

# Introduction

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The essays collected in the present volume investigate various aspects of the complex relations between *Image, Imagination, and Cognition* during the period between 1500 and 1700. What motivates the focus on these three concepts and the chronological delimitation to the early modern period? It is our conviction that, in Europe between 1500 and 1700, a thoroughgoing transformation affected the complex nexus comprised of the following: (i) what it means to understand or know phenomena in the natural world (cognition); (ii) how such phenomena came to be visualized or pictured (images, including novel types of diagrams, structural models, maps, etc.); and (iii) the role of the faculty of the imagination (which surpasses the mere processing of sense data, and takes creative flight beyond them). New conceptions were advanced, as were new ways of comprehending and expressing the relations among images, imagination, and cognition in the early modern period.

Why locate these transformations in the early modern period? According to late medieval and early modern conceptions of the workings of the mind and the senses, all that was perceived by the external senses was transferred, as it were, to the internal senses, in particular to the medium of the imagination. The mental images it produced were then subjected to the further operations of the sensitive soul, such as cogitation and memory. Combinatory imagination, whereby the imagination was deemed capable of producing wholly new images from those provided by experience, was also a key faculty or capacity of the soul. These processes and principles held sway across a variety of disciplines and practices in the early modern period and naturally encompass the triple themes of this volume.

Around 1450, the invention of moveable type enabled entirely new modes of teaching and learning through standardized images—the ‘exactly repeatable pictorial statements’ the print scholar William M. Ivins credited with fostering the rise of modern sciences.<sup>1</sup> In addition to widespread engagement with classical philosophy and theology through printed books, this era witnessed the production and dissemination of the first art historical treatises. In all manner of written texts, the role of the critical terms *imaginatio* and *phantasia* was avidly discussed and debated. But the early modern era was also an age

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1 Ivins, Jr. W., *Prints and Visual Communication* (Cambridge, MA and London: 1953) 3.

of great conflict regarding the status of religious imagery (as in the Protestant and Catholic or counter-Reformations) and of visual tools in education (such as were devised by the French humanist Petrus Ramus). At the other end of the time period under investigation, the invention of microscopes and telescopes in the seventeenth century led to the recognition that material reality far exceeds what presents itself immediately to our senses. The upshot of this recognition was a re-evaluation of the imagination, which was construed as being able to transcend simple sense data; and new forms of representation were adapted to visualize the invisible. This program of graphically visualizing the invisible culminated in the Cartesian-style ‘mechanical models’ of the second half of the seventeenth century.

This volume proposes to examine the relation between scientific (or ‘epistemic’) images, the psychological faculty of imagination, and theories of cognition at a particular moment in their much longer respective and joint histories. The era under investigation gave rise, as other scholars have demonstrated, to conceptions of images, imagination, and cognition—and of their interrelationships—that may seem, and in some cases are, entirely distinct from modern modes of thought and practices. The role of imagination vis-à-vis science or cognition has, for example, been all but outlawed since the late eighteenth century when, as historian of science Lorraine Daston has shown, a new evaluation of genius in the work of Immanuel Kant and others shifted conceptions of the role and privilege of the imagination. Whereas originality and creativity became the standards by which artists were judged, scientists were held to norms of objectivity and factual realism; and the difference hinged on the role of the imagination.<sup>2</sup> Other patterns traced out here concerning early modern conceptions may ring familiar. In his defense of painting as a liberal art, worthy of elevation to the status of a theory, Cennino Cennini (ca. 1370–1440), for example, wrote that painting requires ‘imagination [*fantasia*] and manual dexterity’. He attributed to artists the ability, one that would soon be considered quasi-divine, to create the unknown, to discover ‘invisible things hiding in the shadow of ones in nature and to capture them with [their] hand, so that [they] can make manifest that which is not there.’<sup>3</sup> The fearsome power of the imagination to recombine sensory data, celebrated by Cennini, was both revered and abhorred, and a critical language and modes of representation developed that remain in many regards pertinent. Art historian Martin Kemp has observed that ‘the modes of representation in twentieth-century science are very much the heirs of the Renaissance revolution’, which led to ‘the rise of

2 Daston L., “Fear and Loathing of the Imagination in Science”, *Daedalus* (1998) 73–95.

3 Cennini, Cennino. *Cennino Cennini's Il Libro dell'arte*, trans. L. Broecke (London: 2015) 20.

illustration as a major tool of science'.<sup>4</sup> To this observation, we would add that the ascendance of these new visual 'tools' could not have taken place without the emergence of new theories about cognition and the role of imagination in it. It is exactly this nexus that the present volume investigates.

It seems obvious that this evolving relationship between cognition, imagination, and image led to an increased focus on the visual, in all of its forms. Whereas it is a commonplace that sight was, from Antiquity, the most privileged of the senses in Western culture, the role of the eye and of seeing became even more central and more complex in the period under consideration. The rise of empiricism in the sciences; philosophical deliberations on the workings and powers of vision; refinement of devotional models and theories of vision and perception of the divine; new technologies that offered the means to sharpen and expand the sense of sight: these elements all affected the status of ocularity in the period under consideration. As often as it was celebrated as the most acute of the senses, however, sight was also disparaged, questioned, doubted. In fact, an entirely new physics attempted to reduce all knowledge of the outside world to the sense of touch (while, paradoxically enough, explaining touch in visual terms!). The contested status of sight and vision is reflected in the history of physical images—of art. Fiery questions arose, for example, in the sixteenth century, in the context of the Protestant Reformation, about the status of images, religious images in particular. The key role that the imagination played in early modern considerations on sight and image production is fundamental to understanding artistic matters of the period, and likewise inextricably linked to religious, philosophical, and scientific modes of thinking and practices. The highly specific discourses and historiographies pertaining to the three 'primary' disciplines represented by the editors—the histories of science, art, and philosophy—tend in general to enhance the distinctions between studies of images, imagination, and cognition in the early modern period.

The first essay in this volume, by *Sander de Boer*, sheds light on the ambivalent status of the imagination within the framework of Aristotelian psychology. On the one hand, most Aristotelian philosophers agreed that all human cognition relies on the images (or 'phantasms') provided by the imagination, an embodied faculty of the sensitive soul. On the other hand, they generally believed the human soul to be immortal. This implies that, after death, the soul should be able to engage in some form of cognitive activity in the absence

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4 Kemp M., "Seeing and Picturing: Visual Representation in Twentieth-Century Science", in: Krige J. – Pestre D. (eds), *Science in the Twentieth Century* (London, New York, NY: Routledge, 2014) 361–390, at 363.

of the body, and therefore that the imagination should be able to continue to generate images. Hence, Aristotelian philosophers deemed the imagination both essential to human cognition and a potential threat to the immortality of the human soul. De Boer focuses on the highly controversial Italian philosopher Pietro Pomponazzi (1462–1525), who made the necessary dependence of human cognition on the embodied faculty of imagination the cornerstone of his attack on the possibility of immortality. According to Pomponazzi, relying on Aristotle, the human mind necessarily depends on the images provided by the imagination. Therefore, human thought without imagination is simply impossible. In his essay, De Boer examines two philosophers who responded to Pomponazzi's position: Agostino Nifo (c. 1470–1538) and Francisco Suárez (1548–1617). He argues that their rebuttals of Pomponazzi made it clear that the imagination cannot function as the link between embodied sensation and disembodied intellection—and that, in the long run, dualism and materialism would emerge as the only remaining plausible alternatives to the Aristotelian hylomorphic view of the relation between soul and body.

In the secondary literature (especially in the field of philosophy), the concept of imagination is generally discussed in relation to psychological theories of (internal) sensation and cognition. *Barbara Obrist* demonstrates that imagination played an important role in another context as well—namely, in astronomy. Her essay offers an overview of twelfth-century cosmographical and astronomical documents that refer to the imagination and to imaginary geometrical models of the spherical universe. Several of these texts also contain actual figures of previously described imaginary representations of the universe, thus enhancing our understanding of the transition from imaginary to actual, material figures. Obrist makes clear, on the one hand, that it is difficult to determine whether textual descriptions of the structure of the universe rely on actually observed three-dimensional figures (in particular, the so-called 'armillary sphere') or whether they are merely based on imaginary (memorized) representations. On the other hand, she demonstrates that, in all documents examined, the epistemic function of the actual three-dimensional figure is that of an illustration.

A number of the essays in this volume address figuration—up to and including of the workings of the imagination itself. Giving pictorial form to the imagination requires, first and foremost, commitment to a specific conception of the workings of the faculty. A number of sixteenth-century authors and practitioners advanced conceptions of the imagination in pictorial form and, by so doing, weighed in on the role of the imagination vis-à-vis the visual arts. Sixteenth-century Italian artistic practice and theory was, as several chapters in this volume emphasize, rife with considerations on the role and limits of

the imagination. *David Zagoury* traces the art theoretical term '*ingegno*' in the Florentine art world, the birthplace of Renaissance and early modern art, and in particular in the writings of Benedetto Varchi (1503–1565), a philosopher deeply engaged in Florentine cultural debates. A cognate of genius, *ingegno* was understood as a cognitive ability, and thereby related to imagination. As Zagoury shows in the course of a micro-historical analysis of events that took place over several weeks in 1547 and in which Varchi plays the central role, *ingegno*, a natural or inborn ability, was contrasted with '*fatica*' or physical labour, and the role of each in artistic production carefully weighed and judged. That these theoretical considerations were germane to artistic practice Zagoury demonstrates by way of an ingenious interpretation of a painting by the biographer and artist Giorgio Vasari of *The Forge of Vulcan*. This allegorical work, devised by Vincenzo Borghini (1515–1580), translates the tale of Thetis, Achilles's mother, commissioning a shield from Vulcan into an encounter between Minerva and Vulcan that embodies the dynamic relationship between *ingegno* and *fatica*. Zagoury thus ably shows that *ingegno* was a key concept in art, poetry, and academic discussions of the time and links it to conceptions of the imagination and to the valuation of the figure who towered over all of these domains, Michelangelo Buonarroti.

*Leen Spruit's* essay discusses one of the most prominent sixteenth-century *novatores*, Bernardino Telesio (1509–1588). In his *De rerum natura iuxta propria principia* Telesio broke with Aristotle and developed his own account of nature. While Sander de Boer focuses on authors working within the (dominant) Aristotelian psychological framework, Spruit demonstrates that in Telesio's new theory the imagination is deprived of its pivotal place. Contrary to most Aristotelians, Telesio no longer saw the imagination as a faculty that mediates between the (external) senses and the intellect, and attributed all psychological activity to 'spirit' (*spiritus*), a hot, subtle, corporeal substance common to man and animal. Telesio considered sense perception the most important cognitive function, superior to both imagination and intellectual knowledge. For him the imagination is just a capability of the 'spirit' that constitutes the human soul. Like all operations of the spirit, the workings of the imagination are grounded in the physiological structure of the organism (human or animal) and do not imply internal representations or mental images. Perception, imagination, and cognition are the result of the spirit's active response to alterations caused in the physiological structure of the organism by external stimuli.

The concept of 'spirit' also plays an important role in the essay by *Sergius Kodera*. Kodera examines one of the most prominent representatives of natural magic in the late sixteenth and early seventeenth century: Giovan Battista

Della Porta (1535–1615). In addition to writing about natural magic, Della Porta also developed a practice of natural magic, the main goal of which was to stimulate and transform the imagination of his audiences. His approach was thus not primarily theoretical (in fact, his works lack a systematic or explicit theory of the imagination) but was geared towards manipulation: Della Porta aimed at exploiting the occult and marvelous powers of the human imagination. He did so against the background of Marsilio Ficino's psychological theories, according to which *imaginatio* is the soul's primary means of communication with the body. Both Ficino and Della Porta held that images produced by the imagination are made of 'spirit', but Della Porta places greater emphasis on the material aspects of 'spirit'. In his view, 'spirit' is a powerful material 'essence' that a trained practitioner of natural magic can extract by means of distillation from almost any substance. For Ficino *imaginatio* is a faculty capable of transmitting the *figura* of an object; its main function is to represent objects. Della Porta, on the other hand, stresses the idea that the *imaginationem* cannot be abstracted from the matter of the object it represents. He describes the *imaginamentum* as a subtle body that embodies the material qualities of things. In a way, it is for Della Porta a subtle but material essence of the thing itself rather than a formal recreation of a sense impression. The body plays a causal role in the formation of *imaginamenta* just as, conversely, *imaginamenta* have the power of transforming not only the soul but also the body.

The Netherlandish author and artist Karel van Mander translated Italian art theory into a northern idiom in his 1604 *Schilder-Boeck*, the first comprehensive history and theory of northern art and a volume of enormous cultural historical significance. In her essay, *Christine Göttler* examines Van Mander's preoccupation, as expressed in his writing and in an extraordinary drawing coeval with the *Schilder-Boeck*, with Morpheus, the god of dreams. Morpheus, the best-known child of Somnus, god of sleep, had already been described by Ovid as a 'craftsman and simulator of (human) form', able to produce in the body, by virtue of the imagination, dream images. The unusual imagery Van Mander evokes in his drawing links his artistic practice with contemporary reflections on artistic imagination and embodies his own written considerations on what was involved in artistic invention '*uyt zijn selven*' or '*uyt den gheest*'. Dream imagery was understood as the product of the imagination and Göttler shows, subtly, that Van Mander's notion of painterly spirit ('*schilder-gheest*') was rooted in a conception of the creative process being located at the boundary between visible, imagined, and dreamt worlds. Göttler considers these realms—the domains of Domogorgon, Chaos, Somnus, and related gods—in light of wider interest in theories of artistic fabrication, while demonstrating that the 1601 drawing by Van Mander ably embodies a profound conception of the workings of the artistic imagination.

In their essay, *Ralph Dekoninck, Agnès Guiderdoni, and Aline Smeesters* present and analyse a fascinating volume attributed to the *pictor doctus* Otto Vaenius (Otto van Veen, 1556–1629), *Physicae et theologicae conclusiones* of 1621. Best-known as teacher of the young Rubens, the Dutch-born Vaenius was a widely respected humanist and published emblemist in addition to being affiliated with the Habsburg court at Brussels. The *Conclusiones* is nominally a treatise on free will and predestination but, as Dekoninck, Guiderdoni, and Smeesters show, it is underpinned by an original conception of the human imagination. That such a treatise would contain an explication of the power and products of the imagination is perhaps as surprising as the fact that the illustrations, all presumably designed by Vaenius, are mathematical figures, or diagrams. Imagination, Vaenius argues, is a real being, ‘consisting of a body, a spirit, and a soul’, and man, through his imagination, creates real beings. This essay situates the remarkable agency Vaenius attributes to the imagination in the context of contemporary practices and theories and demonstrates the risks that Vaenius and the chemist Jan Baptist van Helmont (1580–1644) ran vis-à-vis church authority; that Vaenius extended and expanded on the theory propounded by the professor of medicine Thomas Fienus (1567–1631); and that Vaenius’s notions bear comparison with late sixteenth-century art theory and conceptions of *disegno*. In this regard, Dekoninck, Guiderdoni, and Smeesters’s essay relates to both Zagoury’s and Göttler’s observations on the centrality of the imagination to art theory and practice. Indeed, the essay on Vaenius concludes with an insightful analysis of an emblem (and the preparatory drawing for it) published in Vaenius’s 1607 *Emblemata Horatiana*, whereby Dekoninck, Guiderdoni, and Smeesters demonstrate that the emblem takes up Horace’s suggestions regarding the power of the imagination and reframes them in light of Vaenius’s adherence to alchemical theory and an investment in the freedom of the artist alike. That Vaenius configured an allegorical image in accordance with his working conception of the imagination makes sense, as the authors demonstrate, given the context in which he worked. The geometrical diagrams by which he elucidated his conception in the *Conclusiones* point unequivocally in the direction of later developments, however.

What kind of imagination is involved in doing mathematics, notably in solving a geometrical task? That the answers to this question varied widely over time is well known, but in his essay, *Guy Claessens* demonstrates the surprising heterogeneity even among such a narrow group as early-modern Italian defenders of the certainty of mathematics. At one extreme, the Jesuit Giuseppe Biancani (1566–1624) mistook Aristotle’s question, ‘How is it that a child can be a mathematician, but cannot be a wise man or a natural philosopher’ for an attack on mathematics, based on the assumption that mathematicians, like children, rely heavily on the imagination. In his odd answer to the alleged

reproach, Bianciani connects *imaginatio* not to Aristotle's φαντασία (*phantasia*), but to a particular interpretation of Plato's εἰκασία (*eikasía*), which he moreover rejects. Bianciani concludes that imagination is utterly unrelated to mathematics, the latter being essentially discursive. Albeit relying mostly on the same authorities, the Pisan professor Jacopo Mazzoni (1548–1598) reached a very different conclusion. A comparison between Aristotelian and Platonic philosophy had convinced Mazzoni that 'imagination is not a different disposition from discursive thought, since both arrive at their conclusions by means of a mathematical object'. According to Mazzoni, a proper demonstration proceeds discursively, but by means of mathematical objects (*per mathemata*).

The topic of the subsequent essay, by *Christoph Lüthy*, is tangentially related to that of Claessens. It analyses the role that mathematical ratios, real or pseudo-diagrammatic images, and the presumed connection between musical intervals and astronomical magnitudes played in the controversy between Johannes Kepler (1571–1630) and Robert Fludd (1574–1637). Kepler, the imperial astronomer, and Fludd, the Rosicrucian doctor, shared the conviction that the organization of the cosmos was related to musical ratios, but they disagreed violently over the application of these ratios to physical space, and over the status of their respective visual 'demonstrations'. Images and imagination became central topics in the controversy, which revolved around the antagonists' diametrically opposed notions regarding the limitations of God's mathematical mind; the evidence furnished by the human imagination; and the relation between astronomical data-collecting and aprioristic understanding. In the course of the debate, Kepler tried to establish his intellectual superiority through his 'diagrams', which he pitted against Fludd's (mere) 'paintings'. Not only did Kepler's diagrams fail to persuade Fludd but, as it turns out, Kepler stretched the original meaning of the diagram beyond Euclidean rigor, smuggling in presuppositions that do not pertain to mathematical diagrams.

*Dennis Sepper* offers an analysis of the role attributed to imagination by two founding figures of Western philosophy, Aristotle for ancient and medieval thought, and Descartes for modern philosophy. The Aristotelian model is progressive: motion in sensation continues in the body and produces similar appearances anew in the *phantasia*, enabling purposive behaviour. While animals also possess imagination, only humans use its ingredients, the *phantasmata*, for higher abstraction and for thinking and reasoning. Sepper closely examines how these *phantasmata* work within the Aristotelian economy of the human psyche. It is interesting in the light of the essays by Claessens and Lüthy to note that because of the role of imagination in mathematics, Descartes was convinced from early on that imagining could be practiced, improved, and made methodical; this conviction lies behind



his early *Regulae ad directionem ingenii*. From the 1630s onwards, the mental manipulation of geometrical forms became ever more a model for thinking about the physical world, namely in terms of moving particles possessing merely geometrical extension (*res extensa*). At the end of his life, Descartes attributed to imagination yet another role: first and foremost an act of the will, it could therefore be connected to the practical, ethical, and political dimensions of human life.

This volume concludes with a contribution by *Sybille Krämer*, which examines the way in which schematization, imagination, and intuition are related in Immanuel Kant's mature writings. Commentators have often been taken aback by Kant's assertion that philosophy proceeds discursively and on the basis of deductive reasoning, but that mathematics proceeds intuitively and on the basis of 'pure intuition'. How could intuition—so the objection goes—produce necessarily deductive mathematical truths? Krämer tries to respond to that objection through a 'diagrammatological interpretation' of Kant's claim. There exists, she maintains, for Kant a type of non-empirical form of intuition that is an abstraction from a specifically mathematical form of figuration. The key text is the chapter of the *Critique of Pure Reason* on the 'Schematism of the Pure Concepts of Understanding', which explains how 'conception' (which is about the general) and 'intuition' (which is about the particular) can be conjoined by the mediation of the 'transcendental schema', which is a 'product of the imagination'. The synthetic function of imagination (or *Einbildungskraft*) which is active in the schematism makes it possible to match up (i) empirical concepts, (ii) mathematical concepts, and (iii) concepts of pure reason with images, in a dynamic process that applies an operational rule to the concept at hand. When geometers imagine a triangle, they mentally construct it: they produce 'a priori the intuition corresponding to it'. With his combination of empirical, but rule-guided construction and a priori necessity, Kant is found to be an heir to a Euclidean understanding of geometry as a non-empirical science that involves rules for the graphic embodiment of forms through points, lines, and planes. Krämer's essay not only suitably rounds off a volume that examines early modern notions of image, imagination, and cognition, but it also adds a further twist to the question, also addressed in the essays by Claessens and Lüthy, regarding the connection between imagination, geometrical figuration, and proof.

This volume is the final byproduct of two projects. The first was *From Natural Philosophy to Science*, which was funded by the *European Science Foundation* (ESF) and hosted between 2003 and 2007 by the Center for the History of Philosophy and Science at Radboud University, Nijmegen (The Netherlands).

The aim of that project was to investigate the emergence of the modern natural scientific disciplines out of the shared context of natural philosophy, and the concomitant fragmentation of the notion of knowledge. All four working groups addressed, in one way or another, the question of the relation of knowledge to the structure of reality, on the one hand, and to the structure of the human mind, on the other. Working group 1 (led by Sophie Roux) addressed the emerging understanding of the world as a machine and the imaginary structures that were postulated to explain it. Group 2 (led by Henrik Lagerlund) studied the evolving ideas of mind in its relation to the body and to its cognitive faculties. Group 3 (led by Frans de Haas) investigated the evolution of the logical and methodological structures of theory formation; and Group 4 (led by Sachiko Kusakawa) examined the contexts of natural philosophy, with a focus on the role of the visual in the presentation, memorization, and transmission of knowledge.

The second project the present volume caps was *Visualizing the Invisible: Representations of Matter and Motion since the Renaissance*. This research project, funded between 2005 and 2010 by the Netherlands Organization for Scientific Research (NWO), investigated the logic and function of historical scientific (or ‘epistemic’) images, and specifically the evolution and taxonomy of chemical and physical diagrams, images, and emblems from the sixteenth through the eighteenth century. It concluded in November 2012 with a conference entitled *Image, Imagination and Cognition: Early Modern Theory and Practice*, generously hosted by the Netherlands Institute for Advanced Studies (NIAS). That conference formed the basis for the present collection of essays.

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