

# The Authority of Practice in the Alchemy of Sir John Heydon (1588–1653)

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The social, ideological and personal contours of Lieutenant-General John Heydon's alchemy provide a case study of how philosophical questions and solutions arise from intertwined practice, theory, and scientific *persona*. The development of Heydon's alchemical theory in an unpublished manuscript, *A Synopsis of the Universall Entity of Ideas or of ye Systemes of the Maeteriall and Immateriall World*, illuminates theories concerning generation and the maintenance of life through aerial nitre theory, which links the early seventeenth-century investigations of Michael Sendivogius and Cornelis Drebbel with later writers such as Kenelm Digby and Robert Boyle. It also provides the context for the early use of thermostatically controlled ovens. Practical concerns within the Ordnance Office could help to explain such interests in saltpetre and efficient ovens. Such practical concerns, however, do not determine the shape that Heydon's theories took. Rather, theory also shaped Heydon's notions of practice. Heydon's particular strand of vitalism granted philosophical authority to experimental practitioners, whether or not they were learned in a traditional sense.

## Introduction: artisanal and philosophical practice in Heydon's orbit

Which come first, ideas or practice? In England in the 1640s, this was a chicken-and-egg question. Sir John Heydon (1588–1653), lieutenant-general of the Ordnance Office in London from 1627 to 1642 and in Oxford from 1642 to 1646, was one of four individuals who opened and observed chicken eggs in order to study animal generation.<sup>1</sup> Chicken eggs were a popular choice because, as William Harvey

<sup>1</sup> Sir John Heydon is not to be confused with his many relatives of the same name or the younger Rosicrucian writer, John Heydon. On John Heydon, his brother William, and their relationship with Cornelis Drebbel, see Edward Murray Tomlinson, *A History of the Minorities, London* (London: Smith, Elder & Co., 1907), 134–43, and 400. All transcriptions have been given in the original spelling and punctuation.

explained, they were so cheap, common, and easy to observe.<sup>2</sup> They illustrated how the book of nature could be easily laid open to ocular inspection. However, the fact that John Heydon, Kenelm Digby, Nathaniel Highmore and Harvey all drew different philosophical conclusions from their observations of chick generation demonstrated that there was more to experimental practice than easily met the eye.<sup>3</sup> The ways in which natural philosophical knowledge was drawn from experimental practice depended upon differing views of philosophy and of practice.

Studies of alchemical, artisanal and academic laboratory practice should lead us, as Ursula Klein has urged, to “replace the simple distinction between scholarly and artisanal knowledge” made in the past with a “broad spectrum of forms of knowledge, with differences only in degree.”<sup>4</sup> Of the four observers of chicken eggs (Harvey, Highmore, Digby, and Heydon), Heydon, at first blush, appears to be at the practical edge of this spectrum. Given his hard-pressed career as a military supplier in a losing battle, it would be easy to explain his philosophical concerns through allusion to a practical context. His investigations into the chemical properties of nitre might aid saltpetre production (and in turn gunpowder production), while philosophical theories of respiration, combustion, temperature and smoke could be linked to the design of portable campaign ovens suitable for the battlefield or colonial ventures. Samuel Hartlib, for instance, noted how useful Heydon’s “experimentum” for “turning salt water into fresh” would be for supplying ships, and he also remarked upon Heydon’s calculation that the portable, self-regulating ovens invented by his chief engineer, Cornelis Drebbel, would save the king’s army £40,000.<sup>5</sup>

Although undoubtedly relevant, such practical concerns do not constitute a full explanation for the philosophies of such figures as Heydon, or of his engineer, Drebbel.<sup>6</sup> Others facing similar pressures made different philosophical choices.

<sup>2</sup> William Harvey, *Anatomical Exercitations concerning the generation of living creatures* (London: Pulleyn, 1653), 2.

<sup>3</sup> Karin Ekholm, “Harvey’s and Highmore’s Accounts of Chick Generation,” *Early Science and Medicine* 13 (2008): 568–614. Highmore was responding to the theories of Kenelm Digby, who also served as a conduit of observations between Harvey and Highmore. Highmore refers to “That observation of Doct. Harvies, related to us by Sir Kenelm Digby” in Nathaniel Highmore, *The History of Generation* (London: John Martin, 1651), 100. Digby and Heydon used Drebbel’s newly invented self-regulating furnace as an artificial incubator for their experimental chicks, as Digby recalled in 1644. See Kenelm Digby, *Two treatises in the one of which the nature of bodies, in the other, the nature of mans soule is looked into in way of discovery of the immortality of reasonable soules* (Paris: Gilles Blaizot, 1644), 220: “Sir Ihon Heydon, the Lieutenant of his Maiesties ordinance (that generous and knowing Gentleman; and consummate souldier both in theory and practise) was the first that instructed me how to do this, by meanes of a furnace so made as to imitate the warmeth of a sitting henne.” Decades later, during a discussion of artificial incubation in the Royal Society, Sir Jonas Moore, Surveyor General of the Ordnance Office, would remind the Fellows how “Sir Christopher [*sic*] Heydon together with Drebell long since in the Minorities hatched several hundred eggs; but mentioned not the way.” See Thomas Birch, *A History of the Royal Society* (London: Millar, 1757), 455.

<sup>4</sup> Ursula Klein, “The Laboratory Challenge: Some Revisions of the Standard View of Early Modern Experimentation,” *Isis* (Focus) 99 (2008): 769–82, on 781.

<sup>5</sup> Samuel Hartlib, *The Hartlib Papers* CD, 2nd ed. (Sheffield: HROnline, Humanities Research Institute, University of Sheffield, 2002), 29/2/32B, 29/5/73A.

<sup>6</sup> Bruce White and Walter Woodward have argued that colonial pressures to save fuel encouraged the adoption of a version of Drebbel’s oven in the circle of John Winthrop Jr. in “‘A Most Exquisite Fellow’ — William White and an Atlantic World Perspective on the Seventeenth-Century Chymical Furnace,” *Ambix* 54, no. 3 (2007): 285–98. However, in addition to sharing similar pressures, Heydon and Winthrop shared similar philosophical concerns. In 1640–1641, Winthrop Jr. and his associates at this time were also very interested in the

Furthermore, these pressures make the attention that Heydon paid even at the height of his career to more speculative investigations all the more remarkable. Heydon and his brother-in-law, Sir Christopher Gardiner, explored the works of Nuisement, Isaac Hollandus, Sendivogius, and other alchemical authorities, even as political tensions flared in 1638 (see the postscript of Appendix A). Heydon was also the author of a speculative text that he described in correspondence to Thomas Browne and Elias Ashmole. On the basis of these descriptions, I will argue that an anonymous text in MS Ashmole 1446, *A Synopsis of the Universall Entity of Ideas or of ye Systemes of the Maeteriall and Immateriall World*, can be attributed to him. Heydon's alchemy, I will argue, allowed, in particular, for the intersection of philosophical and practical identities.<sup>7</sup>

Heydon's conception of who might be considered a philosopher was far broader than that of some of his contemporaries. For instance, Harvey championed the importance of experimental practice, or *habitus*. Practice honed ideas in the mind about nature, just as practice honed the phantasy of artists and poets, who might all observe the same thing and yet express it quite differently, depending upon their mental conceptions.<sup>8</sup> However, although the habits of art and science were analogous, they could also be sharply distinguished, according to Harvey. His distinctions between art and science also etched divides between artisans and philosophers.<sup>9</sup>

Heydon, by contrast, sought to broaden the category of philosopher. As Heydon wrote to Browne in 1652 while offering to enter into an alchemical correspondence with him, "I have ben abundantly satisfied by ye testimony of very knowinge men, as well literat as illiterate." For, as he continued, "Non qui graeca scit, aut verba calet Latina doctus est, aut sapiens; sed qui vera videt; & falsis discernere novit" (It is not he who knows Greek, nor who proclaims Latin words, who is learned or wise, but he who finds out truths and can distinguish them from falsehoods).<sup>10</sup> Heydon presented himself as an informed skeptic concerning traditional learning (although, tellingly, his disdain of ancient languages was expressed in Latin). He particularly approved of Browne for not subscribing to the "traditions" of either philosophy or medicine, "beyond what effects of Nature, his owne Experimentale practice, or demonstrable Reason shall manifest to be really true."<sup>11</sup>

<sup>6</sup> *Continued*

alchemical theories for which the oven was designed. Robert Child's alchemical library catalogue of 1641, for instance, included Drebbel's philosophical text, *On the Elements*. See William Jerome Wilson, "Robert Child's Chemical Book List of 1641," *Journal of Chemical Education* 20, (1943): 123–29. See also William Newman and Lawrence Principe, *Alchemy Tried in the Fire: Starkey, Boyle, and the Fate of Helmontian Chymistry* (Chicago, Ill.: University of Chicago Press, 2002), 158–61.

<sup>7</sup> Compare Benjamin Worsley, whose intertwined practical interests in saltpetre and theoretical interests in Sendivogius and Nuisement are explored in: Charles Webster, *The Great Instauration: Science, Medicine and Reform, 1626–1660* (New York: Holmes & Meier Publishers, 1976); John T. Young, *Faith, Medical Alchemy, and Natural Philosophy: Johann Moriaen, Reformed Intelligencer and the Hartlib Circle* (Brookfield, Vt.: Ashgate, 1998); and Newman and Principe, *Alchemy Tried in the Fire*, 239–49.

<sup>8</sup> William Harvey, *Exercitationes de generatione animalium* (London: Pulleyn, 1651), B2v–B3. On philosophical *habitus*, see Jean-François Gauvin, "Instruments of Knowledge," in *The Oxford Handbook of Philosophy in Early Modern Europe*, ed. D. M. Clarke and C. Wilson (Oxford: Oxford University Press, 2011), 315–37.

<sup>9</sup> Harvey, *Exercitationes*, B3, "nam ut ars circa facienda, ita scientia circa cognoscenda, est habitus: ut illa ab imitatione exemplarium; ita haec, à rerum naturalium cognitione procedit." For Harvey's relationship with alchemists, see Walter Pagel, *New Light on William Harvey* (Basel: Karger, 1976), 42–61.

<sup>10</sup> John Heydon to Thomas Browne, 23 September 1652, Bodleian Library, Rawlinson MS D 391, 26.

<sup>11</sup> John Heydon to Thomas Browne, 23 September 1652, Bodleian Library, Rawlinson MS D 391, 26.

The focus on practice in the history of science in the last few decades has sometimes had the unintended consequence of reaffirming divides between practitioners and philosophers. We now have many studies of the practices, inventions and instruments of the learned.<sup>12</sup> Often, these take the form of showing how the learned drew ideas from the world of practical concerns and brought them to natural philosophy.<sup>13</sup> Such studies of relations *between* worlds of learning and of practice can unintentionally solidify divisions between the two. Meanwhile, we often do not pay the same attention to the explicit philosophies and ambitions of “practitioners,” or seek to determine how these individuals came to be categorised as practitioners rather than philosophers in the first place.<sup>14</sup> Celebrating practitioners for their implicit knowledge can unintentionally confirm their identity on a lower epistemic rung, even as their explicit views may go unstudied.<sup>15</sup> Rather than showing, for instance, how practical concerns such as incubation, oven design and saltpetre research travelled from the world of Heydon and Drebbel to that of Digby, Highmore, and Harvey, this essay will seek to illuminate the Ordnance Office as a very practical world that was intertwined with philosophical concerns of the greatest epistemic ambition.

Heydon first encountered his future colleague in the Ordnance Office, the inventor and philosopher Cornelis Drebbel, in a world that refused to distinguish between philosophers and practitioners. In 1653, Heydon would recall that he “first began to practice Spagyrically in London” in 1615, when he was twenty-seven years of age.<sup>16</sup> At that time, he and his brother William, friends of Constantijn Huygens Sr., belonged to an Anglo-Dutch courtly circle whose optical, mechanical and mathematical pursuits are well known, but whose alchemical interests have not been

<sup>12</sup> For a review of numerous studies of practice in the history of science, see James Secord, “Knowledge in Transit,” *Isis* 95 (2004): 654–72.

<sup>13</sup> For example: Marjorie O’Rourke Boyle, “Harvey in the Sluice: From Hydraulic Engineering to Human Physiology,” *History and Technology* 24 (2008): 1–22.

<sup>14</sup> The identity of the “mathematical practitioner” has been considered to be a highly important link between theory and practice, and Drebbel has been classified as one. See Eva Germaine Rimington Taylor, *The Mathematical Practitioners of Tudor and Stuart England* (Cambridge, UK: The Institute of Navigation Stet, 1954), 191. See also: Stephen Johnston, “Mathematical Practitioners and Instruments in Elizabethan England,” *Annals of Science* 48 (1991): 319–44; and Katherine Hill, “‘Juglers or Schollers?’: Negotiating the Role of a Mathematical Practitioner,” *British Journal for the History of Science* 31 (1998): 253–74. Frances Willmoth has suggested investigating relationships in the Ordnance Office between practitioners and philosophers in “Mathematical Sciences and Military Technology: The Ordnance Office in the Reign of Charles II,” in *Renaissance and Revolution*, ed. J. V. Field (Cambridge: Cambridge University Press, 1993), 117–32. Like Simon Forman, however, Drebbel claimed a higher status than mathematical practitioner through his alchemical access to the hidden causes of nature. See Lauren Kassell, *Medicine and Magic in Elizabethan London: Simon Forman, Astrologer, Alchemist, and Physician* (Oxford: Oxford University Press, 2005), 53.

<sup>15</sup> In Matteo Valleriani, *Galileo Engineer* (Dordrecht: Springer, 2010), Drebbel is criticised as a “machine maker” (162). Valleriani does not refer to Drebbel’s published natural philosophy. By contrast, while identifying Drebbel as an “artisan,” Pamela Smith categorises his works among “texts by natural philosophers” rather than among “texts by artisans.” See Pamela Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago, Ill.: University of Chicago Press, 2004), 162–63, 366. Pamela Long has emphasised the importance of authorship to a claim of epistemic status in *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance* (Baltimore, Md.: Johns Hopkins University Press, 2001).

<sup>16</sup> MS Ashmole 1446, 166v.

emphasised.<sup>17</sup> In the 1610s and early 1620s in London, Huygens experimented with Drebbel's inventions alongside the diplomat Sir Robert Killigrew, his wife, Lady Mary Killigrew, and other political figures. The Huygens papers in The Hague contain medical and cosmetic receipts from Robert and Mary Killigrew, their literary son Thomas, and Drebbel.<sup>18</sup>

Despite Heydon's very practical concerns in the Ordnance Office, his chambers there were comfortably furnished for a virtuoso and his guests, with six "pictures," "12 stooles of red cloath and turky worke," "3 small turkye carpetts," "4 paire of old hangings of tapestry," "2 globes," "2 old boxes with Instruments," and a "violl and other things." They also contained the goods of Stevens, his servant, and a library of over sixty volumes of Reformed piety, contemporary literature, philology, dictionaries and grammars, the classics, global travel narratives, and cartography, law, architecture and medical works, and surprisingly few (three) practical military and mechanical works.<sup>19</sup> He was himself the dedicatee of several works.<sup>20</sup>

After Drebbel's death in 1633, his secrets remained with Heydon. Drebbel's children sold the secret of his self-regulating ovens to Hildebrand Pruson (a long-time associate of Heydon and Drebbel) and Howard Strachey, Heydon's clerk.<sup>21</sup> Hartlib noted that "Gardiner at Croydon," Heydon's brother-in-law, "got all Drebbel MS and Arcana," and that "Gardiner cures feliciter."<sup>22</sup> Heydon's alchemical correspondence with his brother-in-law reveals that Gardiner oversaw Heydon's alchemical processes and acted as his alchemical reader at Haling manor in Croydon.<sup>23</sup> There, Gardiner tended a reverbatory, a digesting oven, and a "vaporing oven." Gardiner also regularly read works for Heydon, including Nuisement and Sendivogius (Appendix A), and gave his frank opinion on them.<sup>24</sup> The two frequently discussed

<sup>17</sup> Lisa Jardine, *Going Dutch: How England Plundered Holland's Glory* (New York: Harper, 2008). In his autobiography, Huygens referred to both John and William Heydon ("Heidonios hic nempe duos, par nobile fratrum"). See Rosalie Colie, *Some Thankfulness to Constantine: A Study of English Influence Upon the Early Works of Constantijn Huygens* (The Hague: Nijhoff, 1956), 103.

<sup>18</sup> Huygens Papers, Koninklijke Bibliotheek, The Hague, vol. 47, 503, 532, 576, 580. On Killigrew's alchemical interests and medical cures, see Hugh Trevor-Roper, *Europe's Physician: The Various Life of Sir Theodore de Mayerne* (New Haven, Conn.: Yale University Press, 2006), 182–83, 186, 356.

<sup>19</sup> "An inventory of part of the goods and chattels of Sir John Hayden Knight taken the 28th of July 1643," British Library Additional MS 28191, roll d.

<sup>20</sup> These included: Henry Hexham, *An appendix of the lavves, articles, & ordnances, established for marshall discipline, in the service of the Lords the States Generall of the United Provinces* (The Hague: Isaac Burchoorn, 1643); Robert Ram [Thomas Swadlin], *The Soldiers Catechisme* (London: J. Wright, 1645); and Robert Sheringham, *Joma. Codex Talmudicus* (London: Junius, 1648). *The Soldiers Catechism* is a royalist tract masquerading as the parliamentary tract of the same title by Robert Ram.

<sup>21</sup> A.D. 1634, no. 75, "Stoves or Furnaces for Drying and Heating," in *Appendix to Reference Index of Patents of Invention*, ed. Bennett Woodcroft (London: Patent office, 1855), 16.

<sup>22</sup> Hartlib, *The Hartlib Papers CD*, 29/5/102B.

<sup>23</sup> For Gardiner's biography and an overview of his alchemical correspondence, see Louis D. Saco, "Sir Christopher Gardiner," *Transactions of the Colonial Society of Massachusetts* 38 (1959): 3–15.

<sup>24</sup> UK National Archives, 5 November 1637, State Papers 16/373, 67. Like Heydon, Gardiner was a learned reader who transferred his humanist skills to practical matters. Thomas May stressed this quality of Gardiner's when he dedicated his *Virgil's Georgicks Englished* (London: Walkley, 1628). Thomas Morton described Sir Christopher Gardiner as "a Knight, that had bin a traveller, both by Sea and Land; a good judicious gentleman in the Mathematicke, and other Sciences usefull for Plantations, Kimistry, &c. and also being a practicall Engineer." See Thomas Morton, *New English Canaan* (Amsterdam: Jacob Frederick Stam, 1637), 182.

and disagreed over degrees of heat.<sup>25</sup> On one of Gardiner's letters, Heydon sketched in new designs for the digesting oven.<sup>26</sup> Good ovens were important to any alchemist, but distinguishing degrees of heat was a particular interest of Heydon's. As he would write in 1653, "since the yeare 1615, in which I first began to practice Spagyrically in London, I have not met with more then 2 that understand the right Fabrick of the severall Furnaces necessary . . . together with the Respective and much differing degrees of Heate in all which I have long since so fully satisfied my selfe that I have many yeares remained without any scruple in any of them."<sup>27</sup>

## Heydon as the author of the *Synopsis*

MS Ashmole 1446 includes an English translation of Nuisement's 1621 *Traitez du Sel*, followed by the *Synopsis*, and, among other material, an "Abstract of letters sent to Mr Stevens from Sir John Heydon, upon the sending to him my Theatrum Chemicum Brit & Fasciculus Chemicus."<sup>28</sup> Ashmole had been the friend of Heydon at least since Heydon moved with the Royalist Ordnance Office to Oxford from 1642 to 1646.<sup>29</sup> Ashmole would later sadly note the death of Heydon, "my worthy friend," in his diary on 13 October 1653.<sup>30</sup> The attribution of the *Synopsis* to Heydon is suggested by this setting and by a comparison with the alchemical ideas that Heydon expressed in his surviving correspondence with Stevens and Browne. Notably, the author of the *Synopsis* held a broad view of philosophical authority, discussing, for instance, Drebbel's philosophical ideas. Such attributions of philosophical authority to Drebbel had become common in Ramist Central Europe, but were rare in England.<sup>31</sup>

The *Synopsis* presents a highly explosive view of the generation of the world and its contents. It connects the formal to the material world through the ability of "salts" such as saltpetre to attract and congregate spirits (equated with light, as an entity both material and immaterial) under the right environmental conditions, including heat, cold, density, and rarity.<sup>32</sup> The ability of salt to dissolve, and thus appear to lose its form, and yet then to coagulate repeatedly into a specific crystal structure maintaining formal integrity, suggested a model for how a hidden form might structure mineral and biological matter.<sup>33</sup>

<sup>25</sup> State Papers 16/374, 17 December 1637, 39; State Papers 16/397, 80, 3 August 1638.

<sup>26</sup> State Papers 16/374, 28 December 1637, 109.

<sup>27</sup> MS Ashmole 1446, 166v.

<sup>28</sup> MS Ashmole 1446, 153–162v.

<sup>29</sup> For John Heydon in Oxford from 1642 to 1646, see Ian Roy, *The Royalist Ordnance Papers, 1642–1646* (Oxford: Oxfordshire Record Society, 1964–1975).

<sup>30</sup> Elias Ashmole and William Lilly, *The lives of those Eminent Antiquaries Elias Ashmole, Esquire and Mr William Lilly* (London: T. Davies, 1774), 298, 320.

<sup>31</sup> Vera Keller, "How to Become a Seventeenth-Century Natural Philosopher: The Case of Cornelis Drebbel (1572–1633)," in *Silent Messengers: The Circulation of Material Objects of Knowledge in the Early Modern Low Countries*, ed. Sven Dupré and Christoph Lüthy (Berlin: LIT Verlag, 2011), 125–52.

<sup>32</sup> Compare the role of light in the embryology of Jan Marek Marci z Kronlandu, *Idearum operatricium idea; sive, Hypotyposis et detectio illius occultae virtutis, quae semina faecundat, & ex iisdem corpora organica producit* (Prague: Typis Seminarii Archiepiscopalis, 1635), which includes an extended discussion of egg formation (D2). William Harvey received a copy of this book from Marci in Prague; the latter complains that Harvey did not discuss it in his *De generatione animalium*. See Walter Pagel, *William Harvey's Biological Ideas. Selected Aspects and Historical Background* (New York: Hafner, 1967), 288.

<sup>33</sup> Norma E. Emerton, *The Scientific Reinterpretation of Form* (Ithaca: Cornell University Press, 1984), 19–47.

In the generation of the world, material and immaterial light penetrate the mass of the world, igniting the incombustible oil at the centre of all material. A tremendous explosion ensues. This “big bang” disburses matter through the universe. According to the author, the *tria prima* of Paracelsus were the products of one of the elements working upon the other, all of which were included within earth: “Fire acting upon Air, produces Sulphur, Aire upon Water Mercury, Water upon Earth produced Salt. But the Earth (in regard it had nothing else to worke upon) did not produce any thing, but became the Receptacle, Matrix & Nurse of the rest.”<sup>34</sup> Or, “the 4 Elements be the 3 Principles Congregated & Concreted into one substance of Earth.”<sup>35</sup>

The differences between the elements, however, were not those of specific qualities, but greater or lesser degrees of subtlety. The author of the *Synopsis* wrote that “according to Drebell, That Fire, is subtile Air/ Aire, is subtile Water/ Water, subtile Earth/ Earth, subtile Fire./ For the elements are naturally convertible into themselves, & so do mutually live in each other.”<sup>36</sup> The author, however, did not swallow his theories whole from the works that he read, but criticised them. “Drebel is deficient in ye efficient cause of Fire, or in the Primitive beginning thereof & makes the finall Constitution thereof, to be too grosse,” he complained.<sup>37</sup>

These views can be compared with the philosophical theories that Heydon expressed to Browne and Ashmole via Stevens. To Browne, Heydon described his philosophy as a fusion of “Hypocrates & Hermes,” one giving an account “of ye Forme of this Materiall; of ye intellectual constitution of ye universe; & of ye omniscous & (therefore omnipotent) Essence of all Entities & Essences” and the other “a full & satisfactory notice of ye Materiall & compounded world; by ye compositione & constitutione of Light (which is ye General Spirit thereof) wherein ye General Form & material substance, of necessity must be comprised.”<sup>38</sup> This balance of and relationship between “formal” and “material” worlds matches the *Synopsis*’s description of “Materiall and Immateriall” worlds.

Heydon continued to describe to Browne the role of salt, and saltpetre in particular, in condensing the spirit of the world. Light, as an entity both “partly materiall, partly immatiale,” served as the link between material and formal worlds. As the “true Elementary and Elementating bodily substance,” light, through the intervention of three luminaries, is

more & more condensed untill within ye bosom of ye Ocean, & bowells of ye earth, it be coagulated into ye terminating substance of mercuriall or liquid salt: which (by ye concurring centrale heate of ye earth of ye sol: is after concreted into ye volatil, midl & fixed spes of saltpeeter, sal armoniae, & fix salt (whereof every minerall, vegetable & animale, hath specificale & peculiar proportion:) so that the conclusion of that Spagyricke will be found orthodox; in sole & sale sunt omnia [Everything is in sun & salt].<sup>39</sup>

<sup>34</sup> MS Ashmole 1446, 155r–v.

<sup>35</sup> MS Ashmole 1446, 156r. Compare Clovis Hestean de Nuisement, *Traitez de l’harmonie et constitution generale du vray sel, secret des Philosophes, & de l’Esprit universelle du Monde, suivant le troisieme Principe du Cosmopolite* (Paris: Perier and Buisard, 1621), 173: “Et sans doute les elemens ont une telle connexion & afinité entr’eux que l’un participe de l’autre: & chacun d’eux se trouue en son compagnon.”

<sup>36</sup> MS Ashmole 1446, 159r–v.

<sup>37</sup> MS Ashmole 1446, 160.

<sup>38</sup> MS Rawlinson D 391, 26v.

<sup>39</sup> MS Rawlinson D 391, 27r.

The discussion of light by the author of the *Synopsis* is also very close to that found in Heydon's letter to Browne. The author of the *Synopsis* wrote that "the Opticks have determined Light to be the proper subject of Colour, & Colour to be the proper Accident of Light. All Tincture therefore proceeds from Light. that Sulphur doth illuminate, & give Tincture to every Body, & that it is the painter of all Colours, the Spagericks doe teach."<sup>40</sup> In Heydon's letter, the "Opticks" are also cited:

of which sulphur Geber makes this protestation: Per Deum vivum, id ipsum illuminat omne corpus: quoniam est lumen a lumine & Tinctura [Through the living God, it itself illuminates every body, since it is light from light and a Tincture]: & by generall consent, it is agreed that calor est omnium Tincturam luminumque pater [heat is the origin of Tincture and all light] . . . since according to that rule of ye opticks; Lux est subiectum proprium coloris; color accidens proprium lucis [Light is the subject proper to colour; colour is the accident proper to light]: (as by ye Ranebowe &c).<sup>41</sup>

The author of the *Synopsis* constantly sought substances that might link the two realms he discussed, and that could be connected to actions of light, colouring, flame, life and death, particularly as observed in the action of ovens. The author of the *Synopsis* wrote that, "Vapour was the first & next action of Fire; And Fire, continually ejecteth a spirituall Vapour, as the French Author p[ro]p[er]ly affirmeth," and "all Flame, as its beginning was from smoake, more unctious then vaporious; Soe it hath its ending from smoke, more vaporious then Oyly. And the Vapour therof by cooling & by condensing at length is coagulated & incorporeated into a saltnes; as we may see in the Soote of all Chymnies."<sup>42</sup> Writing to Browne, Heydon likewise described this salty vapour, ejected by fire and visible in ashes, in what was again a partially verbatim Latin version of the *Synopsis*: "nam vapor est prima proximaque ignis actio: ignisque vaporem continuo ejicit spirituosum, luminosum, & salsuginosum [for vapour is the first and next action of fire: and fire continually ejects a spiritous, luminous, and salsuginous vapor]: both which the smoake, smout, & ashes of every combustibile substance do sufficiently manifest."<sup>43</sup> Nuisement had argued that impure or noxious matter, such as the soot produced in chimneys or sulphuric vapours given off by fire, might pollute or burn away the vital spirit, and thus cause disease and snuff out life (and not the *semina* of disease discussed by Severinus, Fracastoro, Fernel, and Sennert).<sup>44</sup>

Eight months after writing to Browne, Heydon wrote to Stevens on 1 June 1653, after a "brief & Cursory inspeccon made into Captaine Ashmoles Booke," which had been sent to him. He boasted that

I know Radicalls really & fundamentally from the first Originalls, & by practicall Reduccon can prove & demonstrate the 3 or rather 4 principles thereof, & of all the 3 species of Minerall, vegetable & Animall Natures, &c. & the same to proceede from one forme

<sup>40</sup> MS Ashmole 1446, 157r.

<sup>41</sup> MS Rawlinson D 391, 27v.

<sup>42</sup> MS Ashmole 1446, 158–158v.

<sup>43</sup> MS Ashmole 1446, 141r.

<sup>44</sup> Nuisement, *Traitez*, 183–84: "Que cette choses volatile soit un excrement il se prouue assez par les puantes fumees des corps bruslans desquels s'engendre la suye attachee aux cheminees & planchers enfumez; la quelle retient l'odeur des corps bruslez, & l'amertume des excrements des sels."



& matter omitted & againe diversified & disprid by one & the same generall Spirit, adequately composed & consisting of them both, & that those 3 species & their Individualls do differ secunda matrices tantis [according to such matrices], & are convertible the one into the other, as the 4 Elementating Elements are & the 3 principals resulten from them.<sup>45</sup>

This is the same view as that found in the *Synopsis* concerning the general nature of matter and spirit preceding specification, the role of the matrix in specification, the convertibility of the Elements, and the Elements as the origins of the *tria prima*. As the author concluded there, animal, vegetable and mineral beings “are natured” according “to the Nature & disposicon of the place, or Matrix into which the Generall Spirit is infused & incorporated . . . nor are they otherwise produced into being.”<sup>46</sup>

### “The difference only in degrees”: the Sendivogian school and Heydon’s theory of generation

William Newman has described a division in seventeenth-century alchemy between the adherents of a “mercurial school,” according to which the matter employed in the production of the Philosophers’ Stone must be metalline, and a “Sendivogian school,” according to which the alchemist began with a “universal salt extracted from elemental earth.”<sup>47</sup> The *Synopsis*, like Drebbel’s *On the Nature of the Elements* and Nuisement’s *Traitez du Sel*, belongs to the latter school. Nuisement also cast his treatise as a continuation of Sendivogius’s work. According to Libavius, Sendivogius and Drebbel were so similar that, had Sendivogius written in the vernacular, the two books would have been the same. He particularly criticised their theory of generation.<sup>48</sup>

Sendivogius and Drebbel argued that starting with expensive metalline matter was unnecessary according to a matter theory in which all spirits are specified not according to *semina*, but according to degrees of purity, density, and rarity within the matrix. The greatest alchemical processes could thus be produced starting with the cheapest substances, including saltpetre produced from excrement. Likewise, Heydon promised an easy shortcut to the heart of nature. A theory of generation according to which all the seeds of all species (other than man, Heydon specified) were made of the same matter, and were only differentiated by the matrix into which they fell (according to purity and degree of subtlety), made the specification of matter into desired substances a seemingly simple matter. Ashmole, as Heydon wrote again the following week, would never find the right magistry, without consulting Heydon, as

<sup>45</sup> MS Ashmole 1446, 165. C.H. Josten, ed., *Elias Ashmole (1617–1692): His Autobiographical and Historical Notes, his Correspondence, and other Contemporary Sources relating to his Life and Work*, Vol. II (Oxford: Clarendon, 1966), 646–8.

<sup>46</sup> MS Ashmole 1446, 162–162v.

<sup>47</sup> William R. Newman, *Geheemical Fire: The Lives of George Starkey, an American Alchemist in the Scientific Revolution* (Cambridge, Mass.: Harvard University Press, 1994), 212–13.

<sup>48</sup> Vera Keller, “Drebbel’s Living Instruments, Hartmann’s Microcosm and Libavius’ Thelesmos: Epistemic Machines before Descartes,” *History of Science* (2010): 39–74, on 54–55; Andreas Libavius, “Apocalypseos hermeticae pars posterior,” in *Syntagma arcanorum chymicorum . . . tomus secundus* (Frankfurt: Kopff, 1613), 443, 450.

one who has “taken the paines first to understand the tru constitucons” “of Natures first composicon & Principles.”

The first principles of nature were

but few yet Generall, most efficacious, infallible, easy & obvious, to those yt have inquired into them, the direct & simple way of Nature, who is non other then the mediate Minister of the Omnipotent Creator, & (according to ye divine immutable & infallible Order which he was pleased from the beginning to prescribe, continually produceth all things, as well supersolary as sublunary, whether Minerall, Vegetable or Animall, Celestiall or Luminous from the Horizon to the Center of the whole Materiall, harmonically & Compounded world) the forme conjoyning medium & matter, or Generall soule, spirit & Bodily substance of all which & of every species & individuall (the Soule of Man excepted) are the same, & the generale sperme & seedes of them all being one & the same, & the difference only in degrees of subtiliacon & Condensacon, of purity & impurity, in respect of the different Matrices, into which they are inspired & infused.<sup>49</sup>

Drebbel, Sendivogius, Nuisement and Heydon (unlike Libavius and Sennert) did not argue that the specification of matter was due to specific *semina* implanted in nature by the creator.<sup>50</sup> For them, generative and life-sustaining vital spirits could be attracted and coagulated by salts. Before being specified by this process, all matter was identical, and the differentiation in species occurred only through the density and rarity of the coagulated matter caused by heat and cold, as well as the level of purity of its vital spirit. Subtle variations in heat along a continuum of rarefied or condensed matter, therefore, played an important role in Heydon’s matter theory. This was why, as Heydon wrote to Stevens, it was so important to have the “right Fabricket of the severall Furnaces necessary,” “together with the Respective and much differing degrees of Heate.” Drebbel’s self-regulating oven included the first thermostat differentiating degrees of heat according to the greater or lesser subtlety of mercury (which, as it rose, operated a lever opening and closing the air supply). Such ovens were not simply a means to save the king’s army money or to produce chicken eggs efficiently. Their structure fitted a particular alchemical theory in which combustion was linked to a substance in the air circulated through the vaporisation and condensation of matter through degrees of heat and cold.

## Digby mechanises Heydon’s experimental chickens

Ironically, removing the source of specification from the privileged and protected position of the *semina* and diffusing it more widely through the world means that this very generally vital universe could be easily overturned to be a more mechanist universe. Once specific *semina* are removed, writers influenced by Descartes, such as Digby, might easily reinterpret the universal vital spirit as vegetative, thus granting

<sup>49</sup> “Abstract of letters sent to Mr Stevens from Sir John Heydon, upon the sending to him my Theatrum Chemicum Brit[annicum] & Fasciculus Chemicus,” MS Ashmole 1446, 165v–166r.

<sup>50</sup> William R. Newman, *Atoms and Alchemy: Chymistry and the Experimental Origins of the Scientific Revolution* (Chicago, Ill.: University of Chicago Press, 2006), 147.

extreme agency to processes such as rarefaction and condensation, and a more radical divide between the human soul and the rest of matter.

The incubation of chicks offers a case in point. Nuisement argued that the artificial production of chickens, without the eggs having been incubated by the hen, demonstrated that the entire world was full of “pregnant vivacity, and always in vital action.”<sup>51</sup> The development of the chick within the incubated egg served as Nuisement’s model for all generation. It was the tempered fire incubating the egg that allowed the egg to ferment and the chick to coagulate within into the appropriate form.<sup>52</sup> As Heydon would later also argue, there was, according to Nuisement, a continuum between formal and material worlds to be found in vapours, which explained how heat might allow a link between form and matter to be generated. Fire threw off vapours midway between body and spirits, “participating in both substances.” Once coagulated by a salt, such vapours were the source of life, but also the source of disease.<sup>53</sup> This passage from Nuisement sheds light on why Heydon would be interested in observing the development of chick embryos as they were formed within Drebbel’s oven.

The very same experience of watching chicks slowly forming within the egg might be interpreted either in favour of the vitalism of all matter, or in favour of the artificiality of all life.<sup>54</sup> Digby described in great detail the development of chicks that he observed alongside Heydon, which he suggested — like Nuisement — could easily serve as the basis for a new understanding of life processes for all beings. The chain of events witnessed in the artificial production and further development of the chick, however, did not appear to him as proof of the vitality infusing the entire world. Rather: “the birdes . . . are but passiuè instruments, and know not why they do those actions: but do them they must . . . like the allarum that necessarily striketh, when the hand of the dyall cometh to such a point; or the gunnepowder that necessarily maketh a ruine and breach in the wall, when the burning of the match reacheth to it.”<sup>55</sup> Phenomena that appeared to be the most spectacular proofs of vitality to Nuisement, instead confirmed ideas that Digby had encountered when reading Descartes.

Just as Digby would discuss the powder of sympathy or aerial nitre while removing the explanations of vital universal spirit and astral influence commonly associated with these ideas, so he also re-purposed the experiment of chick incubation against the prevailing vitalist interpretation.<sup>56</sup> He reinterpreted “specificke vertues” as “such

<sup>51</sup> Nuisement, *Traitez*, 15–16: “Nous voyons bien aucunes fois que sans acouplement de masle & de femelle, voire sans l’un ny l’autre, plusieurs choses sont engendrees, ausquelles par naturelle fomentation est inspire la vie, de la vie de l’univers: comme quelques uns artificiellement sont esclorre des poulets, sans que la poule en ait coué les œufs . . . tant le monde est plein de vivacité preignante, & tousiours en action vitale.”

<sup>52</sup> Nuisement, *Traitez*, 70: “Cecy apparroist au petit vaisseau d’un oeuf; de-dans lequel le sperme se putrifie par la chaleur de fomentation; puis apres le poulet se coagule & forme, le mesme arrive en la generation de l’home.”

<sup>53</sup> Nuisement, *Traitez*, 72: “Cete vapeur s’eslevant n’est donc pas encore corps, mais bien une chose moyenne entre corps & esprit, comme participant de l’une & de l’autre substance.”

<sup>54</sup> Compare Christoph Meinel, “Early Seventeenth-Century Atomism: Theory, Epistemology, and the Insufficiency of Experiment,” *Isis* 79 (1988): 68–103.

<sup>55</sup> Digby, *Two treatises*, 326.

<sup>56</sup> Betty Jo Teeter Dobbs, “Studies in the Natural Philosophy of Sir Kenelm Digby: Part II, Digby and Alchemy,” *Ambix* 20 (1973): 143–63, on 149; Elizabeth Hedrick, “Romancing the Salve: Sir Kenelm Digby and the Powder of Sympathy,” *British Journal for the History of Science* 41 (2008): 161–85.

degrees and such numbers, of rare and dense partes mingled together.”<sup>57</sup> The vitalist interpretation that Digby would have encountered in Heydon’s orbit, however, shaped his mechanically oriented reinterpretation. Drebbel, Sendivogius, Nuisement and Heydon had already recast the four Aristotelian elements as nothing other than rarer or denser states of matter, differing “only in degrees.” This interpretation also appears in Digby, and it helps to support Digby’s fusion of Aristotle and Descartes. Yet, whereas a continuum of rarity and density allowed Heydon to identify entities that participated in both a formal and a material world, for Digby, “*Rare and Dense*” provided a definitive divide between body and soul as “the primary and adequate diuision of *Bodies*” and not of the soul.<sup>58</sup>

## Heydon, Browne, and the transmission of aerial nitre theories

Important seventeenth-century scientific ideas have often been linked to the mechanisation of the universe. Betty Jo Teeter Dobbs has described Digby’s mechanisation of earlier alchemical ideas as a great leap forwards in the development from alchemy to chemistry.<sup>59</sup> Not only were the alchemical theories that preceded Digby themselves new and contested, but the mechanisation of such theories did not necessarily entail a step forwards in the progress of scientific ideas. Not all of what would ultimately appear to be the correct insights of the early seventeenth-century vitalist theories of saltpetre persisted when taken up and reinterpreted by writers of other philosophical persuasions. For instance, while aerial nitre — as a life-giving *pabulum* — was subsumed from early seventeenth-century writers such as Sendivogius and Drebbel by Digby, Robert Boyle, and John Mayow, its opposite — the life-consuming invisible, sulphuric vapour — was not taken up, and only reappeared in the eighteenth century.<sup>60</sup> This appears in the case of Browne’s view of aerial nitre, which can be reconsidered now in light of his correspondence with Heydon.

E. S. Merton has described how Browne’s theories of respiration and combustion shifted over time to reflect Mayow’s idea of a “nitrous spirit” in the air. Heydon’s letter to Browne, discussed here, shows that Browne might equally have encountered such an idea through Heydon or other earlier alchemists, such as Nuisement. This additional line of transmission would explain a detail of Browne’s theory that even Merton considered paradoxical:

One phase of Browne’s theory is, paradoxically, far in advance of the more modern theory of Boyle and his colleagues. Browne distinguishes between the black exhalations

<sup>57</sup> Digby, *Two treatises*, 223.

<sup>58</sup> Digby, *Two treatises*, 342.

<sup>59</sup> Dobbs, “Studies,” 150.

<sup>60</sup> Aerial nitre has attracted substantial scholarly research, because evolving views of the life-sustaining properties of aerial nitre have been traced over time through to Lavoisier’s idea of an acid-generator, or oxygen. See Anna Marie Roos, *The Salt of the Earth: Natural Philosophy, Medicine, and Chymistry in England, 1650–1750* (Leiden and Boston: Brill, 2007). Currently, the prominence of aerial nitre theories among early fellows of the Royal Society such as Kenelm Digby, Robert Boyle and John Mayow is well known, and it has also been pointed out that theory of aerial nitre did not originate in Restoration England, but earlier in the century in the writings of figures such as Michael Sendivogius and Cornelis Drebbel. See Zbigniew Szydło, “The Influence of the Central Nitre Theory of Michael Sendivogius on the Chemical Philosophy of the Seventeenth Century,” *Ambix* 43 (1996), 80–97.

of charcoal and the invisible exhalations of “pure and refined sulphur, as in the spirits of wine often rectified.” This distinction was made earlier by Van Helmont but escaped the notice of Boyle, Lower, and Mayow. Boyle, and his followers, intent upon the pabulous supply of nitre in the air could ascribe expiration of fire or of life to a lack of nitre alone, rather than to this lack plus the noxious exhalations of combustion and of respiration.<sup>61</sup>

Before Van Helmont, Browne’s correspondent Heydon did discuss a variety of vapours given off by both combustion in the world at large and within the living organism. As Heydon wrote to Browne, fire gives off a spirituous, a luminous, and a salty vapour, and he also cited Sendivogius, “ignis in aeris produxit sulfur” (fire in air produced sulphur).<sup>62</sup> For Nuisement also, two such vapours — the terrestrial and the sulphuric — could counter the vital *pabulum* of air in two different ways. The terrestrial blocked it through gross corporeality and polluted its purity, while the volatility of sulphuric vapours burned away the balm of life and prevented its fixation within the body. He wrote in 1621: “Inflammable air is that which gives rise to kindling and sulfuric matter, which easily catches fire and consumes along with it also that which is vital & radical, carried away by the greater quality of what is volatile and burnable.”<sup>63</sup>

These examples show yet again that a progression in scientific concepts from vitality to mechanisation cannot be assumed. Studies of the origins of many seventeenth-century philosophical concepts, such as aerial nitre and inflammable air, often begin with mechanisation.<sup>64</sup> Mechanically inclined experimental philosophers, however, did not necessarily observe nature more effectively than did their vitalist counterparts. Vital alchemical philosophies were not themselves static, and they contributed to and shaped mechanical theories in a variety of ways that require closer attention. With their vital origins forgotten, the complex theoretical, social and practical interactions giving rise to such foundational concepts remain unanalysed.

## Conclusion

The content of Heydon’s philosophy, which offered a link between the world of immaterial forms and the material world of gunpowder and explosions, related to the links that Heydon allowed between the social identities of artisan and philosopher. A study of Heydon’s alchemical reading, authorship and practice links an important

<sup>61</sup> E. S. Merton, “Sir Thomas Browne’s Theories of Respiration and Combustion,” *Osiris* 10 (1952): 206–23, on 217.

<sup>62</sup> MS Rawlinson D 391, 27v. Compare MS Ashmole 1446, 155: “Fire acting upon Air, produced Sulphur.”

<sup>63</sup> Nuisement, *Traitez*, 177: “L’air inflamable est ce qui y engendre la matiere soufreuse & adustible: la quelle aysément concevant l’ardeur, consomme aussi avec elle ce qui est de vital & radical, emporté par la plus grand quantité de ce qui est volatil & bruslable.”

<sup>64</sup> Leslie Tomory, in “Let it Burn: Distinguishing Inflammable Airs 1766–1790,” *Ambix* 56 (2009): 253–72, at 254, n. 1, although not focusing on the origin of the idea, represents a wider habit of tracing the early appearance of such ideas to Robert Boyle. Boyle discussed such air as the product of minerals, either as exhalations from subterranean, heated mines, or as vapours produced by metals burned in the laboratory, and not as a regular byproduct of all combustion and respiration. See: Robert Boyle, *New Experiments and Observations Touching Cold* (London: John Crook, 1665), 767–68, 775–76; Robert Boyle, *Touching the Relation Betwixt Flame and Air* (London: Richard Davis, 1672), 63–66; and Robert Boyle, *An Essay of the Great Effects of Even Languid and Unheeded Motion* (London: Richard Davis, 1685), 17.

stage of the development of the salt-centred alchemy, including the theory of “aerial nitre,” to a saltpetre-based military practice. More widely, it links vitalist theories to corpuscularian ones along a different and concurrent strain of development to Boyle’s reception of Daniel Sennert and *semina* theory.<sup>65</sup> By arguing that, as Heydon wrote to Stevens, “the generale sperme & seedes” of animals, vegetables and minerals are all “one & the same,” and the difference lay “only in degrees of subtiliacon & Condensacon, of purity & impurity, in respect of the different Matrices, into which they are inspired & infused,” Heydon diminished the importance of seminal content, and paved the way for his friend Digby to see rarity and density as sufficient descriptions for all bodies.

The great esteem that Heydon displayed for the knowledge of those generally deemed to be unlearned, both in his alchemical correspondence and in the *Synopsis*, contrasts with the ideas of his contemporary, Harvey, about practice as a distinctively philosophical *habitus* analogous to but ultimately distinguished from artisanal practice. Likewise, while “mechanist” philosophies have been seen as a means to connect philosophy and practice, Digby’s mechanist account of chick generation, which divided bodies from souls, also distinguished between the authority of the philosopher and the practitioner.

Heydon, however, remained resolutely formal and vitalist. His use of Drebbel’s thermometrically controlled oven did not lead to Galileo’s theory, recently discussed by Matteo Valleriani and developed through experimentation with a thermoscope, that motion causes heat. Rather, heat causes motion, and heat is ultimately caused by form. As Heydon wrote in the *Synopsis*: “That which giveth Being, giveth also Lyfe/ That which giveth Lyfe, giveth Moc[i]on also/ And Heate only, causeth Moc[i]on, not Moc[i]on, Heate./ But it is Form that giveth Being. Therefore Forme, gives Lyfe, Heate, Moc[i]on, & all Acc[i]on. For by the Consent of all the Parapateticks, Quantity hath no Acc[i]on.”<sup>66</sup> The belief that all heat and all motion could only be found through a fundamental understanding of form goes a long way towards explaining why the lieutenant-general of the Ordnance Office was incubating chicks and reading and writing highly speculative alchemical works.

Heydon’s friend Digby, as a commissioner for the navy, shared similar pressures and experimented alongside Heydon with the same objects. Nevertheless, the two developed very different theories, and, along with their theories, two different views of the relationship between practice and philosophical authority. Whereas Digby is remembered today as a philosophical thinker rather than a navy commissioner, Heydon and Drebbel are remembered as a lieutenant-general and an engineer, respectively. Repeating such labels in historiography, rather than uncovering lost philosophical identities, can reenact a historical process of retrospective division between practitioners and philosophers: a division that may, in turn, map onto and support the mechanical reinterpretation of vitalist ideas. This study of the relationship of social and practical contexts, the invention of objects and the authorship of texts in the orbit of John Heydon has demonstrated how practice, theory and sources of philosophical authority were enmeshed.

<sup>65</sup> On Sennert and Boyle, see, among others: Antonio Clericuzio, *Elements, Principles, and Corpuscles: A Study of Atomism and Chemistry in the Seventeenth Century* (Boston, Mass.: Kluwer Academic Publishers, 2000); and Newman, *Atoms and Alchemy*.

<sup>66</sup> MS Ashmole 1446, 158v.

## Acknowledgements

I am grateful to Mary Fuller, Margaret Garber, Alex Marr, Jenny Rampling, Anna Marie Roos, Mary Terrall and the *Ambix* reviewers for helpful comments.

## Appendix A

State Papers 16 397, fol. 80. 13 August 1638. Sir Christopher Gardiner to Sir John Heydon.

De Nuisement in his first chapter of his second booke discoursing of his universall spirit upon which he soe much insists in my poore opinion doth much involve himself in obscurities for that striving to shew how this spirit taketh a bodie he saith that it hath alreadie a bodie, without intimating what manner of one it is is, so that yf one doe nott rather applie himself to his scope in his ensuing discourse whereof he fixeth himself upon a salt which is the seate and house wherein this spiritt dwelleth and domineereth a man shall runne round in a circle and butt confound himself. Butt where he commeth to the operation of the Elements and theire qualities how they worke upon and subtiliate each other especiallie the activitie of the fire to which he attributes the first beginning of things and maketh it the last distruction of formes and that he alone converts a body in a [spirit] by resolution and corruptions and still intimating all this to bee done in a salt which he saith is hott because it congeleth and moist because it disolveth he discourseth with great reason and perspicuite and yf there were noe other Author extant he were alone sufficient for the prooffe of our Matter. of which once to doubt were to make a question whether fire will burne a combustibile matter or the sunne to give light at Noone. Now the manner how to bring this matter to such a height of perfection as it must necessarilie have to worke such admirable effects yf one consider the puritie of it and then the possibilitie of nature out of this Author and N[ovum].L[umen].C[hymicum]. and little doubt or ambiguitie will arise and I am of opinion clearlie as I told you at my last being with that this manner of working which we pursue now is the onelie and surest way to effect it. And though your opinion be that it must be often dissolved and again congealed untill it putrifie upon a gentle heatt yett I thinke that needlesse after it will once dissolve in fusile which sheweth then that it is then fitt and apt to be wrought upon and must come of necessitie to that passe for that solution and coagulation which they speake of then after it is brought to that habit is done in calido which I. H. stileth the true solution and calcination. and then it is called permanent and water of Paradise. And is but the Preservation of the worke. for after a while will the coulours appeare which thy soe much speake of and advertise soe much to take heede of for till then Nature doth butt secrettlicke worke and who may nott unfittlie be said to delight in soe working (as Julian saith in another subject, ἡ φύσις φιλεῖ χρυπτεσθαι [Nature loves to hide]) for the longer that preparation is and the gentler the heat the subtiller and excellenter will the effects be. You have my opinion and it is nothing butt what I have learned of you. I returne it to you as a river falling into the Ocean from whence it came

I wish you all happinesse and rest in hast

13 August 1638

your true loving Brother

Chr. Gardiner

Here there will be a muster very shortly in our Countrie and my Armes ar at fault. I intreat you to lett some of your servants direct this bearer to a Armorer to scowre and repaire what is wanting in them and that they goe on worke upon them on Monday morning and dispac[he]th them with as much speed as may be. the middle of weeke I will see you. I intreat you to excuse me I am acquainted with noe Armorer and I would have them well donne whasoever they cost me.

## Appendix B

[153] A Synopsis of the Universall Entity of Ideas or of ye Systemes of the Maeteriall and Immateriall World

[153v] Whatsoever is in being, hath its Existence either from Forme, which is altogether Incorporeable or from Materiallity, which is wholly Corporeall: and every Compounded Substance, both from Corporeity & Incorporeity.

The Generall Forme of the Materiall world (& consequently of all Compounded Bodies,) was the Immateriall & Incrated Light, of the immateriall World, every where encompassing all Immateriallity.

And the Materiallity of that world, a certaine kinde of moist Nature, impregned with all kinds of Humidity.

Vapors

Mucilaginous

Unctious

Fatty

Oily

Pulpous

Slimy

Viscous

Glutinous

Saltish

and therefore

Rarifiable

Extensive

Condensable

Coagulable

Soluble

Fusible

&c.

[154] From the efficacy of that Light working every where upon ye humid praeiacent and Elementating Nature, the most Aeriall & Aethericall substance was sublimed which being Informed & Illuminated, by the Agency of that incrated Light first formed the Empyrean Light, the first compounded & first visible Essence. Both Visible & Invisible Lights together further operating upon the same Masse of Humid Materiality, In the next place sublimed the Subtill Vaporous & diaphanous substance of the Heavens: Where onto succeeded the Grossest Substance of Elementated Aire, next under the Region of the Heavens, filling all the Intervall of Materiality, betweixt ye inferiour gross & the superior subtill substances. And yet further working and every where penetrating into the residue of the Praeiacent Masse (towards the Center) — Both the beames of simplest light infused, & of the created & compounded Light, were not only more & more narrowly contracted, but [154v] diametrically did approach towards & every where drew nearer each other. By meanes whereof, the Combustible Oyle of Humid Materiality, with the residue of the Incombustible Oile in the very Center of Materiality was kindled. And the Solary & Centrale Fire, making a Horrid Noise forthwith brake out, which (by reason of its unresistable Nature) instantly dispatched the Thicker & the Fixer substances, of the Remaining materiallity. erat [*sic*] the Waterish, Saltish & Earth. And According to the Gravity or Levity of either, gave to each a scituacon, more remote or neare to it selfe.



For the Element of Fire will not permit any compound or Grosse Substance to have accesse unto it.

And out of that (every way sublim'ed Incombustible Oyle) betweene the Accons of the Sun, et Centrall, & the Emphyrean terminating Light, The Aetheriall Lamps or Fixed Starrs were Illuminated. [155] But out of the thicker, opacous darke and more faeculent substances of the last Masse of Materiality by the conflagracon & eruption of the Solary fire Last of all eiected, betweene the beames of the Sun, & of the Stars, were compacted & compressed together the heaveier & darke bodies of the Planet viz: Saturne, Jupiter, Mars, Venus Mercury The Earth & the Moone. Within the Orbes whereof the grosser Elements of Fire Water & Air are either inhaerent or adjacent & daily are Elementate by their Superioure: For the Elementating Elemente, or are inhaerent in the Influences & in the Actions and passive substances of the Heavens. And the four Elements doe generate nothing but the 3 principles of Salt Sulphur & Mercury. And out of the 4 Elements the Three Principles are generated as followeth. Fire acting upon Air, produced Sulphur

Aire upon Water Mercury

Water upon Earth produced Salt.

[155v] But the Earth (in regard it had nothing else to worke upon) did not produce any thing, but became the Receptacle, Matrix & Nurse of the rest. Of all Compounds the Hypostate Substances:

Of the soule remaining in ye sulphurious

of the Spirit in the Mercuriall

Of the Body in the Saltish

The Soul liveth & dwelleth in the Spirit

The Spirit, in the Radicall moysture or blood.

The Radicall moysture either in the Bodily Salt or in the Flesh

The most subtile extreame of every Compound in the Incorporiall & Internall Soule.

And the Grossest extreame, in the Corporeale & external Substance. But the Mercuriall Spirit betwixt both alwaies in the conioyning meane, perportionably participating of the Essence of each, & soe each one becometh partly Corpreall & partly Incorporall. For two Extreames without a proportionall & conioyning meane, can neither agree nor be conioynd: But it is called Spirit, from transpiring because that which the Luminaries soe breathe or bye Emanacon continually doe transpire, is the generall Spirit of the World. [156] For the Starrs produce nothing that is Materiall, but only doe impress their vertues & spirituall Influences, which doe contribute no waight.

Upon these & such like foundacons, are grounded all that reverend Naturall Magick hath so aenigmatically delivered, in so many Volumes & Ages. Unto which that of Leno doth not unaptly sate [*sic*].

Fire, by meanes of the Aire, being converted into water, & therein conserved (as the Universal Sperme) was the first matter of the Universe. And likewise that of the Polander. Whatsoever Aire distilles into Water by meanes of the Fire, that the Water gives unto the Earth. From whence wee see the 4 Elements be the 3 Principles Congregated & Concreted into one substance of Earth. For Vapour was the first & next action of Fire; And Fire, continually ejecteth a spirituall Vapour, as the French Author *properly* affirmeth. [156v] And Fire is nothing else, but contracted, thickend, & (as it were) Compressed Light. For Light from Fire, or Heate from Light are inseperable. The day is hotter then the night, & the Night colder then the day. Heate therefore is the Action of both the most sencible & most penetrating quality: But is altogether invisible as Primitive Light is, which was the Originall forme of Visible Light. Light is said to be therefore: Intense & More Remisse.

The Intense, is that which being inhaerent in a luminous body by the beames thereof, doth still adhere thereunto. From thence the Animall Soul of Compounds, & the Centroll Sulphur of Mineralls & Vegetables by infusion, are generated & infused, into their respective seedes, or the Hypostasis of their seeds, which is incombustible Oyle, according to that of the Arabian. That very shining illuminateth every Body because it is Light from light & Tincture which he bindeth with an Oath speaking of Sulphur, for Tincture covereth the Lyfe of every thing, [157] and so the accidentall effects of Naturall heate, as well in Animalle as in Vegetable, & Mineralle.

The more Remisse Light is that Effluxed light which flowing further from the Light body and commixed with the most subtile quallitie, and substances of the Aetheriall Essences, & Aire, & at length more & more separated & condensed becomes diminished & as it were extinguished light. And from thence the Spirits of Animals, & the Mercury of Mineralls, & Vegetables are infused, coagulated & incorporated into a vaporous substance of Primitive Salt. As the Solary Light spread abroad by the beames is an effluxed, diminished, & as it were extinguished Fire, by Condensing & at length conducting the Oyle substance of Sulphurous fatnes, into the Wombe of the Earth.

By what meanes therefore, & how the generall Spirit by Condensing, & litle & litle coagulating, is at last Incorporated into the bowells of the Earth, & by the 3 Principles, produceth all Compounde, may (as I suppose) cleerely appeare, out of what hath byne foresaid. [157v] Mineralls have their Rootes in the Aire & their Heads in the Earth: And the Polander teacheth every where, that all things are produced out of moist Aire or Vapour. He that knowes well what makes ye beginning, knowes well, what shall finishe. For the end of every thing is terminated upon its beginning. Trismegista prescribeth us especially to contemplate & to know Light: Perusadeth & Instructeth us sedulously, to observe the nature of Moysture. The Polander likewise calleth Water ye sperma & general Menstrum of the World. Polyphylius calleth Diespiter, the Supreme Rector of the Highest, Midlemost & Lowest Essences & for such doth often invoke him.

The Opticks have determined Light to be the proper subject of Colour, & Colour to be the proper Accident of Light. All Tincture therefore proceeds from Light. that Sulphur doth illuminate, & give Tincture to every Body, & that it is the painter of all Colours, the Spagericks doe teach. For the House of Sulphur is Mercury, & the house of Mercury is Water or the Radicall Moysture of all Compounds. [158] And the same Spagyrics doe reduce the Radicall Moysture of all Compounds or Composed Essences, to the two humours of Vapour & Fatnes; or of Combustible or Incombustible Oyle; In which they doe cheifely place two of the Principles of the 3 Genusses as it were in their Carriages & their Native dwellings, namely the Mercuries & Sulphurs. Whose Coagulators, are said to be salt & Allums, which only are soluble & being comixed with a white & powdered Earthiness are Coagulated & produced out of those Humours. But the 3rd Principle of Salt or of Harmonicall salt. the middle substances of the compounding essences, lyes hid in the Center of Combustible Oyle as the Batavian congruously teacheth: conteyning in it selfe all the three Principles.

For every salt & Oyle Substance is Combustible & easily converted into Flame. And all Flame, as its beginning was from smoake, more unctious then vaporous; Soe it hath its ending from smoke, more vaporous then Oyle. [158v] And the Vapour therof by cooling & by condensing at length is coagulated & incorporeated into a saltnes; as we may see in the Soote of all Chymnies. But such salt of every Compound, is called Harmonicall Salt, because it conteyneth Harmonicall & adequate Proporcon of the Radicall Moysture & naturall heate, which are the Tyes, & supporters of all Essence & Lyfe; For the middle substance in every Compound is the Choicest.

The Mercuriall Spirit of all things, cohabiteth in the Radicall Moysture, according to the Tenet of all Philosophers. And in the Sulphuriall Tincture of Naturall heate the Lyfe & Soule of all Compounds. For the the 3 noble spirits of: Tast, Smell & tincture which do containe the strength & vertue, of all Mineralls & Vegetables are Comprehended in ye Naturall heate, as the Batavian affirmeth.

That which giveth Being, giveth also Lyfe  
 That which giveth Lyfe, giveth Mocon also  
 And Heate only, causeth Mocon, not Mocon, Heate.  
 But it is Form that giveth Being

Therefore Forme, gives Lyfe, Heate, Mocon, & all Accon;  
 For by the Consent of all the Parapateticks

Quantity hath no Accon. [159] All Vegetables, from the Mineralls  
 All Animalls, from ye Vegetables do daily take their Nourishment: Increase, & Subsistence.  
 The Mineralls from the 3 Principles  
 The 3 Principles from the Elementating Elemente.  
 The 4 Elements from the Light: Inhaering, Adhering & Effluxed.  
 from the Globes of the Light Bodyes.

In which, that as well the Naturall heate as the Radicall Moysture of all things, doe originally inhaere, & joyntly doe flow from thence. Namely from the primitive Fountaines of Immaterial Light, & of the moist Nature, or from the formall Forme & materiating Matter of all things.

By what hath byne already said, we have hitherto endeavored to declare at least to point at all which if not to promise & demonstrate to the senses, we dout not at least to illustrate, & make cleare, when leasure & what is necessary for prooffe shalbe afforded.

In the Interim I hold it not to be from the purpose, to ioyn the following Animadversions to the preceeding. Namely that according to Lenos Opinion before recited, & according to Drebell [159v]

That Fire, is subtill Air  
 Aire, is subtill Water  
 Water, subtill Earth  
 Earth, subtill Fire.

For the elements are naturally convertible into themselves, & so do mutually live in each other.

Because every Element hat another Element in it by which it is Elementated: for Earth & Water do make but one Globe & do produce all things joyntly, because they are tangible Elements. In which the other 2 elements do secretly operate. Fire, conserves the Earth, least it should be drownd or disolv'd, The Aire conserves the Fire, that it be not Extinguished. & The Water conserves the Earth, that it be not burned as the Polonian aptly teacheth.

But Leno hath not at all taught ye Originall or Composicon of Fire, nore doth precede to the Coagulation of Water, or to the Concretion thereof into Earth. And than Drebel is deficient in ye efficient cause of Fire, or in the Primitive beginning thereof & makes the finall Constitution thereof, to be too grosse. But the Polonian saith much better, whatsoever Air distilleth into water by the meanes of Fire, that Water communicates to Earth. [160] but what the Forme or what the Matter of Fire is, doth not at all thereby appear unto us. Wherefore, I thought it now agreeable to Reason, to constitute & to examine the State of the Elemente, diametrically opposite & quite contrary: that from thence we may yet search more strictly a righter Constitution of the World.

According to ye most certaine denominacon of the Batavian, we may perceive, that the insides of all Compounded or Concreate Substances are contrary to their Outsides & on the Contrary. By determining that the Earth (virt [sic] of salt) is Gross, dry, & concrete Water. Water, Grosse, moyst & Ayre. Aire, Grosse, vaporous & (as it were) extinguished Fire. Fire, Grosse constipated, & (as it were) compressed Light. And that visible Light, out of the Forme of Invisible Light & the most subtile aeriell substance or incombustible Oyle of the moyst Nature, was the first visible & gratest Compound.

And the Emphyraean Light, the Horizon, and Terminator, between the Materiall & Immaterial world, from whose Peripherie (being ye outmost of the materiall World) the heate of all [160v] things as well Vital as Naturall, through the Orbe of the Stars (to the Solary Center) is continually infused. And so by the Beames of the Sun, & of the encompassing Stars, is againe imptied to all the Species, & Individualls, of the 3 kinds.

Lastly according to the Positions & Supposition something must be said of the Immaterial World. All Forme is Immateriall, yet a substance, but Incorporeale. As therefore we have deduced the Generale Forme of the materiall World from the Region of Immaterial Light, on all sides encompassing Materiality; I have held it agreeable & altogether necessary, in like manner from thence & from without, we should likewise deduce the Respective formes of all Animalls indued with Lyfe, reason, Intellect & Minde. Wherefore we determine the Region of Light to be the Conveyor of Lyfe, Lyfe of Reason, Reason of Intellect, Intellect of the Divine Minde.

And by a Concentrick incolucon to comprehend, to Informe & to inspire each other: And that by the Incomprehensible, Omnipotent, & botomless depth of Aeternale, Interminable & ineffable goodness, the Essence of All Essences whose center is every where, & circumference noe where, all the aforesaid Essences are Comprehended & preserved. [161] And likewise, that the cheifest knowledge of his Goodness (that is the cheifest goodness) which for so many Ages, by all Men hath byn sought for; which could by no other meanes be obteyned, but by their contemplacon: which cheifest Goodness (after the Creacon) by Contemplacon was found to be good, yea very Good.

Since every thing that is in being, must necessarily have a place to be in. And every thing naturally must Move in a place, that must be more large & more subtile than it selfe. Whence, as a necessary Corollary, it followeth, that place by how much more spacious & exterior it is; by soe much the more sublime & subtile, it will be even to Infinity. For Nature, abhorreth all Vacuity or Emptiness. Neither will the Infinity of Divinity, admit of any Termination. And all Reason rejecteth & utterly forbids the Creator either to be included, or excluded by his Creatures: Wherefore being fortified on all sides, with so potent & prevalent Reasons, wee will [161v] make no further doubt of representing the Systeme of either, or both Worlds for ye better illustracon of the point, as they are figured in the following Schemes & as they have often appeared unto us, in the Urania of our Minerva & Idea.

For the divine Minde, being ye Both-sexed source of all Ideas & therefore ye beginning of all Formes & Essences in either World or in the Universe. By Imagination is likewise the first & the perpetuall Mover; For whatsoever the Divine Minde imagineth the Region of the Intellect forthwith conceives, And that of Reason instantly disposeth into vitall Essence. And the Immaterial Light, immediately infuseth that Lyfe into the Emphyraean Light, or visible Essence, or Compound. And the Emphyraean Light, what Essences soever are infused & received thereunto, by an Instantaneous mocon transfereth them, even to ye Center of ye starrs. And the fixed starrs instantly do project them into the womb of the materiall World within ye Circumference of the Centrall or Solary Fire. [162] And Solary Fire, whatsoever it hath contracted as

its proper food, by such inspiration, againe incessantly breaths out, & by its expiracon & emanacon towards & even unto the spheares of the Planets, & fixed starrs.

And so between the Opposite operations of those Light Bodies; as well the Forme as the first matter of all Compounds by the conveyance of the Generall Spirit of the Worlde, are on all sides incessantly, & every where, circulated, infused & incorporated, by the mediacon of the aforesaid Generall Spirit, namely of the Effluxed Light & extinguished Fire, carrying in their bosomes the Fountaines & Generall Principles of the several seedes & spermes of all Compounds.

Fore every Species & the Individualls of all the 3 kinds, according to the first Type of all the Ideas in the first Minde. And According to the Nature & disposicon of the place, or Matrix into which the [162v] Generall Spirit is infused & incorporated are natured, nor are they otherwise produced into being. For Nature is nothing else, but the Efficacy of Formes of Visible & Invisible Light incessantly working upon & altogether with the Matter, wherewith it is mixed, throughout the whole Composition & Entity of the Materiall World.

### Notes on Contributor

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