

SIGNS VS. CAUSES?

AN EPISTEMOLOGICAL APPROACH TO PROGNOSIS IN THE LATIN MIDDLE AGES*

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Abstract

From the 12th century onwards, prognostic disciplines were part and parcel of the Latin *ordo scientiarum*. This is true for astrology and divination as well as for medicine and weather forecasting. While scholarly research has focused very much on the moral discussions of knowledge of the future in the Middle Ages, the epistemological challenge of integrating this form of knowledge into a coherent theoretical framework has been neglected so far. This article shows how the traditional account of prognostic disciplines as sign-based forms of knowledge was revised and refined during the 13th century in the light of new philosophical (Aristotelian) and also theological paradigms. As a result of this, Latin philosophers and theologians established important criteria which allowed for a clear-cut epistemological distinction between different forms of prognostic signs and thus radicalized the discussion about the legitimacy of some prognostic disciplines.

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Key words: signs, causes, prognosis, epistemology, Middle Ages.

Resumen

Desde el siglo XII, las disciplinas pronósticas formaban una parte integral del *ordo scientiarum* latino. Esto es cierto para la astrología y la adivinación, así como también para la medicina y la predicción del tiempo. Mientras que se han estudiado con detalle los debates morales acerca del conocimiento del futuro en la Edad Media, el reto epistemológico de integrar esta forma del saber en un marco teórico coherente se ha descuidado hasta ahora. En este artículo se muestra cómo durante el siglo XIII la descripción tradicional de las disciplinas pronósticas como formas de conocimiento basadas en el signo fue revisada y ajustada a la luz de los nuevos paradigmas filosóficos (el aristotélico) y también teológicos. En consecuencia, los filósofos y teólogos latinos establecieron criterios importantes que permitieron una nítida distinción epistemológica entre distintas formas de signos pronósticos y, con esto, radicalizaron el debate sobre la legitimidad de algunas de las disciplinas pronósticas.

Palabras clave: signos, causas, pronóstico, Epistemología, Edad Media.

Introduction

In a recent paper I have drawn attention to the fact that Latin philosophers and theologians considered prognostic disciplines as sign-based knowledge: astrology and divination, but also medicine and weather forecasting, were not conceived of as sciences which proceed directly from causes which necessarily produce, and therefore explain, the phenomena under scrutiny –this being the scholastic standard definition of science; rather they were described as operating through the interpretation of signs. Astrology and divination focused on the “signification” of the stars and other signs, and medicine and meteorology observed symptoms or weather signs. Hence, all these disciplines were likewise classified as semiological sciences.¹

¹ See Alexander FIDORA: “Divination and Scientific Prediction: The Epistemology of Prognostic Sciences in Medieval Europe”, *Early Science and Medicine* XVIII-6 (2013), pp. 517-535.

This may seem surprising, since it means that, from an epistemological point of view, these disciplines seem to have had exactly the same status. I say “seem,” since, as I will try to show in this paper, during the 13th century Latin philosophers and theologians developed different models of prognostic signs and, hence, of prognostic disciplines. As I will try to argue in what follows, the Latin theory of prognostic disciplines as sign-based uses an equivocal concept of “signum” which draws on two alternative models of signs and causality.²

The Aristotelian Model and the Epistemology of Medicine and Meteorology

The first of these two models goes back to Aristotle, who in his *Prior Analytics* described certain kinds of scientific knowledge which draw on signs or *sêmeia*. Signs, he says in chapter 27 of the *Prior Analytics* II, can indeed be propositions which are used to prove something, as in the following three cases:

1st A woman was pregnant because she has milk;

2nd Wise men are good because Pittacus was good;

3rd A woman is pregnant because she is sallow.

As Aristotle states, only the first of these so-called *enthymema* can lead to an irrefutably true conclusion, because only in this case the relation between the terms is adequate.³ Now, the complete form of this first *enthymemon* is:

² An important step towards clarifying the notion of sign in medieval epistemological debates was made by Alfonso MAIERÙ: “‘Signum’ dans la culture médiévale,” in: Wolfgang Kluxen et al. (eds.), *Sprache und Erkenntnis im Mittelalter. Akten des VI. Internationalen Kongresses für mittelalterliche Philosophie der Société Internationale pour l’Étude de la Philosophie Médiévale. 29. August – 3. September 1977 in Bonn – 1. Halbband*, Berlin: de Gruyter 1981, pp. 51-72.

³ The second and third examples are invalid syllogisms since, in the first of these two, the middle term (i.e., Pittacus) appears as the subject of both premises, while in the other case the middle term is the predicate for both premises (i.e., sallow).

Every woman who has milk was pregnant;

This woman has milk;

Thus, this woman was pregnant.

Here the sign, i.e. “having milk,” which serves as the middle term of the syllogism, is not only a *sêmeion*, Aristotle says, but a *tekmérion* or probative “index” – a distinction which goes back to Hippocrates’ *Prognóstikon* (§ 25) and which Aristotle also uses in his *Meteorology* (cf. *Meteor.* 344b 19 *et passim*).⁴

Now, as Aristotle explains in his *Posterior Analytics* II, 11, a demonstrative syllogism in the strict sense generally involves a middle term which is the real cause of its conclusion.⁵ It is evident that in the sign-based syllogism from the *Prior Analytics* the “index” is not the cause of the conclusion in this sense, i.e. “having milk” is not the ontological cause of pregnancy. However, Aristotle claims, the name *tekmérion* or “index is given to that which causes us to know, and the middle term is especially of this nature.”⁶ In a sign-based syllogism the middle term can therefore be understood as a cause, though not in an ontological sense, but rather in a logical one.

Medieval philosophers and theologians elaborated on Aristotle’s remarks, trying to further develop their theoretical implications. Thus Richard Fishacre, during the first half of the 13th century, referred to chapter 27 of the *Prior Analytics* II and interpreted Aristotle’s position as follows:

⁴ For a more detailed interpretation of chapter 27 of the *Prior Analytics* II, see Myles F. BURNYEAT: “The Origins of Non-Deductive Inference,” in: Jonathan Barnes *et al.* (eds.): *Science and Speculation. Studies in Hellenistic Theory and Practice*, Cambridge: Cambridge University Press 1982, pp. 193-238.

⁵ See ARISTOTLE: *Posterior Analytics* II, 11, 94a 20-24: “We only think that we have knowledge of a thing when we know its cause. There are four kinds of cause: the essence, the necessitating conditions, the efficient cause which started the process, and the final cause. All these are exhibited through the middle term,” (transl. by Hugh Tredennick, LCL 391, pp. 209/211).

⁶ ARISTOTLE: *Prior Analytics* II, 27, 70b 2-3 (transl. by Hugh Tredennick, LCL 325, p. 527).

As Aristotle says in the penultimate chapter of the *Prior Analytics*, at the place “Ikos etc.”: every effect can be the sign of its cause, as smoke is of fire and a footprint of a foot.⁷

This is a crucial interpretation of the passage under scrutiny: apparently Aristotle’s concept of sign-based knowledge was understood during the Middle Ages in terms not only of logical but also of ontological causal relations. Accepting that the signs in question are not ontological causes, Fishacre maintains that they are, however, the effects of such causes, and that as such they signify their causes. Applied to Aristotle’s medical example referred to above, the sign of “having milk” should therefore be understood as an effect which is indicative of its cause, namely pregnancy.

This interpretation applies not only to medicine, but also to weather forecasting, as can be shown with a view to Aristotle’s discussion on weather signs in the *Meteorology*. Let me give but one brief example taken from Aristotle’s text: a full halo is a sign of rain, because it indicates a uniform condensation of air and vapor into cloud, which in turn produces rain (*Meteor.* 372b 12-34).⁸ This example is very instructive, because it shows how the sign-based demonstration can become part of a more complex argumentation that leads to a cause-based demonstration, for here the halo is the effect of a the condensation of air and vapor, which, in turn, is the cause of rain.⁹ This argumentative approach: from one effect to its cause and from there to another effect,

⁷ Richard FISHACRE: *In IV Sententiarum*, d. 1: “Sicut dixit Aristoteles, in penultimo capitulo, II *Priorum*, ‘Ikos’ etc.: omne causatum potest esse signum suae causae, ut fumus est signum ignis et vestigium pedis.” Joseph Goering is currently preparing a critical edition of this text for the Bayerische Akademie der Wissenschaften.

⁸ For a detailed discussion of the role of *sêmeia* and *tekmêria* in Aristotle’s *Meteorology*, see Cynthia A. FREELAND: “Scientific Explanation and Empirical Data in Aristotle’s *Meteorology*,” *Oxford Studies in Ancient Philosophy* VIII (1990), pp. 67-102.

⁹ In fact, one can formalize this two-step argument with the help of two syllogisms: 1) One that leads from the effect to its cause: Every full halo comes from a uniform condensation of air and vapor into cloud; today the sun has a full halo; thus, today a uniform condensation of air and vapor into cloud takes place. 2) One that leads from this very cause to a further effect: Every uniform

is well described by Albert the Great in his *Meteora*. When dealing with earthquakes, he states that “there are several signs which precede an earthquake and which prove its cause.”¹⁰ It is clear therefore that the signs are indications, if not proofs as Albert puts it, of the causes which can explain the phenomena one wishes to study.

In this perspective, medical and meteorological signs are eventually traced back to causal explanations. This is confirmed if one takes a closer look at the medieval description of the specific *modus probandi* of medicine and meteorology, namely the *demonstratio signi*.¹¹ While this concept doubtlessly reflects Aristotle’s discussion in the *Prior Analytics* II, 27, it is not found in Aristotle himself. In the *Posterior Analytics* I, 13 Aristotle outlined two different modes of demonstration, one that proves the effect through the cause, which the Latins termed *demonstratio propter quid*, and a second one which proves the cause through the effect, which they called *demonstratio quia*. In the *Prior Analytics*, when dealing with sign-based knowledge, Aristotle does not refer to this distinction, yet medieval philosophers and theologians did: they simply identified the *demonstratio signi*, as developed in the *Prior Analytics*, with the *demonstratio quia*, i.e. the demonstration through the effect, from the *Posterior Analytics*. Thomas Aquinas, for instance, speaks of the *demonstratio per signum vel per effectum*, blending together both notions, in order to describe the mode of demonstration which is used in meteorology, medicine and in the natural sciences in general:

condensation of air and vapor into cloud is followed by rain; today a uniform condensation of air and vapor into cloud takes place; thus, today rain will follow.

¹⁰ ALBERTUS MAGNUS: *Meteora*, III, tr. 2, c. 13, ed. Paul Hossfeld (Ed. Colon. VI/1), Münster: Aschendorff 2003, p. 142: “Signa autem praecedentia terraemotum per quae probatur causa terraemotus sunt plura.” In what follows, Albert explains that calms in windy zones, for instance, are a sign of earthquakes, because subterranean vapors usually produce wind when not prevented from getting to the surface; yet, when they do not reach the surface they cause earthquakes.

¹¹ It was Averroes who introduced this concept into the Latin West in his Commentary on Aristotle’s *Physics*: “Viae doctrinae huius libri sunt species doctrinae usitatae in hac scientia, et sunt modi omnium disciplinarum, scilicet *demonstratio signi* [...].” (AVERROES, *Commentarium magnum in Aristotelis Physicorum librum*, Venice: Apud Iuntas 1550) – See Danielle JACQUART: *La science médicale occidentale entre deux renaissances* (XIIe s. – XVe s.), Aldershot: Ashgate 1997, no. XII, pp. 115-117.

Natural science proceeds from what is better known to us and less knowable in its own nature. This is evident in the first book of the *Physics*, and the demonstration by means of a sign or an effect is used especially in natural science.¹²

Prima facie, this identification of *demonstratio signi* and *demonstratio quia* may appear rather insignificant, yet it is not, and even today discussion continues among Aquinas scholars as to the possibility of this identification.¹³ While this is not the point here, what is important to note in the present context is that, in this view, sign-based demonstration is identical or at least a subset of effect-based demonstration of natural sciences, that is, these signs have a probative force because they are effects which indicate causes.

The *signum sacrum* as a Model for Astrology, Magic and Divination

As the previous remarks show, the Aristotelian sign-model underlies the epistemology of medicine and meteorology during the Middle Ages; but does this model also apply to other sign-based disciplines? In other words, are the signs used in astrology and divination effects of causes?

Already in Albert the Great we encounter the idea that astrological signs, i.e. the stars and their constellations, are ontological causes, and not just effects thereof:

The sign is a remote cause, which disposes one towards an action, which it does however not cause by necessity and not without the concourse of other causes.¹⁴

¹² THOMAS AQUINAS: *In Boethium De Trinitate*, pars 3, q. 6, a. 1, co. 3: “Scientia naturalis procedit ex his, quae sunt nota magis quoad nos et minus nota secundum naturam, ut patet in I *Physicorum*, et demonstratio, quae est per signum vel effectum, maxime usitatur in scientia naturali.”

¹³ See Christopher MARTIN: “Rules for Demonstration and Rules for Answering Questions in Aquinas,” in: Klaus Jacobi (ed.): *Argumentationstheorie: Scholastische Forschungen zu den logischen und semantischen Regeln korrekten Folgerns*, Leiden: Brill 1993, pp. 621-635, esp. p. 627.

¹⁴ ALBERTUS MAGNUS: *De IV coaequaevi*, q. 16, a. 1, quoted according to: ALBERTUS MAGNUS: *Ausgewählte Texte. Lateinisch-Deutsch*, ed. and German trans. by Albert Fries, Darmstadt: WBG 1981, p. 98: “Signum autem est causa remota,

For Albert it is clear that astrological signs are causes in themselves, and he is at pains to explain how they can fulfill this function without determining human action and hence compromising free will.

The same is true for Roger Bacon, according to whom the astrologer is concerned with past, present and future events which he knows by means of signs which are their causes. As he writes in the *Opus maius*:

Our fourth point concerns judgments and knowledge of things past, present and future. For, if the cause of the composition of things is the celestial constellation, one can know the effect by means of this cause.¹⁵

Again, this expresses very clearly the idea that astrological signs are taken to be causes which explain their effects, and not the other way around.

A third and last example is Nicholas Oresme, who, in his *Quaestio contra divinatores horoscopios*, writes:

They say: "If Saturn is good, this signifies these good things, if he is bad, those bad things." But to say here that he signifies means nothing else than to say that he is the cause; otherwise he would be nothing.¹⁶

These examples show that the model of sign-based knowledge in terms of effects described above does not apply to astrology. Astrological signs have a completely different epistemological status, because they are efficient signs.

inclinans, non de necessitate causans, sine coniunctione aliarum causarum." (Fries provides a more reliable text than the Ed. Borgnet XXXIV, Paris: Vivès 1895, p. 450.)

¹⁵ ROGER BACON: *Opus maius*, IV, c. 8, ed. John Henry Bridges, 3 vols., Oxford: Clarendon Press 1897-1900, reprint Frankfurt am Main: Minerva 1964, here vol. I, p. 388: "Sequitur quartum, quod est consideratio de iudicio et cognitione praeteritorum, praesentium et futurorum. Nam si causa complexionum rerum est coelestis constellatio, poterit huiusmodi effectus scriiri per hanc causam."

¹⁶ Stefano CAROTTI: "Nicole Oresme, *Quaestio contra divinatores horoscopios*," *Archives d'histoire doctrinale et littéraire du Moyen Âge* 43 (1976), pp. 201-310, here p. 258: "Et dicunt: 'Si [Saturnus] est bonus significat ista bona, et si malus ista mala'; modo dicere quod significat est dictum quod est causa, aliter nihil esset."

As I shall argue in what follows, the fact of being efficient signs sets the astrological *signa*, along with divinatory and magic signs, in a completely different context, namely in that of sacramental theology. Since the role of signs in sacramental theology has been studied in depth by Irène Rosier-Catach,¹⁷ it may suffice here to recall some fundamental passages on sacramental signs. The first comes from the *Summa sententiarum* from the mid of the 12th century:

As Augustine says, a sacrament is the sign of something holy. [...] it is the visible form of invisible grace which it contains and which it transmits. For it is not only the sign of something holy, but it is efficient.¹⁸

This text provides the basic ingredients for Peter Lombard's important characterization of sacramental signs in his *Book of Sentences* (ca. 1150):

Sacrament in the proper sense is a sign of divine grace and a form of the invisible grace, in such a way that it is its image and its cause.¹⁹

These are the essential ingredients of what should become the standard description of sacrament during the Middle Ages: "Sacramentum id efficit quod figurat" – "the sacrament produces what it signifies," namely divine grace. The *signum sacram* is therefore a cause and not an effect.

Of course Christian theologians were well aware of the fact that this understanding of signs was at odds with their interpretation of Aristotelian signs as effects. Yet they explained that one had to distinguish with Augustine natural signs from instituted signs (*signa*

¹⁷ See her important study which is fundamental for the reflections presented in this article: *La parole efficace. Signe, rituel, sacré*, Paris: Vrin 2004.

¹⁸ ANONYMOUS: *Summa Sententiarum*, IV, c. 1, PL 176, cols. 41-174, here col. 117: "Augustinus: 'Sacramentum est sacrae rei signum.' [...] est visibilis forma invisibilis gratiae in eo collatae, quam scilicet confert ipsum sacramentum. Non enim est solummodo sacrae rei signum, sed etiam efficacia."

¹⁹ PETRUS LOMBARDUS: *Sententiae*, IV, d. 1, c. 4, a. 2, ed. Ignatius Brady, 2 vols., Grottaferrata: Editiones Collegii S. Bonaventurae Ad Claras Aquas 1971-1981, vol. II, p. 233: "Sacramentum enim proprie dicitur quod ita signum est gratiae Dei et invisibilis gratiae forma, ut ipsius imaginem gerat et causa existat."

naturalia vs. *signa data/instituta*).²⁰ While natural signs, as they occurred in medicine and meteorology, had to be understood as effects, this was not the case with instituted signs, which could operate as causes.

As Thomas Aquinas explains, when dealing with the sacraments in his commentary on the *Book of Sentences*, this difference can be accounted for as follows:

The sign as such refers to something which is manifest for us and which leads us to knowledge of something else which is hidden from us. And since frequently the effects are more manifest for us than the causes, we tend to distinguish signs and causes, as for instance the *demonstratio quia* is defined as based on signs which are taken from what is common (*Physics* I), while the *demonstratio propter quid* proceeds by means of causes. Sometimes however the cause is manifest to us, since it falls under the senses; and the effect is hidden from us, e.g. when it belongs to the future. And then nothing impedes us from calling the sign a cause of its effect.²¹

This passage is highly significant since it draws a very sharp epistemological distinction between natural signs and instituted sacraments: while the former must be placed in the context of *demonstratio quia* or by the effect, as we have already seen above, the latter would rather pertain to the realm of *propter quid*-knowledge. In this way, Christian theologians developed a model of sign-based knowledge,

²⁰ Cf. AUGUSTINE: *De doctrina christiana*, II, I-IV (1-5), ed. Joseph Martin (CCSL XXXII), Turnhout: Brepols 1962, pp. 32-34. For the medieval reception of this doctrine and its particular role in the present context, see ROSIER-CATACH: *La parole...*, pp. 57-67.

²¹ THOMAS AQUINAS: *In IV Sententiarum*, d. 1, q. 1, a. 1, q^a 1, ad 5: "Ad quintum dicendum, quod signum, quantum est in se, importat aliquid manifestum quoad nos, quo manuducimur in cognitionem alicuius occulti. Et quia ut frequentius effectus sunt nobis manifestiores causis, ideo signum quandoque contra causam dividitur, sicut demonstratio quia est quae dicitur esse per signum a communi, ut in I *Physicorum* dicitur; demonstratio autem propter quid est per causam. Quandoque autem causa est manifesta quoad nos, utpote cadens sub sensu; effectus autem occultus, ut si expectatur in futurum; et tunc nihil prohibet causam signum sui effectus dici."

which, through the integration of Aristotelian and Augustinian material, offers a very different account of the epistemological role of signs.

That this account was attractive also in order to explain instituted signs other than sacramental signs can be gathered from several examples, on both a theoretical and a practical level. With regard to theory, it is worth quoting a text by William of Auvergne from his *De legibus*, in which he attacks magic:

It is clear that these figures and characters [i.e., magic symbols] do not operate any miracles through any natural power, but by means of a pact with the demons, which their admirers respect through these signs; just in the same way as the sacred signs, which Christian religion uses, do not operate through any natural power but on the grounds of a pact with God the almighty.²²

Notwithstanding the hostile attitude of the Bishop of Paris with regard to magic, the passage definitely describes magical and sacred signs in a strictly analogous manner: both are not natural, but instituted signs, and both are thought of as being operative or efficient by themselves.²³

Also on the practical level one can observe a strong rapprochement of magical and sacred signs already during the 12th century. The Abbot of Cluny, Peter the Venerable, for example, recounts in his *De miraculis* the story of a peasant from Auvergne who was very worried about his bees which produced an excellent honey. Since he feared that they could

²² WILLIAM OF AUVERGNE: *De legibus*, c. 27, in: *Opera omnia I*, Paris: Apud Ludovicum Billaine 1674, reprint Frankfurt am Main: Minerva 1963, pp. 18-102, here p. 89: "Declaratum est tibi figuræ et characteres huiusmodi non ex virtute sua aliqua naturali operari mirifica illa, sed ex daemonum pacto, quo cultoribus suis per huiusmodi signa se adesse polliciti sunt, sicut et signa sacra, quibus utitur christiana religio, non ex virtute sua naturali aliqua, sed ex Dei altissimi pacto [...] operantur."

²³ Cf. also *ibid.*: "Declaratum est in praecedentibus per figuræ huiusmodi nihil fieri posse, nisi quemadmodum per signa posita seu instituta inter aliquos ex consensu mutuo seu pacto." – See also Irène ROSIER-CATACH: "Signes sacramentels et signes magiques: Guillaume d'Auvergne et la théorie du pacte," in: Franco Morenzoni *et al.* (eds.): *Autour de Guillaume d'Auvergne († 1249)*, Turnhout: Brepols 2005, pp. 93-116.

fly away or die, the peasant consulted a magician to see how he could protect his bees. Following the advice of this magician, he smuggled a consecrated Host in his mouth out of the Church in order to give it to his bees. However, when he was about to do so, the Host fell down on earth and, as through a miracle, all the bees concurred, carefully picked up the Host and sheltered it in their beehive. The peasant felt repentance and punished himself by killing all his bees. As Peter the Venerable says, the magicians do not even refrain from “abusing the divine sacraments for their magic crafts” (“divinis sacramentis per artes magicas abutuntur”).²⁴

But not only the Sacrament of the Altar was used for magical purposes, as we learn from the trial of the bishop of Cahors, Hugues Géraud, who was accused of having made an attempt against the life of Pope John XXII by means of a magical wax figure. In the aftermath of this event, John XXII established a commission of experts and asked them to analyze this and similar cases. The resulting dossier (from 1320), which has been edited recently,²⁵ not only deals with magic in general, which is defined by Guido Terrena as “superstitiosa divinatio futurorum,” but also puts particular emphasis on the baptism of inanimate objects.²⁶ This suggests that the magical practices concerning wax figures addressed in the dossier frequently entailed the performance of sacramental practices.

While it is true that these practical examples refer to magic, the sign-model developed in sacramental theology seems to satisfy the theoretical requirements not only of magic but also of astrology and related forms of divination²⁷ which draw on instituted efficient signs.²⁸ However, there exists one important difference between the efficiency

²⁴ Cf. PETRUS VENERABILIS: *De miraculis libri duo*, I, c. 1, PL 189, cols. 851-954, here cols. 851-852.

²⁵ Cf. Alain BOUREAU: *Le Pape et les sorciers: Une consultation de Jean XXII sur la magie en 1320* (Manuscrit B. A. V. Borghese 348), Rome: École française de Rome 2004.

²⁶ *Ibid.*, p. 57 and pp. 65 ff.

²⁷ One should note that not all mantic arts were understood as basing themselves on instituted signs; in particular those crafts which interpreted human physiological signs were often conceived of along the lines of the Aristotelian model, in close relation with medical signs. See the examples given by MAIERÙ, “‘Signum’ dans la culture...,” pp. 67-69.

²⁸ Cf., e.g., Augustine’s remarks on astrological signs in *De doctrina...*, II, 22 (34), p. 57: “Istae quoque opiniones quibusdam rerum signis humana

of the sacramental sign and that of divinatory signs. While both concern the future, the sacraments are efficient causes of divine grace which is said to bear its manifest fruits in the eschatological future, whereas the effects of astrological and magic signs become manifest already in the secular future; this implies that astrological and magical causality, in contrast to sacramental efficiency, can be falsified in this life.

Conclusion

As a result of this inquiry into the epistemological role of signs in the prognostic disciplines of the Middle Ages, it is worth noting that in both models that we have outlined signs are traced back to causal relations, being identified either with effects or with causes. In this perspective, the notion of sign is transformed during the 13th century into a purely formal epistemological category: a sign is what leads from what is better known to that which is less known.

For medicine and meteorology this meant that signs were interpreted as the manifest effects of less known natural causes, the *modus probandi* of these disciplines, as well as of natural science in general, being therefore described as demonstration by the effect. In contrast, in astrology and magic signs were interpreted according to the paradigm developed in sacramental theology: just like the *signum sacrum*, they were thought of as instituted signs which are causes rather than effects, possessing and displaying their proper efficiency.

So, while it is true that all these disciplines can be described as semiological, there is a marked difference between them which explains their respective future developments and, in particular, the deep concern among medieval theologians about astrology and magic. That these disciplines shared basic epistemological assumptions with central Christian doctrines must have made them particularly suspicious and dangerous in the eyes of Christian theologians, and may thus account for the progressive radicalization of their accusations from superstition to heresy.²⁹

praesumptio institutis ad eadem illa quasi quaedam cum daemonibus pacta et converta referenda sunt."

²⁹ On this radicalization see Graziella FEDERICI VESCOVINI: *Le Moyen Âge magique. La magie entre religion et science aux XIIIe et XIVe siècles*, Paris: Vrin 2011, pp. 168-172 and 279-307.

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