting?] my Iron works'.[55] Stringer may have used his medical service on a *quid pro quo* basis to advance his mineral pursuits, that is, soliciting investment and other help from business partners who had received his medical services. The renowned mining entrepreneur Talbot Clerk, for example, had been distributing Stringer's Elixir

[51] BL, Loan 16(2), fol. 220v; Stringer, *Variety*, 1700, p. 15.

[52] Stringer, *Variety*, 1700, esp. pp. 3-16.

[53] [Stringer], *A most wonderful and true relation*, 1698 [hereafter cited as *Relation*]; Stringer, *English and Welsh mines and minerals discovered*, 1699, [hereafter cited as *Mines*], p. 24.

[54] National Archives Scotland [hereafter NAS], GD 406/1/4359, Stringer to James Duke of Hamilton, 28 Sep. 1699.

[55] NAS, GD 406/1/4359.

and Salt of Lemon to his kinsmen; Clerk offered to send his 'ablest fire man and refiner' to assist Stringer in his proposed Scottish dispatch.[56] What the chymist acquired through medical service was not so much a substantial purse to erect the laboratory singlehandedly, as a network of partners and patients willing to support him in return.

The same letter further reveals that Stringer was capable of hiring two or more craftsmen, but was lacked sufficient funds to travel up north or to apply for a patent to protect his 'furnaces and Mills' and his 'invention of smellting of Iron and other Mettals with pitt coals' - an application which cost approximately £70 or more.[57] Stringer also needed clay and bricks 'to line our first furnace'. In total, Stringer asked £30 worth of investment from the duke so that 'we may work this winter ... in more particulars than I have yett had opportunity to demonstrate.'[58]

In the end Stringer did not venture into Edinburgh, but instead moved to Hugh's Court, Blackfriars in March 1700 at an annual rent of £23 10s. Here he set up his 'Laboratory and Foundery', later also called the 'Mineral-Office-General'.[59] We soon find him demonstrating his capacities. On 15 February 1701, on the eve of the War of Spanish Succession, Stringer struck a deal to receive disused ordnances from the ship chandler John Martin, and to melt and recast them into cannon balls.[60] The agreed payment of £50 in just one month – (more than twice his annual rent), with raw materials provided, must have been attractive. Stringer did in fact deliver quantities of shots, as we shall see below. But the enterprise ended in disputes soon after Martin 'received Some intelligence and informac[i]on touching the plaintiff's [Stringer's] Character

[56] Stringer, *Variety*, 1700, p. 14; NAS, GD 406/1/4359.

[57] NAS, GD 406/1/4359. For the cost of a patent, see Christine MacLeod, *Inventing the Industrial Revolution: The English Patent System, 1660-1800*, Cambridge: CUP, 1988, p. 76.

[58] NAS, GD 406/1/4359. See also Stringer, *Variety*, 1700, p. 10.

[59] TNA, C 5/632/110, Stringer con Martin, Jan. 1702 (Stringer's bill); Stringer, *Variety*, 1700, title-page; *Opera*, p. xii. It is possible that Stringer expected his grateful patients to help pay the rent.

[60] TNA, C 5/316/55, Stringer con Martin, June 1702 (Martin and others, answer to C 5/632/110).

and Circumstances that rendered this def[enden]t very uneasy'.[61] In order to secure the deal, Stringer went so far as to deposit the property indenture of his house to Martin's partner as a security. Stringer was clearly 'very desirous' of employment, as Martin slyly remarked.[62] Despite his self-presentation as an Oxford 'professor', Stringer of the 1690s was little better than an itinerant chymist with limited means, restlessly looking for patients and opportunities.

The Capacity of a Humble Chymist

Lofty natural philosophers, like satirists, would assume that there was little substance behind the chymist's grandiose self-presentation. This could not be the case if he was to find patients and seize opportunities in the emerging world of public science. In the absence of his notebooks or recipe books, it is impossible to reconstruct his chymical practices, as has been done for the alchemist George Starkey.[63] Yet scattered evidence suggests that Stringer's medical and metallurgical pursuits were accompanied by strenuous effort to demonstrate his knowledge, experience and credibility. Just as Desaguliers and others did, Stringer even sought to stay above the unreliable 'projects'. Although the chymist did not live up to his own exalted estimation, such effort did enable him to distance himself from common empirics and miners, and to forge a pocket of authority in which he could impress those around him.

The medical side of Stringer's chymical ideas, outlined ably by Appleby's article, would require only brief treatment here. The chymist followed an emerging medical ontology, inspired by Paracelsus and subsequently developed by Thomas Sydenham. The more traditional Galenic medicine was oriented towards customised diagnosis and the healing of

[61] TNA, C 5/316/55. Martin was not alone in making reservations about Stringer. See Harold J. Cook, 'Sir John Colbatch and Augustan Medicine: Experimentalism, Character and Entrepreneurialism', *Annals of Science* (1990) 47, 475-505, at p. 486, fn. 58.

[62] TNA, C 5/316/55. It was probably very unusual to hand lease documents to a third party. I thank Natasha Glaisyer and Anne Murphy for advice.

[63] Newman and Principe, op. cit. (39), pp. 100-55.

humoral imbalance in individual patients.[64] By contrast, Sydenham supposed that certain chemical substance caused obstructions inside the body. His goal was thus to conduct trials to develop medical specifics that could remove such obstructions 'no matter to whom it was given', irrespective of individual humoral constitution. Following this line of thinking, Stringer suggested that 'the Effect will not cease till the Cause be removed'.[65] '*Obstruction* causes *Pain*', Stringer explained elsewhere; '*Pain* raiseth a *Fever*, and sometimes begets a *Tumor*'; his Elixir was efficacious, he argued, because it 'promotes *Transpiration* by removing the *Impediments* which hinder Nature in that daily necessary Operation.'[66]

This is not to suggest that Stringer was among the ranks of Fellows of the Royal College of Physicians. Medical providers like John Colbatch often articulated and defended their medical theories and interpretations in order to enhance the credibility of their practice.[67] Although he started as a medical 'irregular', Colbatch went on to become a licentiate of the Royal College of Physicians - a move that could consolidate his contested credibility.[68] In contrast, Stringer never seems to have applied for a licentiate. He instead continued to rely on shorter bills and advertisements, appealing not so much to respectable practitioners as to potential patients.[69] No mention of him been found in the manuscript Annals of the College. It is unlikely either that Stringer

[64] See Harold J. Cook 'Practical Medicine and the British Armed Forces after the "Glorious Revolution"', *Medical History* (1990) 34, pp. 1-26, (quotation p. 16). See also Andrew Cunningham, 'Sydenham versus Newton: The Edinburgh Fever Dispute of the 1690s between Andrew Brown and Archibald Pitcairne', *Medical History* (1981) Supplement 1, 71-98, esp. pp. 77-9.

[65] Stringer, *Variety of surprising experiments, made of two incomparable medicines*, 1707, pp. 6-7.

[66] Chetham's Library, Manchester, HP H.P.2526, Moses Stringer, *An advertisement. Of two incomparable medicines* [n.d. 1705?].

[67] Cook, op. cit. (61), pp. 489-94; Cunningham, op. cit. (64), pp. 72-3. Cf. Noel G. Coley, 'Physicians and the Chemical Analysis of Mineral Waters in Eighteenth-Century England', *Medical History* (1982) 26, pp. 123-144.

[68] Cook, op. cit. (61), p. 488. Licentiates were defined as non-Fellows 'Skilled in Physick' who were 'not capable to be Elected' because of ages, foreign nationality, the lack of a doctorate, or 'their not being Eminently Learned'. See *The catalogue of the fellows and other members of the Royal College of Physicians, London*, 1695.

[69] See, for example, Stringer, *Variety*, 1700, passim.

corresponded with savants like Plot, Martin Lister (1639-1712), Edward Lhuyd (1659/60?-1709) or Hans Sloane (1660-1753).[70]

Given his peripheral position in the world of medical erudition, it is perhaps not surprising that Stringer relied upon, rather than critically engaged with, Paracelsian tenets. In a handbill advertising his medical specifics for 'recovering *Old-Age*', Stringer recounted how Paracelsus gave his 'Renovating Quintessence' and rejuvenated an old hen so 'very Old that no body would kill it'. In fact, the whole episode had beee silently taken from Boyle's *Usefulness of Natural Philosophy* (1663).[71] This indicates that Stringer either read or learned about Boyle's work in Oxford or elsewhere - an inkling of medical learning. What is absent in Stringer's chymico-medical practice, however, is a sustained scrutiny of received theories based on hands-on trials, something the alchemist George Starkey conducted for establishing his own 'generalized principles and a universalized method'.[72]

Similar limitations can be observed in the mineral side of chymistry. A good place to start is his 1699 mining proposal that sought parliamentary backing. Stringer suggested that one quarter of the British Isles remained unimproved, and that much of the land was rich in minerals. He argued that, because overhead charges were overwhelming, the government should not leave the matter to private hands, but instead should launch a national scheme for encouraging new mining projects, to be funded partly by local parishes and by nationwide public subscriptions.[73]

In order to attract serious attention from the Commons, Stringer went on to display the information gathered from reading and direct observations. In order to suggest that the British Isles were rich with silver, Stringer drew on

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[70] Royal College of Physicians, London, *Annales Collegii Medicorum*, vol. 7, covering 1695-1710. As for Lister and Plot, I am grateful to Anna-Marie Roos for her advice. As for Sloane, I thank Alice Marples who is completing a thesis on Sloane's correspondence networks.

[71] Compare *Old-age*, p. 1, with Michael Hunter and Edward B. Davis (eds.), *Works of Robert Boyle*, 14 vols., London: Pickering & Chatto, 1999, vol. 3, p. 408.

[72] Newman and Principe, op. cit. (39), p. 154. See also Richard Yeo, *Notebooks, English Virtuosi, and Early Modern Science*, Chicago: University of Chicago Press, 2014.

[73] *Mines*, pp. 6, 10-11, 14.

John Webster's natural history of metals, *Metallographia* (1671), particularly a passage about silver ores in West Riding of Yorkshire.[74] Information culled from his reading was combined with the results of direct observations. Not only did he see 'the pretious Stones ... [of] our *Museum* at *Oxford*' presumably as part of the chymistry course, Stringer also examined at Apothecaries' Hall some 'brown Copper Ore' found in Black Heath, south of Greenwich.[75] True to the pedagogical emphasis placed at Oxford upon identifying local diversity of minerals, the chymist repeatedly noted where different minerals would be had, and what industries they might serve. All this knowledge about minerals affairs across the country, he argued, set him apart from miners 'ignorant of any thing but what is common in that County', and, crucially, also from 'Pretenders, who have reduced the best [mineral] Discovery to the Scandal of a Project'.[76] Just like Desaguliers, Stringer thus distanced himself unreliable projectors, recommending himself as the potential superintendent of mineral affairs. 'propense to Mineral Studies, and understand Mines, Soughing, Levelling, and Refining, &c in each County where Mines are found'.[77]

Conspicuously absent in his mineral writings were, however, gustatory analysis, visual depictions, testimonies, and the critical investigation of the scale of mines and the quality of minerals. It was a widespread practice for medical practitioners and naturalists alike to 'taste' minerals, vegetables and even bodily fluids in order to examine their composition. Such gustatory practices required discipline and repetition accompanied by record keeping. Stringer's writings show little evidence of such bodily engagements.[78] More critical still was the limited range of literary techniques employed. In the 1699 pamphlet, Stringer declared that '*England* is a most wholesom scituated Island' blessed with 'a Fruitful Surface, but a thousand times more Wealthy in

[74] *Mines*, p. 8. The source was John Webster, *Metallographia*, 1671, p. 20-21. Stringer also cited John Houghton's *Collections for the Improvement of Husbandry and Trade*.

[75] *Mines*, p. 21.

[76] *Mines*, pp. 9-10.

[77] *Mines*, p. 28.

[78] Mark S.R. Jenner, 'Tasting Litchfield, Touching China: Sir John Floyer's Senses', *Historical Journal* (2010) 53, pp. 647-670; Elizabeth L. Swann, '"The Apish Art": Taste in Early Modern England', DPhil Thesis, University of York, 2013, pp. 159-60, 163-7, 196.

Subterraneous Productions'.[79] Patriotic hyperbole was no novelty. Yet, when a contemporary mining company, the Mine Adventurers of England, declared that its Welsh mines were as rich as silver mines of Potosí in the Spanish Americas, the company published not only details of the mines complete with engravings and the computation of future profitability, but also testimonies of local miners attesting as 'matters of fact' both the scale of the veins and the quality of ores in order to enhance their credibility.[80] By 1699, Stringer was aware of this Welsh enterprise, mentioning its mines when addressing the parliament.[81] Yet, having been an itinerant chymist in Staffordshire, and then seeking employment in London, Stringer probably had neither adequate funds nor close ties with wider mining districts to command comparable estimates or testimonies.

This had implications for the depth of analysis one could command. A good point of comparison would be the case of the learned naturalist John Woodward, FRS, FRCP (1665/1668-1728). His extant notebook records extensive observations taken during his visits to mine shafts in Cornwall.[82] In order to ascertain the relative productivity of given mines, he frequently combined his first-hand experience with *more than one nugget of information*. Thus, when Woodward visited the Forest of Dean, he approximated the quality of local mines by juxtaposing them with those of Cornwall and Mendip (Somerset).[83] The notebook also suggests that Woodward read a pamphlet on the Welsh mines belonging to the Mine Adventure. When Woodward took notes on this, he assessed the relative richness of the much-promoted 'Welsh Potosi' not only against what he knew about current silver yield at Cumbrian

[79] *Mines*, p. 4.

[80] See William Waller, *A description of the mines in Cardiganshire*, 1704; *A true copy of several affidavits and other proofs of the largeness and richness of the mines, late of Sir Carbery Pryse, the original whereof are fil'd in the high court of Chancery*, 1698. For background, see Koji Yamamoto, 'Piety, Profit and Public Service in the Financial Revolution', *English Historical Review* (2011) 126, pp. 813-4.

[81] *Mines*, p. 9.

[82] Cambridge University Library, Special Collection [hereafter CUL], MS Add. 9386/1, John Woodward, 'Journey into Cornwall'. For Woodward, see Joseph M. Levine, *Dr. Woodward's Shield: History, Science, and Satire in Augustan England*, Berkeley, LA: University of California Press, 1977.

[83] CUL, MS Add. 9386/2, John Woodward, 'Of the Forrest of Dean'.

lead mines, but also against information derived from mines near Newcastle, Edinburgh and from 'a Mine of Lead in the Estate of my Lord Wharton, in Swaledale' in Yorkshire.[84] This multiple juxtaposition enabled him to suggest that the Welsh lead mine boasted veins of ores twice as wide as those of Wharton's in Yorkshire, with its ores containing at best 50% more silver per ton than the Cumbrian counterpart.

With fewer resources at his disposal, Stringer's mineral writing was clearly dwarfed by that of Woodward. To be sure, the information culled from reading and direct observations were backed up by some trials upon ores from different places; Stringer also reported the amount of lead he could smelt out of the ore from Cumberland.[85] Yet, unlike Woodward, Stringer did not present any informed comparisons of these trials. Instead, he simply boasted the fact that he 'had 18 sorts of English Copper Ores, as Blew, Green ... Copper-colour' and 'Eight or Nine sorts of Lead Ores; as White, Black, Small grain'd, and Pottern, &c', and had so far 'discovered' mines of gold, silver, quick-silver, tin, copper, lead, iron, and antimony 'for Founders and Pewterers'.[86] The chymist thus named these minerals without developing further comparative analysis.

Stringer's mineral expertise rested less on analytic rigour than on hands-on operation, something most revealingly displayed in his 1698 demonstration for Peter the Great. According to the handbill advertising the performance, Stringer delighted the Czar by first separating gold, silver and lead, and then, in another trial, by making 'an Artificial Gem of what colour he pleased to name ... out of an Old Broom staff and a piece of Flint'.[87] Hardly noted by previous studies, this artificial gem was most probably a small piece of lead glass, often called 'flint glass'. While no further detail of Stringer's experiment has been found, this type of glass was typically produced by mixing calcined flint with

[84] CUL, MS Add. 9386/4, John Woodward, 'Mr W[illia]m Wallers Acc[oun]t of the great Lead Mines in Cardiganishire of S[i]r H. Mackworth', pp. 45-48, esp. p. 47.

[85] *Mines*, pp. 8-9.

[86] *Mines*, pp. 9, 7. This is true of his subsequent discussion of minerals. See BL, Loan 16(2), fols. 227v-228; his 1713 *Opera*, pp. 221-2.

[87] *Relation*.

molten lead in a crucible, both mentioned in the handbill.[88] The procedure was closely associated with alchemy; its end product, lead-glass vessels, had an economic potential since it could compete with highly-prized Venetian glass. No wonder that luminaries like Boyle and Newton, and more practical men such as Hooke, Houghton, Plot and Wren, all took interest in its production.[89] Thanks perhaps to his Oxford training, Stringer was able to follow this trend at the crossroads of alchemy, metallurgy and international industrial competition.

But how well did he follow? A superior method discovered at the time was the use of lead oxide (PbO) which enhanced the crystalline brilliance of the glass, an aesthetic appeal vital for competing with the beautiful Venetian glass. As Christine MacLeod suggests, this was the technique developed by glassmakers under George Ravenscroft who procured a patent in 1674 to protect the method for seven years.[90] By the time John Houghton wrote about the lead glass in 1696, the patent had been expired for more than a decade; there were at least nine manufacturers producing flint glasses using similar methods.[91] Stringer was probably not privy to this artisanal technique, however. Had he gained access, he would have presented a gem similar to surviving Ravenscroft lead glasses (with the PbO content of more than 30%), a gem with soft, oily, texture, as the presence of lead oxide makes the material softer and more fragile.[92] Such a gem could have stood as a befitting symbol of England's imminent victory over Venetian craftsmanship, impressing the Czar 'how good

[88] I am grateful to Anna Marie Roos for this suggestion. The composition of lead glass is discussed by Colin Brain, 'Vitrum Saturni: Lead Glass in Britain', in Dedo von Kerssenbrock-Krosigk (ed.), *Glass of the Alchemists: Lead Crystal-Gold Ruby, 1650-1750*, Corning, NY: Corning Museum of Glass, 2008, pp. 107-21. The colouring of glass would have required further knowledge about which minerals to add, as outlined in Antonio Neri, *The art of glass*, 1662, pp. 110-21.

[89] Christine MacLeod, 'Accident or Design? George Ravenscroft's Patent and the Invention of Lead-Crystal Glass', *Technology & Culture* (1987) 28, pp. 776-803 (esp. pp. 781-3, 797-8); Brain, op. cit. (88), pp. 107, 114.

[90] MacLeod, op. cit. (89), pp. 777, 803.

[91] John Houghton, *The collection for the improvement of husbandry and trade*, 4 vols., 1727-8, vol. 2, p. 48 (no. 198, 15 May 1696).

[92] MacLeod, 'Accident', op. cit. (89), p. 792; *Encyclopaedia of Chemistry, Practical and Theoretical*, 2nd ed., Philadelphia, 1854, p. 682.

they are at improving of arts', as Houghton put it in 1696.[93] Such presentation probably never took place. As the handbill intimated, the 'Gem ... proved so hard that it cut Glass' - indicating the lower rate of lead oxide in the gem (probably 14% PbO or lower).[94] If accurate, the report of the 1698 experiment suggests the chymist lacked access to the artisanal knowledge that was at the heart of the English lead-glass industry.[95] Yet a lead glass hard enough to scratch glass surface could be produced by adopting a recipe of the Florentine writer Antonio Neri, whose book was translated into English by Christopher Merret, FRS.[96] Stringer's 'artificial gem' thus points towards the chymist's certain familiarity with the metallurgical procedures promoted under the helm of the Royal Society.

Stringer's real competence as the chymist therefore lay in his hands-on experience in trying different recipes, heating crucibles, and delicately mixing and separating molten minerals. Those who visited Stringer in person, however, were presented with what was probably the most tangible evidence of his competence - his furnace. The Chancery case with Martin suggests that the chymist received 10 tons of disused ordnances, and produced more than 1280 shots of 'seker' and 'minion' shots, weighing in total over 2.8 tons. In his own estimation, the chymist did delivere more than 4.5 tons of these shots within 6 weeks.[97] Stringer and Martin disputed the quality of the shots produced; but as to the fact that the chymist had enough furnaces for casting tons of iron, there was no dispute. The impression of authority was reinforced by the presence of

[93] Houghton, op. cit. (91), p. 48.

[94] The scientific analysis present here owes much to Colin Brain who has been making lead glasses according to different seventeenth-century recipes. Using lead glasses of different PbO content, he tested if it is possible to scratch glass surface of 4mm thick. It was not possible to create any visible scratch with lead glasses of PbO contents (34.5% or 41.3%). The harder lead glass with 14% PbO content was, however, able to create a shallow scratch.

[95] *Relation*.

[96] See Neri, op. cit. (88), pp. 142-3. Stringer would have replaced 'sulpher saturni' (lead sulfide PbS) mentioned there with lead carbonate (PbCO3). This would have created a lead glass with approximately 11% PbO.

[97] TNA, C 5/316/55, Stringer con Martin, 1702.

mineral specimens and the corporate records of the two mining companies recovered in early 1709.[98]

It was in the presence of these embodiments of his knowledge that the humble chymist forged an impression of authority. At a meeting of the Mineral Battery Works in May 1709, now held at his laboratory, Stringer presented 'a particular of the various Minerall Earths and Mettals (w[hi]ch are 70 different speicies)', and from them identified 'fifty Branches of Profits belonging of Right to these Societys', ranging from the obvious privilege in gold and silver mining, to copper-wire drawing and the collection of pearls. What he presented was little more than a list of minerals, semi-precious stone and metallurgical procedures. The company was, however, suitably impressed, and responded with the 'Urgent perswasions to Dr Stringer to take upon him the Mannagement'.[99] Led by the self-styled doctor, the united company appointed high-ranking men into its office, such as Thomas Earl of Pembroke, Henry Bishop of London, and even Isaac Newton himself.[100] Stringer may not have been as learned as Woodward, nor as specialised as the best London glassworkers. Yet his skill as a chymist, backed up by his furnaces, specimen and corporate records, enabled him to create a small pocket of authority wherein he could, at least temporarily, persuade his partners of his credibility as 'Dr Moses Stringer', proficient in chymical matters.

Into naval medicine and colonial expansion

We are thus moving beyond both the chymist's inflated self-fashioning and the contemporary portrait of greedy, unreliable, quacks and projectors with few or

[98] BL, Loan MS 16(2), fol. [218v]. Stringer hoped to build an upper-floor extension to his laboratory to hold meetings and keep specimen and the corporate records. See BL, Loan 16(3), fol. 97.

[99] BL, Loan 16(2), fols. 220v, 227v-228.

[100] BL, Loan 16(3), fols. 96v-97.

no skills. What is beginning to emerge instead is a story of surprising survival and success *despite* social, financial, technical and intellectual constraints. Stringer's survival strategy was not the obtaining of institutional membership, however. His self-promotion was probably too dubious, his means, erudition and network too limited, for this kind of upward mobility. The chymist did not claim to impartiality and disinterest either. Instead of disowning political and economic interests, Stringer drew on his chymical expertise to pursue opportunities in naval medicine and colonial expansion, two areas that were less well regulated. He was not alone, however. Retracing his serial encounters with imperial expansion, we can begin to unravel how the humble chymist followed the paths well trodden by his better-known contemporaries, and how he nevertheless acquired his peculiar imperial outlook.

By the end of the seventeenth century, Britain's navy was taking on an ever more important role for its imperial strategy. In May 1702, with Austria and the United Provinces, England declared war against France, thus entering the War of Spanish Succession. Hostilities spread to the Caribbean; there, as elsewhere, the health of military personnel turned out to be crucial. One real challenge that plagued all imperial rivals was the protection of sailors against yellow fever and scurvy. In Admiral Hosier's expedition to the West Indies in 1726, for example, more than 4000 men died in a squadron of 4750; less than one in five survived the two-year voyage due to poor hygiene and malnutrition.[101] No wonder that naval medicine became an attractive avenue for aspiring medical practitioners.

Fellows of the Royal College of Physicians stressed the importance of tailor-made treatment of individual patients based on their humoral imbalance. As Harold Cook has shown, however, the Board of Admiralty sought something different: quicker, more efficacious cures for specific conditions such as scurvy that could be administered on board with minimum training and

[101] Patricia Kathleen Crimmin, 'British Naval Health, 1700-1800: Improvement over Time?', in Geoffrey L. Hudson, (ed.), *British Military and Naval Medicine, 1600-1830*, Amsterdam: Editions Rodopi, 2007, pp. 183-200, at p. 183.

supervision.[102] During the 1690s, the Board deprived the College of its traditional privilege of controlling the provision of military medicines, making it possible for enterprising medical practitioners to offer their specifics and experiments for trials on board.[103] This was how medical practitioners like Colbatch and William Cockburn had their medicine tested by the navy in the mid 1690s.[104] Having engaged with the naval contractor Martin in the run-up to the War of Spanish Succession, Stringer followed suit, armed with his chymical cures.

By 1700, Stringer's medicines reportedly saved patients coming back from 'a Voyage to *East-India*', and also had been shipped to Port Royal, Jamaica, and sold there at a higher price because of their reputed capacity for 'Removing all kinds of *Fevers* in a little time'.[105] Also helpful were examples of successful cures that he plentifully advertised in print and in newspaper. Appleby has speculated that the chymist may have been connected through a relative's marriage to Sir John Benbow, the vice admiral who provided a lodging for the czar for whom Stringer performed experiments.[106] Be that it may, Stringer was given opportunities in 1701 to test his medicines for the navy. In July, *Post Boy* reported 'Many extraordinary and successful Experiments' that the chymist performed for the navy at Portsmouth and Spithead.[107] Then, in response to a 'very good character' that the Admiralty Office had received of Stringer's 'two chemical medicines', they were tried upon a fleet of nineteen ships, 3,000 strong, headed by Benbow bound for the West Indies.[108] For this medical trial, the Admiralty Office ordered £30 worth of his medicines, Elixir Febrifugium Martis and Purging Salt of Lemons.

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[102] Cook, op. cit. (64), p. 14.

[103] Cook, op. cit. (64), pp. 12-14; Harold J. Cook, *The Decline of the Old Medical Regime in Stuart London*, Ithaca, NY: Cornell UP, 1986, pp. 236-8, 246.

[104] Cook, op. cit. (64), pp. 16-25.

[105] Stringer, *Variety*, 1700, pp. 7, 16.

[106] Appleby, p. 33.

[107] *Post Boy*, 15-17 July 1701.

[108] R.D. Merriman (ed.), *The Sergison Papers*, Navy Records Society, (1950) 89, p. 221; BL, Add. 36525, fol. 2, a report by Benbow, 22 June 1701.

Stringer encouraged physicians and surgeons serving naval and merchant vessels to follow suit and purchase the medicines.[109]

No report of the trial, or evidence of further commission, has been found. The experiment with Benbow's squadron probably met with mixed results. Although Stringer kept details secret, it is likely that much of the vitamin content was lost by the distillation of lemon juice. Stringer did not stop there, however. The sojourn into a naval medical experiment was followed by active moves to tap into England's colonial trade and imperial expansion. As in naval medicine, the chymist was following an emerging trend. England's commodity trade grew by nearly 50% in total between the 1660s and the early 1730s; but the colonial sector grew by almost 250%. The trans-Atlantic trade was not as tightly controlled as the south Asian trade presided over by the East India Company.[110] This was why so many medical promoters moved in ahead of Stringer. While plantations could provide new markets for proprietary medicines, Caribbean islands and North American soils also offered a wide range of medicinal herbs and minerals. Sir Hans Sloane, a Fellow of the College of Physicians, travelled to the West Indies in the 1680s, and this laid the groundwork for his two-volume *A voyage to the islands* (1707), including Barbados and Jamaica.[111] In the mid 1690s, Hugh Chamberlen, another physician of the College, became one of the proprietors of the Tobago scheme led by Captain John Poyntz. When the map-seller John Lloyd dedicated a map of the island to Chamberlen, he highlighted 'plenty of Rootes, Herbs, Flowers, and Medicinal Drugs' to be found in the island.[112] Chamberlen quoted another physician on the virtue of global expansion: 'if he went beyond Sea for Food,

[109] TNA, ADM 3/16, 5 Aug. 1701, unfoliated; TNA, ADM 1/3591, fol. 221, 6 Aug. 1701; Moses Stringer, *Variety of surprising experiments made of two incomparable medicines*, 1703 [hereafter *Variety*, 1703], p. 16.

[110] Nuala Zahedieh, 'Colonies, Copper, and the Market for Inventive Activities in England and Wales, 1680-1730', *Economic History Review* (2013) 66, pp. 805-825, at p. 809; eadem, *The Capital and the Colonies: London and the Atlantic Economy*, Cambridge: CUP, 2010, p. 11.

[111] Pratik Chakrabarti, *Materials and Medicine: Trade, Conquest and Therapeutics in the Eighteenth Century*, Manchester: Manchester UP, 2010, pp. 146-7.

[112] BL, Map Room 82510.(4.), John Lloyd, *To the Worshipful Hugh Chamberlen ...an account of the situation, product, and other advantages of the island of Tobago*, n.d. [the 1690s].

as *Wine* and *Spice,* he must do the like for *Physick*.'[113] Just like the plant-gatherers and natural historians studied by Richard Drayton and Londa Schiebinger, medical practitioners of all descriptions were at the forefront of imperial expansion.[114]

Stringer likewise rubbed shoulders with Royal College physicians as well as with merchants. Never content with naval medicine, Stringer began promoting his medicines to colonial merchants, advertising that his medicines 'sell in the West Indies above 115 per Cent. profit, being well esteem'd of there'.[115] He was also seeking to take part in the expansion of the colonial base itself. In June 1702, just ten months after the Navy-backed experiment had been sanctioned, Stringer and Woodroffe joined Poyntz's Tobago scheme, in which Chamberlen had been involved. The enterprise captured a concern of statesmen. France was laying claim to Tobago as a trading base;[116] as Nottingham, then the Secretary of State, put it, 'Nothing can be more for our interest and to the prejudice of France' than to prevent it 'from the fruits he expects from the West Indies'.[117] The fruits Stringer and others expected went beyond colonial settlement. As a petition jointly signed by Poyntz, Woodroffe and Stringer reveal, they also expected to hunt for 'rich Earth-Mines and Lapis Lazuli, as also of Pearls, and Ambergrease', by which 'great and vast wealth (to the value of several hundred thousand pounds) may yearly redound to your Majtie and yr Subjects'.[118] In order to promote the scheme, Stringer subsequently negotiated with the Duke of Courland (modern-day Lithuania) who also claimed a right of possession of the island, and with Thomas Earl of

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[113] Hugh Chamberlen, *Manuale Medicum, or a small treatise of the art of physick in general*, 1685, p. 29.

[114] Richard Drayton, *Nature's Government: Science, Imperial Britain, and the 'Improvement' of the World*, New Haven, CT: Yale UP, 2000; Londa L. Schiebinger, *Plants and Empire: Colonial Bioprospecting in the Atlantic World*, Cambridge MA: Harvard UP, 2004.

[115] *English Post with News Foreign and Domestic*, 8-11 June 1703.

[116] Henry E. Huntington Library, BL 415, 1st Earl of Jersey Answer to the French Ambassador's memorial relating to Tobago, c. 1698; TNA, CO 29/7, pp. 15-20.

[117] Quoted in Henry Horwitz, *Revolution politicks: the career of Daniel Finch second earl of Nottingham, 1647-1730*, Cambridge: CUP, 1968, pp. 177-8.

[118] TNA, CO 28/6, no. 62.

Strafford, then an ambassador to Brandenburg-Prussia, in order to raise subscription from Protestant allies abroad.[119] Unfortunately for Stringer, the Tobago settlement did not materialise, partly because it met oppositions from those London traders having a stake in Barbados. They were, Stringer alleged, intent upon keeping Tobago 'as a park to Barbadoes to supply them[selves] w[i]th wood water Hoggs Turtle &c w[i]thout paying', a status quo that the Committee for Trade and Plantation hesitated to change.[120]

Stringer's imperial turn

Facing the multiple social, intellectual and material constraints, Stringer therefore accelerated, rather than attenuated, the promotion of new schemes and proposals that made him look dubious in the first instance. This had far-reaching consequences. As Harold Cook has shown for the case of early modern Dutch commerce and science, 'both the content and the framework of knowledge could be reshaped in the encounters with strangers.'[121] Similar epistemic transformation happened even to the humble chymist. Here, we find something unique about Stringer's career. Following his 'imperial turn' will now enable us to make better sense of the chymist's rise in the mining companies in 1709.

At one level, Stringer's imperial turn was simply about the importation of economic plans. One striking example came in 1709, when London was swayed by an influx of German refugees from the Palatine region. Within six weeks from 1 May that year, no less than 10,000 German Palatine refugees arrived, escaping from French persecutions – some ill, many with children, all

[119] BL, Add. Ms 22265, fols. 94-5, 98.

[120] BL Add. Ms. 22265, fol. 95. See also TNA, CO 29/7, p. 20, a petition against the settlement of Tobago signed by Stamford, Lexington, Ph. Meadows, William Blathwayt, John Pollexsen, Abraham Hill, and George Stepney.

[121] Harold Cook, *Matters of Exchange: Commerce, Medicine, and Science in the Dutch Golden Age*, New Haven CT: Yale UP, 2007, p. 48.

exhausted.[122] A crisis of public health ensued. The SPCK and other charitable bodies sprang into action, setting up tents, distributing foods and drugs, and raising funds for further actions. The Commissioner of Trade and Plantation was informed that this sudden rise of population might 'produce a proportionable Increase of their Trade & Manufacture' if, 'instead of sending them to the West Indys', the government encouraged them to settle within the British Isle.[123] Stringer stepped in at this point, and proposed to set up 'Mineral Colonies'. His plan was to send the 'strong & those th[a]t can Labour' to a manor of Penrhyn in north-western Wales, 'to be Imployed in the Silver & Copper Mines there open'd' by the Mines Royal.[124] Some of the ideas came directly from the Tobago project discussed above. Stringer and fellow promoters had then proposed a 'Bank and Factory of Creditt', a bank that would offer securities for transatlantic trades in return for the payment of 3% premium on the value of the goods consigned.[125] Now, facing the need to facilitate foreign refugees to start earning an independent living in Welsh countryside, Stringer proposed that a proportion of the money raised for their relief be set aside to establish the 'Mineral Bank of Factory and Credit', so that the refugees might borrow money at a small interest.[126] Economic historians, such as Maxine Berg and Prasannan Parthasarathi, have shown how global trade and imperial expansion shaped consumer behaviour and even technical processes at cotton mills back in Europe.[127] Stringer's imperial encounter likewise informed his economic response to the Palatine refugees.

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[122] TNA, CO 388/76, no. 70.

[123] TNA, CO 388/76, no. 54, 3 May 1709, Sunderland to the Commissioners of Trade and Plantation.

[124] TNA, CO 388/76 no. 76, Memorial signed by Stringer and others, 23 June 1709; TNA, CO 388/76 no. 58, 23 May 1709.

[125] CO 28/7, no 19, petition of Moses Stringer to Queen, received and read 21 Feb. 1704, fols. 231-231v. The idea had been borrowed from Stringer's business associate John Poyntz. See John Poyntz, *The present prospect of the famous and fertile island of Tobago*, 1683, p. 46.

[126] TNA, CO 388/76 no. 76, [fol. 2].

[127] Maxine Berg, 'In Pursuit of Luxury: Global History and British Consumer Goods in the Eighteenth Century', *Past & Present* (2004) 182, pp. 86-8, 140-1; Prasannan Parthasarathi, *Why Europe Grew Rich and Asia Did Not: Global Economic Divergence, 1600-1850*, Cambridge: CUP, 2011, pp. 103-9.

The impact of colonial engagements went further. By the time the chymist revived the mining companies in 1709, he came to view his mineral pursuits as a global, imperial, concern. The difference is unmistakable. When Stringer spoke of mines in 'her majesties dominions' in his proposal of 1699, he meant mines across the British Isle, ranging from Snowdon in Wales to Staffordshire and Scotland. As a new head of the Battery Works, Stringer gave in 1709 an entirely different, global, picture. The company was endowed with

> Mines in all the Dominions, Territorys and Confines thereof what soever Uppertaining to the Imperial Crown of Great Brittaine In various and Far Distant Luttitudes & Longitudes[.]

Stringer further proposed to employ those 'skilled in the Mines ... Bottorny [i.e. botany], Agriculture, and', he added, 'Geography'.[128] What had been primarily domestic livery companies came to be envisioned as a company operating across the expanding empire.

Stringer's imperial turn had further conceptual dimensions. Sarah Irving has suggested that the biblical vision of Adam's dominion over land lent itself to the idea that man might take whatever he 'discovered' and 'improved' as his property, even across the ocean. As David Armitage puts it, 'External "imperialism" was the offspring of "internal colonialism"'.[129] Yet, on the other hand, Alix Cooper has shown that the discovery of mines in the Americas spurred matching interests in mines and the natural history back home among European virtuosi and chymists, Paracelsus among them.[130] The case of Stringer suggests that even a humble chymist took part in such epistemic transactions crisscrossing the Atlantic: if his chymical expertise first paved the way for naval medicine and colonial engagements, he then brought the imperial

[128] BL, Loan 16(2), fol. 211.

[129] David Armitage, *The Ideological Origins of the British Empire*, Cambridge: CUP, 2000, pp. 6, 114; Sarah Irving, *Natural Science and the Origins of the British Empire*, London: Pickering & Chatto, 2008, p. 110. Cf. Drayton, *Nature's Government*, ch. 1; William Cronon, *Changes in the Land: Indians, Colonists, and the Ecology of New England*, New York: Hill and Wang, 1983, ch. 4, esp. pp. 63, 77.

[130] Alix Cooper, *Inventing the Indigenous: Local Knowledge and Natural History in Early Modern Europe*, Cambridge: CUP, 2007, esp. pp. 3, 22-30, 39, 50. See also Pratik Chakrabarti, *Medicine and Empire, 1600-1900*, Basingstoke: Palgrave, 2014, p. 9.

vision of dominion and jurisdiction over the land to bear upon the ancient mining companies.

The change was dramatic. When he published the mining in 1699 (prior to his extensive imperial engagements), he then reassured the Commons that 'all those that have Mines, and do work them, shall enjoy them according to the present Right and Custom'. The underlying assumption is clear: those who 'discovered' and 'improved' the mines should enjoy them undisturbed.[131] As he engaged with colonial schemes, however, Stringer came to witness a very different, imperial, set of claims. Consider the Tobago plantation scheme, which was based on Poyntz's ' Several Secret discoveries' of mines and gemstones. These riches and the island itself were to 'be anext to yr Majties Realm of England'. The petition signed by Stringer and others declared that peace with the natives would help 'enlarge your Majesties Territories and Dominions', something that were to be defended against other parties such as France and Courland.[132] The Committee for Trade and Plantation was in fact resolved 'not to allow' the Duke of Courland's right of possession, until 'its in the hands of English subjects so as totally to surrender it to the Crown.'[133]

This was the conception of imperialism that Stringer brought to bear upon his mineral undertaking. When Stringer rose to become the Mineral Master General, he sought the reinstatement of Crown's exclusive possession and jurisdiction over mines, minerals and related industries. Just as Stringer upheld the Crown's dominion in the New World against natives and the sovereignty of France, Spain and Courland, he now sought to 'assert the Right of the Crown to the *Mineral Kingdom*; and to maintain our *Corporations Rights*, and *Fee Simple* to every [mineral] Species thereof under the Crown', this time to the exclusion of all its subjects who acted without the permission from Stringer's united company.[134] Stringer thus argued that the united societies

[131] *Mines*, pp. 5, 21 (at p. 21).

[132] TNA, CO 28/6, no. 62; CO 28/7, no 19.

[133] BL Add. Ms. 22265, A letter from London of Moses Stringer on the 'Setling and Fortifieing the Island of Tobago in America', to Thomas Wentworth, Earl of Strafford, an ambassador to Brandenburg-Prussia April 1706, fol. 94.

[134] *Opera*, p. 10.

were entitled to levy fees, or else 'to obstruct and hinder all other her Subjects, or others, to Dig or Search for the said Minerals, or to use their Tools, Instruments, Engines for gaining the same, or ... the Engines, Hearths, Furnaces, or Methods of *Stamping, Roasting, Boiling, Smelting, Melting or Refining*'.[135]

On 30th April 1709, when Stringer began rising to prominence in the two companies, he in fact argued for discovering such defaulters.[136] The scope of operation now being imperial, the long-term associate Thomas Oswin was appointed a deputy mineral master in Ireland. His appointment was deemed appropriate because he had just come back from Ireland, where, 'by an Industrious *Search* he had *discovered* Several Rich Mines, which were already opened, and many Battery Workes of Several Sorts that were sett up in that Kingdome'. His job was to act as a de facto informer.[137] It was also resolved that the iron and battery work near Boston owned by one John Hubbard, and 'severall Copper and Silver Mines' there 'may be Encouraged and Regulated under the Protection Powers and Previledges of this Corporation'.[138] Later that year, a newspaper advertisement encouraged other entrepreneurs to comply and pay 'easy Rents'.[139] There may have been financial pressures at play too. In November 1709, Stringer cajoled one coach driver Thomas Potter into paying £30 so that he could serve the united company. Potter subsequently launched a legal action as Stringer and the company provided neither a coach nor a 'Silver Badge w[i]th the Companyes Armes Engraved thereon'. Like the ship chandler Martin, the driver alleged that 'their representac[i]ons were alltogether Fictitious'.[140]

Perhaps driven partly by the need for steady income, the same stern position was applied equally to England. Stringer alleged encroachments by

[135] *Opera*, p. 28.
[136] BL, Loan 16(2), fols. 220ff.
[137] BL, Loan 16(2), fol. 222.
[138] BL, Loan 16(2), fol. 211v; Loan 16(3) fols. 98-98v.
[139] *Post Boy*, 8-10 Dec. 1709.
[140] TNA, C 11/2729/154, Potter v Hippocrates Stringer [son of Moses], a bill of complaint, 20 Dec. 1716.

prominent mining entrepreneurs such as Thomas Foley, John Trippe, and John Coster. The chymist argued that Society had not 'taken care so [as] to informe themselves ... as to call any of those Persons to an account for their soe doing'. The self-styled former Oxford professor of chymistry made the point to other members, 'haveing the Counterparts of Mr Foleys leass in his hands' - a dramatic gesture towards the legal record kept at his Blackfriars laboratory where the meeting took place.[141] The united companies later estimated that £460,000 worth of assets and arrears had been 'usurp'd by several Invaders and Interlopers into the Mines, Minerals, and Battery Works, and Lands of their Societies, as also for taking their Wire-works, Mills, and other Parts of their Mineral and Battery Works'.[142] Instead of improving mines, the united companies at Stringer's behest would 'regulate' them by collecting the arrears from other mining operators across the empire.

The chemist's renewed ambition (which would have brought handsome profits) defied the evolving relationship between the Crown's prerogative and subjects, especially in England. After the Restoration of Charles II in 1660, industrial monopolies became something of an anathema, an encroachment upon 'Free-born' Englishmen.[143] Even the Crown's exclusive rights over 'mines royal', those mines containing silver and gold, came under challenge as something infringing upon subjects' rights and liberty. As most natural ores contained some trace of precious metals, the definition of 'mines royal' could be stretched to include virtually every mine within the realm. This was precisely what happened in the early years of the Royal Mines Company. The Exchequer ruling of 1568 affirmed this expansive interpretation; under this rubric the Mines Royal became a powerful agency of the Crown, capable of searching private lands for discovering and ascertaining mines royal.[144]

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[141] Loan 16(2), fol. 220.

[142] TNA, CO 5/865, no. 85, *The order of court for taking up 20000l* n.d. [1712?], p. 5.

[143] MacLeod, op. cit. (57), p. 27.

[144] Eric H. Ash, 'Queen v. Northumberland, and the Control of Technical Expertise', *History of Science* (2001) 39, pp. 215-240.

This was the course of action that Stringer's imperial turn inspired him to revive. Yet the timing could not have been worse. The Glorious Revolution of 1688 accelerated the decline of a wider range of royal corporations such as the College of Physicians and the Royal African Company. They now struggled in the shadow of institutions like the Bank of England that were fiercely defended by parliamentary Whigs.[145] Acts of parliament in 1689 and 1693 reversed the Exchequer ruling of 1568 in favour of subjects' rights and properties. The 1693 act affirmed that all proprietors of mines containing 'Copper Tin Iron or Lead shall and may hold and enjoy the same ... notwithstanding that such Mine or Mines or Ore shall be pretended or claimed to be a Royall Mine' by any other parties.[146] Stringer sought to restore the ancient privilege in defiance of these acts, fuming that 'late Act[s] of Parliament made about Mines Royal' were 'a Scarecrow only, and of little vallidity'.[147] The chymist declared: 'All *Minerals*, *Earths* and *Metals*, *Salts* and whatsoever is subterraneous, is the *Prerogative Royal*', hence to be regulated by the united companies. This was evident because, he proclaimed, all mines and minerals had belonged to the Crown long since the Norman Conquest.[148] This defied legal precedents, for even the 1568 Exchequer ruling conceded that base metal mines belonged firmly to the landowner.[149] In seeking to resuscitate the old privilege, Stringer thus ended up advancing claims that were legally dubious, and politically anachronistic.

The revival of monopoly was ultimately unsuccessful. The solicitor general did issue a summons in favour of the company's request to bring Trippe to a court meeting. Yet when the company pressed a charge against him, the solicitor general prevaricated, answering that he could not judge the matter 'without he had a view of the Original Patents or an Authentique Coppie

[145] Cook, op. cit. (103), pp. 248-51; William A. Pettigrew, *Freedom's Debt: The Royal African Company and the Politics of the Atlantic Slave Trade, 1672-1752*, Chapel Hill, NC: University of North Carolina Press, 2013, pp. 94, 110-11, 118.

[146] *Statutes of the Realm*, vol. 6, p. 95 (1 W&M, c.30), pp. 446-7 (5 W&M, c.6, quotation at p. 446).

[147] BL, Loan 16(2), fol. 211.

[148] *Opera*, pp. 233, 238, 251, 255 (at p. 255).

[149] Ash, op. cit. (144), p. 228.

thereof', which he probably knew had never been recovered due to its secretary's earlier defection.[150] Support for the revival of monopoly meanwhile faded away. Although the powerful men such as the Earl of Pembroke and Newton initially accepted their respective election, few seem to have been sworn in. Newton soon 'excused' himself from taking the oath. Pembroke, though a moderate Tory, likewise distanced himself from the concern.[151] The company was soon embroiled in internal disputes among members; Stringer was on the verge of insolvency, and may have been detained for debts in 1710 and in 1713, both in relation to the legal action of the driver Potter. The company's activities dwindled by 1711, with only one meeting each held in each of the years 1712 and 1713. The chymist died the following year, leaving his son Hippocrates trapped in Potter's legal action.[152]

Projecting, Piety and Public Service

Given Stringer's demise, the range of schemes that he pursued may on the whole appear to have little in common except aggressive opportunism. Was he not a needy chymist, after all, who was all too happy to pursue less well-regulated avenues like naval medicine, only to turn towards the reintroduction of monopoly over the mining industry? A more nuanced picture will emerge if we dwell upon the alchemical connotation of the term projecting. Like the alchemist's crucible that would transmute base metals into gold, Stringer's wide-ranging schemes promised to turn untapped resources into profit and plenty, thus enriching the public as well as himself. Such promises were also made by his better-known contemporaries. Stringer's case thus reveals that their promises (or pretension) to serve the public through expertise were in fact remarkably similar.

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[150] BL, Loan 16(2), fol. 236v.

[151] BL, Loan 16(2), fols. 233v (quotation), 231.

[152] TNA, PRIS 1/2, pp. 174, 315; 'Morton thesis', pp. 43-6; Rees, op. cit. (24), pp. 662-5.

The political benefits of mining were well understood by rulers across early modern Europe. In the late sixteenth century, Duke Julius of Braunschweig-Wofenbüttel and Elector Augustus of Saxony took great interest in raising revenues and reinvigorating trades by developing local mines; the alchemist Becher promoted his career by yoking together the grammars of productive art and industry with that of statecraft.[153] England saw corresponding developments. Under Charles I, the self-appointed disciple of Francis Bacon, Thomas Bushell, won royal patronage over Welsh lead mines by promoting them as the key for unlocking the productive nature and enhancing royal glory against parliamentarians.[154] Gabriel Plattes, who sided with Parliament, likewise highlighted multiple public benefits of 'digging, melting, and refining' metals; Sir Humphrey Mackworth made his parliamentary career by promoting his Company of Mine-Adventurers as the joint pursuit of profit, piety and public service.[155] Stringer's mining scheme drew squarely on this tradition.

In his 1699 pamphlet on mining, for example, Stringer promised to raise a 'great quantity of *Tin, Lead, Copper, Iron, Alom, Vitriol, Salt, Marble, Pitch, &c'*. These minerals, he said, would give jobs to hundreds if not thousands of the poor. He also highlighted far-reaching consequences of the mining industry and its produce:

> if none of these, and the other Staple Commodities [i.e., minerals], be Permitted to be sold abroad, till they are some way Manufactured; as, the *Lead* into Sheets ... Trade must needs flourish, and Money Circulate freely amongst all sorts of People[.]

[153] Tara Nummedal, *Alchemy and Authority in the Holy Roman Empire*, Chicago, University of Chicago Press, 2007, pp. 79-85. See also Smith, op. cit. (41), p. 243; Vera Keller, 'Mining Tacitus: Secrets of Empire, Nature and Art in the Reason of State', *BJHS* (2012) 45, pp. 189-212.

[154] See C.E. McGee, 'Bushell's Rock: Place, Politics, and Theatrical Self-Promotion', *Medieval and Renaissance Drama in England* (2003) 16, pp. 31-80.

[155] Gabriel Plattes, *A discovery of subterraneal treasure*, 1639, sig. [B2v]; Yamamoto, op. cit. (80), pp. 818-23.

If wisely backed with protective policies, then, the scheme would 'not only enrich me [Stringer]' and bring dividends to 'the able Person[s] Adventuring' with him, but would also prove 'very beneficial to both King and Nation' by giving jobs to many, from 'Smiths, Carpenters, Coopers, Ropers, Refiners' to mechanics and those selling food and other necessities to them near the mines.[156]

Promises of profit and plenty were never confined to the smelting and refining of ores; they pervaded the emerging worlds of public science, of the financial revolution, and of Defoe's 'projecting age'. Savery promoted his draining engine as 'conducive to increasing the mining trade', claiming that its promoters and their nation would be enriched, thereby increasing the king's revenue.'[157] When Humphry Walcot (like Desaguliers a protégé of the Duke of Chandos) sought public subscribers to invest in a desalination engine small enough for ships, he promoted it not only as a wise investment, but also as capable of saving lives, promoting naval supremacy, stimulating long-distance trade, and thus even increasing customs revenue.[158]

The humbler Blackfriars chymist applied the same pomp across the mineral, medical and imperial spheres. 'Trade', Stringer declared, was 'the Life of this Kingdom'. There was a major obstacle: the relief of the idle and indigent poor, which was 'the far greatest Tax the Nation pays'. Many of his schemes proposed to employ the poor to advance the trade, thereby turning the problem into a solution.[159] The Tobago plantation project was promoted this way. The proprietors would mine and gather precious substances such as lapis lazuli, pearls and ambergris. If 'transporting themselves thither' to Britain, 'the poorer sort of any of y[ou]r Majties Subjects', might be given relief and comfortable

[156] *Mines*, pp. 5, 13. Stringer made similar arguments when he responded to the arrival of German refugees in London in 1709. See TNA, CO 388/76 no. 65(i).

[157] Savery, op. cit. (1), p. 83.

[158] Humphrey Walcot, *Sea-water made fresh and wholsome*, 1702, non-paginated handbill.

[159] TNA, CO 5/865, no. 85, 'The order of court for taking up 20000l', p. 7; Stringer, 1699, pp. 27-28, at p. 27.

living; and their labour would help raise 'several hundred thousand pounds' for the Crown.[160]

Stringer's medical provision did not quite create jobs, but it was presented as enabling sailors, merchants, and labourers to perform their duties. His medicines were said to have 'saved and served Thousand[s] ... to the Honour of England'; thus testimonies about his 'Surprising [medical] Performances' were printed 'for Publick Service' in 1703.[161] Stringer even compared his cures to the universal medicine. Given that some provincial medical irregulars tended to be 'more businesslike in their rhetoric', Stringer was more akin to the more ostentatious quacks that Roy Porter has studied, albeit without a nationwide fame.[162] Stringer was adamant that such a fame was long overdue; he asserted that 'Mankind ought to be, Grateful to their Physitian, who like the Glorious Angels of God, bring Health, Ease and Life.'[163]

The invocation of God was another important theme that Stringer shared with others. As Lissa Roberts suggested, public science lectures promoted by men like Desaguliers often mixed 'business with pleasure, the work of the hand with that of the mind, and consideration of the here and now with the hereafter'.[164] More broadly, creating jobs for the poor, be they in mines or in workhouses, was considered a public act of Christian charity, conducive also to the augmentation of national wealth.[165] Likewise, Stringer suggested that employing the poor through the mining scheme was 'an Act of *Christian*

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[160] TNA, CO 28/6, no. 62, original petition of John Poyntz, Benjamin Woodroffe Moses Stringer 'Physician and Chymist', 24 June 1702.

[161] *Variety*, 1703, 'appendix' with separate pagination, pp. 4, 1.

[162] Jonathan Barry, 'Publicity and the Public Good: Presenting Medicine in Eighteenth-Century Bristol', in W.F. Bynum and Roy Porter (eds.), *Medical Fringe and Medical Orthodoxy, 1750-1850*, London: Croom Helm, 1987, p. 30 (quotation); Roy Porter, *Health for Sale: Quackery in England, 1660-1850*, Manchester: Manchester UP, 1989.

[163] *Variety*, 1703, p. 1 of the appendix with separate pagination, p. 2.

[164] Lissa Roberts, 'Going Dutch: Situating Science in the Dutch Enlightenment', in William Clark, Jan Golinski, and Simon Schaffer (eds.), *The Sciences in Enlightened Europe*: Chicago: University of Chicago Press, 1999, 350-88, at p. 372. For a late eighteenth-century case study, see Jan Golinski, 'Joseph Priestley and the Chemical Sublime in British Public Science', in Bensaude-Vincent and Blondel (eds.), *Science and Spectacle*, 117-127, esp. pp. 123.

[165] Donna T. Andrew, *Philanthropy and Police: London Charity in the Eighteenth Century*, Princeton, NJ: Princeton UP, 1989, pp. 22-30.

Charity ... truly worthy the Imitation of all good Men'.[166] For 'God sake', Stringer offered to cure twice a week all those 'Poor People' sent out of hospitals or 'hospital ships', or 'left off by their Physicians as Incurable' - a practice possibly adopted from the medical irregular William Salmon (1644-1713) who also lived in Blackfriars.[167] In the Tobago plantation scheme, Stringer among others proposed 'to Devote Several thousand Acres of Land in Tobago as alsoe the 20th part of Such other purchases, and acquisitions, as they shall make, to such Pious uses whereby the Gospel may be propagated among the Indians' in Tobago and elsewhere.[168] Upon becoming the Mineral Master General, Stringer promised out of 'his own will meer Motion, pious Zeal and Charity' to give 2% of the clear profit 'towards the Building and Reparing the houses of God', and another 3%

> towards the Erecting of Hospitales and Schooles for a Liberal Education of poore Infants and Orphans, and the farnishing of fit Liberarys[,] Mathematicall and Phylosophical Instruments &c.[169]

Even the corporate monopoly was promoted as a radical solution to parish poor relief across the nation. In his 1713 tract, building further upon his earlier proposal for Palatine relief, Stringer tapped into the supposed 'dominion' over mines and minerals 'for planting of colonies upon the waste lands' across the nation. Justices of Peace were urged to consult local churchwardens and overseers of the poor to identify 'Overstock'd Parishes', and raise funding for sending burdensome families to the nearest mining districts. The united company was to be 'Impowered ... [to] build houses for the support' of the incoming families, and to lease each family several acres of land, with 'necessary Houshold Goods', 'also a milch Cow' and other animals.[170] Such measures would, he declared, 'set the Works vigorously on foot, and make a

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[166] *Mines*, 28.

[167] *Post Man and the Historical Account*, 18-20 May 1708; *Oxford Dictionary of National Biography*, 60 vols., Oxford: OUP, 2004, vol. 48, p. 734.

[168] TNA, CO 28/6, no. 62. See also TNA, CO 28/7, no 19, petition of Moses Stringer to Queen, received and read 21 Feb. 1704

[169] BL, Loan 16(2), fol. 228v. For similar promises under Stringer, see also *Post Boy*, 8-10 Dec. 1709; *Opera*, p. 305.

[170] *Opera*, pp. 294-6.

speedy Advantage of the Mines, Mineral and Battery Works, which will make Trade flourish, and employ several Thousands of Hands.'[171] Political and economic historians have shown that the financial revolution went alongside the revived reformation of manners. Charitable missions like the Society for the Propagation of the Gospel in Foreign Parts (SPG) adopted public subscriptions and corporate structures to further their ends; many business enterprises, from Mackworth's mining company to trading companies such as the Royal African Company, stressed charitable dimensions of their business.[172] Despite the difference in institutional membership and the breadth of learning and networks, the chymist's medical and metallurgical activities were closely entwined with this broader pattern of projecting which drew on the mobilisation of useful knowledge at the intersection between profit motives, charitable impulses, and the pursuit of national interests.

Conclusion

This paper has not provided a comprehensive account of Stringer's life or his chymical activities. Rather, moving beyond the pervasive negative description of projectors with which this article opened, it has 'followed' the chymist's footprints from Oxford and High Peaks of Derbyshire, to York Buildings and Blackfriars in London. Its broader goal has been to understand how a humble chymist fared in the emerging world of public science based on his limited chymistry training.

The episode has illuminated an intriguing aspect of education in Oxford. While providing a base for philosophers like Boyle and Plott, its chymical

[171] *Opera*, pp. ii, 9, at p. ii.

[172] Geoffrey Clark, *Betting on Lives: The Culture of Life Insurance in England, 1695-1775*, Manchester: Manchester UP, 1999, p. 83; Pettigrew, op. cit. (145), pp. 198-200; Brent S. Sirota, *The Christian Monitors: The Church of England and the Age of Benevolence, 1680--1730*, New Haven, CT: Yale UP, 2014, pp. 96-98.

establishments also equipped Stringer with basic training to launch himself into the metropolitan marketplace replete with drugs and ideas for creating employment, stimulating trade, raising revenues and serving the empire. Stringer's career thus invites us to consider affinities between places of learning and of marketing. As Anna Marie Roos has shown, Plot was required by the Oxford University to make the Ashmolean laboratory profitable; the provision of chymistry teaching was itself an entrepreneurial undertaking.[173] We have seen that Stringer's instructor Woodroffe was involved in the Tobago plantation scheme. We also know that natural philosophers frequently moved between the Royal Society and the Exchange Alley. How, then, do Oxford and Cambridge fit into the picture? Hitherto, studies of British universities have tended to focus on their curriculum and better-documented fellows who studied or taught there for an extended period.[174] We need more empirical works to explore how the two universities may have, through chymistry training or otherwise, contributed to the emerging marketplace for knowledge.

Compared to physicians and natural philosophers, we have found Stringer to be not as inclined towards the scrutiny or refinement of theories behind his own and others' practices. His mining proposals deployed a limited range of legal and literary technologies; his mineral analysis lacked rigorous quantitative analysis or gustatory examination, and was constrained by the breadth of information network upon which he could draw. By approaching Stringer's 'gem' from the scientific, as well as historical, perspectives, we have found that the chymist was probably not privy to the method of lead-glass production patented by Ravenscroft. These limitations, together with the undeniable gap between his boastful self-presentation and material constraints, set the chymist as much apart from best artisans and learned physicians and philosophers, as from the common sort of miners and mountebanks. Although

[173] Anna Marie Roos, 'The Chymistry of "The Learned Dr Plot" (1640–96)', *Osiris* (2014), 29, *Chemical Knowledge in the Early Modern World*, pp. 81-95.

[174] See Feingold; Anita Guerrini, 'Chemistry Teaching at Oxford and Cambridge, circa 1700', Piyo Rattansi and Antonio Clericuzio (eds.), *Alchemy and Chemistry in the 16th and 17th Centuries*, Dordrecht: Kluwer, 1994, pp. 183-199.

Stringer had some learning, reading and hands-on experience, the naval contractor Martin and the coach driver Potter did not hesitate to bring him to Chancery, casting serious questions about his credibility.

Far from going out of business, however, the humble chymist was able to operate without institutional membership, gentility, disinterest, theoretical sophistication, or even technical distinction. Here, we have found it helpful to dwell upon the early modern concept of projecting - the uncanny generation of wealth out of untapped resources. For, his strategy was to tap into his chymical expertise to project himself further into virtually every avenue that was open to him. In so doing his wide-ranging pursuits brought him into contact with the New, as well as Old, Worlds.

The most idiosyncratic aspect of Stringer's projecting was what I have called his imperial turn. As a result of his serial imperial encounters, Stringer came to view the two mining companies as operating over the whole British empire, and concurrently began to view domestic wastelands as places to be 'colonised' by the 'transplantation' of poor families. He thus drew parallels between overseas colonies and the subterranean 'Mineral Kingdom'. Crown's dominion over them was to be asserted and established against interlopers, both foreign and domestic. This audacious, self-serving, project ultimately failed. But it testifies to his *bricolage* out of his imperial encounter, and reveals what he knew (and did not know) about chymistry and shifting political conventions of post-revolutionary England.

The story of Stringer's imperial encounter complements recent scholarly reassessment of the role of disinterestedness in early modern science. Vera Keller and Leigh Penman have suggested that the claim to disinterest, 'made most emphatically in Restoration England, can itself be seen as an artifact of political contingencies.' Focusing on the 1650s, they have instead shown how the convergence of Protestant political interests (rather than gentlemanly disengagement) shaped the flow of natural knowledge between Cromwellian

London and Gottorf (north of Hamburg) under the Duke Friedrich III.[175] We have found corroborating evidence from the lower end of the early eighteenth-century public science. Not being able to claim disinterest, the humble chymist instead redoubled his efforts in projecting. In the process, he manufactured cannon balls for the navy, provided cures useful at home and abroad, promoted a settlement of Tobago against imperial rivals, and proposed to 'regulate and encourage' mineral industries across the empire. All these he did by embracing (rather than renouncing) opportunities afforded by imperial and economic expansion, and did so by highlighting his service to the empire and its subjects. How many Stringers are waiting to be discovered, promoters who relied heavily upon intensive projecting, adjusting and re-adjusting expertise to the pressing needs of the empire? Such promoters would tell us much about the vast, stormy, ocean of opportunities and profits in which islands of respectable institutions like the Royal Society floated.

The present case study also provides a useful point of reference when we develop more comparative, transnational, accounts of the making of emerging modern science and technology as they intersected with the emerging market and empire. Studies of chymists and alchemists active in the sixteenth and seventeenth centuries have shown that many of them were itinerant, often moving from one princely court to another, from one trading centre to another.[176] In this respect, it is striking that Stringer was able to sustain his family with four children without abandoning his Blackfriars laboratory.[177] Could the chymist have thrived in other cities like Amsterdam, Berlin, and Paris as much as he did in London? Conversely, was the market for ideas and

[175] Vera Keller and Leigh T.I. Penman, 'From the Archives of Scientific Diplomacy: Science and the Shared Interests of Samuel Hartlib's London and Frederick Clodius's Gottorf', *ISIS* (2015), 106, pp. 17-42.

[176] Bruce T. Moran, *The Alchemical World of the German Court: Occult Philosophy and Chemical Medicine in the Circle of Moritz of Hessen, 1572-1632*, Stuttgart: Steiner, 1991; Smith, op. cit (41); Nummedal, op. cit. (153).

[177] Appleby, pp. 37-8.

expertise in the continental cities large and open enough even for an unremarkable promoter to find patrons and patients in succession?[178]

One thing is clear about Stringer's London, however. The public utility of expert knowledge - be it about minerals or medicine - was never propagated by natural philosophers alone. Through their pretension and the need to find opportunities even humbler projectors like Stringer also embodied and promoted the mobilisation of useful knowledge for public ends, whereby, as Samuel Hartlib eloquently put it in 1648, 'all Mens talents may become usefull to each other ... [so] that for their own Temporall Ends, they wou'd countenance, and promote the same'.[179] However much satirical writers mocked his (and others') rhetorical excess, therefore, the case of Stringer does remind us that, even at the shadier end of the spectrum, survival in the emerging marketplace of ideas hinged upon bold presumptions of tapping into one's knowledge to generate wealth for oneself and for the benefit of the empire and its inhabitants. In this Stringer and his better-known colleagues were remarkably similar.

This brings us back to where we began: the disapproval of the projectors like Stringer by Savery and other natural philosophers. It is by now clear that they frowned upon the projector not because their activities were categorically different, but rather because the distinction was so disturbingly slight when it came to the practical application of their knowledge. Indeed, Savery's fire engine, like Richard Steele's fish-pool scheme, did not answer expectations. Even men like Steele, Chamberlen and Woodward were subject to mockery in

[178] Pertinent recent works include Margaret C. Jacob, *The First Knowledge Economy: Human Capital and the European Economy, 1750-1850*, Cambridge: CUP, 2014; Lilian Hilaire-Pérez, *L'invention Technique au Siècle des Lumière*, Paris: Albin Michel, 2000; Andre Wakefield, *The Disordered Police State: German Cameralism as Science and Practice*, Chicago: University of Chicago Press, 2009; Dániel Margócsy, *Commercial Visions: Science, Trade, and Visual Culture in the Dutch Golden Age*, Chicago, University of Chicago Press, 2014.

[179] [Samuel Hartlib], *A further discoverie of the office of publick addresse for accommodations*, 1648, p. 3.

the press.[180] The weight of suspicion, satire and business failure - something we have found in Stringer's case - was felt across the spectrum despite the appreciable differences in social, cultural and intellectual resources at disposal.

A closer look at the lower end of public science thus enables us to clarify how the negative depiction of the 'projector' may have facilitated the constitution of authoritative knowledge. Far from working as a neutral category, early moderns used it as something of a stereotype that helped forge an impression of clear-cut distinction between the reliable and the unreliable.[181] In so far as natural philosophers disparaged the 'projector' as the dubious, fictionalized, 'other', inasmuch as they set aside significant similarities between them, the promotion of natural philosophy depended not only upon enlightened discourse and demonstration, but also upon comforting misrepresentations of their shady neighbours like Stringer.

[180] John Dennis, *The characters and conduct of Sir John Edgar*, 1720, p. 17; *Hue and cry ... being an answer to the late verses about the man-midwife and the land-bank*, 1699, non-paginated handbill; Levine, op. cit. (82), esp. pp. 13-17; 124-7.

[181] Analogous situations in early modern political (rather than natural) philosophy have been discussed by Jon Parkin, 'Straw Men and Political Philosophy: The Case of Hobbes', *Political Studies* (2011), 59, pp. 564-579.