Picturing Seeds of Poppies
*Microscopes, Specimens, and Representation in Seventeenth-Century English Botany*

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**Abstract**

The middle of the seventeenth century saw the emergence of a new kind of botanical observation: Microscopical observations of seeds. Previously, naturalists had made observations of seeds to complete their description of plants published in herbals, but for the first generation of Royal Society microscopists—Henry Power, Robert Hooke, and Nehemiah Grew—seeds became the centre of attention. This essay details this transition in plant knowledge by zooming in on just one kind of seeds: The poppy seed. Poppy seeds were abundant in early modern England as they were found in fields, gardens, kitchens and pharmacies. They were also excellent specimens to look at through microscopes, but for different reasons. Focusing on pictorial representation, especially, I analyse the diverse ambitions behind Power, Hooke, and Grew’s observations of poppy seeds, and how they used pictures to further these. The comparison of these three observations of the same specimen highlights the diversity of strategies for scientific representation in the early Royal Society while showing that intense, instrument-enhanced observation did not produce a stable epistemic object, but a multiplicity of epistemic images.

**Keywords**

microscopes – seeds – early modern botany
1 Introduction: From the Herbal to the Microscopical Atlas

In the 74th chapter of his much-expanded 1633 version of John Gerard’s *Herball, or General Historie of Plants*, the English botanist Thomas Johnson concluded his description of the species of poppy then known as prickly poppy, *papaver spinosum*, with a concise description of their seeds. The seeds of prickly poppy, Johnson wrote, are “round, blakke, and pointed, being six times as big as that of the ordinary Poppy.” Compared to the other descriptions of poppy seeds in the *Herball*, the description of those of the prickly poppy is a lengthy one, and the fact that Johnson considered this particular kind of poppy seeds to be important is apparent from the picture that he chose to represent the prickly poppy as well.

In line with the prevalent visual conventions of the herbal genre, the plant is represented with what Sachiko Kusukawa has called ‘completeness’ as all its parts are depicted at once. The specimen is quite large, it has multiple prickly leaves, its root is visible in its entirety, and four poppy flowers are visible revealing the developing stages of bloom from budding flower to withered poppy head. More than that, on the right side just below the biggest poppy head four individual poppy seeds are depicted on their own detached from the plant. Even though they are supposedly six times bigger than ordinary poppy seeds, they are still so small that they only look like small dots. Nevertheless, their inclusion serves to give a complete representation of the poppy plant.

1 John Gerard and Thomas Johnson, *The Herball or Generall Historie of Plantes* (London: Adam Norton & Richard Whitakers, 1633), 372. For more on Gerard, see Leah Knight, *Of Books and Botany in Early Modern England: Sixteenth-Century Plants and Print Culture* (London: Routledge, 2016), chap. 4, and for more on Johnson, see Dmitri Levitin, “‘Made Up from Many Experimentall Notions’: The Society of Apothecaries, Medical Humanism, and the Rhetoric of Experience in 1630s London†,” *Journal of the History of Medicine and Allied Sciences* 70, no. 4 (2015): 549–587.

2 Sachiko Kusukawa, *Picturing the Book of Nature: Image, Text, and Argument in Sixteenth-Century Human Anatomy and Medical Botany* (Chicago: University of Chicago Press, 2012), 113–119; Sachiko Kusukawa, “The Uses of Pictures in the Formation of Learned Knowledge: The Cases of Leonhard Fuchs and Andreas Vesalius,” in *Transmitting Knowledge: Words, Images, and Instruments in Early Modern Europe*, ed. Sachiko Kusukawa and Ian Maclean (Oxford: Oxford University Press, 2006), 73–96.

3 Note that Johnson did not design the woodcuts himself, but copied them from the herbals of Rembert Dodoens, Matthias de l’ Obel and Carolus Clusius, as he acknowledged in the preface to his *Herball*. In spite of the fact that the design was unoriginal, the point stands: Johnson deliberately chose this picture to represent the prickly poppy and its seeds. For more on these woodblock and the recycling of pictures in early herbals, see Jessie Wei-Hsuan Chen, “A Wood-
Now compare this to the description found in the 30th observation of the experimental philosopher and polymath Robert Hooke’s *Micrographia* (1665). Speaking in the praising tone that marked this entire work on small things, Hooke wrote about the seeds of poppies: “for their prettiness, they may be compar’d to any microscopical seed I have yet seen; for they are of a dark brownish red colour, curiously Honey-comb’d all over with a very pretty variety of Net-

block’s Career: Transferring Visual Botanical Knowledge in the Early Modern Low Countries,” *Nuncius* 35, no. 1 (2020): 20–63.
work, or a small kind of imbosment of very orderly raised ridges, the surface of them looking not unlike the inside of a Beev’s stomach.”

To Hooke, the poppy seed was more than just a part of the poppy plant: It was an object in its own right as well as evidence of the beauty and ordered complexity found on the lowest levels of nature that were only visible through microscopes. This impression is reinforced by the design of Hooke’s picture of poppy seeds.

Here, five poppy seeds are elegantly placed on the page so as to reveal them from different angles with only the label identifying the image as schema 19 to distract the viewer. No sense of scale is given; what we see is not something small, but rather, according to Hooke, the true view of one of nature’s jewels.

The differences in representation between Johnson and Hooke’s observations of poppy seeds speak to the major transition in plant knowledge that happened around the middle of the seventeenth century. Whereas the Renaissance herbals, like Johnson’s, were committed to a Galenic framework and primarily focused on the pharmacological uses of plants, the new kind of botanical literature was increasingly based on instrument-aided observations and experiments and sought broadly speaking to describe plants mechanically and chymically. Seeds stood at the centre of these pursuits for a number of reasons. Seeds were one of the most important natural objects as they were used as medicinal ingredients and as spices (two often overlapping categories), but also in gardens and fields, where their life cycle from seeds to plants, which, in their turn, generated a multiplicity of other seeds, provided the basis of husbandry. Therefore, knowledge of the nature of seeds was a crucial step towards “improvement” of the land in the Baconian sense.

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4 Robert Hooke, *Micrographia: Or, Some Physiological Descriptions of Minute Bodies Made by Magnifying Glasses, with Observations and Inquiries Thereupon* (London, 1665), 155.

5 For brief overviews of the herbal genre in the Renaissance, see Brian W. Ogilvie, *The Science of Describing: Natural History in Renaissance Europe* (Chicago: University of Chicago Press, 2008), 182–203; Brent Elliott, “The World of the Renaissance Herbal,” *Renaissance Studies* 25, no. 1 (2011): 24–41; Leah Knight, “Horticultural Networking and Sociable Citation,” in *Worlds of Natural History*, ed. Helen Anne Curry, Nicholas Jardine, James Andrew Secord, and Emma C. Smary (Cambridge: Cambridge University Press, 2018), 61–77. See also the excellent if inevitably dated book by Agnes Arber, *Herbals: Their Origin and Evolution: A Chapter in the History of Botany, 1470–1670* (Cambridge: Cambridge University Press, 2010 [1912]). For an overview of seventeenth-century plant knowledge, see Fabrizio Baldassarri and Oana Matei, “Manipulating Flora: Seventeenth-Century Botanical Practices and Natural Philosophy. Introduction,” *Early Science and Medicine* 23, no. 5–6 (2018): 413–419; Fabrizio Baldassarri, “Descartes and the Dutch: Botanical Experimentation in the Early Modern Period”, *Perspectives on Science* 28, no. 6 (2020): 657–683.

6 Paul Slack, *The Invention of Improvement: Information and Material Progress in Seventeenth-Century England* (Oxford: Oxford University Press, 2015).
A copperplate of five poppy seeds shown from different angles. From Robert Hooke, *Micrographia: Or, Some Physiological Descriptions of Minute Bodies Made by Magnifying Glasses, with Observations and Inquiries Thereupon* (London, 1665)

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of natural-philosophical projects aiming at understanding why and how seeds germinate, how foreign seeds might take to a new kind of soil and the role played by soil, salts, waters and fertilisers in the growth of seeds.7

Although they are one of the smallest seeds, the seeds of the poppy plant were widespread in seventeenth-century England. If not exactly everywhere, they were to be found in a lot of important spaces: They were a staple in kitchens, where they were used in bread and pastries or squeezed into oil that supposedly tasted delightful; they were found in the pharmacy, where seeds as well as the roots and heads of poppies were sold as ingredients to be used in medicines relieving the stomach or making the patient sleep better; and in summer and spring the characteristically frail poppy flowers were seen spreading light on fields and gardens all around leaving their seed-filled heads to be collected by the end of the season.8 Poppy seeds were everyday objects and they were easy to get a hold of, but at the same time they were laden with cultural and economic importance gained from the contexts of the kitchen, the pharmacy, the field and the marketplace. At the heart of this paper lies an interest in the dynamics that play out when a non-scientific object suddenly becomes the centre of a highly scientific investigation.

Already in early seventeenth-century Leiden, as shown by Saskia Klerk, the qualities of poppies had spurred intellectual debate as the soporific effects of opium on the body had caused a number of physicians to question Galen’s clas-

7 For recent examinations of such projects, see Elizabeth Scott, The Secret Nature of Seeds: Science & Seed Improvement c. 1520–1700, Ph.D. Diss., University of East Anglia, 2016; Justin Robert Niermeier-Dohoney, A Vital Matter: Alchemy, Cornucopianism, and Agricultural Improvement in Seventeenth-Century England, Ph.D. Diss., The University of Chicago, 2018; Guido Giglioni, “Touch Me Not: Sense and Sensibility in Early Modern Botany,” Early Science and Medicine 23, no. 5–6 (2018): 420–443; Antonio Clericuzio, “Plant and Soil Chemistry in Seventeenth-Century England: Worsley, Boyle and Coxe,” Early Science and Medicine 23, no. 5–6 (2018): 553–583. See also Justin Niermeier-Dohoney’s contribution to this special issue.

8 For studies of the role of food in the early modern period, see Joan Thirsk, Food in Early Modern England: Phases, Fads, Fashions, 1500–1760 (London: Bloomsbury Academic, 2007); Emma C. Spary, Eating the Enlightenment: Food and the Sciences in Paris, 1670–1760 (Chicago: University of Chicago Press, 2013). For early modern seed-growing in gardens and fields, see Malcolm Thick, “Garden Seeds in England before the Late Eighteenth Century: I. Seed Growing,” The Agricultural History Review 38, no. 1 (1990): 58–71. For analyses of these different spaces of observation and experimentation in early modern natural history, see, e.g., Valentina Pugliano, “Natural History in the Apothecary’s Shop,” in Worlds of Natural History, 44–60; Paula Findlen, “Anatomy Theaters, Botanical Gardens, and Natural History Collections,” in The Cambridge History of Science, vol. 3: Early Modern Science, ed. Lorraine Daston and Katharine Park (Cambridge: Cambridge University Press, 2003), 272–289; Clare Hickman, “The Garden as a Laboratory: The Role of Domestic Gardens as Places of Scientific Exploration in the Long 18th Century,” Post-Medieval Archaeology 48, no. 1 (2014): 229–247.
sification of poppies as cold. Galen had based his categorization of the properties of opium on its taste, but physicians like Adrianus Spigelius noted that the experience of opium rather showed opium to be warm. Without directly contradicting Galen, Spigelius argued that opium worked on the body through a special power based on its ‘total substance’, and not just its simple qualities, and that the cause of this power was ‘occult’, that is unknown and inexplicable. Throughout the century, though, the occult connection between materia medica and their effects was understood in new ways within corpuscularian and mechanical frameworks. Considering another quality, namely the stingy sensation caused by spices such as pepper, nutmeg and cloves, the Dutch microscopist Antoni van Leeuwenhoek found through his microscopes that the minute figure of these seeds was somewhat pointed and in this way he explained why they hurt the tongue. By the end of the century, this form of explanation found an idealised expression in the philosopher John Locke’s argument that it would be possible to predict bodily effects through sensible knowledge of the “mechanical affections” of substances, such as “the particles of rhubarb, hemlock, opium.” But what exactly does the minute configuration of a substance causing a body to sleep look like? As we shall see, the desire to observe opium’s mechanism did not translate directly into an account of a specific sleep-inducing structure of poppies or poppy seeds, but rather a more general wish to look at the size and shape of poppy seeds as a way to study the fundamental structure of vegetable matter.

These new, detailed observations of poppy seeds were made possible through the availability of a new kind of instrument: the microscope.

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9 Saskia Klerk, “The Trouble with Opium. Taste, Reason and Experience in Late Galenic Pharmacology with Special Regard to the University of Leiden (1575–1625),” Early Science and Medicine 19, no. 4 (2014): 287–316.
10 Ibid., 309–315.
11 Antoni van Leeuwenhoek, Alle de brieven (Amsterdam: Swets & Zeitlinger), vol. 2, 63–161.
12 “Did we know the mechanical affections of the particles of rhubarb, hemlock, opium, and a man, as a watchmaker does those of a watch, whereby it performs its operations; and of a file, which by rubbing on them will alter the figure of any of the wheels; we should be able to tell beforehand that rhubarb will purge, hemlock kill, and opium make a man sleep”. John Locke, An Essay Concerning Human Understanding, ed. Peter Harold Nidditch (Oxford: Clarendon Press, 1975), 4.3.25.
13 Important contributions to the study of early modern microscopy include Catherine Wilson, The Invisible World: Early Modern Philosophy and the Invention of the Microscope (Princeton: Princeton University Press, 1995); Edward G. Ruestow, The Microscope in the Dutch Republic: The Shaping of Discovery (Cambridge: Cambridge University Press, 1996); Marian Fournier, The Fabric of Life: Microscopy in the Seventeenth Century (Baltimore: Johns Hopkins University Press, 1996); Christoph Lüthy, “Atomism, Lynceus, and the Fate
first observations made with a lens instrument identified as a microscope date back to the 1620s, but it was not until the 1660s that the first English books devoted to microscopical observations were published: Henry Power's *Experimental Philosophy* (1664), a highly ambitious publication intended to establish Cartesian natural philosophy through 'microscopical, mercurial and magnetical' experiments; Hooke's *Micrographia* (1665), a very popular work designed as an all-encompassing tour de force through the 'terra incognita' of the invisible world; and Nehemiah Grew's *Anatomy of Plants* (1682), a massive tome published with the ambition to establish plant anatomy as a sub-discipline of natural history. While these books contained observations of all kinds of natural objects (snow crystals, mercury blobs, fleas, and the pith of stems, to name but a few), the only specimen that was pictured in all of them was the poppy seed. The specific shape and the size of poppy seeds seems to have been important in guiding this choice. Mid-seventeenth-century microscopes of the compound kind used by Power, Hooke and Grew were able to magnify around 50 times. By magnifying these seeds just 50 times, structures that are truly invisible to the naked eye become visible, and thus new visual information can be obtained. At the same time, the poppy seed is so small that the whole seed—in fact multiple seeds—can be seen at once through a microscope, whereas a barley grain, for instance, is too big to be viewed in its entirety without having to be moved around on the object plate. Likewise, through this kind of microscope the geometrical structure of the poppy seed is revealed, and you can see light reflecting in the individual cells on the surface. As we shall see, the...
microscopists used this information to account for the sparkling appearance of poppy seeds. Taken together, this made the poppy seed an extraordinary specimen to look at through a microscope.

Recent scholarship on the history of early microscopy has successfully demonstrated the high number of processes that went into the production of a microscopical observation. To make an observation of something small you needed more than just a good microscope, as the observation was the product of the entire observational set-up of microscope, specimen, light, different media for refraction, recording devices such as notebooks, the observer himself and possibly an assistant. These factors need to be taken into account if one wants to understand the specific kind of knowledge that the microscopical observation presented. In order to do so, this article focuses on the interplay between the selection and pictorial representation of a single specimen, the poppy seed. Building on the growing literature on the visual culture of science, I show that the focused, instrument-enhanced observations of the poppy seed did not produce a stabilized, objective picture, but rather a set of different epistemic images. As the poppy seed emerged as a scientific object, it did not lose its epistemic connection with the garden, the pharmacy or the kitchen. Instead, I argue that the very different representations that were made of it produced a multiplicity of new meanings and contexts for the seed that were added to its cultural status. For this purpose, I begin by looking at the ambitions behind Power's choice to study seeds and connect these ambitions to his schematic...
woodprint of the poppy seed. I then take a closer look at Hooke’s copper engraving of his five poppy seeds arguing that Hooke consciously fashioned the poppy seed as a beautiful object in order to heighten the status of sub-visible things. Lastly, I show that Grew used the poppy seed as an example of nature’s hidden geometry and the scale-dependent appearance of plants.

2 The Logic of Poppy Seeds: Henry Power’s Woodcuts

In April 1659, the physician and natural philosopher Henry Power wrote a letter to Richard Reeves, one of London’s most skilled makers of optical instruments. For a while, Power, who had a medical practice in Halifax in Yorkshire, had been making observations of the night sky along with a group of like-minded naturalists using telescopes. Now he wanted to be able to do observations during the daytime, too, and to do that, he needed microscopes. Reeves therefore sent him four of his best microscopes, and offered some advice on how to handle them. Having obtained the microscopes and quickly made a number of observations, Power enthusiastically reached out to his friend Reuben Robinson asking him to send down whatever seeds or powders he might want him to make observations of. By August 1661, just two years after, he had finished the observations that he would eventually publish as the first book of the Experimental Philosophy, the two other books being devoted to mercurial and magnetical experiments, respectively.

The book on microscopy consisted of 51 observations of a variety of things: Primarily insects, but also plant parts, sparks of flint, mercury blobs and even animal spirits (which in itself raises interesting questions about observability), and was published in 1664 by the Royal Society as the first English book dedicated to microscopy preceding Hooke’s Micrographia by one and a half years. Among the observations, Power included four observations of seeds, although only one of them was depicted visually: the poppy seed.

Power’s image is a relatively simple woodcut depicting two poppy seeds, one slightly bigger than the other, both depicted from above, as it were. They have a distinct shape and the scale-like structure on their surface stands out very

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19 British Library, Sloane ms 1326, ff. 20–21. For information about Reeves, see Simpson, “Robert Hooke and Practical Optics: Technical Support at a Scientific Frontier.”

20 British Library, Sloane ms 1326, f. 23. For Power’s botanical research, including his correspondence with Robinson, see Charles Webster, “The Recognition of Plant Sensitivity by English Botanists in the Seventeenth Century,” Isis 57, no. 1 (1966): 11–15.
They are none of them globular, nor of a smooth surface, but all like Kidneys in form, and of the seeming bigness of Walnuts, and like an Hony-Comb on the surface, with regular Sides and Angles, making all of them pentagonal and hexagonal areola’s; and glittering in the Sun-shine like Tissue, or the Foil on the backside of a Looking-glass, as is presented in these two Figures. Some other Seeds also looked not unlike them, as Henbane, Flower of Bristow, &c.

**Figure 3** Two poppy seeds represented visually right next to the verbal description. From Henry Power, *Experimental Philosophy: In Three Books: Containing New Experiments Microscopical, Mercurial, Magnetical. With Some Deductions, and Probable Hypotheses Raised from Them, in Avouchment and Illustration of the Now Famous Atomical Hypotheses* (London: T. Roycroft, 1664)

**Courtesy of the Whipple Library, University of Cambridge**
clearly. The image itself is inserted next to the text making text and image work together to comprise this observation number 41.

In many ways, Power’s career quite neatly reflected the change in early modern plant knowledge from the herbal tradition to the tradition of experimental natural philosophy. Being the oldest son of a wealthy merchant family, Power enrolled at Christ’s College, Cambridge at the age of 15, where he completed both his BA and MA over the next years.21 Quite early on, it seems, he decided that he wanted to become a physician, so after obtaining his MA he began the studies for a medical degree at Christ’s College, as well.22 From his correspondence with the natural historian Sir Thomas Browne, as well as his letters and notebooks, we know quite a lot about what Power was doing at Cambridge. In an early letter from 1649, Browne suggested to Power that in order to become familiar with nature and ultimately become a better doctor, he should study William Harvey’s ideas about anatomy and conduct his own dissections, go see what the apothecaries and the chymists were doing in their laboratories, and acquaint himself with the chief herbalists of the age as well as begin his own simpling trips collecting herbs in the fields and meadows surrounding Cambridge.23

Power’s early natural-philosophical interests are visible in his correspondence with Browne as well as in the commonplace books that he kept during his years at Cambridge. These reveal that Power was just as keen on learning about plants and taxonomy as he was to learn anatomy and physiology and that he was well versed in the herbal tradition. For instance, the manuscript that he titled “Theatrum Botanicum” consists in part of a number of recipes extracted from Johnson’s second edition of Gerard’s *Herball* and another unknown book.

21 For valuable insights into the life of a Cambridge student in this period, see Richard Serjeantson, “The Education of Francis Willughby,” in *Virtuoso by Nature: The Scientific Worlds of Francis Willughby FRS (1625–1672)*, ed. Tim Birkhead, 2016, 44–98.
22 For a very informative overview over Power’s career, see C. Webster, “Henry Power’s Experimental Philosophy,” *Ambix* 14, no. 3 (1967): 150–178. See also Adrian Johns, “Power, Henry (c. 1626–1668),” *Oxford Dictionary of National Biography*, https://www.oxforddnb.com/view/10.1093/refodnb/9780198614128.001.0001/odnb-9780198614128-e-22665 (last accessed October 7 2021).
23 Thomas Browne, *The Works of Sir Thomas Browne*, ed. Geoffrey Keynes, vol. 4 (London: Faber & Faber, 1964), 255–256. For Browne’s studies of the plant world, see, e.g., Kevin Killeen, “Duckweed and the Word of God: Seminal Principles and Creation in Thomas Browne,” in *The Word and the World: Biblical Exegesis and Early Modern Science*, ed. Kevin Killeen and Peter J. Forshaw (New York and London: Palgrave Macmillan, 2007), 215–233; Sarah Cawthorne, “Experimenting with ‘Garden Discourse’: Cultivating Knowledge in Thomas Browne’s Garden of Cyrus,” *Journal of Early Modern Studies* 6, no. 1 (2017): 137–159.
In another, larger recipe book probably produced later in his life when he had a household of his own, Power and his wife Margery compiled an inventory and description of products connected to the household ranging from different kinds of vegetables, herbs, fruits and spices to all sorts of animals and descriptions of milk, sauces and drinks. These lists were followed by a collection of various recipes some of which were for medicines, while some were for making things such as good ale.24

Among the useful herbs, we find an entry on poppies. Here, Power listed the different kinds of poppies noting that “the red is wild & growth among Corn the white and black are commonly in gardens,” and he noted that their properties were to be “cold and dry in the first degree” in line with the Galenic model. He wrote that “the seeds of white and black poppies are used to be eaten.” And he went on to mention some medicines that red poppies could be used to make, primarily sleep-inducers.25 This shows that Power had an extensive knowledge of different kinds of poppies that could be used for specific purposes, their qualities and their places of growth. Poppies were clearly important enough to him to be listed among the plants that he considered an essential part of the household.

Power also had ideas about how to classify poppy species. The title of the manuscript “Theatrum Botanicum” was borrowed from the apothecary John Parkinson’s 1640 herbal of the same name. Parkinson’s Theatrum Botanicum was one of the last printed larger herbals in England.26 It was a massive tome

24 British Library, Sloane ms 1319. For the role of recipe books and household manuals in early modern England, see Elaine Leong, Recipes and Everyday Knowledge: Medicine, Science, and the Household in Early Modern England (Chicago: University of Chicago Press, 2018); Elaine Leong, “Collecting Knowledge for the Family: Recipes, Gender and Practical Knowledge in the Early Modern English Household,” Centaurus 55, no. 2 (2013): 81–103.

25 British Library, Sloane ms 1319, f. 11. Power also knew about the medical power of opium, or milk of poppy. Among his papers, there are some “chemical receipts” wherein is contained a “Recipe to make laudanum using opium” under the heading “Laudanum Opiatu Paracelsi” (Sloane ms 496, f. 93). Laudanum was the most popular opium-based medicine at the time. For a discussion of the circulation of Paracelsus’ laudanum recipe in England, see Allen G. Debus, “John Woodall, Paracelsian Surgeon,” Ambix 10, no. 3 (1962): 108–118. For a discussion of the use of the laudanum recipe among the fellows of the early Royal Society, see Antonio Clericuzio, “From van Helmont to Boyle. A Study of the Transmission of Helmontian Chemical and Medical Theories in Seventeenth-Century England,” The British Journal for the History of Science 26, no. 3 (1993): 329–334.

26 John Parkinson, Theatrum Botanicum (Tho. Cotes, 1640). For an introduction to Parkinson, including a discussion of his garden, see Margaret Willes, The Making of the English Gardener: Plants, Books and Inspiration, 1560–1660 (New Haven: Yale University Press, 2011), chap. 7.
in two volumes listing descriptions and uses of plants in the same way as John-
son’s *Herball*, but it had more clearly stated taxonomical interests, as Parkinson
catalogued all listed plants into 14 tribes or ‘flowerbeds’ according to their qual-
ities, use or appearance. As he commonplaced this book, Power recorded all
the names of the plants according to their tribes, but not the descriptions.27
This turned Parkinson’s almost *1700* pages of descriptions into a much more
handy work of around *35* pages, which essentially was a taxonomy of all known
plants.28 Within this taxonomy, we find poppies listed under two different
headings. In the second tribe listing the “catharticke or purging plants,” we find
“Horned Poppy. *papaver Corniculatum,*” and in the third tribe containing all the
“virtous, sleepy & hurtfull plants & their Counter-poyson,” we find “Poppy
& its kinds.”29 A testimony of this taxonomical interest can be seen in Power’s
later observation of poppy seeds, as he presented the observation to be of “Corn
poppy seeds,” and not just any poppy seeds.

In comparison to Johnson’s *Herbal*, Parkinson’s *Theatrum Botanicum*
expressed a much stronger interest in specific parts of plants as opposed to
whole plants as Parkinson dedicated whole woodcuts to seeds in order to show
their specific appearance. This marked a break from the earlier visual tradition,
where parts might be highlighted, but where they were shown in relation to
their wholes, or where spices or medicinal plants were represented visually in
very general ways such as depicting these within a number of jars.30 This separa-
tion of seed and plant continued in Power’s work. Comparing Power’s verbal
and visual observation of poppy seeds to the description found in the herbals
that he was studying, the most distinctive feature is that Power made his obser-
vation of seeds without mentioning or depicting the poppy plant. There were
precedents, such as Parkinson’s seeds, but the fact that Power cut off the seeds
from the plant entirely was innovative.

In full, the written observation read like this:

27 British Library, Sloane ms 1343, f. 59—. Power’s decision to omit plant descriptions fits
well with Brian Ogilvie’s discussion of the limitations of verbal and pictorial representa-
tion for the taxonomical purposes of seventeenth-century botany. See Brian W. Ogilvie,
“Image and Text in Natural History, 1500–1700,” in *The Power of Images in Early Modern
Science*, ed. Wolfgang Lefèvre, Jürgen Renn, and Urs Schoepflin (Basel: Birkhäuser, 2003),
141–166.
28 For more on the ‘information overload’ of nature, see Brian W. Ogilvie, “The Many Books of
Nature: Renaissance Naturalists and Information Overload,” *Journal of the History of Ideas*
64, no. 1 (2003): 29–40. For the role of paper technologies in managing such information,
see, e.g., Lorraine Daston, “Taking Note(s),” *Isis* 95, no. 3 (2004): 443–448.
29 British Library, Sloane ms 1343, ff. 63–64.
30 Kusukawa, *Picturing the Book of Nature*, 111–114.
Corn Poppy Seeds. They are none of them globular, nor of a smooth surface, but all like Kidneys in form, and of the seeming bigness of Walnuts, and like an Hony-Comb on the surface, with regular Sides and Angles, making all of them pentagonal and hexagonal areola's, and glistening in the Sun-shine like Tissue, or the Foil on the backside of a Looking-glass, as is presented in these two Figures. Some other Seeds also looked not unlike them, as Henbane, Flower of Bristow, &c.31

It is impressive just how much information Power was able to squeeze into this short observation. Power made a note of the poppy seeds’ 1) figure (‘like Kidneys in form’), 2) structure (‘regular Sides and Angles’), 3) qualities (‘glistening in the Sun-shine like Tissue’, etc.), 4) size (‘the seeming bigness of Walnuts’), and 5) their resemblance to other seeds (‘Some other Seeds also looked not unlike them’), which tells us that Power performed observations of more seeds.32 For our purposes, though, the most remarkable thing is the way that Power guided attention towards the image: “as is presented in these two Figures.” The image was not included to show the whole plant, or even to give a true representation of the seed, but to help establish a certain point about the structure of the seed’s surface that was also given in the text.33

In order to make this connection stronger, Power chose the technique of the woodcut instead of the copper engraving, which was the other option for printing images in the period. One of the advantages of the woodcut, a relief printing technique, was that it could be inserted right next to the movable types on the printing plate. This was not possible to do with the copper engravings, which were produced using a different technique, and which had to be done separately on individual copper plates cut to fit the preferred size of the printed page.34 Power was not adverse to this technique. In fact, the Experimental Phi-

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31 Power, Experimental Philosophy, 49.
32 From Power’s earlier letters to Browne, we know that he had thought about the substance of seeds and seeds as vehicles of generation before making his microscopical observations, cf. Thomas Browne, The Works of Sir Thomas Browne, ed. Geoffrey Keynes, vol. 11 (London: Faber & Faber, 1964), 266. Letter from Power to Browne, 10 May, 1659. For an overview of the role of seeds in Renaissance debates on generation, see Hiro Hirai, Le concept de semence dans les théories de la matière à la Renaissance de Marsile Ficin à Pierre Gassendi (Turnhout: Brepols Publishers, 2005).
33 Thus, I disagree with Marian Fournier, who writes that Power’s images are “indifferent illustrations,” cf. Marian Fournier, The Fabric of Life, 99. For an important discussion of the interplay between verbal and visual picturing, see Alexander Wragge-Morley, “The Work of Verbal Picturing for John Ray and Some of His Contemporaries,” Intellectual History Review 20, no. 1 (2010): 165–179.
34 For comparisons between the uses of woodcuts and copper engravings in early modern...
Losophy included a foldout page of illustrations of tubes, which in a pedagogical way showed the viewer how to set up the mercurial experiments on air pressure that Power described in the second book. But for the microscopical observations, Power opted for the woodcuts.

As such, Power's use of the simple woodcut resembled the use of images in contemporary mathematical and natural-philosophical treatises, where woodcuts were inserted on the page and referred to in the same manner as Power did in the Experimental Philosophy. In the version of René Descartes's (1596–1650) Principia Philosophia (1644) that Power is most likely to have had, for instance, the images are positioned and presented in a similar way on the page.  35 Here, as well, the image's function is to present clearly and distinctly to the reader's eyes what the text says in words.  36 This resemblance in form and function reinforces the interpretation that Power's choice to use woodcuts as his medium for the microscopical observations, and not the technique of the copper engraving, was a conscious decision.

This view is reinforced if we take a look at the handwritten manuscript of the first book of the Experimental Philosophy, which is preserved among Power's papers. Presumably as a way to give instructions to the printers, Power used a lined, blank square to indicate where the image of the poppy seeds should be inserted.  

This tells us that Power chose the medium of the woodcut himself, and that he consciously placed the image right next to the text. Unfortunately, the image of the poppy seeds itself is absent (Power probably sent that separately), but in the observation of the eyes of a white field spider, Power has drawn the image in his own hand.  38 Comparing this hand drawing with the printed image, we see that the artist who produced the woodcut stayed very true to Power's own draft.

35 Educated by Henry More at Christ's College during the period when More was working out Cartesian metaphysics, Power identified himself quite clearly as a Cartesian in the preface to the Experimental Philosophy stating that the ultimate goal of his microscopical observations was to avouch Cartesian ideas about matter (Henry Power, Experimental Philosophy, Preface). In his library, which he catalogued in 1664, he held a number of Descartes' works, among others the Principia, cf. British Library, Sloane MS 1346, f. 4.

36 For Descartes's use of images, see C.H. Lüthy, “Where Logical Necessity Turns into Visual Persuasion: Descartes’ Clear and Distinct Illustrations,” in Transmitting Knowledge: Words, Images, and Instruments in Early Modern Europe, ed. S. Kusukawa and I. MacLean (Oxford: Oxford University Press, 2006), 97–133.

37 British Library, Sloane MS 1393, f. 82.

38 British Library, Sloane MS 1393, f. 65.
Power's image of the poppy seeds is not very pretty or impressive in other ways. But beauty was not what Power was after. Instead, the purpose of the image was to communicate specific knowledge about the structure of the surface of the poppy seed, and to assist the description given in words. It is an epistemic image in a quite restricted way as Power's intention with it was to express a diagrammatic logic, and decidedly not to give a mimetic representation of the poppy seed.\footnote{I am here drawing on the notion of the epistemic image as given by Alexis Smets and Christoph Lüthy, "Words, Lines, Diagrams, Images: Towards a History of Scientific Imagery," \textit{Early Science and Medicine} 14, no. 1–3 (2009): 398–439. For valuable discussion of the historiography of epistemic images, see Alexander Marr, "Knowing Images," \textit{Renaissance Quarterly} 69, no. 3 (2016): 1000–1013.} Rather than representing what the poppy seeds 'really looked like,' Power used the image to establish a specific point about their...
geometry and as such it was successful. Keeping this distinction in mind will help us as we now turn to Hooke's image, which clearly situated itself within the mimetic tradition.

3 Into a World of Poppy Seeds: Robert Hooke's ‘True’ Representation

Power's *Experimental Philosophy* does not occupy a central place in the historiography of seventeenth-century natural philosophy. Power died only a couple of years after publishing this work making it his only book, and although he was elected a Fellow of the Royal Society he only took little part in their research projects based as he was in peripheral Halifax. Another reason for his relative obscurity is that Robert Hooke's *Micrographia* was published just one and a half years after his *Experimental Philosophy*, and that this popular work, which was similarly concerned with microscopy, overshadowed Power's publication.

The relationship between Power and Hooke's contributions to the emerging observational genre of microscopy, and between the two men, is complex. We know that the Royal Society's interest in microscopes that would eventually result in the *Micrographia* was instigated before Power published his findings. In 1661, Christopher Wren presented to King Charles II a number of insect images that he had made with the help of the microscope. Charles was so impressed with these drawings that he ordered more to be produced, which he let the newly founded Royal Society know, and so they ordered Hooke to begin a series of microscopical observations under their supervision. Some years after, on June 22 1664, it was reported that the *Micrographia* was finished, and the book was published in 1665.41

According to Hooke himself, Power's book only came to his attention, as he was almost finished with the *Micrographia*. Towards the end of the long preface, he wrote: “After I had almost compleated these Pictures and Observa-

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40 I am here drawing on Peter Galison's distinction between the image tradition and the logic tradition of scientific representation, cf. Peter Galison, *Image and Logic: A Material Culture of Microphysics* (Chicago: University of Chicago Press, 1997), 19–31. See also the discussion in Mario Biagioli, *Galileo’s Instruments of Credit: Telescopes, Images, Secrecy* (Chicago: University of Chicago Press, 2007), chap. 3.

41 Janice Neri, *The Insect and the Image: Visualizing Nature in Early Modern Europe, 1500–1700* (Minneapolis: University of Minnesota Press, 2011), 106–108. For an account of the social origins of the *Micrographia*, including an overview of the dates of the specific observations, see John T. Harwood, “Rhetoric and Graphics in Micrographia,” in *Robert Hooke: New Studies*, ed. Simon Schaffer and Michael Hunter (Woodbridge: Boydell Press, 1989), 122–134.
tions, I was inform’d, that the Ingenious Physitian Dr. Henry Power had made several Microscopical Observations.” This, he continued, almost made him suppress his work had it not been for the fact that Power’s “design was only to print Observations without Pictures.” Of course, this was not entirely true. Power’s *Experimental Philosophy* did indeed contain pictures, including that of the poppy seeds, although Hooke might simply not have considered these pictures at all. Whatever the reason, it is evident that visualisation played an entirely different role for Hooke than for Power. First of all, Hooke’s picture of poppy seeds is much larger than Power’s; it takes up the entire recto page of the folio book. The five poppy seeds are elegantly placed on the empty page in positions that reveal them from different angles, and much care has gone into the use of shadows, especially. The edges of what here really looks like a honeycomb structure stand out in white because of Hooke’s use of darkness to make the impression of depth in the individual cells. In this way, Hooke was also able to make the impression that some of the cells reflect light so as to shine, and thus to make them appear lively.

As Meghan C. Doherty has argued, it was Hooke’s superior artistic skills and his deep knowledge of printing techniques that made him able to create this impressive image. But keeping our analysis of Power’s image in mind, we should not just think about which kind of images the image-makers were able to make, but which kind of images they wanted to make, and Hooke was indeed very specific about the purpose of his images. In the preface, he wrote that in order to promote the reformation of philosophy that he aspired to he had used nothing but “a sincere Hand, and a faithful Eye, to examine, and to record, the things themselves as they appear.” Later, he wrote that in order to produce the book’s images he “indeavoured (as far as I was able) first to discover the true appearance, and next to make a plain representation of it.” In these passages, Hooke styled himself simply as nature’s scribe who after discovering the ‘true form’ of nature’s objects made a faithful visual reproduction of them without adding or subtracting. As such, Hooke presented his visual strategy in opposition to Power, who used his images to convey a specific interpretation of nature’s forms. But as Matthew C. Hunter has argued, this way of staying true to nature was just as much a specific visual and rhetorical technique as Power’s.

42 Hooke, *Micrographia*, Preface.
43 Doherty, “Discovering the ‘True Form.’ ”
44 Hooke, *Micrographia*, Preface.
45 Hooke, Preface.
46 See Matthew C. Hunter, *Wicked Intelligence: Visual Art and the Science of Experiment in Restoration London* (Chicago: University of Chicago Press, 2013), 34–43. As Hunter also
Hooke’s observation of poppy seeds was one of four observations of seeds, the other three being of corn violet, thyme and purslane seeds. All four observations had a corresponding schema with five to nine individual seeds depicted. Hooke spoke of the seeds as the plants’ “Jewels and Master-pieces,” and as “exceeding pleasant and beautiful objects,” although he also made the observation that the seeds of corn violet appeared more beautiful to the naked eye than they did through the microscope. Using a sharp pen-knife, he cut the seeds open in order to inspect their insides. He commented, for instance, that in purslane seeds “the inside [is manifested] to be fill’d with a whitish green substance or pulp, the Bed wherein the seminal principle lies envelop’d.” Interestingly, the image of the purslane seeds did not show these dissected insides, but only whole seeds. This was in accordance with Hooke’s general visual strategy for representing specimens. Even though he dissected his insects or based images on several individuals, he always represented them as wholes, not parts, and as if they were living. The seeds and insects were presented in their entirety as were they untouched by the observer—which we know for a fact that they were not.

This was part of Hooke’s strategy to create the illusion of the microscopic world as a peaceful, beautiful and orderly world teeming with life, and not a dead, ugly and chaotic space. Like many of his fellow naturalists during the Restoration, Hooke spoke of the relationship between man and nature in a religious vocabulary emphasizing the fallen state of the human mind and senses and thus the inability of men to truly see nature. The reformation that Hooke sought, then, was just as much a moral as an epistemic reformation, and he spoke of it both in terms of a reparation, a mechanical term, and a cure, a medical term. The microscope, as well as the view of nature made possible through

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47 Hooke, Micrographia, 152, 154. Here, Hooke might have taken inspiration from Power, who described the pistil of a lily flower as “beset round about with small chives, which are tipped with pendants,” cf. Power, Experimental Philosophy, 49.

48 Hooke, 156.

49 Matthew C. Hunter has called Hooke’s images an “ex post facto summation of discovered entities”, cf. Hunter, Wicked Intelligence, 54. See also Lawson, “Crafting the Microworld.”

50 For more on this strategy, see Neri, The Insect and the Image, 112–123.

51 For this, see, especially, Charles Webster, The Great Instauration: Science, Medicine, and Reform, 1626–1660 (London: Duckworth, 1975); Peter Harrison, The Fall of Man and the Foundations of Science (Cambridge: Cambridge University Press, 2007). For an interpretation stressing the interplay between the moral, medical, theological and natural-philosophical elements, see Sorana Corneanu, Regimens of the Mind: Boyle, Locke, and the Early Modern Cultura Animi Tradition (Chicago: University of Chicago Press, 2012).
the use of the microscope, was not as much an augmenting of the sense apparatus as it was a return to a former superior way of seeing nature. With their crisp lines, clearly delineated geometrical shapes and calm layout, Hooke’s poppy seeds were not a value-free representation of nature, but functioned rather as a model of a more perfect view of nature the way that God designed it; they were utopic-mimetic rather than purely mimetic.52

In order to achieve this, Hooke modelled his images of seeds on the genre of still life paintings of fruits. In the observation of thyme, he wrote: “The Grain affords a very pretty Object for the Microscope, namely, a Dish of Lemmons plac’d in a very little room,” and in the accompanying image the thyme seeds did look very much like still life paintings of citrus fruits.53 This is an example of Hooke modelling the microscopic on the appearance of the macroscopic. As the readers of the Micrographia were unfamiliar with this appearance of thyme seeds—it takes a good microscope to see these structures of the seeds—Hooke used the well-known visual vocabulary of the Stillleben genre to make them recognizable and thus trustworthy.

4 Scaling Seeds of Poppies: Nehemiah Grew’s Technique of Double Representation

I will now turn to the last of these pictures of poppy seeds made with the assistance of the microscope, namely Nehemiah Grew’s image in The Anatomy of Plants. Like the other treatises on microscopy, Grew’s book was published by the Royal Society in 1682. Grew had been under a contract to conduct plant-anatomical observations since the mid-1670s and the book was the product of these years of intense research into plants.54 The initial idea was Grew’s own, though. In the late 1660s he wrote a small manuscript titled The Anatomy of Vegetables Begun in which he sought to describe the plant in all of its ‘estates’,

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52 For more on this kind of natural-theological argument, see Wragge-Morley, Aesthetic Science, chap. 1.

53 Hooke, Micrographia, 1665, 153. Before his work with the Royal Society, Hooke trained with the Dutch-born painter Peter Lely. For discussions of the still life genre, see Claudia Swan, “Ad Vivum, Naer Het Leven, from the Life: Defining a Mode of Representation,” Word & Image 11, no. 4 (1995): 353–372 and the essays collected in Thomas Balf, Joanna Woodall, and Claus Zittel, Ad Vivum?: Visual Materials and the Vocabulary of Life-Likeness in Europe before 1800 (Leiden: Brill, 2019).

54 Michael Hunter, “Early Problems in Professionalizing Scientific Research: Nehemiah Grew (1641–1712) and the Royal Society, with an Unpublished Letter to Henry Oldenburg,” Notes and Records of the Royal Society of London 36, no. 2 (1982): 189–209.
or situations, that is as a seed and bud, with roots and stems, flowers and fruits and finally going back to the generation of seeds again.⁵⁵ Not unlike the ideal of the herbal books, Grew sought to describe the whole of the plants, but unlike these books Grew was more interested in the processes of plant transformation, or plant physiology and less in the descriptions of particular species of plants.

Many of Grew’s observations were carried out on garden beans. His explanation for this choice was the following: “The Essential Constitutions of the said Parts are in all Vegetables the same: But for Observation, some are more convenient, in which I shall chiefly instance. And first of all, for the Seed we chuse the great Garden-Bean.”⁵⁶ The function of Grew’s plants and plant parts, then, was to work like model organisms: Studying these plants not only gave insight into the appearance and qualities of this particular type of plant, but into plants, or even vegetable nature, in general. Through observations of the garden bean, Grew was able to study seeds in general. The reason that Grew chose the garden bean was two-fold: First, the garden bean is quite a large seed. This gives the obvious advantage that the individual parts and structures of the seed are easier to observe. And when they are not, he explained, it is quite easy to manipulate it (such as soaking it in water or boiling it) so that they reveal themselves even more.⁵⁷ Secondly, the garden bean is one of the most well-known and accessible seeds, which meant both that it was easy to come by for Grew himself, but also that it would have been easy for his readers to go find a garden bean and verify Grew’s observations, should they want to. In all of his observations, Grew wanted to compare different perspectives on plants, and using the common bean was another way to do this.

With his half-brother Henry Sampson acting as intermediary, Grew’s work was introduced to the fellows of the Royal Society in 1672, and a scheme was set up paying Grew to continue his observations in the following years.⁵⁸ This allowed Grew to move to London to concentrate on his botanical research instead of setting up a medical practice in the province as he had intended to. It also allowed him to make use of the Society’s microscopes, which he did

⁵⁵ This manuscript was eventually published in 1672 by the Royal Society, cf. Nehemiah Grew, *The Anatomy of Vegetables Begun. With a General Account of Vegetation Founded Thereon* (London: Spencer Hickman, 1672). For a commented bibliography of Grew’s works, see William Richard Le Fanu, *Nehemiah Grew: A Study and Bibliography of His Writings* (St Paul’s Bibliographies, 1990).

⁵⁶ Grew, *Anatomy of Vegetables Begun*, 2.

⁵⁷ Later in the chapter, Grew writes about the radicle (the budding root of the seed): “‘Tis not easie to be observed, saving in some few Seeds, amongst which, that of the Bean is the most fair and ample of all I have seen" (Ibid., 7).

⁵⁸ For this, see Hunter, “Early Problems in Professionalizing Scientific Research.”
in the books and lectures that eventually comprised the *Anatomy of Plants* in 1682, although he was always careful to label how he made his observations.59 This is clear from the frontispieces of the individual volumes, but also in the text itself, where he clearly identified which observations he had made with the microscope and which he had made without.

In the table of seeds, this carefulness is apparent as well. We know from looking at his notebooks that Grew worked extensively with plants. He kept lists of seeds that he wanted to acquire, correspondences with other natural historians or botanists interested in seeds, lists of plants in gardens and many commonplace taxonomical lists.60 Like Power, Grew trained as a physician at Cambridge (although for political and religious reasons, he acquired his MD from the university at Leiden), and he specifically pointed towards the Cambridge Professor of medicine Francis Glisson's work on the analogies between animals and plants as one of the reasons that he got involved with plant anatomy.61 His initial reasons for magnifying plants thus seem more akin to Power's than to Hooke's. Interestingly, among his unpublished notes the only entry specifically about microscopy turns out to be commonplace from Power's *Experimental Philosophy*.62

Looking at Grew's table of seeds, the most striking difference to Power's and Hooke's images is that this is a table of seeds in the plural. The poppy seed is not alone, but is joined by 17 other seeds that are placed neatly beside each other.

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59 We have some indication about the microscopes that were in the Society's possession from the catalogue of its museum that Grew incidentally also compiled. Here, Grew gives a description of two microscopes, a larger compound microscope with three lenses, and a smaller one "somewhat more managable [sic] than the other" (Nehemiah Grew, *Musæum Regalis Societatis: Or, A Catalogue & Description of the Natural and Artificial Rarities Belonging to the Royal Society and Preserved at Gresham Colledge* (W. Rawlins, 1681), 359). For a recent analysis of Grew's catalogue, see David Thorley, "Nehemiah Grew's Aims for the Musæum Regalis Societatis and How the Text Was Used," *The Seventeenth Century* 33, no. 3 (2018): 337–361.

60 Sloane ms 1926. For a detailed analysis of the role of seed lists and botanical exchange in seventeenth-century natural history, see Stephen A. Harris and Peter R. Anstey, "John Locke's Seed Lists: A Case Study in Botanical Exchange," *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 40, no. 4 (2009): 256–264.

61 Francis Glisson, *Anatome Hepatis (The Anatomy of the Liver)*, 1654, ed. Andrew Cunningham, Cambridge Wellcome Texts and Documents 3 (Cambridge: Cambridge Wellcome Unit, 1993). For the influence on Grew’s conception of nature, see Brian Garrett, "Vitalism and Teleology in the Natural Philosophy of Nehemiah Grew (1641–1712)," *The British Journal for the History of Science* 36, no. 1 (2003): 63–81; Anna Marie Roos, "Nehemiah Grew (1641–1712) and the Saline Chymistry of Plants," *Ambix* 54, no. 1 (2007): 51–68.

62 British Library, Sloane ms 1950, ff. 49–51.
Figure 5  A table of 18 different kinds of seeds, including poppy seeds in the upper left hand side. Notice the four natural-scale seeds just next to the magnified poppy seed. From Nehemiah Grew, The Anatomy of Plants: With an Idea of a Philosophical History of Plants. And Several Other Lectures, Read Before the Royal Society (London: W. Rawlins, 1682)

Courtesy of the Whipple Library, University of Cambridge
to fill up the page. These seeds are all engraved in a style resembling Hooke’s, although the level of detail is lower. Shadow is used to give depth to the individual seeds, but except for the seeds of spergula and lychnis there is no shadow on the base of them making them somehow float virtually above the white page. As in Power’s image, the kidney-like shape of the poppy seed is quite distinct, and there seems to be a high number of cells on the surface.

Interestingly, the large poppy seed is joined by four more seeds represented in true size—as very small, that is. This strengthens the impression that the large seeds are given in the size that they appear through the microscope, which would effectively show the amount of magnification of Grew’s microscope. What Grew achieved with his double representation of seeds was, obviously, to give the viewer an impression of how big the represented specimen actually was and, thus, how powerfully it was magnified. Here, it is important to note that the small seeds—the unmagnified seeds—were actually given quite precisely in a one-to-one scale: On the page of the folio book, the size of the seeds corresponded to their true size.63

Power and Hooke had faced similar challenges when it came to communicating the size of poppy seeds, but found different solutions. Power wrote that the poppy seed was “of the seeming bigness of Walnuts” meaning that the magnified seed was of the same size as an unmagnified walnut—a technique that he seems to have picked up from Richard Reeves.64 Hooke, on the other hand, simply wrote that poppy seeds “for the most part [are] so very little, that they exceed not the bulk of a small Nitt, being not above 1/32 part of an Inch in Diameter.”65 But in their images of the seeds, we do not find any indication of scale.

63 As Anna Marie Roos has observed, Anna and Susanna Lister, illustrators and daughters of the natural historian Martin Lister, used the same technique of picturing specimen in a one-to-one scale. For this, see Anna Marie Roos, “Fossilized Remains: The Martin Lister and Edward Lhuyd Ephemera,” in Archival Afterlives, ed. Vera Keller, Anna Marie Roos, and Elizabeth Yale (Leiden: Brill, 2019), 150–172. As I do not have access to the poppy seeds that Grew observed and drew, I cannot be entirely sure of the exact correspondence in size, but judged from comparisons made with commercially bought poppy seeds as well as comparisons between other specimens, to the best of my knowledge this seems to be the case.

64 Power, Experimental Philosophy, 49. Richard Reeves writes in a letter to Power about a microscope that “it magnifies a mite to ye appearing bigness of a mouse” (British Library, Sloane MS 1326). Similarly, the Dutch microscopist Antoni van Leeuwenhoek used a strategy comparing the size of his microscopic specimens to the unmagnified size of different types of hair and sand. See, for instance, Leeuwenhoek, Alle de brieven, vol. 1, 96–97; vol. 5, 26–27.

65 Hooke, Micrographia, 1665, 155. For more on Hooke’s strategies of scaling, see Janice L. Neri, "Some Early Drawings by Robert Hooke," Archives of Natural History 32, no. 1 (2005): 41–47.
which at least in the case of Hooke seems to be deliberate. While Hooke did use visual scale objects in some of his schemas, such as the inclusion of a ruler or objects shown with different amounts of magnification, his representation of poppy seeds did not reveal that these natural objects were in fact tiny.

Differently, Grew decided to include the sense of size in his table, but he did more than this: He also allowed his viewers to compare the two representations of seeds with each other. As mentioned, Grew was careful to mention when he made his observations with and without the microscope. As such, he acknowledged that often objects look very differently viewed with the naked eye than they do studied through the microscopes.66 To give an example, Grew wrote about a cross-section of a root: “In some, the Pricks are so exceeding small, and stand so close, that, to the bare eye, they seem to be continuous Rings, which yet, through the Microscope, appear distinct.”67 Here, the observations made with the naked eye and with the microscope were at odds—they simply showed different structures. Grew trusted his microscopic observation to reveal a true view of nature, but he did so while acknowledging the equally important unmagnified view. Likewise, in the case of the seeds, Grew was able to communicate size as well as different appearances and qualities at the same time.

In the same way, by having so many seeds on the same page, Grew made it possible for the viewer to make comparisons between them either on their own initiative or instructed by himself. In the corresponding text, Grew compared all their figures and shapes and he especially pointed out their individual geometrical shapes.68 The poppy seed was classified under the hemispherical seeds, though Grew added that its particulars were a kidney-like shape and a honeycomb structure.69 Unlike in Hooke’s rendition, where the cells were either four, five or six-sided polygons, all Grew’s poppy cells are pentagons, which reinforced the status of the poppy seeds as exemplary geometrical objects. By reading the table and the text together, the table was turned into a catalogue of the geometrical variations of plant seeds rather than a representation of individual seeds.70

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66 Grew’s continued insistence on the value of unenhanced observation has been analysed by Al Coppola, “‘Without the Help of Glasses’: The Anthropocentric Spectacle of Nehemiah Grew’s Botany,” The Eighteenth Century 54, no. 2 (2013): 263–277.
67 Grew, The Anatomy of Plants, 69. There is a number of instances where Grew corrects the common view of plants with his microscopic observations throughout the Anatomy of Plants, see e.g. Grew, 77, 85.
68 Grew, The Anatomy of Plants, 195–198.
69 Grew, 196.
70 For this, see Wragge-Morley, “The Work of Verbal Picturing for John Ray and Some of His Contemporaries.”
5 Conclusion

In the Renaissance herbals, botanical knowledge of poppies and poppy seeds had a strong connection to medicine mainly because of the medical properties of opium. This remained the case throughout the seventeenth century as poppy seeds were studied in order better to understand the qualities that they incurred on the body. But at the same time, poppy seeds increasingly became scientific objects in their own right. Because of their specific size and shape being very small and finely structured, they became a treasured specimen for the first generation of Royal Society microscopists. The poppy seed was considered one of nature’s ‘least things’ containing the key to the riddle of generation, and studying the poppy seed was deemed an optimal way to elucidate the fundamental make-up of plants. The values attached to the minute scale of poppy seeds were not the same, though, nor were the ways they were represented.

Although the poppy seed was observed multiple times by observers belonging to the same scientific community using very similar techniques and instruments, this did not result in a stabilization or simplification of the poppy seed. While the shared observations of Power, Hooke and Grew do tell a story about an enhanced focus on the minute details of plants and plant parts as well as the separation of plant knowledge from the realm of medicine throughout the seventeenth century, they also show how the singling out and continued investigation of one area of nature will cause it to become more complex. As we have seen throughout the article, Power, Hooke and Grew had very different ambitions with their observations of poppy seeds, and we can see these ambitions reflected in the different ways that they chose to represent the seeds visually: Whereas Power’s simple woodcut of poppy seeds served to validate his point about the atomic composition of nature, Hooke designed his copper engraving to convey a sense of beauty and awe towards the sub-visible world. Grew, differently, highlighted the poppy seed as an exemplar specimen revealing the hidden, geometrical structure of the plant world.

The fact that these three observers of the micro-world produced three different images of poppy seeds tells us that they all agreed that visual representation was important to the communication of natural-philosophical knowledge about the plant world. This was not given, for, as Brian Ogilvie has argued, some seventeenth-century botanists considered botanical illustrations to be superfluous as they could express their knowledge just as well if not better through verbal descriptions in technical language. But such language did not

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71 Ogilvie, “Image and Text in Natural History, 1500–1700,” 157–162.
yet exist for microscopic things, and the microscopists could not assume that their readers would know what the minute things that they described looked at. Therefore, images were important even when, as in Power’s case, they primarily worked to give a visual expression of something that was already described in the text.

Images were not just important to the communication of plant knowledge; they were also important to its production. In order to visualise what few people if anyone before them had seen, Power, Hooke and Grew orientated themselves towards their predecessors and established genres of representation. As we have seen, Power worked carefully with the herbals of Gerard, Johnson and Parkinson with their large-scale illustrations of plants just as he oriented himself towards the natural-philosophical treatises of Descartes. It was from such works that Power drew his inspiration, and this is evident in his schematic woodcut of the two poppy seeds. Similarly, we have seen that Hooke was aware of Power’s treatise and their images as he prepared the *Micrographia*, even if he framed Power’s inspiration in negative terms. Finally, as he was learning how to make microscopical observations, Grew spent time commonplacing Power’s *Experimental Philosophy* in order to familiarize himself with the vocabulary of microscopy, just as he read and referred to Hooke’s work. This speaks to the existence of an on-going visual dialogue within the community of the early Royal Society. What emerged from this dialogue, though, was not a uniform or objective view of the poppy seed, but rather a multiplicity of epistemic images that all spoke to different aspects of the poppy seed as a botanical specimen. Rather than simplifying the vegetable world, the use of microscopes and microscopic images served to render its smallest parts more complex.

Acknowledgments

Earlier versions of this paper were presented at the annual Scientiae conference in Belfast in June 2019, with the research group “Visualizing Science in Media Revolutions” at the Bibliotheca Hertziana in Rome in January 2020, and with the Early Science and Medicine Workshop at University of Cambridge in April 2020. I would like to thank all participants in those settings for their valuable feedback, and Fabrizio Baldassarri, Sietske Fransen and Carolin Schmitz, especially, for organising. Special thanks goes to Dániel Margócsy for reading multiple drafts and for our numerous discussions about poppy seeds and visual culture. The Carlsberg Foundation generously supported my research while writing this paper. The Royal Society supported the archival work through the Lisa Jardine Award.