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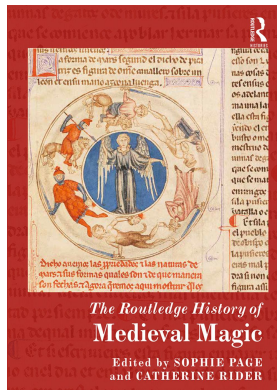
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THE NOTION OF PROPERTIES

Tensions between *Scientia* and *Ars* in medieval natural philosophy and magic

Isabelle Draelants

This chapter looks at a central notion used in medieval natural philosophy and magic: the properties of creatures and substances, called *proprietas*, *vis*, *virtus* (or *virtus specifica*), *qualitas* or even *natura*. The importance of this concept comes from its use both in traditional Western thought, in order to define the nature of a thing or physical action, and in Arabic medicine, as an essential concept to explain a transformation or an effect. The first half of the thirteenth century was the time when these disciplines came together most intensely, because it was the period when we see the assimilation of Aristotle's natural philosophy and its commentators, and of the works of Arab physicians and philosophers which had been translated into Latin during the last hundred and fifty years. We also see in thirteenth-century scholasticism a growing curiosity about nature and about the science of the soul's faculties ("psychology", coming from the *De anima* of Aristotle), and a growing importance given to causation, all of which enhanced considerably theories of knowledge and the study of perceptions and sensations. In this period, the comprehensive notion of *natural property* served equally to describe and define nature for educational purposes, and to explain natural or magical properties for therapeutic or prophylactic purposes. Therefore, it helps us to address the intellectual context of the birth of natural magic in medieval Europe as a peripheral branch of natural philosophy.

The concepts of *proprietas* and *virtus* were the basis of the traditional study of *De rerum natura* (The Nature of Things) in the West. Medieval scholars read and interpreted the natural features of a body or a creature in terms of properties that allowed them to define it unequivocally. In the early thirteenth century, various explanatory traditions relating to physical dynamics in the world were connected under a common term, "property": 1. The concept of the "property and nature of things" that underlay the traditional description of the universe, 2. The description of a sensible effect (i.e. one that could be seen or felt) of a transformation in the physical world, following Aristotelian physics. 3. A therapeutic operation, according to Arabic medicine, 4. The virtue of magical action. The notion of natural *proprietas/virtus* was particularly convenient for learned medieval thought, which was increasingly interested in causality and sensation, and it seemed, therefore, that it would play a central role in medieval physics. However, in its relationship with magic, the notion of properties did not have the expected epistemological success, for reasons that are partly due to competition between classifications coming from the various inherited sciences. Indeed,

the various traditions (Latin, Greek, Arabic) for classifying knowledge did not find a durable way to coexist in the West, at this time. First, medicine was attempting to gain a more important place as an intermediary between art and science, and second, the theoretical branches of natural philosophy were coming to be defined according to the Aristotelian books on nature.

Amid these epistemological developments, “natural magic” was a paradox that struggled to find its place in the West: in both a theoretical and practical sense, it also sought to marry the natural and the extraordinary, while at the same time avoiding the trap of superstition. Over the following centuries, as religious orthodoxy became increasingly defined, and scholarly disciplines increasingly professionalized, the “naturalistic bet” of natural magic was not won, although there were still numerous attempts to legitimize it during the Renaissance.

This chapter seeks to clarify the meaning of “natural magic” by focusing on the notion of the natural property in the thirteenth century, and examining the significant intellectual traditions and textual sources at this crucial moment in medieval thought. The chapter is divided into five parts: the first part examines the areas where the concept of *property* was applied; the second recalls the legacies and origins of this concept; the third is about the diverse vocabulary of medieval magic; the fourth argues that *nigromancy* was accepted as the *science of properties* and the final part examines attempts to theorize this science. The chapter concludes with some new research directions that could fruitfully develop from the current state of research.

Proprietas, vis/virtus, natura: the ubiquity of the notion of property in medieval natura rerum literature

Traditionally, the term “nature”, for a thing, covers its essence, that is the set of constant and universal characteristics that distinguishes it from other things and enables it to be defined. Philosophically, the form of a living being becomes approximately identified with its nature (*physis*) in its etiological and essential characterization. As for the *properties* of a living thing, they represent its internal and external characteristics that allow us to describe it as belonging to a given species, but also to explain how it can be the origin of a transformation, called *operatio* in medieval treatises.

In the Middle Ages, the quest for the nature of things and the conception of their properties was rooted in the long literary tradition of the Latin *Natura rerum* literature (for example, Varro, first century AD), and more distantly in the collections of *physika* and *paradoxa* in Hellenistic literature. In the twelfth century, the exegetical, tropological tradition, which was based on seeing the constant correspondences between things in the lower world as a reflection of the divine one, greatly influenced by Augustine of Hippo, was merged with a new philosophical conception influenced by Aristotelianism and the humoral theory of Galenic medicine. *Physis* then came to be seen as a reality apprehensible by the senses (*a sensu*), and physical transformations were explained by the four fundamental elements (earth, water, fire and air). Indeed, the craze for texts on *natura rerum* increased at the beginning of the thirteenth century, under the influence of two related factors: a new interest in nature for its own sake, and an explosion of the former *quadriivium*, now widened to “natural philosophy”, thanks to the translations of philosophical and medical texts from Arabic and Greek made during the twelfth century.

In the thirteenth century, the literature on nature and on the properties of things provided an encyclopaedic description of the world, using the new concepts of *materia* and *forma*, and

organizing reality according to the four sublunary elements. This approach competed with the previous naturalistic discourse that was built according to the sequence of the *Hexaemeron* and described biblical realities.¹ An excellent example of this new literature is the prologue of the *De proprietatibus rerum* (1230–40) of the Franciscan Bartholomeus Anglicus.² All these medieval works on nature divided up reality into short descriptive notes that tried to understand the essence of every thing according to a number of properties or, ideally, a unique, symbolic property. This univocity is more convenient for allegorical thought, as every thing could play the role of a symbol, following the example of the *Physiologus'* animal sections.

At the same time, in the natural philosophy of the thirteenth century, in Latin and in Hebrew,³ every compound sublunary body, whether it is mineral, vegetal or animal, was constituted of elements and primary qualities which together made up its *complexion*. This concept of *complexion* was well understood only after the translation from Arabic, in c. 1230, of the Aristotelian work *De generatione et corruptione*.⁴ As a consequence, whether in the field of physics, medicine, physiology, zoology or alchemy, the cause of a transformation was explained by the effect resulting from the property of the body at the origin of this action.

The lapidaries are another rich scholarly literature describing natural properties. Often incorporated into natural history, *summae*, or *pharmacopoeias*, some “scientific” or “philosophical” lapidaries aimed at describing and classifying the mineral realm and at explaining its chemical transformations and therapeutic applications. Most often, they took their main inspiration from the fifth book of the Greek herbal of Dioscorides (which had undergone several revisions in Greek, and then in Latin, before the twelfth century), and from Book 16 of Isidore of Seville’s *Etymologiae*, which classifies stones by colours and has as its main source Book 37 of Pliny’s *Naturalis historia*. Another ancient source was the syncretic Greek–Latin Damigeron–Evax lapidary. We tend to think that all these sources were gathered together in the environment of Montecassino c. 1100, along with some of the first Arabic contributions that emphasized celestial influences such as the *Liber de gradibus*, the *Practica Pantegni* of Constantine the African and the *De physicis ligaturis* of Qustā ibn Luqā.⁵ Written at the end of the eleventh century, the poem *Liber lapidum* by the bishop of Rennes, Marbode, remained the most significant testimony of this kind of *philosophical* lapidary until the remarkable rise of encyclopaedic lapidaries between 1220 and 1260. The *De mineralibus* (1250–63) of the Dominican Albertus Magnus offers, in this regard, a textbook example, accumulating all previous knowledge on the subject.⁶ Like the encyclopaedic lapidary of Arnoldus Saxo (c. 1230–45), which is the main source of the second and third *tractatus* of Albertus’s Book 2, it also integrates lapidaries that deal with astrological seals, and these show clear antique and Eastern influence. The most famous of these astrological lapidaries is the work of the Jew Zael, known under the name of Thetel’s *De sigillis* in the versions transmitted by Arnoldus Saxo and by Thomas of Cantimpré’s *De natura rerum* (and consequently by Konrad von Megenberg and Camille Leonardi). In these astrological lapidaries, the physical, medicinal and magical virtues of the stones are connected to a “seal” which is engraved, and which is supposed to strengthen the stone’s basic virtue by making a connection to the celestial power (*virtus celestis*). To this category of astrological lapidaries, we can add “magical” lapidaries, where stones are treated as talismans that should be worn in order to benefit from their powers, and sometimes consecrated with incantations as well. The mineral section of the *Kyranides* collection,⁷ first written in Greek in the Alexandrine period and attributed to Hermes-Harpocraton, and then translated into Latin c. 1168–69, is an example with which we may compare the later pseudo-Albertinian *De virtutibus herbarum, plantarum et animalium*, probably compiled c. 1240. The latter constituted the first part of the

so-called *Liber aggregationis*, an extremely famous collection of texts of natural magic, which was printed more than 300 times during the next two centuries, despite the fact that only a few manuscript copies are preserved.⁸

In the middle of the thirteenth century, the border was thin and sometimes invisible, between the diverse types of literature on the properties of stones. They merge together in Book 3 of Albertus Magnus' *De mineralibus*, as is shown by the following excerpt, which emphasizes the value of nigromancy as the science of natural, astrological and magical properties. This passage appears in the book dedicated to astrological seals that are supposed to strengthen the intrinsic virtue of the stone:

After that, it is necessary to speak about lapidary images and seals: although this section is a part of *nigromancy*, according to this sort of *nigromancy* which is subordinated to astronomy, and that we say concerns images and seals. However, because of the quality of this knowledge, and because our companions wish to learn it from us, reckoning as completely unfulfilled and false whatever we can find written about that by numerous [authors], we shall say something about it here. Because few know the writing of the ancient wise men concerning lapidary seals, and it cannot be known, unless one knows at the same time, astronomy, and magic things, and the *necromantic* sciences. [...].⁹

Apart from the *De virtutibus lapidum* and the *De virtute universali* of Arnoldus Saxo, there is no doubt that one source in particular influenced Albert in his conception of how the lapidary virtue was connected with the celestial virtue: the letter *De physicis ligaturis* or *Epistola de incantationibus* of the Arabic mathematician and astronomer Qûstā ibn Luqā (830–910),¹⁰ an author that Albertus confuses with Constantine the African,¹¹ as does Roger Bacon. This treatise is dedicated to talismans and ligatures, i.e. amulets made from natural substances, which are to be carried in order to achieve a therapeutic effect. Qûstā ibn Luqā, who used a Syriac or Arabic version of the pseudo-Aristotelian lapidary, considers that stones and animal substances worn as amulets act by means of an *occult property* that he does not want to conflate with their nature: “Ego quoque in multis antiquorum libris legi, suspensa collo suffragari *occulta proprietate*, non sua natura”.¹² Certain causes of physical movement, or actions (*operationes*) or properties generated by certain bodies have effects that can be observed by experience, that is to say, by perception using the five senses. This effect is expressed in Qûstā ibn Luqā's final words, after mentioning magnetic attraction and the inflammability of saltpetre:

All of which things, if not seen, we do not believe, yet if they are tested [*tentata*], they are confirmed [*certificantur*]; and perhaps the sayings of the Ancients are to be considered the same way. The action of these things is therefore of the order of properties and not of reasoning [enim *actio ex proprietate* est non *rationibus*]: this is why it cannot be understood by this pathway. Indeed, reasoning leads to understanding only of what is accessible to the senses. Certain substances therefore sometimes have a property that cannot be understood by reason because of its subtlety, providing nothing to the senses because of its great elevation.¹³

The physician Arnau of Villanova would later attach great importance to this opuscle in his own treatise against nigromancy, *Epistola de reprobacione nigromantice fictionis*.¹⁴

The concept of natural properties: legacies from Hellenistic, Hermetic and Arabic thought

In naturalistic, medical and more particularly pharmacological Arabic literature relating to properties, the notion of *khawāṣṣ* (Pl. of *khāṣṣa*, فصوص) dominates. This notion continues the Hellenistic neo-Pythagorean tradition of the Φυσικα developed in Egypt and Syria. It expresses the specific quality that characterises a compound natural body, that is to say a specific property (*mujarrabāt*) that allows the physical transformation defined by the medieval word *operatio*. This quality is expressed by its effect, often without the cause being detectable or demonstrable by the usual laws of natural science. In the collections of properties rooted in the Greek tradition, such as the *Kyranides*,¹⁵ the components of the mixed bodies that demonstrate these qualities are often introduced as pairs or triplets of associated qualities, linked by correspondences or mysterious sympathies. A Latin version of Ibn al-Jazzār's (d. 1004) *Kitāb al-Khawāṣṣ*, entitled the *De proprietatibus*, also survives, and this text became the main source of *The Book of the Marvels of the World* (*De mirabilibus mundi*), a work claiming to pertain to natural magic which was sometimes attributed to Albertus Magnus.¹⁶ Abū l-'Alā' Zuhri ibn 'Abd al-Malik (d. 1131), a Cordovan physician, wrote another book on occult sympathies, classifying numerous qualities in alphabetical order, illustrated with quotations from Hermes, Razi, Aristotle, Pythagoras, Serapio, Johannes Mesue, Galen, Dioscorides and other Persian and Roman authors; there is some evidence to suggest that the contents of this book were also transmitted in Latin.

The basis of a substance's *khawāṣṣ* is the mixture of the primary qualities of the four elements (air, fire, water, earth) in proportions which are determined during the composition of a natural body. This corresponds with the teaching of Galenic medicine, in which the proper complexion of every body is determined by medical tradition, but the way in which the primary qualities are compounded is nevertheless not enough to explain the operations that result from the constitutions of certain compound bodies, which are owed to their *specific form*. The specific form constitutes the fourth and last kind of quality that Arabic physicians employed to characterize a medicinal action. The action (*operatio*) of the specific form is an "added value" that can only be determined by experience. Avicenna, in his *Canon*, delivered the most precise definition of the specific virtue emanating from a substance taken in its entirety (i.e. linked to the substantial form), in order to complement Galenic complexion theory.

In formulating a theory of compound medicines, Avicenna established the essential meaning of *forma specifica* as "that by which a thing is what it is [for] when simple elements mix with one another and an individual thing is generated from them, preparation is thus made for the reception of a species and a form is added to what its simple elements possess. A specific form therefore imbued the substance with particular occult powers. This form is "not from primary qualities ... nor from the complexion generated from them, but is perfected more than acquired following the aptitude that [the form] acquired from [the matter's] complexion, as in the attractive force of a magnet."¹⁷

This Avicennian quotation appeared for the first time in Latin c. 1235, in the preface of Part 4 of Arnoldus Saxo's natural encyclopaedia, a work dedicated to the properties of the so-called "universal virtue",¹⁸ and whose matter was afterwards reused in Book 2 of Albertus Magnus' *De mineralibus*. In these works and in most others, the emblematic example of a specific virtue is the magnet's attraction to iron.¹⁹ At the end of the thirteenth century, the *virtus specifica*, connected with *tota substantia*, supported by the assimilation of

Avicenna's *Canon*, had become a causal commonplace in medicine. It was used in particular to explain the so-called "occult" action of poisons, which had been proved by experience, for example by Jean of Saint-Amand (d. 1303) in Paris; by Arnau of Villanova (d. 1311) in Montpellier; by Pietro d'Abano (d. 1316) in his *De venenis*; and also by Bernard of Gordon (d. 1320) in his *Lilium medicinae*.²⁰

In natural magic, as in other works which discussed nature, the properties called "occult", because their causes are invisible, are always considered in relationship with their actions (*operationes*). In fact, the word *occult* is related both to the nature of the object being studied and to the methods of investigation used in medieval natural science.²¹ Thomas Aquinas (c. 1225–74) traced the origin of occult properties to the heavens,²² while others attributed them to the "substantial form" of the matter itself. The latter is defined as follows by Saint Bonaventure: "The substantial form of every thing, considered in itself, is called *essence* and, is considered with regard to the operation, its *nature*."²³

In natural philosophy, the notion of the "specific property" was spread from the beginning of the thirteenth century in the West because it was a useful concept for causal explanation. It was part of a typically medieval desire to explain everything in a rational way in order to reach the universal truth and extend the boundaries of the known. It seems that the specific virtue, which was known to Arabic physicians as the "fourth virtue", was not really identified as such in the West, but it penetrated into the compilations of natural properties that linked the fields of natural philosophy and medicine to magic.²⁴ Between the Middle Ages and the Renaissance, this virtue passed from being seen as natural to supernatural. Largely illustrated by the *Speculum astronomiae*'s listing of astrological and Hermetic works (see below), the concept of *nigromancia* lays on the borders of natural philosophy; its magical part could also be considered as natural, if it did not use incantations and malefic powers. But little by little, the part of *nigromantia* which came to be defined as not natural became part of illicit occultism.

The medieval understanding and vocabulary of natural magic

The difficulty of defining "natural magic" lies especially in the evolution of intellectual categories between the Middle Ages and the present day, because the limits of and relations between science, magic and religion have changed so much that neither the retrospective vision of the *progress* of the sciences away from superstition (which is often employed in an anachronistic way by historians) nor anthropological distinctions between science and magic as formulated by modern structuralists as Marcel Mauss or Claude Lévy-Strauss are useful.

The claim of medieval magic to be considered as a natural discipline, that is one in accord with nature, also renders inadequate the current definitions of medieval magic that emphasize the use of tricks and rites to provoke extraordinary effects.²⁵ Only a precise investigation of this transitional stage in intellectual history, which seeks to define the contents and the characteristics of a *natural* discipline that acts as an intermediary between science and art(ifice) in the classification of natural philosophy, seems able to answer the following questions: Did the theoretical and philosophical texts, which some scholastic authors used to explain magical operations, give magic, in any sense, the status of a learned discipline? And for how long was it able to maintain this learned status? The discipline that scholars of the thirteenth century called the *science of properties* (see below) seems to be a valid candidate for the scholarly natural discipline that was defined as the "natural" part of nigromancy. In the thirteenth century, this discipline, which was both theoretical and practical at the same

time, not only distinguished itself from ancient necromancy (defined as divination using corpses, according to the definition infinitely repeated since Isidore of Seville)²⁶ but it also extended beyond the territory of natural magic into the pure study of nature.

In the history of scholarship on magic, Lynn Thorndike was the first, in 1923, to find an adequate way of conceptualizing the domain of natural medieval magic as *Experimental Science*, that is to say a branch of knowledge that concerned the *testing* of certain effects by the *senses*,²⁷ whose repercussions would eventually develop into modern experimentation. A discipline that focused on effective, *natural* magic was an *objective* magic, that is to say that it was intended to have an effect on objects or people other than the operator. It is also worth highlighting that the works that transmit natural magic or claim to belong to it are testimonies to a *learned discipline*, not a *popular practice*, and argued from the basis of rationality, an important justification for medieval scholars. Two central medieval criteria that define natural magic are, on the one hand, natural causality, and on the other hand, the exclusion of rites, invocations or charms aimed at devils or spiritual entities, purely deceptive illusions, and “characters”. These criteria allow us to exclude from the field of natural magic the following arts: ritual magic, the so-called “solomonic” magic, which seeks to subdue demons; “theurgic” or angelic magic, which uses sacraments to let the operator contact God through angels – like the *Ars notoria*, which aimed at mastering universal knowledge – and also the forms of magic, which seek to increase the natural, physical efficiency of an action by using talismans (astral magic) or incantations (demonic magic). As regards textual sources, natural magic has a more “native” heritage in the Latin world than Solomonian magic, which has distant Jewish roots, or than Hermetic magic. In *c.* 1255, these demarcations clearly appear the first time in an essential repertory for the knowledge of works focusing on astral sciences: the *Speculum astronomiae* (see below).

To avoid anachronism, it is important to build on key medieval concepts and terminology. Generally speaking, when talking about magic, medieval Latin authors do not use the noun *magia*, which appears only in the fifteenth century at the time of Marsilio Ficino, but rather adjectives *magica* (feminine singular or neutral, plural) or *magicalis*. Particularly in the canonical literature or the penitentials, references are made to words such as *ars magica*/*artes magicae* that emphasize processes, tricks, fabrication, and demonic intervention, which are all considered to be superstitious practices. For instance, the words of Augustine in *De doctrina christiana*, taken up by Gratian’s *Decretum*, speak of *artes magicae*²⁸ and, among the works translated from Arabic, the *De radiis* attributed to Al-Kindī – which tries to offer a universal theory of the celestial influence on *naturalia* – bears in manuscript copies the name of *Theorica artium magicarum* (the “theory of the arts of magic”).²⁹ But it was in *c.* 1230 that the bishop of Paris, William of Auvergne, first used the term *ars magica naturalis* (considered below) to refer to the knowledge of surprising natural phenomena that we can experience.

The word *prestigia*, or rather the expression *in prestigiis*, appears also to underline the prodigious illusions worked by the *magus*. It is used, for instance, in Isidore’s *Etymologiae*,³⁰ and in the prologue of Ps.-Appolonius of Tyana’s *De secretis creaturae*, which begins: *in prestigiis et prodigiorum novitate ammirandus*.³¹ It is also found in the mineralogical notes of the naturalistic compendia, which list, among others, the following property for *iscustos* in unnatural circumstances: *et prestigiis valet contra dolorem oculorum* (Arnoldus Saxo);³² or describe how it acts as a natural protection against magical illusions: *veneficiis resistit omnibus et precipue magorum prestigiis* (Thomas of Cantimpré, *Liber de naturis rerum*, 14. 40).³³

It is significant that in some theoretical and practical contexts, however, natural magic is related to *nigromancia*. This is the case, for example, in the important work of spiritual

astral magic entitled the *Picatrix*, which has roots in Harranian doctrines and dedicates a whole chapter to the question *quid sit nigromancia*.³⁴ This last term is frequently used in the thirteenth century, in the context of both natural magic and astral divination, and it is often associated with a Toledan origin,³⁵ reflecting both the origin of the translations that introduced it and the reputation of this Spanish city in the teaching of magic. Astrology and other divinatory or magical sciences may well have been the prime driving forces for the translating activity in Spain, as Charles Burnett has argued.³⁶ In this context, it is likely that the term *nigromantia* was used to describe magic in a broad sense, from the beginning of the twelfth century, by translators and scholars in touch with Arab culture, such as the Spanish Jew Petrus Alfonsi, who converted to Christianity at the very beginning of the twelfth century and lived in al-Andalus before spending some years in England as a *magister* of Arts. These translators began to use the term *nigromantia* to translate the Arabic word *sihr*, which has no real Latin equivalent. A crucial question is why this term prevailed over *prestigium* or *magica*, which were also recorded in the Latin tradition. Once again, the answer lies most likely in the fame of the Isidorian words (“νεκρόν means dead and μαντεία divination”) that were constantly reiterated. The transmission of this quotation led to a confusion between *necros* and *nigrum* to identify a sort of ancient divination through the animation of the dead or the use of the blood of dead bodies that was no longer a well-known practice at the time of Arabic–Latin translations.³⁷ The Isidorian distinction provided the word *necromancy*, inherited from the semantic field of the demonic, as the correct designation for a new multifaceted science, and was used to cover the recently translated works that did not qualify for other categories of knowledge.

***Experimenta* and the birth of *nigromancy* as the “Science of Properties” at the beginning of the thirteenth century**

In his *Disciplina clericalis* on the training of clerks, Petrus Alfonsi lists the six main liberal arts as follows: (1) dialectic (standing in for the rest of the *trivium*), and then (2) arithmetic, (3) geometry, (4) medicine (i.e. *phistica*), (5) music and (6) astronomy. But he said the following about the seventh art: “The philosophers who are adept at prophecies say that the seventh art is *nigromancia*; some of those who do not, say it is philosophy ... and those who do not study philosophy say that it is grammar.”³⁸ It can therefore be inferred that for Petrus Alfonsi philosophy stemmed from an extended *quadrivium* and that *nigromancia* became the science that headed all the subdivisions of philosophy. Petrus Alfonsi was more precise about the “art” of *nigromancia* in his *Dialogus contra Judeos*, which subdivided this science into nine sections. The first four concern the study of the four elements, characterizing the content of what became “natural magic” in the West during the thirteenth century. According to Alfonsi, the other five sections of *nigromancia* operated by means of the invocation of evil spirits. As has been shown by Charles Burnett, the division in the *Speculum astronomiae* of *nigromancia* into three disciplines – two unlawful and one permitted, “depending on whether they operate naturally” or not, was thus prefigured by Petrus Alfonsi.³⁹

In Toledo in the mid-twelfth century, Dominicus Gundisalvi, a Spanish translator of treatises on natural philosophy, adapted the classification of sciences set out by Alfarabi (d. 950). In his *De divisione philosophiae*, Gundisalvi separated *humana scientia*, or what he called “universal natural science” (*scientia naturalis universalis*) into eight parts: (1) medicine, (2) (astrological) judgements, (3) necromancy (*nigromancia*), specifying *secundum physicam* – which recalls the interpretation given by Petrus Alfonsi, (4) the science of images, that is

to say talismans or astral magic in a more general sense, (5) agriculture, (6) navigation, (7) the science of mirrors (catoptrics) and (8) alchemy.⁴⁰ Charles Burnett has shown that Gundisalvi's division was taken from the *De ortu scientiarum*, a work on the division of sciences that was adapted from an anonymous Arabic work.⁴¹ This text probably also influenced Daniel of Morley, an Englishman who said that he went to Toledo at the end of the twelfth century to observe the dynamism of the new Arabic sciences. In his *Liber de naturis inferiorum et superiorum* (between 1175 and 1187), he mentioned "those who calumniate astrology" (*astronomia*).⁴² He classifies *nigromancia* among the eight sciences that derived from astrology and benefited from it. For Daniel of Morley, in comparison with the writings of Gundisalvi, the *scientia de prestigiis* replaced navigation, and astrology took the predominant place in a universal natural science divided into the following hierarchy: (1) *scientia de iudiciis* (astrological judgements), (2) *de medicina*, (3) *de nigromancia "secundum physicam"*, (4) *de agricultura*, (5) *de prestigiis* (illusionism),⁴³ (6) *de alchimia*, (7) *de ymaginibus* (astrological images) "which the great and universal book of Venus published by Thoz Grecus transmitted," and finally (8) *de speculis*, catoptrics.

In the same vein, the translator Michael Scot uses the term *scientia de proprietatibus* as an equivalent of *nigromancia*. Both a translator of Arabic to Latin and an original author, he worked as an astrologer in Toledo and then in Sicily at the Court of Emperor Frederick II Hohenstaufen. These three features make him a close witness to the establishment of new notions coming from Arabic science. Before 1237 (the presumed year of his death), he offered a division of the sciences that only Vincent of Beauvais passed on.⁴⁴ There, he placed *nigromancia* within practical philosophy, which was not the usual position of the *quadrivium* in the tree of sciences:

Also the practical (part of) philosophy is divided into three parts, of which the first is that which was invented on the model of natural things and pertains to natural things [*ad similitudinem naturalium et quae pertinet ad naturalia*], such as medicine, agriculture, alchemy, and also the science which is concerned with the properties of things [*scientia quoque de proprietatibus rerum*], which is called *nigromancia*; but also the science concerning the significations of things, which is called the science of judgements; moreover, the sciences of optics, navigation and many other sciences which have a relation to that part of theory which is called natural [*partem Theoricae quae dicitur naturalis*], belong to it as if to its practical (part).⁴⁵

This division agreed fundamentally with what we have read in the works of Dominicus Gundisalvi and Daniel of Morley. However, it stresses three linked aspects that enrich the definition of *nigromantia*. First, the fact that all these disciplines are practical; this option for the new sciences at a time when the *quadrivium* had changed was probably influenced by the last part of the *Didascalicon* (bef. 1137) of Hugh of St. Victor, where the passage involving divination (ch. 15) makes astrology a part of the mechanical sciences, said to be *adulterine*, that copy natural reality by art or artifice.⁴⁶ Second, the fact that the disciplines formed part of *philosophia naturalis* insofar as they involved resemblances to the products of nature, *naturalia* (referred to as mixed bodies, as seen above). In the third place, the fact that as a result, *nigromancia* is par excellence the science of the properties of natural things (resulting from occult causes), referring presumably to the word *khāṣṣa*, pl. *khawāṣṣ* in Arabic. Therefore, the works compiling and listing the properties of stones, plants and animals in order to form collections of *experimenta* are part of natural science.

The Parisian bishop William of Auvergne seems to have been the first person in the West to talk of “natural magic” in the form of *ars magica naturalis*, in which he sees the *nigromancia secundum physicam* found in the writings of Gundisalvi and Daniel of Morley as part of natural science or astrology.⁴⁷ However, he says that it is wrong to describe it in this way: “the science of this kind of operation [wonders that have natural causes but that are considered by ignorant people to be the work of demons] is natural magic, that philosophers call ‘*nigromanciam* according to physics’, but in a very inappropriate manner, and that is the eleventh part of natural science.”⁴⁸ From the context, we can understand that William includes in natural philosophy magic, alchemy and the knowledge collected in the books of *experimenta*, all of which are acceptable to the Creator as they are all natural things coming from his beneficence, and because their operations have natural sources. He says something similar in his impressive *De universo* (written c. 1220, with additions until 1240), where he draws a parallel between the knowledge of how human and animal organs can be linked with “spiritual substances,” and seemingly used as amulets or talismans, and “*magica naturalis* as a part of natural science.”⁴⁹ Like Michael Scot, he associates “magic works” (*opera magica*) with “necromantic” works in his chapter devoted to the arts of illusion (*ludificationes – praestigium*) in the introduction to the third part of the second volume of *De universo*, but the part of necromancy that is related to apparitions and the summoning of demons is not considered to be natural and tends towards idolatry.⁵⁰ It should be stressed that in the same part of *De universo*, in a passage concerning *libri experimentorum* in the chapter *De tribus generibus magicorum operum, et de mirificis virtutibus quarundam rerum*, William links the notion of the art of natural magic (*ars magica naturalis*) with the natural properties of the plants listed in these books. He underlines that this art of natural magic is much practised “among the Indians,” who were to the Arabs what the Arabs were to the Europeans,⁵¹ and that the *libri naturalium narrationum* aim at explaining the causes of wonderful phenomena. In these so-called books, we may see works on *de natura rerum* and compilations *de proprietatibus*:

From all that and from similar things which can be read in the books of *experimenta*, and in many books on nature, you could in one way or another know the cause and the reasons for certain magical acts which are proper to natural magic (*ex arte magica naturali*).⁵²

Again in 2, pars 3, c. 25, 1 (col. 1060aG-H), William gives examples of natural virtues arising from the properties of natural (animal and vegetal) bodies. It therefore seems that William of Auvergne did not always draw a clear distinction between the marvellous effects of natural substances that have natural and knowable causes, and the wonders that result from vivification caused in nature by the action of a demon. He keeps the former within natural science and condemns the latter but he seems to consider that the term *nigromancia* applies to both practices.

Magic was a particularly rich discipline in the Iberian Peninsula, especially under King Alfonso X, who encouraged, from 1250 to 1260 onwards, the translation of Arabic works into the vernacular, and sometimes into Latin afterwards. Among other works, he ordered in 1256 the Castilian translation of the *Ghāyāt al-hakīm*, a work written in Arabic probably in the eleventh century, whose Latin version, retranslated from Castilian, was titled *Picatrix*. This work transmitted the idea that *nigromancia* was a science, and attributed to Thābit ibn Qurra, a Sabeian of the eleventh century, the idea that “the most noble part

of astrology is the science of (astrological) images".⁵³ The "natural" part of *nigromancia* dealing with natural properties seems then to have disappeared, in favour of the science of talismans and *prestigia*.⁵⁴ Consequently, in the *Book of Seven Parts* that bears the name of Alfonso X, there is in the seventh part a chapter devoted to the "nigromancers" (VII, title 24, law 2 and 3), giving the following definition: "*Nigromancia dicen en latin a un saber extraño que es para escantar los espiritus malos.*"⁵⁵ This knowledge became the prerogative of a few, which somehow manifests how it had failed to be recognized as an "honest" and useful science.

Towards a Western "Natural" magic: philosophical theorization and problems of orthodoxy

The thirteenth century was a period of dynamic assimilation of new knowledge coming from competing and complementary traditions that saw important strides in the classification and subdivision of the sciences. Medieval authors working at the crossroads of Jewish, Arabic and Latin influences extended the scope of nature, out of a desire to explain the transformations of the world in a rational way, and the need to make a distinction between what was lawful and what was forbidden, in order to build religious orthodoxy and draw the boundaries of superstition.⁵⁶ In the medieval debate about the interrelations of religion, science, magic and superstition, the scholastics revised the definition of superstition to include incorrect or improper Christian practice, usually on the basis of Gratian's *Decretum*. The final result was that in the late Middle Ages, Christian thinkers endorsed the thoughtful deployment of natural and divinely aided magic.

The *Speculum astronomie* attributed to Albertus Magnus illustrates plainly the rational preoccupation to list works covering "astral science" and to identify the works that were suspected of employing demonic intervention.⁵⁷ The author justifies the "naturalness" of talismans by arguing that the power that acts through them is a *natural virtue* used by man. He succeeds in rendering the science of talismans compatible with Aristotelian science and Christian rational theology, by referring to the theory of the hierarchy of causes and subtracting phenomena from the devil, while preserving free will.⁵⁸

The animation of mixed bodies must be limited to recognizing or stimulating in them the action of their specific virtue, as in encyclopaedic pharmacopoeias or lapidaries, and not, in addition, employing the calling up of demons by invocations and inscriptions. Within the broad field of scholastic natural philosophy, this limit marks the boundary of the study of *naturalia* in the "books of experiments" mentioned several times by William of Auvergne;⁵⁹ but natural properties are also described in the lists of stones, plants and animals in thirteenth-century encyclopaedias. However, this did not make them worthy of being called nigromantic works. The sources they use gather together various classical and patristic Latin authors of compilations about nature, such as Pliny the Elder, Ambrose of Milan, Isidore of Seville, but also authorities coming from late Hellenistic Antiquity, such as Hermes, Evax and Aaron, Belbetus-Bālinus (Apollonius of Tyana), Ps-Aesculapius and Thetel the Jew, all these last close enough to the ancient tradition of *physika*.

With Marsilio Ficino's translation of the *Corpus hermeticum* at the end of the fourteenth century grows a learned magic increasingly ruled by platonism and hermetism; the principle of universal animation spreads and magic is addressed as an anti-religion heresy, causing a clearer and different split from the thirteenth century.⁶⁰

Future directions

David Pingree traced the routes of the spreading of magic as an independent art, surveying the movement and transmission of magical texts.⁶¹ This initial mapping of the dissemination of magic (dealt with in more detail elsewhere in the volume) deserves to be put to the test and qualified, by an investigation dealing with the regional assimilation of the distinctive doctrinal concepts of medieval physics such as specific “force”, “property” and “form”, and “occult virtue”. Among the concepts that deserve to be explored more deeply, it seems that the shared territory and the slight differences between “universal virtue”, *virtus celestis*, and the platonic and neo-platonic doctrines of *anima mundi* should be further investigated to establish new definitions, bearing in mind both the importance of textual source transmission (Greek, Jewish and Arabic hermeticism) and all the areas in which these concepts were applied: medicine, astrology, sciences of the properties, mineralogy and talismans. It would also be useful to further explore the doctrinal connections with the theory of rays that is found in the works of Ps.-Al-Kindi, Roger Bacon or later Agrippa von Nettesheim.

Furthermore, the importance of Toledo in the philosophical Arabic–Latin translations has been thoroughly studied for the twelfth century, to the extent of being overestimated at the expense of other regions, but the map of the dissemination of knowledge through medieval translations has been extended and become far more diversified. Very recently, the scholarly gaze, criticized for being too Eurocentric, is starting to look not only at the original productions in Greek, Syriac, Arabic and Hebrew but also towards the intellectual context of the areas in which these texts were produced, and to retrieve them and assess their sources. This trend must continue and should perhaps revisit nineteenth-century orientalism, which had the advantage of considering various textual contents, without drawing an unnatural border between the various civilizations and languages that produced or received them.

To give an example that probably led to the legend of the Faustian pact, it would be worth examining in greater depth and on a comparative basis the recurring theme of the magus’ initiation, crystallized in some medieval Western tales in the form of the meeting between a member of a religious order and a Toledan necromancer which results, sometimes briefly, in an agreement giving privileged knowledge of magic. The pattern can already be identified in Syriac literature but also in the pseudo-Clementinian tradition in Ethiopian, Latin and Spanish, in the form of the teaching of magic to Īdhāshîr or Ardeshir (in the Syriac *Cave of Treasures*)⁶² or to ‘Esdzir (in the Ethiopic “Qalementos”, the seven-book Revelation of Peter to Clement).⁶³ It may be compared with the episode featuring the future pope Gerbert of Aurillac⁶⁴ (e.g. in William of Malmesbury’s *Gesta regum Anglorum*, in the *Chronicle of Pseudo-Turpin* or in Michael Scot’s *Liber introductorius*) and all its later variations (such as Salimbene de Adam’s *Chronicle*).

In medieval scholasticism, a particular science is defined by its interest in the *nature* of a being and its *properties*. The concept of property and virtue, on which we have particularly focused in this chapter, needs to be explored further as it became integrated into various philosophical disciplines in the period by focusing on a single author, and on a comparative basis by focusing on various medieval authors and various languages. In this way, the definition of property in Albertinian works on natural philosophy, such as the *De mineralibus*, *De animalibus* and *De vegetabilibus et plantis*, should be investigated in comparison with the term’s meanings in his *Logic*, a work which was strongly influenced by the grammatical legacy of Avicenna, Al-Ghazzālī and Al-Fārābī. This is shown for instance in this section of Albert’s commentary on Porphyrian *Isagogē*, dealing with the unequivocal property of “biting”:

The various names of various things are equivocal, owing to the fact that the one who imposes [these names] was influenced in instituting them, by the various *properties* of various things, like “horse” and “donkey”. [Names] are equivocal when a name was imposed on various things, but according to a diversity of definitions, owing to the fact that some unique property found in these various things, influences the ones who name them; however, this property cannot be found in them according to a single definition. For instance, “dog”: this name was imposed on [the animal] able to bark, on a celestial star, and on a sea fish because of a single property found in them, which is that all these things can bite, although they do so not according to a single definition.⁶⁵

This chronological horizontal approach will also provide a better and more detailed appreciation of the difference of the treatment of the physical concept in pseudepigraphic works attributed to a key author such as Albertus Magnus. But the concept should also be better studied in Jewish works written in the West in a key period such as these of Abraham ibn Ezra in the twelfth century:

This resemblance between living creatures is called sympathy since this matter is not more precisely understood. So things which act by their whole essence are called *segula* (propriety) by agreement, in other words this is the uniqueness of sympathy. (...) It does not matter if you call it force or propriety or similarity, since all of these refer to the notion of propriety alone. This is the view of Hippocrates and Plato and their precursors on the axiomatic statement which has no proof.⁶⁶

In the literature dealing with magic and the so-called occult sciences which derived from them in the Renaissance, emphasis has been placed chronologically on the end of Middle Ages and on humanists such as Agrippa von Nettesheim, Giordano Bruno and Marsilio Ficino. More recently, attention has focused on older authors like Arnau de Villanova, Pietro d'Abano, and Hieronymus Torrella. The defining moment of the attempt of magic to assert itself between 1230 and 1260, and the importance of the testimonies of William of Auvergne and of the *Speculum astronomiae* for the definition of it are now recognized because of the decisive works of David Pingree, Charles Burnett, Paola Zambelli, Paolo Lucentini and Vittoria Perrone-Compagni. Recent historiography has investigated further, examining accurately some short works translated between 1130 and 1230, following up and correcting some cases of attribution and authentication at the border of naturalistic knowledge,⁶⁷ examining further angelology and demonology, and developing titles and classifications suitable for medieval magic such as the concept of “addressativity” formulated by N. Weill-Parot. The remarkable progress of the *Micrologus* journal and series in dealing with natural medieval philosophy testifies to a keen interest in these fields of study. It remains, however, to explore certain aspects or authors whom the attentive interest of scholars has maybe not considered enough.

Notes

- 1 On the definition of medieval encyclopaedia, see Isabelle Draelants, “Le ‘siècle de l’encyclopédisme’: conditions et critères de définition d’un genre,” in *Encyclopédie: Formes de l’ambition encyclopédique dans l’Antiquité et au Moyen Âge*, ed. Arnaud Zucker (Turnhout: Brepols, 2013), 81–106.

- 2 Bartholomaeus Anglicus, *De proprietatibus rerum*, vol. I, *Prohemium*, ed. H. Meyer; *Libri I-IV*, ed. M.W. Twomey (book 1); B. Roling (book 2); R.J. Long (books 3–4) *De diversis artibus* 78 (Turnhout: Brepols, 2007).
- 3 The notion of *segulah* [property/virtue] is significant for the study of late medical Hebrew works, as noted by the way M. Steinschneider, giving the example of Meir Aldabi in 1360: Mauritz Steinschneider, *Zur pseudo-epigraphischen Literatur, insbesondere ueber die geheimen Wissenschaften des Mittelalters aus hebraeischen und arabischen Quellen* (Berlin: 1862), 41.
- 4 Giovanna R. Giardina, *La Chimica Fisica di Aristotele. Teoria degli elementi e delle loro proprietà. Analisi critica del De generatione et corruptione* (Roma: Aracne editrice, 2008).
- 5 The works of Qustā and Constantine were probably transmitted together when an alphabetical version of the mineralogical Book 5 of Dioscorides' lapidary was made. An alphabetical version of Dioscorides' lapidary is attributed to Constantine the African in Bamberg, Staatsbibliothek, MS Med. 6, fol. 28v–29r: *Incipit prologus sequentis libri per alphabetum transpositi secundum Constantinum*. Ed. Colle, 1478 (based on Ms. Paris, B.n.F. lat. 6820), also with Pietro d'Abano's glosses, and Lyons, 1512.
- 6 Isabelle Draelants, "La science encyclopédique des pierres au 13^e siècle: l'apogée d'une veine minéralogique," in *Aux origines de la géologie de l'Antiquité au Moyen Âge. Actes du colloque international 10–12 mars 2005, Paris Sorbonne (Paris IV)*, ed. C. Thomasset, J. Ducos, and J.-P. Chambon (Paris: Champion, 2010), 91–139.
- 7 Louis Delatte, *Textes latins et vieux français relatifs aux Cyranides* (Liège-Paris: Droz, 1942).
- 8 Ed. and study of the sources: Isabelle Draelants, *Le Liber de virtutibus herbarum, lapidum et animalium (Liber aggregationis), Un texte à succès attribué à Albert le Grand* (Florence: Sismel –Edizioni del Galluzzo, 2007).
- 9 Albertus Magnus, *De mineralibus* II, tr. 3, c. 1, ed. A. Borgnet, *Opera omnia*, V, 1895, 48b–49a.

De imaginibus autem lapidum et sigillis post haec dicendum est: licet enim pars ista sit pars *necromantiae* [mss: *nigromancia*] secundum illam speciem *necromantiae* quae astronomiae subalternatur, et quae de imaginibus et *sigillis* vocatur: tamen propter bonitatem doctrinae, et quia illud cupiunt a nobis scire nostri socii, aliquid de hoc hic dicemus, omnino imperfecta et falsa reputantes quidquid de his a multis scriptum inuenitur. Antiquorum enim sapientium scripturam de sigillis lapidum pauci sciunt, nec sciri potest nisi simul et *astronomia* et *magica* et *necromantiae scientiae* sciuntur. [...] Volo autem primo narrare quae vidi, et expertus sum ego ipse, et postea ostendere causam. [...]

- 10 Judith Wilcox and John M. Riddle, eds., "Qustā ibn Lûqā's Physical ligatures and the Recognition of the Placebo Effect," *Medieval Encounters* 1, no. 1 (1994): 1–50; Roberto Casazza, "El De physicis ligaturis de Costa ben Luca: Un tratado poco conocido sobre el uso de encantamientos y amuletos con fines terapéuticos," *Patristica et Mediaevalia* 27 (2006): 87–113.
- 11 "Costabulence" (cf. Albertus Magnus, *De mineralibus*, II, tr. 3, c. 6, *De ligaturis et suspensionibus lapidum*, in Borgnet, *Opera Omnia*, 55 and 56, where Qustā is mentioned with Hermes and Zeno from a quotation found in Arnouldus Saxo's *De virtute universali*). Cf. Isabelle Draelants, "Expérience et autorités dans la philosophie naturelle d'Albert le Grand," in *Expertus sum. L'expérience par les sens en philosophie naturelle médiévale. Actes du colloque international de Pont-à-Mousson, 5-7 février 2009*, ed. Th. Bénatouil and I. Draelants (Florence: Sismel – Edizioni del Galluzzo, 2011) 89–122, see 97.
- 12 Wilcox and Riddle, "Qustā ibn Lûqā's Physical ligatures," 34.
- 13 Wilcox and Riddle, "Qustā ibn Lûqā's Physical ligatures," 37–38.
- 14 *Arnaldi de Villanova opera medica omnia*, VII.1, *Epistola de rebroacione ficcionis (De improbatione maleficiorum)*, ed. Sebastià Giralt (Barcelona, 2006). See in particular the Commentary on occult property, 153–59.
- 15 Cf. Julius Röhr, *Der okkulte Kraftbegriff im Altertum*, Philologus, Supplementband 17,1 (Leipzig: Dieterich, 1923), 96–133, about ancient conceptions of *dynamis*, *energeia*, *praxis*, and *potentia*, *potestas*, *efficacia*, *virtus*.
- 16 I.e. the second part of the *Liber aggregationis*. ed. Antonella Sannino, *Il De mirabilibus mundi tra tradizione magica e filosofia naturale* (Florence: Sismel – Edizioni del Galluzzo, 2011), where the following manuscripts are not mentioned: Montpellier, École de médecine, H. 277, and Milano, Bibl. Ambrosiana, G. 89 sup.
- 17 See Avicenna, *Liber canonis*, I, fen 2, doct.2, Sun.1, cap. 15, éd. Lyon, 1522, f. 29v–30r. On the connections between specific qualities and the *tota substantia* made by Galen and his successors,

- see Brian P. Copenhaver, “The Occultist Tradition and its Critics,” in *The Cambridge History of Seventeenth-Century Philosophy*, vol. I, ed. Daniel Garber and Michael Ayers (Cambridge: Cambridge University Press, 1998), 454–512, esp. 459.
- 18 Isabelle Draelants, “La *virtus universalis*: un concept d’origine hermétique? Les sources d’une notion de philosophie naturelle apparentée à la forme spécifique,” in *Hermetism from Late Antiquity to Humanism. La Tradizione Ermetica dal Mondo Tardo Antico all’Umanesimo, Atti del Convegno Internazionale di Studi* (Napoli, 20–24 novembre 2001), ed. Paolo Lucentini, Ilana Parri and Vittoria Perrone Compagni (Turnhout: Brepols, 2003), 157–88.
 - 19 The *virtus occulta* is already used to mean the natural but extraordinary attractive power of a fish capable of delaying a boat in Alexander Neckam’s *De naturis rerum* (c. 1200), I, c. 43, ed. Thomas Wright (London: Longman, 1863), 156.
 - 20 For these examples, see Frederick W. Gibbs, “Specific Form and Poisonous Properties: Understanding Poison in the Fifteenth Century,” *Preternature: Critical and Historical Studies on the Preternatural* 2, no. 1 (2013): 19–46, esp. 24 and *Le poison et ses usages au Moyen Âge, Cahiers de Recherches Médiévales* 17 (2009), ed. Frank Collard, in particular the article by Joël Chandelier, 23–38.
 - 21 N. Weill-Parot has recently published on the concept of the “occult” in the Middle Ages and Renaissance. See especially, *Points aveugles de la nature. L’occulte, l’attraction magnétique et l’horreur du vide (XIII^e-milieu du XV^e siècle)*, (Paris: Les Belles Lettres, 2013), 57, about the meaning of the “specific form” and its confusion with the “substantial form”: 64 ff., “le terme *occultus* et ses emplois,” and 164 ff., “Nature et origine de la vertu magnétique.”
 - 22 On the discussion of the substantial form by Thomas Aquinas, see Paul Richard Blum, “*Qualitates occultae*: Zur philosophischen Vorgeschichte eines Schlüsselbegriffs zwischen Okkultismus und Wissenschaft,” in *Die okkulten Wissenschaften in der Renaissance*, ed. August Buck (Wiesbaden: Harrassowitz, 1992), 45–64, esp. 50–51 and Sancti Thomae de Aquino, *De operationibus occultis naturae ad quandam militem ultramontanum*, in *Opera omnia iussu Leonis XIII P. M. edita*, vol. 43: *Opuscula IV*, ed. H.F. Dondaine (Rome: Editori di San Tommaso, 1976), 159–86.
 - 23 Bonaventura, *Commentaria in quatuor libros Sententiarum Magistri Petri Lombardi*, I, dist. xxxi, pars 2, dub. 5, in *Opera omnia*, ed. studio et cura PP. Collegii S. Bonaventurae, vol. 1, 2 (Ad Claras Aquas, Quaracchi: ex typographia Collegii S. Bonaventurae, 1883), 551.
 - 24 There is a large scholarship on this. See, for example, Albert Heinekamp and Dieter Mettler, eds., *Magia naturalis und die Entstehung der modernen Naturwissenschaften, Studia Leibnitiana* 7, (Wiesbaden, 1978); Brian P. Copenhaver, “Scholastic Philosophy and Renaissance Magic in the *De vita* of Marsilio Ficino,” *Renaissance Quarterly* 37, no. 4 (1984): 523–54; John Henry, “Occult Qualities and the Experimental Philosophy: Active Principles in Pre-Newtonian Matter Theory,” *History of Science* 24 (1986): 335–81; Brian P. Copenhaver, “A Tale of Two Fishes: Magical Objects in Natural History from Antiquity through the Scientific Revolution,” *Journal of the History of Ideas* 52 (1991): 373–98; Lorraine Daston and Katherine Park, *Wonders and the Order of Nature* (New York: Zone Books, 1998); Brian P. Copenhaver, “Natural Magic, Hermeticism, and Occultism in Early Modern Science,” in *Reappraisals of the Scientific Revolution*, ed. David Lindberg and Robert Westman (Cambridge: Cambridge University Press, 1990), 261–301; Keith Hutchison, “Dormitive Virtues, Scholastic Qualities, and the New Philosophies,” *History of Science* 29 (1991): 245–78; Gundolf Keil, “*Virtus occulta*: Der Begriff des *empiricum* bei Nikolaus von Polen,” in *Die okkulten Wissenschaften in der Renaissance*, ed. August Buck (Wiesbaden: Otto Harrassowitz, 1992) 159–96; Graziella Federici Vescovini, “La concezione della *virtus occulta* nella dottrina medica di Arnaldo di Villanova e di Pietro d’Abano,” in *Ecriture et réécriture des textes philosophiques médiévaux*, ed. Jacqueline Hamesse and Olga Weijers (Turnhout: Brepols, 2006), 107–35; Sebastià Giralt, “*Proprietates*: las propiedades ocultas según Arnau de Vilanova,” *Traditio* 63 (2008): 327–60; N. Weill-Parot, “Astrology, Astral Influences and Occult Properties in the Thirteenth and Fourteenth Centuries,” *Traditio* 65 (2010): 201–30.
 - 25 Jean-Patrice Boudet, “Magie,” in *Dictionnaire du Moyen Âge*, ed. Claude Gauvard, Alain De Libera and Michel Zinck (Paris: Quadrige/PUF, 2002), 863–64.
 - 26 Isidorus Hispalensis, *Etymologiae* 8, c. 9, 2–3 and 10–11, ed. Wallace M. Lindsay (Oxford, 1911; 2nd ed., 1957). The text is almost literally the same in Isidore’s *De natura rerum*, 15, c. 4, *De magis*. On the sustained influence of this Isidorian definition, see Isabelle Draelants, “*Magica vero sub philosophia non continentur*: Statut des arts magiques et divinatoires dans les encyclopédies et leurs *autoritates*, c. 1225–1260,” in *Geomancy and Other Forms of Divination*, Micrologus’ Library 87, ed. Irene Zavattero and Alessandro Palazzo (Florence: Sismel – Edizioni del Galluzzo, 2017), 463–518.

- 27 Lynn Thorndike, *A History of Magic and Experimental Science*, vol. 2 (New York: Columbia University Press, 1923).
- 28 Gratianus, *Decretum*, Pars 1, causa 26, qu. 2, in *Corpus Iuris Canonici*, vol. 1, ed. E. Friedberg (Leipzig, 1879, repr. Graz, 1959).
- 29 Al-kindī, *De radiis*, ed. Marie-Thérèse d'Alverny and Françoise Hudry, *Archives d'histoire doctrinale et littéraire du Moyen Âge* 41 (1974): 139–260; Pina Travaglia, *Magic, Causality and Intentionality: The Doctrine of Rays in al-Kīndī*, (Florence: Sismel – Edizioni del Galluzzo, 1999). Transl. (French) *Al-Kīndī, De radiis*, traduction, commentaire et notes par Didier Ottaviani (Paris: Allia, 2003).
- 30 Isidore, *Etymologiae* 8. 9, § 3 (borrowed as well by *Decretum*, Pars 1, causa 26):

Apud Assyrios autem *magicae artes* copiosae sunt testante Lucano: Quis noscere fibra facta queat, quis prodat aves, quis fulgura caeli servet, et Assyria scrutetur sidera cura? Itaque haec vanitas *magicarum artium* ex traditione angelorum malorum in toto terrarum orbe plurimis saeculis valuit. Per quamdam scientiam futurorum et infernorum et vocationes eorum inventa sunt aruspicia, augurationes, et ipsa quae dicuntur oracula et *necromantia*. Nec mirum de *magorum praestigiis*, quorum in tantum prodire *maleficiorum artes* ut etiam Moysi simillimis signis resisterent, vertentes virgas in dracones, aquas in sanguinem.

- 31 Ed. Françoise Hudry, “Le *De secretis nature* du pseudo-Apollonius de Tyane, traduction latine par Hugues de Santalla du *Kitāb sirr al-halīqa* de Balinus,” *Chrysopoiea* 6 (1997–1999): 1–153.
- 32 Arnoldus Saxo, *De virtutibus lapidum*, in an enlarged manuscript copy of Ms. Heidelberg, Pal. germ. 263, fol. 165r.
- 33 Thomas Cantimpratensis, *Liber de natura rerum, Teil I: Texte*, ed. Helmut Boese (Berlin and New York: De Gruyter, 1973), 363.
- 34 *Picatrix. The Latin Version of the Ghāyat Al-Hakīm. Text, Introduction, Appendices, Indices*, ed. David Pingree (London: Warburg Institute, 1986). See also Vittoria Perrone Compagni, “*Picatrix latinus*. Concezioni filosofico-religiose e prassi magica,” *Medioevo* 1 (1975): 237–70; *Images et magie: Picatrix entre Orient et Occident*, ed. Jean-Patrice Boudet, A. Caiozzo, Nicolas Weill-Parot in *Sciences, Techniques et Civilisations du Moyen Âge à l'aube des Lumières*, ed. D. Jacquart and Cl. Thomasset (Paris: Champion, 2011).
- 35 E.g. in the works of Anglo-Norman Benedictine William of Malmesbury c. 1120, *Gesta rerum Anglorum*, vol. 1, II, 168, 3, ed. and trans. R.A.B. Mynors (Oxford: Clarendon Press, 1969), 284, and N. Bubnov, *Gerberti Opera mathematica (972–1003)*, (Berlin, 1899), 386–88); by Henry of Andeli, before 1229, in the satirical work *Bataille des sept ars*, ed. Alain Corbellari, *Les Dits d'Henri d'Andeli*, Les classiques français du Moyen Âge 146, (Paris: Champion, 2004).
- 36 Charles Burnett, “Astrology, Astronomy and Magic as the Motivation for the Scientific Renaissance of the Twelfth Century,” in *The Imaginal Cosmos: Astrology, Divination, and the Sacred*, ed. Angela Voss and Jean Hinson Lall (Canterbury: University of Kent Press, 2007), 55–61.
- 37 E.g. Thomas Aquinas, *Summa theologiae* 2–2, qu. 95, art. 3, corpus. Literally translated by the Fathers of the English Dominican Province (London, 2nd and revised ed., 1920):

When demons are expressly invoked, they are wont to foretell the future in many ways. Sometimes they offer themselves to human sight and hearing by mock apparitions in order to foretell the future: and this species is called ‘prestigiatio’ because man’s eyes are blindfolded [*praestringuntur*]. Sometimes they make use of dreams, and this is called ‘divination by dreams’: sometimes they employ apparitions or utterances of the dead, and this species is called ‘necromancy,’ [*nigromancia*] for as Isidore [*Isidorus ... in libro etymol.*] observes in Greek, νεκρόν [*nigrum*] “means dead and μαντεία divination, because after certain incantations [*praecantationibus*] and the sprinkling of blood, the dead seem to come to life, to divine and to answer questions. Sometimes they foretell the future through living men, as in the case of those who are possessed: ... Sometimes they foretell the future by means of shapes or signs which appear in inanimate beings.

- 38 Petrus Alfonsi, *Disciplina clericalis*, ed. Alfons Hilka and Werner Söderhjelm, I, *Lateinischer Text*, Acta societatis scientiarum Fennicae 38.4, (Helsinki, 1911), 10; on Petrus Alfonsi and *necromancy*, see Burnett, “Talismans: Magic as Science? Necromancy among the Seven Liberal Arts,” art. I in in Charles Burnett, *Magic and Divination in the Middle Ages* (Aldershot: Ashgate, 1996).
- 39 Burnett, “Talismans: Magic as Science,” 4–5.

- 40 Dominicus Gundissalinus, *De divisione philosophiae*, ed. Ludwig Baur, *Beiträge zur Geschichte der Philosophie des Mittelalters* 4, 2–3 (Münster i. W.: Aschendorff, 1903), 20.
- 41 Burnett, “Talismsans: Magic as Science,” 2. On the influence of the eight species of natural science in *De ortu scientiarum* on the thought of Gundisalvi: “Two Approaches to Natural Science in Toledo in the Twelfth Century,” in *Christlicher Norden – Muslimischer Süden. Ansprüche und Wirklichkeiten von Christen, Juden und Muslimen auf der Iberischen Halbinsel im Hoch- und Spätmittelalter*, ed. Matthias M. Tischler and Alexander Fidora (Münster i. W.: Aschendorff, 2011), 69–80.
- 42 Gregor Maurach, “Daniel von Morley *Philosophia*,” *Mittellateinisches Jahrbuch* 14 (1974): 204–55, esp. 239.
- 43 On the science of *prestigiis* and the science of images, and on the influence of Adelard of Bath on Daniel of Morley in this respect, see Charles Burnett, “Thābit ibn Qurra the Harrānian on Talismans and the Spirits of the Planets,” *La Corónica* 36 (2007): 13–40, esp. 19–20.
- 44 This was shown by Charles Burnett, “Vincent of Beauvais, Michael Scot and the ‘New Aristotle,’” in *Lector et compilator. Vincent de Beauvais, frère prêcheur. Un intellectuel et son milieu au XIII^e siècle*, ed. Serge Lusignan and Monique Paulmier-Foucart, *Rencontres à Royaumont (Grâne: Créaphis, 1997)*, 189–213.
- 45 *Speculum naturale* 1, c. 16, ed. Burnett, “Vincent of Beauvais, Michael Scot,” 200–201.
- 46 Hugo de Sancto Victore, *Didascalicon*, II, ed. C. Buttimer, *Studies in Medieval and Renaissance Latin* 10 (Washington: The Catholic University Press, 1939), 1639; Also in *Epitome Dindimi in philosophiam*, ed. Buttimer, 197.
- 47 On this claim of “naturality” for magic, see Thorndike, *History of Magic*, II, 81 and 346–63, and Richard Kieckhefer, “The Specific Rationality of Medieval Magic,” *American Historical Review* 99 no. 3 (1994): 813–36, esp. 819.
- 48 I thank Jean-Patrice Boudet for showing me an alternative manuscript reading of this passage after my lecture on “*Nigromancy*” held at Louvain-la-Neuve (Belgium) on 7 February 2007. “Et de huiusmodi operibus est *magica naturalis*, quam *nigromanciam secundum physicam* philosophi vocant, licet multum improbie, et est *totius scientie naturalis pars undecima*”: William of Auvergne, *De legibus*, c. 24, Paris, BnF. MS lat. 15755, fol. 71vb, quoted by Jean-Patrice Boudet, *Entre science et ‘nigromance’. Astrologie, divination et magie dans l’Occident médiéval (XII^e-XV^e siècles)*, (Paris: Publications de la Sorbonne, 2006), 128, rather than the incomprehensible reading of the edition of Hotot, *Guilielmus Alverniensis Episcopus Parisiensis, Opera omnia*, I, (Orléans-Paris, 1674) (repr. Frankfurt-am-Main, 1963), 1, 69CDb.
- 49 William of Auvergne, *De universo* 1, pars 1, end of c. 43, ed. *Guilielmus Alverniensis Opera Omnia* I, col. 648Ga
- 50 William of Auvergne, *De universo* 2, pars 3, Preface, ed. col. 1015Cb See also *De Legibus* 24, 1, col. 67aB, about the fifth type of idolatry).
- 51 These treatises may cover hermetic astral magic, which was studied by Pingree, “Indian Planetary Images and the Tradition of Astral Magic,” *Journal of the Warburg and Courtauld Institutes* 52 (1989) 1–13 and Charles Burnett, “Arabic, Greek, and Latin Works on Astrological Magic attributed to Aristotle,” in *Pseudo-Aristotle in the Middle Ages*, (London: Warburg Institute, 1986), 84–96.
- 52 William of Auvergne, *De universo* 2, pars 3, c. 22, ed. col. 1060 Fb, and again col. 1065Aa (on the subject of Indian *experimentatores* and illusionists). In *De universo* 1, pars 1, c. 43 is another mention of *libri naturales narrationum*. On the identity of works in this category, see Steven P. Marrone, “William of Auvergne on Magic in Natural Philosophy and Theology,” in ‘*Was ist Philosophie im Mittelalter*’, *Akten des X. Internationalen Kongresses für mittelalterliche Philosophie der Société Internationale pour l’Étude de la Philosophie Médiévale*, 25. bis 30. August 1997 in Erfurt, ed. J. Aersten and Andreas Speer (Berlin, New York: 1998), 741–48.
- 53 *Picatrix*, I, V, 36, ed. Pingree, 23.
- 54 The affirmation in the *Picatrix* is confirmed by the fact that the *scientia de prestigiis* came to the West via the early twelfth-century translation by the Englishman Adelard of Bath of a work of Thābit ibn Qurra named *Liber prestigiorum Thebidis secundum Ptolomeum et Hermetem*. According to David Pingree, this was an early translation of *De imaginibus*, which was then translated again in the second quarter of the twelfth century by John of Seville and Limia. David Pingree, “The Diffusion of Arabic Magical Texts in Western Europe,” in *La diffusione delle scienze islamiche nel medio evo europeo, Convegno internazionale (Roma, 2–4 ottobre 1984)*, ed. Bianca Scarcia Amoretti (Roma, 1987), 74–75.
- 55 *Las siete partidas del rey Don Alfonso el Sabio, cotejadas con varios codices antiguos por la Real Academia de la Historia*, part. 7, tit. 24, leg. 2 (vol. 3, 1807, repr. 1972), 668.

- 56 Michael D. Bailey, *Fearful Spirits, Reasoned Follies: The Boundaries of Superstition in Late Medieval Europe*, (Ithaca, NY: Cornell University Press, 2013).
- 57 The *Speculum astronomiae* and related bibliography are dealt with in more detail in the chapters by Marrone and Collins in this volume. See the theoretical and epistemological light shed by Paola Zambelli, *L'ambigua natura della magia. Filosofi, streghe, riti nel Rinascimento*, 2nd ed. (Venice: Marsilio, 1996), and Nicolas Weill-Parot, "Science et magie au Moyen Âge," in *Bilan et perspectives des études médiévales (1993–1998). Euroconférence (Barcelona 8–12 June 1999). Actes du I^{er} congrès Européen d'Études Médiévales*, ed. Jacqueline Hamesse, (Turnhout: Brepols, 2004), 540–42. Also Nicolas Weill-Parot, "Astral Magic and Intellectual Changes (Twelfth-Fifteenth Centuries). 'Astrological Images' and the Concept of 'Addressative' Magic," in *The Metamorphosis of Magic from Late Antiquity to the Early Modern Period*, ed. J.N. Bremmer and J.R. Veenstra (Leuven-Paris: Peeters, 2002), 167–87.
- 58 *Speculum astronomiae* 3, ed. Zambelli, *The Speculum Astronomiae and Its Enigma. Astrology, Theology and Science in Albertus Magnus and His Contemporaries*, Boston Studies in the Philosophy of Science 135, (Dordrecht, Boston, and London: Kluwer Academic, 1992), 218–20, explained by Lucentini, "L'ermetismo magico nel secolo XIII," in *Sic itur ad astra. studien zur Geschichte der Mathematik und Naturwissenschaften. Festschrift für den Arabisten Paul Kunitzsch zum 70. Geburtstag*, ed. M. Folkerts and R. Lorch, (Wiesbaden: Harrassowitz, 2000), 409–50: 426–28.
- 59 See e.g. Richard Lemay, "Libri naturales et sciences de la nature dans la scolastique latine du XIII^e siècle," in *XIVth International Congress of the History of Science* (Proceedings 2), (Tokyo-Kyoto, 1974), 61–64.
- 60 See Graziella Federici Vescovini, *Le Moyen Age magique* (Paris: Vrin, 2011), chap. 1, about relations between magic and science.
- 61 Pingree, "The Diffusion of Arabic Magical Texts," 57–58.
- 62 *The Book of the Cave of Treasures. A History of the Patriarchs and the Kings Their Successors from the Creation to the Crucifixion of Christ*, Transl. from the Syriac Text of the British Museum Ms. Add. 25875, by Sir E.A. Wallis Budge, (London, Manchester, Madrid, Lisbon, and Budapest: Religious Tract Society, 1927), 142–44.
- 63 French transl. from Ethiopian by Sylvain Grébaut, "Littérature pseudo-clémentine," III, "Traduction du Qalémentos (suite)," *Revue de l'Orient Chrétien* 17 (1912): 16–31.
- 64 On Toledo as a centre for necromancy (particularly on Gerbert of Aurillac as a necromancer), see Jaime Ferreiro Alemparte, "La escuela de nigromancia de Toledo," *Anuario de estudios medievales* 13 (1983): 206–7.
- 65 Albertus Magnus, *Super Porphyrium De V universalibus*, tr. 1, *De antecedentibus ad logicam*, ed. Manuel Santos Noya, in Albertus Magnus, *Opera omnia*, I, pars 1A, (Monasterii Westfalarum: In aedibus Aschendorff, 2004) 10.
- 66 J.O. Leibowitz and S. Marcus, eds, transl. and comm., *Sefer Hanisyonot. The Book of Medical Experiences Attributed to Abraham ibn Ezra. Medical Theory, Rational and Magical Therapy. A Study in Medievalism* (Jerusalem: Magnes Press, Hebrew University, 1984), f. 133v, l. 5–6, 9–10.
- 67 See the studies carried on magic and alchemical texts attributed to Aristotle in Arab–Latin tradition (e.g. the last book of the *Meteora* studied by Jean-Marc Mandosio) or to Albertus Magnus, after the works of Pearl Kibre (e.g. Draelants, *Le De virtutibus*; and Paravicini-Bagliani 2001 and others on the *Speculum astronomiae*), or on alchemical works that circulated in the West under various names (e.g. *De anima in arte alchemiae* attributed to Avicenna, recently studied by Sébastien Moureau, 2016).