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Caroline Stanford, “The mystery of Cologne or Stone wares”: were John Dwight and Robert Hooke pioneers in the use of fired artificial stone in architecture?”, *The Georgian Group Journal*, Vol. XXVIII, 2020, pp. 1–20

# ‘THE MYSTERY OF COLOGNE OR STONE WARES’: WERE JOHN DWIGHT AND ROBERT HOOKE PIONEERS IN THE USE OF FIRED ARTIFICIAL STONE IN ARCHITECTURE?

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*This paper examines whether the ceramicist John Dwight’s documented discovery of English stoneware, and his relationship with the architect and scientist Robert Hooke, makes either man the plausible originator of the widespread use of fired artificial stone in architecture in the eighteenth century that culminated in Coade stone after 1769, itself essentially a stoneware. Interrogating the evidence of the Hooke-Dwight relationship within its wider scientific context for the first time with this particular question in mind, the paper also offers a case study in the interaction between the natural philosophers of the Royal Society, and architectural and artisanal practice in the late seventeenth century, placed within the wider context of the Society’s History of Trades project. A critical eye is also cast over Dwight’s metropolitan claim to be the true and only discoverer of stoneware in England.*

The starting point for this paper is a quest to identify when fired artificial stone crossed into architecture. For this present context, artificial stone is defined as a composition that achieves hardness through *vitrification by fire* in a kiln (rather than through reaction with the air, as is the case for cementitious compositions). The British climate militated against the widespread external use of decorative, but more brittle, terracotta, initially introduced briefly to these shores in the 1520s, revived in the 1570s, but then hardly found

until the nineteenth century.<sup>1</sup> The durability of vitrified artificial stone solved this shortcoming, and its apogee under Eleanor Coade’s manufactory in Lambeth 1769–c.1835 enabled its widespread use in architectural decoration and statuary.

Coade stone was essentially a kind of stoneware, a mixture of ball clay and pre-fired material (grog), with added finely-ground quartz and flint. This mixture was wood-fired in kilns to produce an end result that was almost indistinguishable from natural stone but hugely exceeded it in resistance to frost and erosion. Coade stone transformed the possibilities for late Georgian and Regency architects like John Soane, Robert Adam, James Wyatt and many others (Fig. 1).<sup>2</sup> However, there are many non-specific documentary references to the earlier use of artificial stone and marbles.<sup>3</sup>

Superficially, artificial stone’s increasing use for architectural embellishment from the 1720s might be interpreted as the start of a decline from the freer accomplishments of the master craftsmen from 1660–1720, a period identified by Colvin as ‘one of the high-water marks of English architectural craftsmanship.’<sup>4</sup> Its use becomes the first step in the inexorable path to the mechanical mass-production of terracotta and cement wares from the mid-Victorian period. However, the development of vitrified stoneware has its roots in much wider historical themes than its use in architecture. These lie in the quest for porcelain, the empirical



Fig. 1. Architectural use of fired stoneware at its finest: one of the lifesize Coade stone herms (1791) supporting the porch at Schomberg House, 80–82 Pall Mall, London. The figure and its pair are now painted with a stone coloured wash. (Photo: author)

investigations of natural resources by the early scientists of the Royal Society and the nature of innovation in an essentially artisanal process during a particularly litigious age. If the boundaries between science and architecture were blurred in the Restoration period, those between scientific enquiry into the nature of materials and processes and banal (everyday, manual) experience are still more indistinct.<sup>5</sup> This nexus makes the point

of crossover of fired artificial stone into architecture relevant to strands of historical enquiry across several disciplines.

John Dwight (c.1634–1703) is a towering figure for historians of ceramics. For historians of science, he is seen as a footnote to Robert Hooke’s life, thanks to his known acquaintance with this polymath scientist and architect. Dwight is even less known among more general historians, and probably not at all to most architectural historians. Hooke’s *Diary* is a key documentary source for Dwight’s activities in ceramics; Dwight’s ceramic discoveries are a rare, concrete example of the sort of socially useful knowledge to which the Royal Society aspired in its History of Trades project.<sup>6</sup> The question of the use of Dwight’s stoneware in architecture places a new spotlight on his career, and also upon Robert Hooke’s use of statuary in his buildings and his keen interest in building technologies.

Dwight was a junior figure in the scientific coterie in Oxford during the 1650s that included men like Robert Boyle, John Wilkins and Robert Hooke. Although after graduating Dwight initially became a church lawyer in Cheshire, in about 1670 he returned to the experiments in the chemistry of ceramics that were his passion. He moved to London where he set up a pottery in Fulham; his personal holy grail was the manufacture of English porcelain, a quest in which he was only experimentally successful.<sup>7</sup> In the process, he achieved for himself the reputation of being the first person to discover stoneware in England.<sup>8</sup> A great deal is known about Dwight’s Fulham Pottery, from his own notebooks, papers and prize pieces, (see Figs. 2 and 4–6), and because the site was excavated in the 1970s.<sup>9</sup>

Archaeometry (the application of scientific techniques to the dating of archaeological remains) has been carried out on samples of both Dwight’s stoneware and of Coade stone. Dwight used a pale, highly vitrified stoneware for the handful of finely modelled busts and figures that represent his pottery’s triumphs, as well as for smaller wares and

sprigging (small, separately moulded decorative elements) applied onto coloured bodies. So too did Coade. Both relied on high levels of silicates for the vitrification of the finished piece, and both their wares exploit the same properties of stoneware formulations: its suitability for modelling and for highly finished casts, its low shrinkage in the kiln and its durability after firing. However, the archaeometry reveals differences between the analysed examples of their respective compositions. This is not a technical paper, but in essence Dwight favoured ground and calcinated flint to boost the silicate content of his raw formulation, while the Coade manufactory used a higher proportion of ground soda glass and ‘grog’ or previously fired material, ground as an aggregate whose size varied depending on the scale of the finished object. Coade sought to

imitate a fine limestone rather than the porcelain or marble to which Dwight aspired. Nevertheless, the two materials are sufficiently similar to represent a developmental continuum.<sup>10</sup>

The ability to produce stoneware in England had long been sought. The clay required to make stoneware is naturally silicate rich itself, which makes it highly refractory (heat resistant). For these silicates to vitrify in firing requires very high temperatures (1000–1300 degrees centigrade). At such temperatures, the resulting body can be easily glazed by throwing salt into the kiln, which vaporises and fuses to the clay (a closely guarded trade secret in the late seventeenth century). Even unglazed, stoneware is hard, robust, impermeable, inert and resistant to high temperatures. These properties made its performance in the early modern period far



Fig. 2. Examples of salt-glazed stoneware produced at John Dwight’s Fulham pottery in the 1670s. The flagon displays his marbled ‘porcelain’. The gorge, thrown and finished on a lathe, is of particular interest in relation to Coade stone for being made of pale stoneware.

(© Victoria and Albert Museum, London)

superior to more brittle earthenware for the storage of food and liquids and for laboratory equipment.<sup>11</sup>

The production of stoneware thus presented the early potter with two challenges: the identification of the right naturally occurring clay, and the ability to build a kiln that could reach sufficiently high firing temperatures. The chemical composition of the clays was unknown. The early scientists of the late seventeenth century were diligent in applying their proto-empirical methods and topographical cataloguing to the composition and occurrence of natural clays, along with everything else that caught their attention. Yet, remarkably, ceramic processes did not receive a passably scientific account until 1837.<sup>12</sup> In the early modern period, the ability to produce stoneware therefore rested purely upon geographical coincidence and artisanal experience.

European stoneware originated in the Rhineland in the early Middle Ages, where sources of the silicate-rich, low-ferrous clays needed to produce stoneware abounded. Salt glazing too was practised in Germany from the fourteenth century, and such wares became familiar objects in Britain from the fifteenth century.<sup>13</sup> Until the brand names of Wedgwood and Coade in the second half of the eighteenth century, ceramics were almost invariably known by their place of origin, and so stonewares were called Hessian, Cologne or Frechen wares. As the English knew only how to make earthenware, these German stonewares were imported into England in huge quantities by the seventeenth century, being especially indispensable for storing wine or ale.<sup>14</sup> Such reliance on imports for an increasingly essential commodity began to prompt unease in the early seventeenth century, and led to patents being granted for ‘stone potts’ long before Dwight’s patent in 1672. While these patents were largely taken out to disguise the imports of German wares, they underline the recognised importance of stoneware for the English economy in a century when foreign imports were vulnerable during the successive wars with the Dutch.<sup>15</sup> Perhaps crucial

in initially prompting Dwight’s own interest in ceramics, Hessian was also the only source for the crucibles used by early alchemists and ‘chymists’, essential equipment for their experiments. And this brings us back to John Dwight himself, and his formative years.

John Dwight was a yeoman’s son from North Hinksey, a couple of miles west of Oxford. Somehow, he found his way to Oxford University, where he studied law and chemistry, as a servitor at Christ Church in the 1650s.<sup>16</sup> It seems probable that the great physician Dr Thomas Willis, also of Christ Church, smoothed Dwight’s passage into the college: Willis’s mother inherited an estate in North Hinksey and there is circumstantial evidence of connections between the Willis and Dwight families’ affairs.<sup>17</sup> One of the Fulham pottery’s first ‘Porcellane’ heads would be of Dr Willis.

The 1650s were a time of great scientific ferment in Oxford, as natural philosophers groped their way via Baconian empiricism towards recognisably scientific practice, turning a lethargic medieval university into a crucible of ideas and new practices despite the tensions of the Interregnum.<sup>18</sup> The young Dwight found himself at the heart of this new activity. Dr Willis, a former servitor himself, also introduced Robert Hooke to Robert Boyle, son of the first Earl of Cork and a prime mover among the Oxford natural philosophers and of the eventual Royal Society in London.<sup>19</sup> Robert Hooke (1635–1703, so Dwight’s exact contemporary) was also a servitor, another young man of exceptional talents from a humble background. He served Boyle in his Oxford laboratory on the High Street, the start of a friendship based on mutual respect that would last for the rest of their lives despite the inequality of social status.

Hooke and Dwight formed their own acquaintance in this circle. It is very possible that Dwight also served in Boyle’s laboratory, although no evidence has been found for this, and the precise nature of Dwight’s relationship with Boyle in

Oxford remains unclear. When Robert Boyle died in 1691, he left Dwight a small bequest describing him as ‘once my servant.’<sup>20</sup> It has been suggested that Dwight may even have been one of Boyle’s scribes in Oxford in the late 1650s, since Dwight’s hand in a single surviving known example bears a striking resemblance to the writing of an unidentified amanuensis with a clear, rounded hand whose contributions can be dated to the 1650s from Boyle’s papers.<sup>21</sup> There may well be more to discover about Dwight’s time in Oxford, where his future career demonstrates that chemistry and the new empirical methods became his chief interests.

After his graduation in civil law in 1661, Dwight became secretary to Brian Walton, Bishop of Chester. There followed a successful decade as diocesan legal advisor to three Bishops of Chester, notably Bishop George Hall (1662–1668) under whom he advanced to be advocate of the consistory court of the diocese. Living eventually in Wigan, Dwight found himself at the heart of a thriving area of small potteries in both Cheshire and neighbouring Staffordshire.<sup>22</sup> Alongside his legal duties, Dwight pursued his chemical interests, specifically the quest to make porcelain.

The Dutch had a near monopoly over the import of Chinese porcelain and German stoneware into England, and, as noted above, the fact that England was intermittently at war with Holland for much of the century proved a major incentive to discover how to produce them in England.<sup>23</sup> According to Charles Leigh’s *Natural history of Lancashire, Cheshire, and the Peak of 1700*:

‘I was inform’d from my Ever-honoured Friend Sr. Roger Bradshaw of Haigh, that it was upon a whitish yellowish Earth, in a Field near the Kennel-pits at Haigh, that Mr. Dwight made his first Discovery of his most incomparable Metal...I have likewise with several of these Earths run black Lead, by which and a little Horse-Dung finely powder’d and then wrought together, I have seen it stand Fire, when a good German Crucible has broke in pieces.’<sup>24</sup>

A better-known part of the retrospective record about Dwight’s years in the north-west is the correspondence between Sir John Lowther, FRS, of Whitehaven and his agent William Gilpen in March 1698: ‘he [Dwight] gives this acct of himself’ that ‘having tried many experiments he concluded he had the secret of making China ware. Thereupon he sold his office, came to London, was encouraged therein by Mr Boyl and Dr Hook.’<sup>25</sup> A detailed reconstruction of Dwight’s key years in Cheshire has yet to emerge and the exact date of his removal to London is unclear, but once there, and by now in his late thirties, he at once set up his Fulham pottery. He must have learnt much from observing the Cheshire and Staffordshire potters: there is no other obvious source for his knowledge of the vernacular science involved with these ceramics.<sup>26</sup>

Dwight immediately employed the best available modellers, throwers and lathe turners, and in April 1672, very soon after his arrival in Fulham, he took out an all-encompassing patent for the ‘Manufacture of transparent earthenwares, as porcelain, china, and Persian-ware; also Cologne-ware.’ This was followed in June 1684 by a still more comprehensive patent for ‘Manufacturing earthenwares, as white gorges, marbled porcelain-vessels, statues and figures, and fine stone gorges and vessels; also transparent porcelain, and opaque-red dark coloured porcelain or china and Persian wares, and Cologne or stone-wares.’<sup>27</sup> There was typically much pre-emptive wishful thinking in such patents at this time; an applicant cannot be assumed to have achieved all that was contained in a patent, merely that they aspired to attain it, and to protect their rights once this was achieved. We can also note that this fussy, Oxford-educated lawyer burst upon a London ceramics scene that had hitherto been largely the province of the artisanal potters of Lambeth, Southwark and the south bank of the Thames: a little secretive perhaps, but seeing technical developments carried by journeymen from pottery to pottery as the fortunes of such small manufactories ebbed and



Fig. 3. Laboratory vessels recovered from the spoil heap behind the Old Ashmolean in 1999. Stoneware vessels such as these had been imported from Hesse for centuries. Dwight made his own in Fulham. (© *Museum of History of Science, Oxford*)

flowed. Not for them the legal expenses and jargon of the patents favoured in more elite circles.

Charles Leigh's reference to 'a good German crucible' in the extract above opens another angle upon why Dwight, as a keen chemist, was fascinated by ceramics and encouraged in his endeavours by his scientific friends. The crucible is an essential part of the chemist's laboratory equipment, then as now. Since the Middle Ages, English alchemists had also relied upon the import of German stoneware crucibles from Hesse. The Dutch Wars made the promotion of domestic English production another pressing issue for the natural philosophers of the Royal Society, founded by royal charter in November 1660 as The Royal Society of London for Improving

Natural Knowledge. When the basement of the Old Ashmolean Museum in Oxford (successor to Boyle's laboratory on the High Street) was extended in 1999, a rubbish heap was found containing bones and chemical vessels, including distinctive triangular stoneware crucibles (Fig. 3). Many such crucibles were also found during the excavation of Dwight's Fulham pottery, from whose residues it was also clear he continued his own wider chymical experiments alongside his ceramic trials.<sup>28</sup> An account of July 1673 refers to Dwight as 'un docteur grand chymiste.'<sup>29</sup>

From the outset, and heavily influenced by the writings of Francis Bacon, the Royal Society sought practical utility for social good alongside the advancement of theoretical knowledge in their

endeavours.<sup>30</sup> A few Fellows were already attempting to apply their epistemological methods to areas of experience as well as scientific experiment. John Evelyn’s *Account of Architects and Architecture* (1664 and still being reprinted in 1720s) was one of the first such treatises to emerge directly from the intellectual milieu of the early Royal Society. Evelyn also claimed that the taxonomy of ‘things Artificial’, such as architecture, could potentially be classified in exactly the same way as natural species and minerals.<sup>31</sup>

Also in 1664, Robert Boyle published his own manifesto for a History of Trades & Manufactures, *On the usefulness of experimental natural philosophy*.<sup>32</sup> This collection of essays sought to encourage and codify the exchange of ideas and knowledge between craftsmen and scientists, breaking down the innate secrecy of the tradesman and the often supercilious superiority of the gentleman scientist, for the overall benefit of society and industry: ‘That the Goods of Mankind may be much increased by the Naturalist’s Insight into Trades.’ Ceramics are one of the many instances given by Boyle for a potentially profitable exchange between artisans and scientists; for example, ‘some of the Tradesmen’s Criteria discover to us a variety and a difference of kinds in Bodies of the same Denomination; as from Potters, the Tobacco-pipe makers, and the Glassemen, we may learn a considerable variety of Clay’.<sup>33</sup> Furnaces and their properties were another preoccupation, part of Francis Bacon’s conception of Solomon’s House and crucial for the alchemists out of whose work early chemistry emerges.

Such passages make clear that the properties and potential of applied ceramics were present among the early scientists’ wide-ranging interests. The History of Trades project was a continuing preoccupation for the Fellows of the Royal Society once founded in 1660 (and confirmed by royal charter in 1663). However, hard examples of practical application proved elusive in the Society’s early decades, as they have to later historians.<sup>34</sup>

Dwight’s scientific training in Oxford and his future career in ceramics, his frequent contact with Hooke, and the hypothesis that they might be jointly responsible for the first use of fired stoneware in architecture, therefore make this case study a compelling one in considering the Society’s History of Trades project, not least in shedding light on the hitherto elusive link between the two men hinted at in Boyle’s bequest of a ring to Dwight.

Perhaps the Society’s desire to provide evidence of practically beneficial achievements explains why Robert Plot, FRS and another Oxford natural philosopher, waxed so uniquely lyrical about Dwight in his *Natural history of Oxford-shire* (1677). Here, he says:

‘the ingenious *John Dwight* ... hath discovered the *mystery* of the stone or *Cologne Wares* (such as *D’Alva Bottles, Jugs, Noggins*) heretofore made only in *Germany*, and by the *Dutch* brought over into *England* in great quantities, and hath set up a *manufacture* of the same, which (by *methods* and *contrivances* of his own, altogether unlike those used by the *Germans*) in three or four years time he hath brought it to a greater perfection than it has attained where it hath been used for many *Ages* ... He hath discovered also the *Mystery* of the *Hessian Wares*, and makes *Vessells* for retaining the penetrating *Salts* and *Spirits* of the *Chymists*, more serviceable than were ever made in *England*, or imported from *Germany* itself.’<sup>35</sup>

Significantly for the present topic of fired artificial stone, Plot also tells us in his *Natural History* that ‘he [Dwight] hath found out ways to make an Earth white and transparent as Porcellane, and not distinguishable from it by the Eye, or by Experiments that have been purposefully made to try wherein they disagree.’<sup>36</sup> In other words, and as the modern analyses have proved, by 1677 Dwight had succeeded in making a pale stoneware similar to porcelain in appearance, and distinct from the more workaday brown stoneware of Hessian ware. This difference in shade is important for its future imitation of natural stone in architecture.



Fig. 4. Salt-glazed Fulham stoneware bust, hand-modelled and thought to be of Dwight himself. c.1673–5. 18.2cm high. (© Victoria and Albert Museum, London)



Fig. 5. Hand-modelled, salt-glazed bust of Charles II from the Fulham pottery. c.1673–5. The similarity in size with Figure 1 suggests that these were unique trial pieces. The head of Dr Willis that Hooke showed to the Royal Society in 1674/5 was probably similar. (© Victoria and Albert Museum, London)

Nor did Dwight restrict his trials in the pale stoneware to crucibles and domestic ware. Again according to Plot, Dwight:

‘hath also caused to be modelled Statues or Figures of the said transparent Earth ... The considerations that induced him to this attempt, were the Duration of this hard burnt Earth much above brass, or marble, against all Air and Weather; and the softness of the matter to be modelled, which makes it capable of more curious work, than stones that are wrought with chisels, or metals that are cast. In short, he has so far advanced the Art Plastick, that ’tis dubious whether any man since Prometheus have excelled him.’<sup>37</sup>

A handful of Dwight’s hand-modelled small busts and figurines have survived, the finest in the Victoria & Albert Museum and the British Museum, known as the Dwight heirloom pieces: Dwight’s own self portrait, a bust of Charles II, some figurines and the touching deathbed image of his little daughter Lydia (see for example Figs. 4 & 5). Their discovery in 1859 in a cache at the pottery is perhaps evidence of Dwight’s secretive nature. Dated by the institutions to c.1673–5, all these are salt glazed, another technique perfected by Dwight, and are clearly in imitation of porcelain. They are not large pieces,

but they confirm Plot’s observation that Dwight was alive to his stoneware’s potential for sculpture, and the firing of such pieces represented a triumph for the seventeenth-century kilnman.<sup>38</sup> It is intriguing too that Plot refers Dwight’s recognition of his composition’s durability ‘against all Air and Weather.’ This phrase clearly suggests that its external use was at least being discussed.

There is another particularly fine Fulham stoneware piece that survived among the Dwight family heirlooms that is not salt glazed, and that further reinforces the potential of the new stoneware. This is a life-sized bust of Prince

Rupert, its size making it explicitly sculptural rather than merely decorative (Fig. 6). This piece is moulded from a cast rather than hand-modelled, suggesting that Dwight had hopes of wider reproduction. The modelling of the original work is attributed to the mason and sculptor Edward Pearce, an interesting example in himself of a Restoration artisan turned architect, who had his own links with Hooke, and whom we will meet again below.<sup>39</sup> The choice of Prince Rupert as the subject for this fine piece also may be significant, whether or not it was commissioned by him. Rupert was a fertile inventor and projector himself who

Fig.6. Moulded bust of Prince Rupert from the Fulham pottery. Its modelling is attributed to Edward Pearce and it represents a triumph of the potter’s art. Rupert was a Vice President of the Royal Society, and an inventor and patentee himself, interested in ceramics and the colouring of marble. The fact that this larger piece is moulded suggests Dwight had hopes of multiple reproductions, although this is the only cast to have survived. Gilded stoneware, 60cm high. (© *The Trustees of the British Museum*)



took out several patents, especially relating to metal working. He was interested in these years in making artificial gems and finding a process to print black onto marble, and so demonstrated his own interest in plastic reproduction.<sup>40</sup> Perhaps Dwight hoped to court his interest.

Dwight also picked up his acquaintance with Robert Hooke in London. Hooke had meanwhile been appointed one of the Surveyors for the rebuilding of London after the Great Fire, and was active in this task, as in so much else, throughout the 1670s.<sup>41</sup> An ‘active restless, indefatigable genius to the last’, as his biographer Richard Waller FRS described him, Hooke knew no physical, social or professional boundaries in his quest for knowledge, whether empirical or banal. Hardly any new works in the City took place without his involvement and he navigated with ease the interface between craftsmen, instrument makers, labourers, gentlemen and noblemen, in coffee houses and salons, on wharves and construction sites, soaking up and putting to use the snippets of information he received.<sup>42</sup>

Hooke’s reputation as an architect has benefited from scholarship since the 2003 tercentenary of his death, although in their preoccupation to attribute buildings to him, few architectural historians have engaged fully with the necessary intertwining themes of his scientific background. Most of Hooke’s buildings have now disappeared and can be hard to identify from his *Diary*, but firmer attributions have gradually emerged through subsequent research, a rehabilitation as an architect that can be traced through the successive editions of Colvin’s *Dictionary*.<sup>43</sup>

Hooke and Dwight encountered each other frequently and Hooke also did his best to promote Dwight’s modelled heads to the Royal Society, despite the fact that the virtuosi apparently preferred more spectacular demonstrations (Wren considered architectural models ‘too tedious an Entertainment’ for their meetings).<sup>44</sup> The first extant volume of Hooke’s *Diary* begins in March 1672, probably

a year or two after Dwight’s arrival in Fulham. His first mention of Dwight comes the following spring: ‘17 Feb 1673/4 ‘Saw Mr Dwights English china, Dr Willis his head, A little boye with a hauke on his fist, Severall little Jarrs of severall colours all exceeding hard as a flint, Very light, of very good shape. The performance very admirable and outdoing any European potters.’<sup>45</sup> This is fulsome praise coming from the usually laconic Hooke, and it is significant that one of Dwight’s first trials was a head of their old tutor in chemistry, Dr Thomas Willis of Christ Church (who had become a renowned physician and died in 1666). Hooke was clearly intrigued: later the same month, he learnt from a goldsmith or a surgeon in Man’s coffee house that ‘Dwights secret consist only in flint powdered and a salt mixed with tobacco pipe clay and a great fire made with dry billet which brings the clay to fusion.’<sup>46</sup> Hooke had now learned the essentials, though he did not acknowledge the need for careful formulation or the skill of the kilnman. As so often, he lost interest in the making once he had the basic principles.<sup>47</sup>

Their next recorded meeting was at the pottery on 16 May 1674, when Hooke was more dismissive: ‘Saw his pottery. I judge it nothing but Tobacco pipe clay. Possibly some burnt allum chalk or lime may be mixed in glazed with ashes. Very hard and close excessive deer.’<sup>48</sup> Given his later secrecy, it is very likely that Dwight was obfuscating. For all his university education, his reliance on the patent system and subsequent lawsuits reveal him as essentially secretive, hardly subscribing to the openness of the History of Trades project. However, Hooke, ever alert to new building technologies, did not hold this against Dwight, and he seems to have taken an example of Dwight’s work around London. Significantly, it is stoneware’s potential for works of sculpture that initially struck Hooke, rather than its more obvious potential for indigenous production of tableware or crucibles. Hooke certainly used external decoration and statuary on his buildings, most famously the pair of sculptures to represent

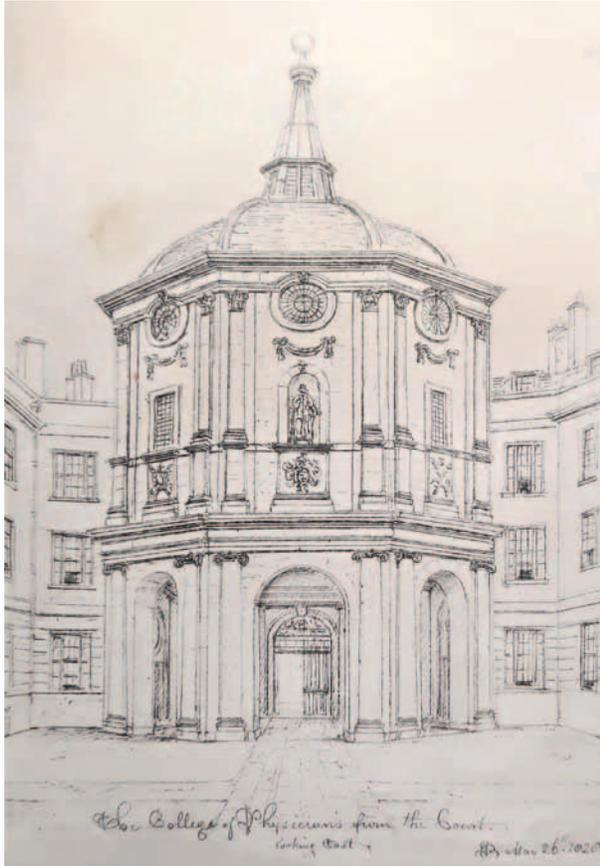


Fig. 7. The Anatomy Theatre at the Royal College of Physicians, Warwick Lane, London, designed by Robert Hooke, foundation laid in 1671 (demolished 1866). The extent of embellishment and statuary is representative of Hooke's buildings. Pencil drawing by J Buckler, May 26th 1828. (© The Trustees of the British Museum Add. MSS. 36370, f.157)

‘Raving and Melancholy Madness’ at the entrance to his Bethlem (Bedlam) Hospital, executed by Caius Gabriel Cibber. He also provided the outline sketches for the carving of the stone pedestal on the Monument, which he commissioned from Edward Pearce, who also modelled the bronze dragons at its corners.<sup>49</sup>

On 126 January 1674/5 Hooke showed Wren ‘Dwights china Figure.’<sup>50</sup> Soon afterwards, one was shown at a meeting of the Royal Society: ‘Mr Hooke brought in an artificial head resembling china, made in England, of English clay, so hard and solid, he said that nothing would fasten on it, except a diamond; and that it received its polish in the fire.’<sup>51</sup> On 24 Feb 1674/5, Hooke, with his friend Tom Hewk, took

the head to Sir John Lawrence, prominent merchant and former Lord Mayor of London: ‘Shewd him Dwights head of Porcellane. Sent it by Hewk to Sir G. Ent about Dr Hamey bust.’<sup>52</sup> This last phrase is the most tantalising for the present topic, since Ent was President of the College of Physicians, who had commissioned Hooke to rebuild their premises, destroyed in the Great Fire in 1666, and to build a new Anatomy Theatre (Fig. 7). Hooke was working hard on both through the mid- to late- 1670s, and the respected physician Dr Badwin Hamey was a major benefactor who was to be commemorated in the building by a bust. Hooke, ever alert to new technologies, thus seriously promoted his friend Dwight’s manufactured wares as an alternative to



Fig. 8. Bust of Dr Baldwin Hamey (1660–1676), major benefactor for the rebuilding of the College of Physicians. Hooke canvassed for this bust to be made of Dwight’s stoneware, but it was eventually carved by Edward Pearce in marble. (© Royal College of Physicians)

natural stone for this work. However, the bust was eventually made in marble, once again by Edward Pearce (Figs. 8 & 9), and Dwight’s ‘Porcellane head’ is mentioned no more by Hooke. This is the closest evidence to date that Hooke considered Dwight’s stoneware for quasi-architectural decoration. It would be fascinating to know whether any of Hooke’s extant buildings include use of such stoneware, whether internally or externally.<sup>53</sup> There was a fast-growing fashion for the display of such busts of prominent people in both public and private settings, and it is strange that the Fulham examples have not so far been demonstrated to have had an afterlife.<sup>54</sup>

As for the future of Dwight’s career, his drive to

discover porcelain above all else seems eventually to have been worn down by financial necessity, and his pottery increasingly concentrated on making domestic and sanitary stoneware. Water pipes too were of interest to the voracious Hooke; he was in charge of draining the Fleet Ditch in these years, and water pipes were a general preoccupation in this era of metropolitan rebuilding, discussed by Hooke with Wren and others.<sup>55</sup> Pipes had also featured in Boyle’s *Usefulness*.<sup>56</sup> After February 1674/5, most of the *Diary* references to meeting Dwight refer in some way to pipes, essential as the rebuilt City and its waterways were reconstructed and improved. It would be interesting to know whether



Fig. 9. The College of Physicians as depicted in Ackermann's *Microcosm of London*. More than a century after it was created, Dr Hamey's bust can be made out above the door at the far end. (William Combe, et al, *Microcosm of London* (1808–9), Plate 20)

any stoneware pipes survive from the period, and whether they match the Fulham composition (although Hooke also notes conversations about pipes with other apparent manufacturers, such as one Daintree, and Davy, a joiner).<sup>57</sup>

Dwight was never more than a peripheral figure for the Royal Society. He never became a Fellow, and all his contact with it was mediated by Hooke. No evidence of direct Court or aristocratic contacts is apparent, despite the bust of Prince Rupert, and Dwight did not make a fortune from his scientific curiosity, unlike Hooke, and indeed other former Oxford servitors from relatively humble backgrounds like Willis and Wren, who all became

wealthy and well-connected. For all his apparent acumen in establishing a monopoly of supply with the Glass Sellers Company in 1676, Dwight's business struggled in the following decades, especially from 1695 when the government imposed a swingeing 50 per cent excise duty on stoneware bottles as part of their drive to raise money for the war with France. Not repealed until 1698, this was a crippling blow for the pottery industry and halted innovation for a decade or more.<sup>58</sup> His descendants remained artisans. Yet perhaps Dwight has the last laugh. It is a frustration to scholars of Hooke that no contemporary depiction of him has survived, but the consensus is that Dwight did leave us his

own likeness, in the small portrait bust that survived among the family heirlooms (Fig. 4).

In old age, Dwight became increasingly litigious against other potters in London and Staffordshire who he believed were infringing his patent. Such was his fussy persistence that the costs of defending against his claims had a discernible effect on the finances of the next generation of stoneware makers, impeding rather than facilitating development in a way that ran entirely contrary to the Royal Society’s aspirations.<sup>59</sup> In reality, it seems likely that the potters of the northwest and of London’s South Bank had also ‘discovered’ stoneware through their own developing practice, but, less worldly than the Oxford-educated former lawyer in London and his patents, they sought only to protect their work by enforcing secrecy on their own premises.<sup>60</sup> History belongs to those who leave evidence behind, and the survival of his notebooks, litigation records and archaeological evidence give Dwight an advantage over these less-educated potters. Were it not for the precocity of his early pieces so fortunately guarded as family heirlooms, it is arguable that the survival of his documentary record, the extensive excavation of his pottery and the court records of his litigious pursuit of his perceived competitors have exaggerated his prominence in the history of artisanal stoneware. So too, perhaps, does his friendship with Hooke, whose own documentary record is one of the richest sources for Restoration London.

Despite Hooke’s clear recognition of sculptural potential of Dwight’s stoneware, no fired artificial stone has so far been identified on a building designed by Hooke or any other late seventeenth century architect, nor, it seems, has any late

seventeenth-century stoneware statuary or sculpture except Dwight’s Fulham pottery’s brilliant early examples. The question therefore remains of how stoneware progressed from John Dwight’s Fulham trials into architecture, and to the socially acceptable fine art reproductions and reliable building supplies produced by Eleanor Coade.

For the purposes of this article, it is Dwight’s ceramic consanguinity with, and proximity to, the Lambeth potters – site of the explicitly architectural artificial stone manufactories in later decades, which do so far seem to have been a purely metropolitan phenomenon – that makes him so relevant to the story of fired architectural stone.<sup>61</sup> The basic route is already mapped out, through the progression of known artificial stone manufacturers for architecture.<sup>62</sup> However, for all his importance in the story of English stoneware and indeed of ceramics in general, a role for John Dwight in the essential moment of crossover of fired stoneware into architecture can now be ruled out. There remains more work to be done on the years after Dwight’s death in 1703 and the next milestone in 1722, when Richard Holt and architect Thomas Ripley take out their own patent for a ‘Compound liquid metal, by which artificial stone and marble is made.’<sup>63</sup> It seems we must after all look to the artisans of the South Bank for the breakthrough, rather than the early scientists.

#### ACKNOWLEDGMENT

I am especially grateful to Michael Hunter for his helpful and corrective comments on an earlier draft.

ENDNOTES

- 1 Pers. Comm. Paul Drury, June 2019. See P. J. Drury and Richard Simpson, ‘Hill Hall: a singular house devised by a Tudor intellectual’, *The Antiquaries Journal* (2009).
- 2 The standard work on Coade stone is A. Kelly, *Mrs Coade’s stone* (Self-publishing Association: Upton-upon-Severn, 1990).
- 3 For example in Richard Holt and Thomas Ripley’s 1722 patent, and references in eighteenth-century trade manuals. Pre-Coade practitioners are therefore known to have existed even if few examples of their wares have been identified.
- 4 H.M. Colvin, *A Biographical Dictionary of British Architects, 1600–1840* (New Haven & London, 2008), p. 21.
- 5 See M. Walker, *Architects and intellectual culture in post-restoration England* (Oxford, 2017).
- 6 The published edition of Hooke’s diary remains R. Hooke, W. Adams & H. Robinson, *The diary of Robert Hooke, M.A., M.D., F.R.S., 1672–1680* (London, 1935). The extant diaries run March 1672 – end Dec 1680 (in 1935 ed.), then intermittently to May 1683; Nov 1688 – March 1690; Dec 1692 – Aug 1693. Felicity Henderson is currently editing a new edition of Hooke’s *Diary*: see for example F. Henderson, ‘Unpublished Material from the Memorandum Book of Robert Hooke, Guildhall Library MS 1758’, *Notes and Records of the Royal Society of London*, 61 (2007).
- 7 It is only with the sophisticated archaeometric techniques of the late twentieth century that it has been proved that Dwight did succeed both in finding British sources of the silicate-rich, high-alkali clays needed to make porcelain, and in firing bodies compositionally akin to certain Chinese porcelains. However, his salt glazes were prone to pitting, and his failure to produce a lime-alkali slip glaze meant he failed to reproduce the smooth, rich appearance of Chinese porcelain glazes. This half-success probably explains Robert Plot’s comment that ‘The skill that hath been wanting to set up a manufacture of this transparent Earthenware, like that of China, is the glazing of the white Earth which hath much puzzel’d the Projector, but now that difficulty also is in great measure overcome’: R. Plot, *Natural history of Oxford-shire* (Oxford 1677), p. 85. The consensus among historians of ceramics is that while the evidence of the kiln wasters (pieces spoiled during firing) show that Dwight succeeded in making experimental porcelain bodies, he was not capable of reliably replicating them for production, nor their fine glazes. See for example R. Hildyard, ‘Dwight, John (1633x6–1703), chemist and potter’ *Oxford National Dictionary of Biography* (Oxford, 2008) and articles on Dwight by various authors in *Transactions of the English Ceramics Circle*, [https://www.englishceramiccircle.org.uk/journal/index.php/ECC\\_Transactions/search/search](https://www.englishceramiccircle.org.uk/journal/index.php/ECC_Transactions/search/search).
- 8 There seems little doubt that stoneware was made in several places in the London area before Dwight’s patent, and perhaps as early as the 1620s, as excavations continue to testify – those at the Woolwich Old Ferry Approach in 1974, for example, yielded a stoneware producing kiln with shards dated to around 1660, assumed to be by a Dutch or German immigrant potter. See J. Horne, *A catalogue of English brown stoneware from the 17th and 18th centuries* (London, 1985). In the late sixteenth century, a William Simpson petitioned for a monopoly in stoneware, as did Rous and Callen in 1626, and David Ramsay in 1636 – although these patents were probably simply to disguise the import of German wares, a huge business. Until a sharp decline during the wars of the 1660s, it is estimated ten million brown beer mugs and jugs were shipped by Dutch merchants along the Rhine from centres at Rarerem, Cologne and Frechen. See R. Hildyard, *English pottery, 1620–1840* (London, 2005), p. 28. Dwight’s court cases in 1695/6 also refer to stoneware manufacture in Southampton in the late 1660s, and to a Killigrew working in Chelsea in the 1670s (whom it seems Hooke also knew – *Diary* 356: 2nd May 1678. ‘spake [at Mans] with Mr Killigrew who profferd £50 for Chelsey.’) An earlier English manufacturer was one William Killigrew who had employed a Dutch émigré called Symon Wooltus to make stoneware in Southampton as early as 1666, but submitted his unsuccessful patent application thirteen days after Dwight’s in April 1672. Killigrew is mentioned in the depositions against Dwight’s later law suits in 1694/5 (Dwight later employed two of Killigrew’s workmen, Henry Parker and John Stearne). This could plausibly have been either Sir William Killigrew, Royalist soldier, fenland projector and playwright; or

- more likely by the 1670s – his son, known as Captain Killigrew: R. Hildyard, ‘Dwight, John (1633x6–1703)’, *Oxford Dictionary of National Biography*, Oxford University Press, 2004; online edn, Jan 2008, accessed 31 March 2019. However, if Dwight was not actually the first to *make* salt-glazed stoneware in Britain, he was the first to *discover the process and document it through scientific trials* through his own dogged experiment as revealed in his so-called recipe books transcribed by Lady Charlotte Schreiber in the 1870s. These reveal a careful, empirical methodology. The whereabouts of the notebooks is now unknown. See D. Haselgrove & J. Murray, *John Dwight’s Fulham pottery, 1672–1978: a collection of documentary sources* (Stoke-on-Trent, 1979), p. 73 ff).
- 9 Dwight’s dominant role in the history of ceramics was established only in the late nineteenth century. Daniel Lysons’s *Environs of London* (1795) gives only a very brief account of Dwight and the Fulham pottery, and Josiah Wedgwood, who took an active interest in the history of his craft, was entirely unaware of his existence. It was only with the death in 1859 of Charles Edward White, Dwight’s last descendant and the discovery of the experimental pieces, the so-called Dwight heirlooms and their loan to the South Kensington Museum’ in 1862 that he came to attention. In 1869 intact wasters were found during rebuilding of the pottery, and a year later came Lady Charlotte Schreiber’s visit and the discovery of the two recipe books of 1689–98. In 1871, the family heirloom pieces were sold, and divided between the British Museum and the South Kensington Museum, and this secured Dwight’s reputation as a great ceramic innovator. Finally, in the 1970s extensive excavations of the Fulham pottery site were carried out by English Heritage, cementing Dwight’s place in the history of ceramics. See D. Haselgrove & J. Murray (1979); also C. Green, *John Dwight’s Fulham Pottery: excavations 1971–79* (London, 1999).
- 10 The specialist papers on the analysis of Dwight’s Fulham stoneware and Coade stone lie hidden in the technical literature. The most significant analyses are M. S. Tite, M. Bimson, I. C. Freestone, ‘A Technological Study of Fulham Stoneware’, *Proceedings of the 24th International Archaeometry Symposium* (1986); and I. Freestone, ‘Forgotten but not lost: the secret of Coade Stone’, *Proceedings of the Geological Association* 102 (2), (1991).
- 11 See for example D. Edwards & R. Hampson, *White salt-glazed stoneware of the British Isles* (Woodbridge, 2005), p.11; C. Read, *A guide to the English pottery and porcelain in the Department of British and Mediaeval Antiquities* (London, 1910), p. 40–42.
- 12 The first scientific account of stoneware production is S. Shaw, *The chemistry of the several natural and artificial heterogeneous compounds used in manufacturing porcelain, glass, and pottery* (London, 1837). For the challenges of producing stoneware in the early modern period, see A. Oswald *et al*, *English brown stoneware, 1670–1900* (London, 1982) and L. Weatherill, ‘Technical change and potters’ probate inventories 1600–1760’, *Journal of Ceramic History*, 3 (1970).
- 13 Read, 1910, p. 40.
- 14 See for example D. Haselgrove & J. Van Loo, ‘Pieter van den Ancker and imports of Frechen stoneware bottles and drinking pots in Restoration London c.1660–67’, *Post-Medieval Archaeology*, 32 (1998).
- 15 J. Horne, *A catalogue of English brown stoneware from the seventeenth and eighteenth centuries* (London, 1985), p. 4; A. R. Mountford & F. Celoria, ‘Some Examples of sources in the history of Seventeenth Century Ceramics’, *Journal of Ceramic History*, 1 (1968).
- 16 Hildyard, *ODNB*, 2008. A servitor was an undergraduate whose lecture and accommodation fees were paid by the college, in exchange for acting as servant to the fellows.
- 17 R. Martensen, ‘Willis, Thomas (1621–1675), physician and natural philosopher’, *Oxford Dictionary of National Biography*, 23 Sep. 2004; Accessed 2 Feb. 2020. Also Haselgrove & Murray, p. 6 ff.
- 18 See for example M. Hunter, *Boyle: between God and science* (Newhaven & London, 2009), p. 93.
- 19 J. Aubrey & K. Bennett, *Brieflives: with An apparatus for the lives of our English mathematical writers* (Oxford, 2018), Vol. 1, p. 98.
- 20 Hunter (2009), p. 345 n. 7.

- 21 M. Hunter, ‘Boyle on the Application of Science’, in J-E Jones (ed.), *The Bloomsbury Companion to Robert Boyle* (London, 2019), p. 299. For the unknown 1650s hand itself see M. Hunter, *The Boyle papers: understanding the manuscripts of Robert Boyle* (Aldershot; Burlington, VT, 2007), p. 55 and Plate 2, the manuscript of an unpublished fragment of Boyle’s *The Usefulness of Natural Philosophy*. The known specimen of Dwight’s handwriting is a letter to William Sancroft of 13 February 1668/9, now in the Bodleian Library, MS Tanner 44, fol. 89.
- 22 Hildyard, *ONDB*, 2008.
- 23 Johann Böttger is generally credited with being the first European to discover how to make hard-paste porcelain in Dresden in 1708: Dwight’s wasters hardly match the Dresden breakthrough. See J. Gleeson, *The Arcanum: The Extraordinary True Story of the Invention of European Porcelain* (London, 1996). The key but then elusive ingredient for porcelain’s strength is kaolin, a silicate rich clay formed by decaying igneous rock. This was not used in England until William Cookworthy’s identification and use of it in Cornwall in the 1740s.
- 24 C. Leigh, et al, *The natural history of Lancashire, Cheshire, and the Peak in Derbyshire*: (London & Oxford, 1700), p. 57. Leigh was a Fellow of the Royal Society, writing in pursuit of the Society’s aim of producing a series of detailed regional topographical studies, as part of the its History of Trades project. ‘Metal’ is frequently used in the early modern period to mean more generally ‘material.’ ‘China ware’ was a term for porcelain; the descriptors for different ceramic bodies were generally used very loosely and can appear confusingly generic, covering compositions today considered quite different from one another.
- 25 Haselgrove & Murray (1979), pp. 143–4. Lowther and Gilpin were trying to set up their own stoneware manufactory in Cumbria, and Gilpin seems to have gained Dwight’s confidence, since Dwight readily supplies answers to Lowther’s questions. The instrumental role of Robert Boyle and Robert Hooke in encouraging Dwight’s move south is testimony to the enduring relationships formed at Oxford. What prompted Dwight’s sudden career change was the arrival of none other than Dr John Wilkins, formerly Warden of Wadham College and perhaps an even greater force in early Oxford science than Boyle. Wilkins was appointed to Bishop of Chester in October 1668. In November 1669, he brought a bill of complaint against Dwight, for failing to yield up certain records and receiving rents due to his new master, in collusion with the late Bishop Hall’s widow. Though the case was unproven, this was enough to end Dwight’s hitherto successful legal career in the church. It is unclear whether Wilkins was justified in his accusation; the sole known example of Dwight’s hand is a slightly cryptic letter to Dean Sancroft of St Paul’s in London 13 February 1668/9, that ‘The desir’d black book is at length fall’n into my hands & it is so great a treasure that I dare not part with it without your particular direction about its Conveyance.’ (Bodleian Library, MS Tanner 44, f. 89.) The case came to nothing after Wilkins’ sudden death from kidney stones on 19th November 1672. Hooke at least lamented this, writing a warm tribute of Wilkins’ ‘sweetness of behaviour ... calmness of his mind ... unbounded goodness of his heart ... Wherever he had lived there had been the chief Seat of generous Knowledge and true Philosophy.’ M. Espinasse, *Robert Hooke* (London, 1956), p. 112.
- 26 Perhaps significantly, Simeon Shaw makes no mention of Dwight in his *History of the Staffordshire potteries: and the rise and progress of the manufacture of pottery and porcelain* (1829). According to Shaw’s folksy tale, calcinated flint – used by Dwight in his stoneware – only came to Staffordshire stoneware manufacturers after Thomas Astbury noticed its qualities when seeking a cure for his horse’s inflamed eye in Dunstable in 1720: ‘The hostler put into the firegrate a small nodule of flint – plentiful in that neighbourhood – and after it had become incandescent, he threw it into water, and pulverized it into a very fine powder, a little of which was blown into each eye of the horse, and the copious discharge which ensued, relieved and cured them both’ (p. 248). This led Astbury to add powdered flint to his own ceramic bodies. Shaw’s account gives a detailed descent from ‘common brown [stone] ware’ before 1680 right up to ‘the queen’s ware of the celebrated Josiah Wedgwood’ (p. 416). In Shaw’s account, everything springs from the Staffordshire potters.

- 27 B. Woodcroft, *Alphabetical index of patentees of inventions : with an introduction and appendix of additions and corrections compiled in the Patent Office Library* (London, 1969), p. 171.
- 28 The Old Ashmolean is today the History of Science Museum. Scientific analyses have been made of crucibles excavated in Oxford and Dwight’s Fulham examples, notably by I. Freestone at UCL and M. Martínón-Torres, now at Cambridge. For the most recently published work on the Oxford crucibles, see M. Martínón-Torres, ‘Inside Solomon’s House: An Archaeological Study of the Old Ashmolean Chymical Laboratory in Oxford’, *Ambix*, 59 (2012). The tradition of making crucibles continued at the Fulham pottery: in 1762, William White (second husband of Dwight’s granddaughter and now ‘master of the Stone Pot House in Fulham’) took out a patent for the ‘New invented . . . White Crucibles or Melting Potts’ Haselgrove & Murray, p. 163.
- 29 Haselgrove & Murray, p. 46. The commentator is Sir John Colladon, physician to Queen Catherine, who has spoken with one of Dwight’s potters about his ‘maytre de foulam’ (master in Fulham).
- 30 There is an extensive literature on the aspirations and extent of effectiveness of the Royal Society in applying the new science to public benefit. See for example M. Hunter, *Science and Society in Restoration England* (Cambridge University Press: Cambridge, 1981), chap. 4; L. R. Stewart, 1992. *The rise of public science : rhetoric, technology, and natural philosophy in Newtonian Britain, 1660–1750* (Cambridge, 1992).
- 31 John Evelyn’s *Account Of Architects & Architecture* was published alongside his important translations of Fréart’s and Alberti’s treatises on architecture and sculpture respectively, both significant contributions in themselves to the dissemination of knowledge and practice. See R. Fréart, *A parallel of the antient architecture with the modern, made Engl. To which is added an Account of architects and architecture. With L. B. Alberti’s Treatise of statues. By J. Evelyn* (London, 1664). These epistemological forays are discussed in detail in M. Walker, *Architects and intellectual culture in post-restoration England* (Oxford, 2017).
- 32 R. Boyle, *Some considerations touching the usefulness of experimental natural philosophy. : Propos’d in a familiar discourse to a friend, by way of invitation to the study of it* (Oxford, 1664).
- 33 R. Boyle, ‘That the Goods of Mankind may be much increased by the Naturalist’s Insight into Trades’ in *Some considerations touching the usefulness of experimental naturall philosophy* (Oxford, 1671) p. 6.
- 34 More recent scholarship has not overturned long-standing accounts pointing out the lack of practical application of the new science in the late seventeenth century, such as W. E. Houghton, ‘The History of Trades: Its Relation to Seventeenth-Century Thought: As Seen in Bacon, Petty, Evelyn, and Boyle’, *Journal of the History of Ideas*, 2, 1941, and M. Hunter, *Science and society in restoration England* (Cambridge, 1981), chap. 4.
- 35 R. Plot, *The natural history of Oxford-shire, being an essay towards the natural history of England* (Oxford, 1677), pp. 84–5. Plot plays close attention to the localised sources of earths, ochres and clays, aware of the importance of the raw materials to successful effort. He was also very interested in the techniques of fired ceramics, and this may be one of the reasons he chose Staffordshire for his next book, *The natural history of Stafford-shire* (Oxford, 1686). Although Plot is loyal to Dwight’s claim to have made his discoveries entirely independently, Dwight was almost certainly aware from his Oxford days of Johann Glauber’s *A Description of New Philosophical Furnaces*, published in English in 1651–52, which essentially sets out the manufacture of stoneware, given the right clay: Haselgrove & Murray (1979), p. 35.
- 36 Plot (1677), p. 86.
- 37 *Ibid*, p. 87.
- 38 There is also a good display of Fulham stoneware in the Ashmolean Museum in Oxford.
- 39 See *Biographical Dictionary of Sculptors*, <http://liberty.henry-moore.org/henrymoore/sculptor/browserecord.php?action=browse&-recid=2075> Accessed 09:33 20/05/2019. Fragments of another cast survive and it is likely to have been a commissioned piece, perhaps for outdoor display. Fine though it is, even the surviving example in the British Museum has some fire cracking and may not have met Dwight’s exacting quality standards.
- 40 ‘Oldenburg shewd Prince Ruperts staid marble. Very curious. I affirmed I could stain all colours and I hoped without spreading but I admird that

- of the Prince.' Hooke's *Diary*, p. 329, cit. R. Iliffe, 'Material Doubts: Hooke, Artisan Culture and the Exchange of Information in 1670s London', *British Journal of the History of Science*, 28/3 (Sept. 1995). Also *Ibid*, n. 54: Henry Oldenburg to Martin Lister on 10 June 1676 that Prince Rupert had sent a specimen of marble with pictures of boys and trees on it painted so that 'all ye outlines of those pictures were perfectly defined without any spreading or flowing of ye colours and ye colours so fixed by ye fire, and afterwards so polish't, yt they will be permanent, as along as the marble lasts.' (Oldenburg Correspondence, Hall & Hall. (4), xii, 334). Rupert also employed 'a potter from Hungary who has found a mixture of earths here in England which is white as chalk'. J. J. Becher's 'Account of Pottery in England c.1680-2', cit. Haselgrove & Murray (1979), p. 67. Rupert too clearly had alternatives to Dutch-imported Chinese porcelain in his sights.
- 41 Much has been written on Hooke. For a good recent synopsis, see J. A. Bennett, M. Hunter, & L. Jardine, *London's Leonardo: the life and work of Robert Hooke* (Oxford, 2003).
- 42 For the coffee house culture within the scientific community see especially L. Stewart, *The rise of public science: rhetoric, technology, and natural philosophy in Newtonian Britain, 1660-1750* (Cambridge, 1992) and R. Iliffe, 'Material doubts: Hooke, artisan culture and the exchange of information in 1670s London', *British Journal of the History of Science*, 28 (1995).
- 43 The assumption that Hooke was essentially Wren's junior partner, as surveyor to architect, was set as long ago as 1937 in the otherwise still serviceable M. Batten, 'The Architecture of Dr Robert Hooke, FRS', *Walpole Society*, XXV (1937). For other accounts of Hooke's architecture, see the chapter in M. Espinasse, *Robert Hooke* (London, 1956). Drawing a veil over Giles Worsley's over-enthusiastic reclaiming of works for Hooke in this journal in 2004 (G. Worsley, 'Taking Hooke Seriously', *Georgian Group Journal* 14, 2004), the next milestones are L. Jardine, *The curious life of Robert Hooke: the man who measured London* (London, 2003); H. Louw's perceptive analysis 'The Mechanick Artist' in M. Cooper & M. Hunter, *Robert Hooke: Tercentennial Studies* (Ashgate, 2006); C. Stevenson, 'Robert Hooke's Bedlam', *The Journal of the Society of Architectural Historians*, 55 (1996), and most recently Matthew Walker's detailed treatments: '*Architectus Ingenio: Robert Hooke, the Early Royal Society and the Practices of Architecture.*' (PhD Dissertation, Cambridge University, 2009), and *Architects and intellectual culture in post-restoration England* (Oxford, 2017). Also Colvin, *Dictionary* (2008), pp. 532-6.
- 44 Walker (2009), p. 51.
- 45 Hooke, *Diary* (1935), p. 87.
- 46 *Ibid*, p. 89.
- 47 See Louw (2006).
- 48 Hooke, *Diary*, p. 103.
- 49 Pearce is another example of the omni-competent Mechanick Artist. A prolific mason and sculptor, he too designed buildings, modelled for Dwight and carved the magnificent marble bust of Christopher Wren, c.1673, in the Ashmolean. While now considered a copy by Pearce after a lost bust by a French sculptor, perhaps Antoine Coysevox, this must surely be considered as part of the same milieu as the Dwight busts. For Hooke's Bethlem Hospital, see C. Stevenson, 'Robert Hooke's Bethlam', *Journal of the Society of Architectural Historians*, 55 (1996).
- 50 Hooke, *Diary*, p. 143.
- 51 T. Birch, *The History of the Royal Society of London* (4 vols., London 1756-7), vol. 3, p. 193.
- 52 Hooke, *Diary*, p. 149.
- 53 The current project to restore Ramsbury Manor, designed by Hooke for Sir William Jones c.1682, will see another of Hooke's buildings analysed in detail.
- 54 See Matthew Hunter, *Wicked Intelligence: Visual Art and the Science of Experiment in Restoration London* (Chicago & London, 2013).
- 55 See for example Hooke, *Diary*, pp. 150, 310, 337. Espinasse (1956, p. 104) notes that in 1677, Dwight made detailed calculations about the bore of pipes for Wren's design of St Paul's Cathedral.
- 56 Boyle 'chanc'd to meet with an ancient Artificer, imply'd to keep in repair the Conduits that brought Water to London [...] he was forward to satisfie the Curiosity I had to know what Cement he employ'd about so important a Work.' Boyle learns from him that for the best way of mending water pipes, he should mix 'a good Clay (such as Tobacco-pipes are made of)' with 'short Flocks'

- and linseed oil and leave it to dry. Boyle, ‘Of mens great Ignorance of the Uses of Natural things’, in *Usefulness* (1671 ed.), p. 28. ‘Stone pipes, ‘cistern heads’ and ‘collars or shoes’ are included in a 1795 list of the manufacture of brown stone ware, in which the Dwight family pottery is included, but it is not clear how early these began to be made, and the use of stoneware water pipes did not become widespread until the 1840s: Haselgrove & Murray, p. 170–1.
- 57 See *Diary*, October 1677 for Daintree, and December 1679 for Davy. Richard Neve’s *The city and countrey purchaser, and builder’s dictionary* (London, 1703) gives detailed instructions on how alder poles might be made into water pipes (p. 3), a job for a skilled carpenter. As in much else, Neve also quotes John Worlidge’s *Systema Agricultura* (1669) in mentioning ‘Earthern-pipes made fine, thin and durable to carry Water under the ground at Portsmouth’ (Worlidge, p. 214).
- 58 Haselgrove & Murray, p. 137 ff.
- 59 *Ibid.*, p. 11. See the depositions from the potters who were defendants in Dwight’s lawsuits, Haselgrove & Murray (1979) XXI *The Lawsuits 1693–1698*, pp. 83–129. Already reeling from the burden of newly imposed duties, some were forced to take on loans to pay their legal fees, making them vulnerable to foreclosure as happened to Luke Talbot and Matthew Garner at the hands of Nathaniel Oade of Southwark, the only other master potter operating at the same scale as Dwight.
- 60 See for example Shaw (1837). The lawsuits Dwight brought against the Eler brothers and others are detailed in Haselgrove & Murray (1979) pp. 83 ff. These testify to the manufacture of brown stoneware in the region long before Dwight started his London pottery.
- 61 Francis Place (1647–1723) in York seems to have succeeded in making fine stoneware but did not succeed commercially. In these two letters he enquires of London friends about Dwight’s patent and its term: Haselgrove & Murray (1979), p. 80.
- 62 See C. Stanford, ‘Revisiting the Origins of Coad Stone’, *Georgian Group Journal* 24 (2016).
- 63 Woodcraft (1969), p. 28. The full title of the patent is ‘Compound liquid metal, by which artificial stone and marble is made, by casting the same into moulds of any form, as statues and capitals; also for house-work, garden ornaments, and other work, to substitute cut or sculptured work.’ Explicit evidence that Holt as also producing *fired stone* comes later, in his *Short treatise of artificial stone, as ‘tis now made, and converted into all manner of curious embellishments, and proper ornaments, of architecture*, published in 1730.