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The Work of Verbal Picturing for John Ray and Some of his Contemporaries

Alexander Wragge-Morley

A famous account of a seventeenth-century collection of rarities is Nehemiah Grew's *Musæum Regalis Societatis: Or, A Catalogue and Description Of the Natural and Artificial Rarities Belonging to the Royal Society* (1685). The work bears a marked similarity to contemporary works of natural history; it verbally describes and sometimes graphically represents a series of natural and artificial things and it digests them into a method. By far the largest part of the *Musæum* is taken up with 'thick', verbal descriptions of things in the Royal Society's repository. Grew's work is both a virtualization of the collection – that is, its extension into the textual space of the Republic of Letters – and its idealized representation in a state of order that was probably never physically achieved. Here again, the *Musæum* resembles a natural history; it represents its subject in a state of order that is unlikely to be found naturally. A first edition copy of the work contains 389 pages of verbal descriptions, to which are added twenty-two leaves of engraved plates.[1] Even if we take into account the fact that most plates show several different things, we are forced by this reckoning to accept that most of the work of virtualizing the Royal Society's collection is done through verbal descriptions, rather than engraved plates.

Grew had a few things to say about verbal description in his preface to the work. Anticipating the complaint that his descriptions were too long, Grew offered his readers two convincing grounds for their necessity. First, they enable us to discern among different species; second, making or reading them has a special cognitive value:

> If any object against their length: perhaps they have not so well considered the necessity hereof, for the cleer and evident distinction of the several Kinds and Species, in so great a variety of Things known in the World […]. Besides, that in such Descriptions, many Particulars relating to the Nature and Use of Things, will occur to the Authors mind, which otherwise he would never have thought of. And may give occasion to his Readers, for the consideration of many more. And therefore it were also very proper, That not only Things strange and rare, but the most known and common amongst us, were thus describ'd.[2]

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[1] N. Grew, *Musæum Regalis Societatis: Or, A Catalogue and Description Of the Natural and Artificial Rarities Belonging to the Royal Society, And preserved at Gresham Colledge. Whereunto is Subjoyned the Comparative Anatomy of Stomachs and Guts* (London, 1685).
[2] Grew, *Musæum*, Preface.

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Not only, Grew suggests, do his descriptions serve to signify the contents of his collection, but they enable us to discern among species and to think about the collection's pieces in new ways. For Grew, description was just as useful when it came to well-known things as it was to very strange ones. It is no stretch to argue, then, that he probably thought his descriptions were just as helpful for someone with easy access to the collection as they were for those far away. Verbal descriptions did not just signify things in the Royal Society's collection, but had the capacity to alter their meanings.

Nehemiah Grew's remarks on description, repeated elsewhere in his own works, and reflected in those of John Ray and his contemporaries, are the occasion of this essay. In it, I will discuss the 'picturing' of natural things in Early Modern Europe with little direct reference to the contemporary media of graphic representation – drawings, engravings, paintings and so on. This is not to dilute the importance of multimedia assemblages, including collections of drawings or even paper museums, to the work of Early Modern natural history. Rather, my intention is to highlight the role of the then most widely used, but now least discussed, of these media – verbal descriptions. The correspondence of John Ray, along with his natural historical works, are some of the most important sources we possess that might shed some light on the descriptive mode in contemporary natural historical writing. By far the greatest part of Ray's surviving output, along with the letters both to and from his friends, consists of verbal descriptions.[3] Moreover, Ray and his correspondents, as well as his contemporaries Nehemiah Grew and Robert Hooke, discussed the work of description itself, paying special attention to its representative capacities and purposes. For these men, verbal description *was* a representational strategy, epistemologically comparable with the graphic and sculptural strategies that they also employed. That is to say that, for Ray and his contemporaries, verbal descriptions could induce *aesthesis* in readers, and this *aesthesis* was generative of philosophical and theological knowledge.

With a few glowing exceptions, description has hardly ever figured as a key term in histories of natural history or collecting.[4] It is possible to identify two broad areas of historiography that have a bearing on this case, however. On the one hand, Anthony Grafton, Brian W. Ogilvie and Nancy G. Siraisi, among others, have made a powerful case for the influence of humanist models of historical writing on natural historians during the sixteenth and seventeenth centuries. Arguing against the notion that natural historians (especially in England during the seventeenth century, it might be added) rejected rhetoric, they have not turned their attention to the aesthetics of their texts.[5] On the other hand, accounts of what might be called *aesthesis* in natural history have focused nearly exclusively on graphic or 'sculptural' representation.[6] Any account that seeks to describe *aesthesis* in the natural historical writing of Ray and others must borrow from both of these streams of work. The descriptive work of John Ray and his contemporaries can be fruitfully connected to 'humanist' arguments about the capacity of rhetoric to place 'things' before the 'eyes' of a reader or hearer. Normally, this move was known as *ekphrasis*, although we cannot

[3] Ray's correspondence exists in printed form, though in three separate volumes, each from a different century. J. Ray, *Philosophical Letters between the late Learned Mr. Ray and several of his Ingenious Correspondents, Natives and Foreigners*, edited by W. Derham (London, 1718), J. Ray, *The Correspondence of John Ray*, edited by E. Lankester (London, 1848) and J. Ray, *Further Correspondence of John Ray*, edited by R. Gunther (London: Ray Society, 1928).
[4] Two books and one edited collection have dealt with 'description' in Early Modern natural history, although not in an entirely satisfactory way. These are S. Alpers, *The Art of Describing: Dutch Art in the Seventeenth Century* (London: Penguin, 1989) (first published London: John Murray, 1983); B. W. Ogilvie, *The Science of Describing: Natural History in Renaissance Europe* (Chicago and London: University of Chicago Press, 2006); and *Regimes of Description: In the Archive of the Eighteenth Century*, edited by J. Bender and M. Marrinan (Stanford: Stanford University Press, 2005).
[5] An edited collection containing essays by each of these authors is *Historia: Empiricism and Erudition in Early Modern Europe*, edited by G. Pomata and N. G. Siraisi (Cambridge, MA: London: MIT Press, 2005).
[6] Take, for example, E. Spary, 'Scientific Symmetries', *History of Science*, 42:1 (2004), 1–46.

separate it from the related notion of *enargheia* or *hypotyposis*.[7] Simultaneously, their descriptive work had an orientation that placed it firmly in the ambit of recent philosophical ideas about sensory cognition, and the representational theories that often went with them. This should not be surprising. Natural historians such as Ray and Hooke approached the study of natural things with a thoroughness that often resulted in their physical destruction. What they sought were perspectives that would enable them to understand design and function in these natural things. The representational strategies they chose when showing these designs or functions were consistent with the variety of optical and sensory perspectives they employed. Sometimes, as Grew suggests in the Preface to the *Musæum*, description was the strategy best placed in the task of revealing 'many Particulars relating to the Nature and Use of Things'.[8]

I

The surviving correspondence of John Ray consists, for the largest part, in verbal descriptions of natural things. Although early on Ray and Martin Lister exchanged many letters, by the 1680s Ray's most important correspondents were Edward Lhwyd, Tancred Robsinon and Hans Sloane. These men placed their extensive holdings at Ray's disposal, sending him their own samples for identification, and descriptions for perusal and revision, until his death in 1704. Generally, Ray inspected them and sent them back to their owners, barring cases of accidental damage or deliberate destruction in the course of his observations.[9] Sloane, Lhwyd and Robinson went to enormous lengths to help Ray to complete his immense natural histories – the *Ornithologiæ* (1676), *Historia Piscium* (1686), *Historia Plantarum* (1686–1704) and posthumous *Historia Insectorum* (1710).[10] Their behaviour, though friendly and generous, was not entirely altruistic. Lhwyd, Robinson and Sloane treated both the man and his works as a resource to enable them to make sense of their own collections of natural things, especially plants (Ray's main expertise). Crucially, they invested Ray's *descriptions* of natural things, including of those things that they could easily inspect themselves, with an enormous value. On countless occasions, they sent him natural things to describe and identify, or descriptions from which Ray might deduce the species. On other occasions, Sloane prompted Ray to write short reviews of botanical works, which dwell to a large extent on the quality of the descriptions and images they contained. For his correspondents, Ray was both the ultimate 'describer' of natural things and the final authority on the work of description.[11]

Although laced with flattery, a letter sent by Tancred Robinson to John Ray in response to some of his queries from Geneva in 1684 gives us some notion of the qualities Ray's friends saw in him. These qualities gave him the capacity to mediate between natural things and knowledge

[7] The three rhetorical figures *enargheia*, *hypotyposis* and *ekphrasis* will be significant in this essay, and will be discussed fully below. *Enargheia* and *hypotyposis* are more or less synonyms. Both imply a verbal representation of an action or scene that is vivid, as if thrown before the eyes. *Ekphrasis* refers specifically to the idea that a verbal representation of a scene can be like a painting, or that an artwork can be rendered verbally without loss of effect.

[8] Grew, *Musæum*, Preface.

[9] Writing to Sloane in 1698 (Old Style), Ray explained that he could not work with some specimens Sloane had sent, because it would be a shame to have to destroy them. Ray to Hans Sloane, 22 March 1698/9, Ray, *Correspondence* (1848), 362.

[10] J. Ray, *F. Willughbeii […] Ornithologiæ libri tres […] Totum opus recognovit, digessit, supplevit J. Raius.* (London, 1676), J. Ray, *Francisci Willughbeii Armig. De Historia Piscium Libri Quatuor, Jussu & Sumptibus Societatis Regiæ Londinensis editi* (Oxford, 1686). Henceforth, Ray, *Historia Piscium*. Ray's *Historia Plantarum* was a work of epic scale, consisting of three volumes, each about 1,000 pages long. J. Ray, *Historia plantarum species hactenus editas aliasque insuper multas noviter inventas & descriptas complectens*, 3 vols. (London, 1686–1704).

[11] Describing, naming and identifying species in response to queries from correspondents was one of Ray's main activities, and it fills his correspondence. Take, e.g., Ray to Martin Lister, 10 December 1669, Ray, *Philosophical Letters*, 52 and Ray to Edward Lhwyd, 10 June 1694, Ray, *Correspondence* (1928), 248–9.

of them through his brilliant descriptions: 'I am over-joy'd that so vast a Memory, so exact a Judgment, and so universal a Knowledge, will be employ'd in compiling a general History of Plants, an undertaking fit only for your extraordinary Talents.'[12] Time and again throughout the letters among Ray and his friends, we learn that exact judgement, combined with vast experience, make a great describer. Surely, then, we cannot speak of the work of description in natural history as a straightforward signification or representation of natural things. Rather, natural historians needed to use their judgement to mediate nature in a useful way to their readers. Ray, his correspondents and his contemporaries had criteria by which to judge a natural historian's success or failure in this mediation by description.

In December 1698, Ray supplied Hans Sloane with reviews of two foreign botanical works, Paolo Boccone's *Museo di plante rare della Sicilia, Malta* (1697) and Paul Hermann's *Paradisus Batavus* (1698), an account of plants in the botanical garden at Leiden.[13] He made short work of Boccone's efforts, listing the sorts of information that had been left out of his descriptions: 'Besides the names, the stature, and magnitude, the places where he found them, or the persons from whom he received them, he hath to a great number of these plants added no descriptions of the principal parts.' In many cases, it seems, Boccone had simply *named* the different plants in his imaginary *Museo*, making it hard for even a man like Ray to identify their species: 'yet can he not easily persuade us but that concise exact descriptions would ease the greatest proficients of much trouble in finding out and exactly determining the species'.[14] In an age when plant names differed from author to author, and were often very long, names without descriptions could prove very hard to interpret. If judged by their success in leading readers to knowledge of species, Boccone's descriptions were – to Ray at least – a failure. They were simply too brief.

By contrast, Ray approved of the *Paradisus Batavus*, and his comments on Hermann's descriptions are well worth laying out in full:

> All that I shall or need say of this piece is, that the descriptions are very accurate, and sufficient alone to lead us into a certain and unerring knowledge of the plants described, and withal concise, and not encumbered with superfluous and unnecessary stuff, which obscures rather than illustrates; and that the icones are answerable to the descriptions, not needing their assistance to give us a certain idea of the species they represent.[15]

We can take three points of significant interest from Ray's short review. First, Hermann's descriptions succeed because they are sufficient *by themselves* to lead us 'into a certain and unerring knowledge' of what they describe. Second, while evidently giving us sufficient information for this, they are nevertheless concise. Third, the images – while accurate – are *not* actually required by the reader for the purpose of species identification. That Ray so peremptorily dismissed Hermann's 'icones' as bearers of knowledge about species is the principal point of interest for this piece. How could Ray argue that the words of descriptions alone could lead us to knowledge of species? Of significance to this question are Ray's hints about the ideal length and contents of a description. While Boccone's descriptions are judged far too short, Hermann's are not overlong, but concise. If we take Ray's words seriously, the question we are left with is; 'How could *concise* verbal descriptions lead Ray to knowledge of species?'

To an extent, the answer to this question depended on the purposes to which descriptions were put in the first place. Description for Ray and his contemporaries was a purposeful and, in a sense, rhetorical activity. It took place in two modes, which we may loosely label 'classificatory' and

[12] Tancred Robinson to John Ray, 18 April 1684, Ray, *Philosophical Letters*, 154.
[13] Ray to Hans Sloane, 24 December 1698, Ray, *Correspondence* (1848), 348–53. The works reviewed are P. Boccone, *Museo di plante rare della Sicilia, Malta, Corsica, Italia, Piemonte, e Germania* (Venice, 1697) and P. Hermann, *Paradisus Batavus, continens plus centum plantas* (Leiden, 1698).
[14] Ray, *Correspondence* (1848), 352.
[15] Ray, *Correspondence* (1848), 349.

'anatomical'. The first aimed at the identification of natural kinds, especially species, while the other sought out the uses of the parts of bodies, whether plant or animal. Ray and his contemporaries generally practised both sorts of description, although their works had different emphases.[16] Ray's natural histories normally focused on species identification, while works like Grew's *Anatomy of Plants* (1682) dwelt to a greater extent on the anatomical description of body parts and their uses. Concision, then, was relative and determined by the ends of the description. When, in these works and in his correspondence, Ray described species, he did so by enumerating what he called 'characteristic notes'. These were the features of the morphology of a natural kind that distinguished it, in his eyes at least, from all others. A typical procedure that Ray followed in his natural histories was to give a full, more or less anatomical, description of the principal member of a family of species, following it with descriptions of other members that just gave their notes of differentiation.[17] In an arrangement like this, a plant description that gave 'the names, the stature, and magnitude, the places where he found them, or the persons from whom he received them, [and…] descriptions of the principal parts' sufficed for the purposes of species identification. However, from an anatomical point of view it was hopelessly shallow. In his 'Idea of a Philosophical History of Plants' (prefaced to the *Anatomy*) Grew argued that a full description of a plant required anatomy down to the microscopic level if we are to understand the uses of all the parts, and their causes.[18] For Ray and his contemporaries, then, the ends of a description determined the meaning of concision. Nevertheless, they deployed more or less the same representational strategies in the work of verbal description, regardless of the ends to which it was put. This is because the *form* of knowledge that they aimed at was the same.

Actually, Ray's review of Hermann's *Paradisus Batavus* leaves us with a puzzle. Although Ray praises its descriptions for their capacity to lead us to 'knowledge' of species, he tells us, here as elsewhere, nothing about what 'knowledge' might mean.[19] Further examples of Ray's descriptive work suggest to us that knowledge could have a fairly prosaic meaning. In early 1692 Jacob Bobart the Younger, the second '*horti præfectus*' of the Oxford University botanical garden, had, by way of Edward Lhwyd, sent Ray a box of preserved butterflies. Ray set about naming and describing them. He had the hard task of describing for Bobart one of these butterflies in a letter to Lhwyd, as he picked his way through the samples. His attempt is worth laying out in full:

> The diurnal Butterfly (I call all those & only those diurnal that have *Antennas clavatas*) new to me is the last, or that next to ye back of the box, in the first row of the diurnal ones; it is not marked with any figure, but next to that marked 13. I have entitled it *Papilio major, alis pullis, exterioribus duplici macula lutea cum oculo in utraque nigro variis*. It is somewhat lesse than ye most common Butterfly wch I call *urticaria*. If this be not sufficient to lead him into ye knowledge of it, I shall in my next send him a more & particular description.[20]

This example seems to show descriptive work at a very basic level. All that Ray sets out to do is to identify a butterfly that both he and Bobart had seen and inspected. Yet, he registers little confidence in a happy outcome. Pre-empting a failure to establish the right butterfly in Bobart's mind, Ray suggests that he might need to send another, more detailed account.

[16] Ray's histories aim at species identification. However, Nehemiah Grew's *Anatomy of Plants* (London, 1682) seeks to explain the functions of different parts of plants.
[17] Ray's descriptions of rays open, for example, with a section about rays in general, followed by a long anatomical description of thornback rays. Thereafter, very short descriptions of other ray species follow, giving their *differentia*. Ray, *Historia Piscium*, 68–78.
[18] Grew, *Anatomy*, 2–10.
[19] We can find further examples of uses of 'knowledge' with the sense of obviousness that Ray gives it here. In 1688 Richard Waller wrote to Ray about his project for a book that would make the identification of plants easy. He began, 'Since one of the chief Ends of an *Herbal* is thereby to attain to a true *Knowledge* of Plants', Richard Waller to Ray, 5 April 1688, Ray, *Philosophical Letters*, 211.
[20] Ray to Edward Lhwyd, 22 March 1692, Ray, *Correspondence* (1928), 234.

'Knowledge', in this instance, seems to refer to bare recognition. Ray's aim (as he states) is to supply sufficient information in the description to conjure up in the reader's mind a clear and distinct 'idea' of the thing itself. We can find both strategy and economy in Ray's descriptions if we bear this aim in mind. Nearly all of the descriptive work is done with the creature's long, pre-Linnaean name (*Papilio major, alis pullis, exterioribus duplici macula lutea cum oculo in utraque nigro variis*). This, in turn, consists rather more of names or definitions than detailed descriptions of morphology. Somehow, these names were supposed to lead Bobart to 'knowledge' of the butterfly they denote. They do this by naming or defining some notable features of its morphology. Ray's use, in the same extract, of the expression 'antennas clavatas' to denote all diurnal butterflies works in this way too. It consists of one name, describing a well-known body part (an antenna), and one qualifying descriptive adjective (*clavata* – 'thorny') that nuances the image we associate with that name with a known morphological trait. The expectation seems to be that if the reader already has a sense of what form is signified by the word 'antenna', he will be able to modify that form with the appropriate thorniness signified by 'clavata'. The description could only work because Ray was writing to another expert who could likely associate, in his mind, the correct morphological forms with the names and definitions he supplied.

The knowledge aimed at in this instance seems to be coherent with the notion of visual or imaginative intelligibility that will be familiar to readers of John Wilkins's universal language scheme, *An Essay Towards a Real Character and a Philosophical Language* (1668) or John Locke's *Essay Concerning Human Understanding*. Ray, Grew and Hooke all endorsed a position that asserted, speaking very broadly, that language consists of signs for ideas that figured visually in the imagination. The visual figuration of ideas applied, regardless of whether they were the results of sensory perception, memory or combinations drawn from either source, or both. Moreover, they understood that the images of things raised by the imagination in response to sensory impressions do not *resemble* the things themselves, but are a consequence of the action of stimuli on the sense organs. As Ray put it, it is 'the mediation of these impressions' that 'cause[s] a particular phantasm to arise in the intellect'.[21] Such a scheme of knowledge-production – I will return to it below – placed certain important demands on description. A description's success or

[21] It is worth supplying two lengthy examples of both Hooke and Ray expressing these notions. For example 'So that our Apprehensions of things seem to be appropriated to our Species: And that if there were another Species of Intelligent Creatures in the World, they might have quite another kind of Apprehension of the same thing, and neither perhaps such as they ought to be, and each of them adapted to the peculiar structure of that Animal Body in which the Sensation is made […] from which it seems evident, that those Imaginations we have of things, are not according to the Nature of the things themselves; but only appropriated to the peculiar Organs, by which they are made sensible to the Understanding', R. Hooke, 'A General Scheme, or Idea Of the Present State of Natural Philosophy, and how its Defects may be Remedied by a Methodical Proceeding in the making Experiments and collecting Observations. Whereby To Compile a Natural History, as the Solid Basis for the Superstructure of True Philosophy.' In R. Hooke, *The Posthumous Works of Robert Hooke*, edited by R. Waller (London, 1705), 3–70 (8–9).

In his *De Variis Plantarum Methodis Dissertatio Brevis* (London, 1696), Ray also expressed the problem of non-resemblance, to defend his classificatory system against Tournefort's criticisms (Tourenfort did not view Ray's system as a consistent system). Ray responded, 'The essences of things are wholly unknown to us. Since all knowledge derives from sensation, we know nothing of the things which are outside us except through the power that they have to affect our senses in some particular way, and by the mediation of these impressions to cause a particular phantasm to arise in the intellect. If the essences of things are immaterial forms, it is admitted by everyone that these are not encountered in any sensible means.' See P. Sloan, 'John Locke, John Ray, and the Problem of the Natural System', *Journal of the History of Biology*, 5:1 (1972), 1–53 (43–4). Sloan argues that Ray changed his opinions about the knowability of essences under Locke's influence, but the only evidence for this is that Ray changed his classificatory system to one that was more oriented towards this philosophical position during the 1690s. Ray's descriptive practices going back to the 1660s all manifest the 'indiscriminate' enumeration of whatever characteristic notes identified a species, rather than the systematist's focus on only the parts of the plant that lead one to knowledge of essences. Peter Anstey and Stephen Harris also note that Sloan's claims about Ray need to be backdated, as it were. See P. Anstey and S. Harris, 'Locke and Botany', *Studies in the History of Biological & Biomedical Sciences*, 37 (2006), 151–71.

failure was determined by its capacity to *cause* roughly the same images ('phantasms', as Ray called them) to arise in the imagination of a reader, as had been envisaged by the author. Its fundamental property was not necessarily one of resemblance to the thing it represented. Rather, a 'describer' like Ray could cast certain attributes of a natural thing before a reader's imagination. He did this by using well-chosen words to provoke and order images in that reader's mind. In the case of Bobart's butterfly, Ray hardly needed to make a full picture or resemblance; a few salient points of morphology, he hoped, would do the work.

II

Of course, Ray could not reasonably expect that most of his readers would have already seen what he was describing to them, as Bobart had. He and his contemporaries had to work hard to make their descriptions intelligible to a more general readership. In a letter of 1694 to Edward Lhwyd, Ray made the task – and its difficulty – clear. Here, as in other letters, he expressed a perennial concern that it would be hard for general readers to work out what species he described without the help of a few engraved plates. As in other instances, Ray had to settle for the fact that the second edition of his *Synopsis Methodica Stirpium Britannicarum* (1696) would have none. Yet Ray tells Lhywd with something approaching confidence that he can get through to his readers using words alone: 'I shall endeavour so to methodize them & give such certain characteristic notes, that whosoever attends to them shall not fail to understand what species I describe.' [22] To achieve this end, he needed to compose his verbal descriptions carefully, with a view to effectively provoking apt images in the minds of his readers. It was entirely possible, for example, to write an entirely correct description that nevertheless did not do much for the imagination. In a letter to Ray of 1670, for example, Martin Lister complained that although a description of spiders by Aristotle is 'very plain in it self, yet it will not easily enter into our Imagination'.[23] In order to get out of this sort of trap, Ray deployed three strategies in his natural historical descriptions.

Let us take one description from Ray's history of fishes, the *Historia Piscium*: the thornback ray, or *raia clavata* (*raja clavata*, Lin.). It opens with a verbal account of the fish's geometric figure: 'The figure of it is rhomboidal, or almost squared.' Almost certainly, the point of this geometric opening is to introduce us to the ray's shape in an easily intelligible way. Immediately, the description of the fish's accidents gets underway. This is peppered throughout with comparisons either to familiar things, or simple geometric forms that help us to grasp the shapes of the different accidents under description; 'The mouth is without teeth [accident], in truth the jawbones are criss-crossed with rude rhomboidal protuberances [geometric form], resembling carpenters' files [rhetoric].'[24] Three different modes of description get their due here, and conspire to help us arrive at an idea of the thornback ray's morphology. These are, as the words I have interpolated into Ray's description indicate, (i) the enumeration of accidents, (ii) naming to simple geometric forms, and (iii) vivid rhetorical comparisons. Together, they conspire to help us apprehend the thornback ray's morphology.

These three descriptive modes correspond quite closely to the three senses in which the term 'description' was understood in Ray's day. The first definition was philosophical; according to the precepts of logical philosophy, the enumeration of accidents made an imperfect definition. Such an enumeration did not produce 'knowledge', because scholastic philosophy argued that external accidents give one no idea of the essence of a thing. In practice, many natural historians

[22] Ray to Edward Lhywd, 1 June 1694, Ray, *Correspondence* (1928), 247.
[23] Martin Lister to Ray, 8 February 1670, Ray, *Philosophical Letters*, 89.
[24] Ray, *Historia Piscium*, 74. In the original Latin, Ray's words are: 'Os dentium expers, verum maxillæ cancellatæ tuberculis rhomboidibus asperæ sunt, limæ instar.'

had begun to change their attitude to description hundreds of years previously, when they began to take description, and *historia* more generally, as preparatory to arriving at knowledge of natural things.[25] The second definition referred to the drawing out of geometric forms with instruments like the ruler and compass. Third, and most importantly for our purposes, description occupied a well-established place in rhetoric and poetry. In his *Cyclopædia*, first published in 1726, Ephraim Chambers tells us that 'DESCRIPTION, in *Poetry* and *Rhetoric*, is a figure, which, by the aid of image and argument, exhibits such a strong and lively representation of a subject, as gives a distinct view […] of it to the reader or hearer'.[26] When John Ray described the thornback ray's teeth he does more than to supply us with an 'imperfect definition' by enumerating its accidents. He goes on to impress their form on the reader's imagination, giving us an instant notion of their shape ('rhomboidal'), and supplying an effective rhetorical comparison ('resembling carpenters' files').

In an article of 1994, David Foster showed persuasively that rhetoric retained a significant place in the works of English natural theologians up to and beyond the turn of the eighteenth century. The attacks on flowery rhetoric made by Francis Bacon and later on by Thomas Sprat in the *History of the Royal Society* (1667) were just that – attacks on *excessive* rhetoric, not on rhetoric in its entirety. Foster's remarks, which he more or less limits to natural theological works, may be extended much further. Sprat's call for a rhetoric founded on images familiar from the experience of nature is coherent with the descriptive programme of Ray, Grew and others. They wanted to make comparisons that would give their readers a fair chance of understanding what forms they were trying to describe.[27] Indeed, it is clear that Ray and his contemporaries sought, in their descriptions, not just to account for phenomena, but to impress them on their readers' imaginations in a vivid way. Their approach to verbal description was deeply aesthetic, and it demands interpretation with reference to rhetoric and poetics. Such an interpretation has important consequences not only for our understanding of the descriptive practices of Ray and his contemporaries, but also for the practice and meaning of natural history in their day.

In his 1989 piece, 'Ekphrasis and Quotation', Carlo Ginzburg makes some incredibly important observations about the place of certain rhetorical figures in Early Modern history writing. During the seventeenth century, he argues, the meaning of the term 'evidentia' underwent a signal transformation. In classical and humanist rhetorical forms of history writing, 'evidentia' referred to the *vividness* with which the historian described a historical action. During the seventeenth century, by contrast, 'evidentia' was constituted more and more by the quotation from and citation of authoritative sources. For classical rhetoricians, the Latin term 'evidentia' was a synonym for the Greek terms *enargheia* and *hypotyposis*, both of which suggest vividness of description. For an author like Quintilian, historical accounts got much of their weight from the success with which the author could achieve *enargheia* or *hypotyposis*. As Ginzburg explains, *ekphrasis* was the main figure with which an author might achieve *enargheia*. This term refers very explicitly to the idea that an author can 'paint' a scene with words. 'The most effective historian', Plutarch suggested, 'is he who, by a vivid representation of emotions and characters, makes his narration like a painting'. For him and other classical writers on history and rhetoric, the graphic and verbal representations of a historical happening were more or less interchangeable – both may cause us

[25] I. Maclean, 'White Crows, Graying Hair, and Eyelashes: Problems for Natural Historians in the Reception of Logic and Biology in the Reception of Aristotelian Logic and Biology from Pomponazzi to Bacon', in Pomata and Siraisi, *Historia*, 147–79 (148) and, in the same collection of essays, '*Praxis Historialis*: The Uses of *Historia* in Early Modern Medicine', 105–46.

[26] Ephraim Chambers, *Cyclopædia: or, an universal dictionary of arts and sciences*, 5 vols. (London, 1778–1788), vol. 2, entries for 'description' (unpaginated).

[27] D. Foster, '"In Every Drop of Dew": Imagination and the Rhetoric of Assent in English Natural Religion', *Rhetorica*, 12:3 (1994), 293–325 (303–7).

to apprehend it in a vivid way.[28] In his 'On the Pleasures of the Imagination' of 1712, with no greater circumspection, Joseph Addison grouped sculpture, painting and descriptions together as the media that could raise beautiful images in the imagination, to the great pleasure of the beholder.

Although Ginzburg was writing about what in the sixteenth and seventeenth centuries were called 'civil' histories, his remarks are nevertheless of considerable interest to us. Indeed, they are especially useful to us precisely because the move to 'quotation' that Ginzburg describes was not possible in natural history. For Ray and his contemporaries, historical authority and usefulness rested partly on the extent to which their descriptions could successfully provoke vivid images for their readers. Their descriptions aim at *enargheia* or *hypotyposis*, and involve not a little *ekphrasis*. Strikingly, Thomas Willis suggested this explicitly in his *Cerebri Anatome* of 1664. In three instances, he uses the term 'hypotyposis' *interchangeably* either to refer to very ample verbal descriptions, or (on one occasion) to an engraved image following a description.[29] This is an example both of the fact that writers such as Willis tried to achieve *hypotyposis* with words and, crucially, that they could be indifferent to the media with which it was achieved, just so long as it was achieved. Mark Robson describes Early Modern literary *hypotyposis* as 'a form of phenomenalisation', drawing on the term's association with the idea of 'putting a thing "before our eyes"'.[30] Like a seventeenth-century poet who tried to 'paint' a landscape before our eyes with words, Ray and other natural historians used words, alongside other media, to 'picture' natural things before the imagination.

We owe it to aesthetic theorists of the later eighteenth century, especially Gotthold Lessing, that this project now seems improbable. His famous arguments about the incompatibility of words and pictures because of their relationship to time (paintings are instantaneous, words unfold one after the other) are well known and need no rehearsal here.[31] In Ray's day, lengthy description in the arts was popular, and verbal and graphic media could be used interchangeably. Svetlana Alpers has rightly noted that the time in which men such as Christiaan Huygens and Robert Hooke (to use her examples) made long and particular descriptions of natural things corresponds almost exactly to a period in which description enjoyed an unusual moment of eminence in the arts. In poetry, description or *ekphrasis*, which usually occupied a lowly place in the hierarchy of poetic or rhetorical modes, was popular. The poetic description of a garden might, according to John Dryden, bring readers more pleasure than the sight of the thing itself.[32]

[28] C. Ginzburg, 'Ekphrasis and Quotation', *Tijdschrift voor Filosofie*, 50:1 (1988), 3–19. He quotes Plutarch on page 10. Similar observations about *ekphrasis* may be found in M. Beaujour, 'Some Paradoxes of Description', *Yale French Studies*, 61 (1981), 27–59 (43).

[29] Willis's implication is that the *hypotyposis* generated by extended description, or a figure, is necessary before we can proceed to talk about uses. T. Willis, *Cerebri Anatome: cui accessit Nervorum Descriptio et Usus* (London, 1664), 119, 288, 312.

[30] M. Robson, *The Sense of Early Modern Writing: Rhetoric, Poetics, Aesthetics* (Manchester: Manchester University Press, 2006), 25.

[31] Lessing famously criticized descriptive poetry by tackling what he took to be its fundamental properties. Extended description of things, he argued, is aesthetically unsatisfying because words communicate successively what is communicated to the eyes in an instant. G. Lessing, 'Extracts from Laocoön: An Essay on the Limits of Painting and Poetry (1766)', in *Art in Theory, 1648–1815: An Anthology of Changing Ideas*, edited by Charles Harrison, Paul Wood and Jason Gaiger (Oxford: Blackwell, 2000), 477–86.

[32] Dryden's words are, 'a Poet in the description of a beautiful Garden, or a Meadow, will please our imagination more than the place it self can please our sight'. J. Dryden, *Of Dramatick Poesie, an Essay* (London, 1693) (first published, London, 1668), 22. It is worth adding here that arguments such as Dryden's were informed by classical and humanist ideas about painting, embodied in the expression 'ut pictura poesis'. This does not translate neatly, but implies that painting could be employed to convey narratives. On this tradition, as well as Dryden's employment of it, and Lessing's criticisms of Dryden, see W. Howard, 'Ut Pictura Poesis', *Proceedings of the Modern Language Association of America*, 24: 1 (1909), 40–123.

On the strength of this evidence, we can begin to argue that the descriptions made by John Ray and his contemporaries were a form of picturing. These descriptions secured part of their own truth claim through their vividness. It is worth reminding ourselves of Martin Lister's complaint about Aristotle's spider description: although 'very plain in it self, yet it will not easily enter into our Imagination.' In other words, Aristotle's words were correct, but not very vivid. These men were deeply concerned with *enargheia* (whether they stated it or not) because their morphological vocabulary consisted of signs for images, and their rhetoric served to make these images clearer. Since the prevailing aesthetic theories of the day did not pay too much attention to the fact that words, when read, follow each other in time, we can view Ray's descriptions as great static tableaux, picturing natural things. Moreover, these tableaux enjoyed the same epistemic status as graphic representations, because (although with more work) they provoked images – and knowledge – of the same sort. The decision to use words alongside, or rather than, images to represent natural things was often forced on natural historians because of the cost of getting engravings made, and the difficulty of finding people skilful enough to make them. Nevertheless, it was also sometimes a matter of representational strategy. By pursuing these strategies we can delve further into the philosophical underpinnings of 'picturing' in the natural history of Ray's day.

III

Engravings were a major problem for John Ray. For the period from the middle of the 1680s to the end of Ray's life, his correspondence buzzes with talk of getting engravings done for his magnum opus, the *Historia Plantarum* (1686–1704). Mainly, it seems, for financial reasons, the project was never realized.[33] Yet Ray was clear enough, in a letter of 1684 to Tancred Robinson, about the benefits that good illustrations could bring to a work like his: 'A good Figure conveys that to the Mind suddenly, and with Ease and Pleasure; an Idea whereof cannot be formed by the Help of a Description without Time and Pains.'[34] We should note that Ray does not argue that a verbal description cannot do the work of an engraved figure. Rather, he suggests that a figure can do that work far more quickly and easily than words. Ray's praise for the capacity of images to represent things to us is, like Hooke's, never quite as straightforward as it seems. What Ray gives with one hand, he takes away with another, and so does Hooke. In his famous 'General Scheme' for improving natural philosophy, Hooke proposes a sort of multimedia commonplacing system for recording natural history. Hooke is, of course, famous for his magnificent use of images in the *Micrographia* (1665), so it might come as a surprise to read his advice on their use in the 'General Scheme': 'The Explication of such things as can be better describ'd by words is rather noxious than useful, and serves to divert and disturb the Mind.'[35] Hooke and Ray praised graphic representation to the rooftops, but they were both sensible enough to work out its limitations, and to deploy it in a judicious manner.

When Ray and Hooke represented different species to their readers, they did so either with verbal descriptions alone, or with verbal descriptions accompanied by engraved plates. Ray's *Historia Piscium*, for example, consists of 386 pages of verbal description, and 188 plates, each showing several fish. On the other hand, their contemporaries Leonard Plukenet (1642–1706) and Martin Lister chose an entirely different strategy in their respective works, the *Phytographia*

[33] S. Kusukawa 'The *Historia Piscium* (1686)', *Notes and Records of the Royal Society of London*, 54:2 (2000), 179–97 (192). See also (for example) Ray to Hans Sloane, 16 December 1706, Ray, *Philosophical Letters*, 319–20.
[34] Ray to Tancred Robinson, 22 October 1684, Ray, *Philosophical Letters*, 169.
[35] Hooke, 'General Scheme', 64.

(1691) and the *Historiae sive synopsis methodicae Conchyliorum* (1689).[36] Both books were made in the same way: every single page was printed with an engraved plate, and the very small amount of text that we can find was made by engraving, not with movable type. It is difficult to generalize about the images in both books. Each page normally contains images of several related species placed near to each other. In Lister's book the shells are realized in a shallow perspective; Plukenet's plants seem to have been artificially flattened out, as if they were the dried samples to be found in a herbarium. In Lister's work, images and even classificatory tables are occasionally surrounded by an engraved picture-frame. In Plukenet's book, every image has a thin border around it. Perhaps most importantly, both Plukenet's and Lister's images display the external surfaces of their subjects. Somehow, these displayed 'icons' of plants and seashells, along only with their names, laid out side-by-side, are supposed to supply us with all the information we need to differentiate (with a few exceptions) between species.[37] Both of these books explicitly set out in their titles to help us do the work of species identification. They do this through their images: they are the descriptions. By comparison with Ray, Grew or Hooke's descriptions, there is hardly any text at all.

Barbara Stafford has remarked on the 'iconic' quality of Lister's history of shellfish. She suggests that:

> Lister's *pictorial* theory of lithic hieroglyphs belonged to a baroque optical epistemology similar to that of Jesuits such as Athanasius Kircher. Richly sculpted gilt borders and compositions calculated to accentuate randomness presented shells as picturesque sketches, not as textualizable documents of once-living marine animals.[38]

Certainly, Lister's icons must 'speak for themselves', in the sense that they must do a vast amount of descriptive work. Stafford neglects, however, the classificatory aspect of the *Historiae*. Nick Grindle more correctly links this to the epistemology of John Wilkins's *Essay Towards a Real Character and a Philosophical Language*. By laying out clear engraved images of whole plants and shells side-by-side, we can more or less instantly note some of their *differentia*.[39] Or rather, the images do this to us through the representational strategy of which they are a part.

On 5 April 1688, Richard Waller, then secretary to the Royal Society, wrote to John Ray with a proposal for a new book that would help even 'one wholly ignorant in Plants' to successfully identify any plant. It would consist simply of 'a few *Tables*, with *Iconisms*'. It seems that Waller was describing a book just like Lister's *Historiæ*. Perhaps, however, he had Comenius's *Orbis Sensualium Pictus* (1659) in mind. A clue comes at the end of his letter: 'my Design in these Tables being only to give an Idea of the Differences of Plants by *Pictures*, (the Representations of Beings) rather than by *Words* (the Representations of Pictures.)'.[40] Waller's off-hand remark about the epistemological difference between pictures and words follows the didactic programme laid down by Comenius in his then-famous and influential *Orbis Sensualium Pictus*.[41] There,

[36] L. Plukenet, *Phytographia* (London, 1691), M. Lister, *Historiae sive synopsis methodicae Conchyliorum quorum omnium picturae ad vivum delineatae, exhibetur liber primus. Qui est de Cochleis Terrestribus* (London, 1689).
[37] A very small proportion of Lister's plates show comparative dissections, presumably where he found external images of the shells to be unsatisfactory. See, for example the plate in Part 1 (there is no pagination) entitled 'Harderi *Tabulæ Anatomicæ Cochleæ alicujus Terrestris Dorniportæ, earumque explicatio*.' This is the twenty-second engraved plate of Lister, *Historiæ*.
[38] B. Stafford, *Artful Science – Enlightenment Entertainment and the Eclipse of Visual Education* (Cambridge, MA: MIT Press, 1994), 231.
[39] N. Grindle, 'No other sign or note than the very order': Francis Willughby, John Ray and the Importance of Collecting Pictures', *Journal of the History of Collections*, 17:1 (2005), 15–22 (20).
[40] Richard Waller to Ray, 5 April 1688, Ray, *Philosophical Letters*, 211.
[41] On Comenius's influence, see A. Blair, 'Mosaic Physics and the Search for a Pious Natural Philosophy in the Late Renaissance', *Isis*, 91:1 (2000), 32–58 (37–9).

Comenius differentiates between the pictures his book uses to teach vocabulary, and the descriptions that accompany them: '*The Pictures* are the Representations of all visible things […] *The Descriptions* are the Explications of the Parts of the Picture'.[42] Perhaps Comenius's *Orbis* is the source of Waller's peculiar assertion that words represent pictures, while pictures represent things. In any case, the epistemological consequences of this are worth following up, because the representational strategies employed by Lister, Plukenet and Comenius are very similar. By presenting us with images of whole things and by allowing us to compare those with others, these books teach us the difference between natural kinds. The *differentia* are impressed on the eye in an obvious way, through line engravings. In a brief review of Plukenet's *Phytographia* (incidentally sent to Waller), Ray waxed lyrical about the epistemological usefulness of such engravings: 'Now a good *Figure* having this advantage of a verbal description that it conveys speedily to the mind with ease & pleasure a clearer & truer *Idea* of the thing delineated'.[43]

As Nick Grindle has shown in an article of 2005, the images of fish accompanying Ray's *Historia Piscium* have much in common with those of shells in Lister's *Historiæ sive synopsis methodicae Conchyliorum*. Both sets of images lay out groups of species alongside each other, and both identify species with images displaying their complete, outward appearance. For Grindle, this is evidence that Lister and Ray used a similar representational strategy to identify species: 'if pictures were understood as 'universal transparent signifiers' […] the isomorphic relationship between reality, perception and signification was achieved' by 'a methodical arrangement, as the power of a picture to signify was activated by its placement next to other pictures'.[44] While it is not to be doubted that both Lister and Ray sought to identify species through the vivid enumeration of characteristic notes, and that their images contributed to this end, we cannot conclude from this that Ray saw his images as entirely *sufficient* for this end. He expressed both praise for, and reservations about, the representational strategy exemplified in these works by Plukenet and Lister. Crucially, he never followed up Waller's suggestion for a similar sort of natural history. His representational strategies, and those of men such as Grew and Ray, never settled on a fixed medium or scenography. Their works do not express the same confidence evinced by Lister and Plukenet that a single, consistently applied representational strategy could expose design in nature, whether in the form of species or the ends of different bodies. Their representational strategies do not transparently signify natural things, but stand at the apex of a long series of shifting observational 'scenes', interventions, manipulations and judgements. Their *aesthesis* was driven by the multiplicity of ways in which design in nature might be brought to light, and in this sense was motivated by the theology of divine design to which they adhered.[45]

Further along in his review of Plukenet's *Phytographia*, Ray seemingly dismisses the images that he had praised so fully just a few lines above:

> The *Titles* subjoined to each Table may supply the place of Descriptions, as containing certain *characteristic* notes, sufficient to distinguish the *species*, to which they belong, from any others whatsoever; so that they alone without any *icon*, if diligently heeded & attended to, might serve to lead a man into a certain knowledge of the plants.[46]

[42] Comenius, *Orbis Sensualium Pictus* (London, 1659), Preface.
[43] Ray to Richard Waller, 19 May 1691, Ray, *Correspondence* (1928), 99.
[44] Grindle, 'No other sign or note', 20. In an otherwise fine article, Sachiko Kusukawa picks up on Ray's statements about the use of images in making descriptions intelligible. Although Kusukawa accurately reports these, it is still necessary to qualify them with Ray's (and indeed Hooke's) more ambivalent pronouncements. Kusukawa, 'The *Historia Piscium*', 183, 186, 192.
[45] Ray, Grew and Hooke's natural theological works are well known, especially in the case of Ray's works. Their most famous natural theological books are J. Ray, *The Wisdom of God Manifested in the Works of the Creation* (London, 1691), N. Grew, *Cosmologia Sacra* (London, 1701) and Hooke's Preface to his *Micrographia, or some physiological descriptions of minute bodies* (London, 1665).
[46] Ray to Richard Waller, 19 May 1691, Ray, *Correspondence* (1928), 99.

As beautiful and useful as the *Phytographia*'s engravings were, the small amount of text to be found at the bottom of each page was sufficient for species identification. The images help to make those species readily intelligible to us. Ray repeated this argument whenever he wrote about the use of images in description: engraved images enhance the intelligibility of, but do not supplant, verbal descriptions.[47]

This was partly because Ray recognized the limits of engraved images as a medium. There is a great deal of information pertinent to species identification that, for Ray, images made up of incised lines do not convey. When, during the 1670s, Ray was putting together the *Ornithologia*, Henry Oldenburg got in touch to offer to have some exotic birds drawn for the work. Of course, Ray endorsed the idea, but with the following proviso:

> If we can get them figured, I must entreat some friend to take a description of them in words, I mean their bigness, shape of the whole body, & particularly of their bills, feet and claws, colour of their bills legs & feathers especially of their wings & tails, the length & figure of their tails & any other considerable or distinctive accident.[48]

This was typical of the sort of admonitions that Ray sent to correspondents who wanted to supply him with information. He could only accurately describe a species if he had information that exceeded what could be conveyed in a draught that just displayed an animal or plant's outward profile. Ray's comments do not simply represent an 'opinion' about how species identification must be performed. They bespeak a far broader set of attitudes to visual curiosity, representation and design. If the characteristic notes that identify a species cannot be represented to us in external surfaces, then species identification requires more probing, and possibly destructive, visual enquiry. The design in nature was not obviously intelligible, but had to be teased out and represented in a special way. Whatever representations Grew, Ray and Hooke made of nature's designs, they had to reflect the non-obvious location of this design in natural things, and the judgements that were needed to find it.

Ray's representational strategy in the *Historia Piscium* differed significantly from that pursued by Plukenet and Lister in these cases. In both instances, assemblies of natural things are 'pictured', but Ray achieved that picturing with a combination of extended *ekphrasis* alongside engraved 'Icons' showing external surfaces. The difference in these representational strategies indicates that these natural historians had arrived at differing judgements about how to identify species in these natural things. Ray generates different sorts of scenography, depending on where he had located the characteristic notes that made a species. These could be on the surface (and this helped for the purposes of identification), but he could just as easily dwell, as we have seen, on extended internal anatomies. Perhaps his anatomy of the thornback ray could have been represented with images, but there can be no doubt that a verbal description provided Ray with a much cheaper (and more practicable way) of picturing it for his readers. Nehemiah Grew and Robert Hooke, too, sought design in nature through a very wide variety of observational strategies. For example, Matthew Hunter has shown that Hooke was more or less indifferent to graphic picturing. He used representations that included paper cut-outs, models, words and drawings employing a bewildering array of techniques, to convey to others the workings of natural things.[49] In his

[47] Ray wrote to Lhwyd in 1694 about the difficulties in making intelligible descriptions without images. In spite of the difficulties, Ray suggests that he will be able to achieve the same outcome with words: 'Without figures, names and Descriptions will be very fastidious & hardly intelligible to ye Reader. But I shall endeavour so to methodize them & give such certain characteristic notes, that whosoever attends to them shall not fail to understand what species I describe.' Ray to Edward Lhwyd, 1 June 1694, Ray, *Correspondence* (1928), 247.
[48] Ray to Henry Oldenburg, 19 September 1674, Ray, *Correspondence* (1928), 66.
[49] M. Hunter, 'Robert Hooke Fecit: Making and Knowing in Restoration London' (unpublished Ph.D. diss., University of Chicago, 2007), 189–90.

Anatomy of Plants, Grew, too, accounted for countless different interventions into his plants, including dissection, microscopic observation, drying out and so on. His descriptions and images account for these interventions, and run through a vast array of scenographies, including microscopic enlargements of slices through roots, composite images of dissected roots and verbal definitions of plant body parts.[50]

IV

One of the premises of the natural historical works of Ray, his correspondents, Grew and Hooke, seems to be that natural things are unintelligible to most people. These men did not necessarily find design in obvious places. Rather, they brought it to light and communicated it with their judgement. This was one reason why Ray's correspondents valued his descriptions so highly. Ray was a privileged mediator of nature's meaning who, through the representation of *his* observations of natural things, could display the divine design encoded in species and the uses of natural bodies. In the 'Discourse of Earthquakes' to be found in his *Posthumous Works* (1705), Hooke listed just some of the different ways in which a natural philosopher might inquire into a natural thing to reveal something interesting about it:

> by several Means and several Methods and Instruments, as by Fire, by Frost, by Menstruums, by Mixtures, by Digestions, Putrefactions, Fermentations and Petrifactions, by Grindings, Burnings, Weighings and Measuring, Pressing and Condensing, Dilating and Expanding, Dissecting, Separating and Dividing, Sifting and Streining; by viewing with Glasses and Microscopes, Smelling, Tasting, Feeling, and various other ways of Torturing and Wracking of Natural Bodies, to find out the Truth or the real Effect as it is in its Constitution or State of Being.[51]

Such a variety of observational strategies demanded, as I have suggested, a similar variety of representational strategies. Natural things did not reveal their nature easily, but had to be inquired into by natural philosophers who could mediate their observations to others in descriptions.

In this piece I have exposed some of the means by which Ray and some of his contemporaries communicated their judgements on natural things. The conclusions that I have arrived at call into question the purposes of picturing natural things for these natural historians. In the opening, I suggested that Grew's account of the Royal Society's collection might have been just as valuable to one with access to the collection as it was to one for whom the *Musæum* also did the work of virtualizing its contents. This was because Grew had honed the skill of provoking in his readers' imaginations images of morphology, whether internal or external, that could enable readers accurately to distinguish species, and gain 'true' knowledge of them.

Ray, Hooke and Grew's apparent indifference to the media with which they achieved the *ekphrasis* of natural things can be accounted for both in philosophical terms, as well as the aesthetic ones for which I have already accounted. Yet it should be recalled that their representations, whether achieved verbally or graphically, were always intended to provoke images for readers. In this sense, their work was always that of *aesthesis*. The hinge of knowledge was visual, and should not be separated from the philosophical and theological arguments that, in the work of Ray and some of his contemporaries, it supported. We need to take care, however, to note that *what* these men represented bore no formal resemblance to the natural things that their representations signified. The seventeenth-century senses did not (as indeed they do not) convey

[50] Grew, *Anatomy of Plants*. It is especially interesting to run over the wide variety of graphic strategies that are employed in his engraved plates.
[51] Hooke, *Posthumous Works*, 279.

information about natural things that in any way *resembled* their objects. Rather, Ray, Grew, Hooke and their contemporaries could only receive sensory impressions that corresponded in a mechanical way to them. These sensory impressions generated 'images' (in the 'imaginary' sense of the word) on which reason could work. Looming large in all of this is the century's most important account of sensory functioning – Kepler's account of vision.[52] Descartes, writing about this, repeated the familiar trope of antiquity by suggesting that seeing is like the impression of a signet ring in wax. In common with many of Descartes's observations on vision, this one is full of wonderful nuance. The impression of a signet ring in wax, like the impression of light on the retina, does not produce anything that resembles the original thing, but an abstracted sort of correspondence.[53]

We can argue, then, that the representations made by Ray and some of his contemporaries did not really resemble any *thing* at all. Perhaps this can help us to understand the equivalence that they drew between verbal and graphic representations. Whether mental images were made verbally or not, verisimilitude was not the main plank in Ray's representative strategy, or in those deployed by Grew and Hooke. Indeed, according to Descartes, a better representation might resemble its object *less* than an unsuccessful one:

> Engravings which consist merely of a little ink spread over paper, represent to us forests, towns, men and even battles and tempests. And yet, out of an unlimited number of different qualities that lead us to conceive the objects, there is not one in respect of which they actually resemble [the objects] except shape. Even this is a very imperfect resemblance.[54]

We have no idea whether Ray, Grew or Hooke thought as deeply as Descartes about non-resemblance in images, but Descartes's argument about images is entirely coherent with the rest of their visual theory. If our senses do not convey resemblances to us, but mechanical correspondences, then the purpose of a good description is not necessarily to resemble those forms, but to cause in us sensory impressions that will create correspondent images in our imagination. It was possible for words to do this work as effectively as engraved images. They, like engraved images, were (nearly) arbitrary signs that we have learned to associate with the images of certain natural things made by sensory impressions and the imagination.

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[52] From the point of view of thinking about *aesthesis*, the best account is still Alpers, *Art of Describing*, 26–71.
[53] Quoted in B. Decyk, 'Cartesian Imagination and Perspectival Art', in *Descartes' Natural Philosophy*, edited by S. Gaukroger, J. Schuster and J. Sutton (London: New York: Routledge, 2000), 447–86 (472).
[54] R. Descartes, 'Discourse 5 of *The Dioptrics*', in *Descartes: Philosophical Writings*, edited and translated by E. Anscombe and P. Geach (Nelson: London, 1954), 245, quoted in J. Snyder, 'Picturing Vision', *Critical Inquiry*, 6:3 (1980), 499–526 (499).