



Insensible and Inexplicable - On the Two Meanings of Occult

Florian Sprenger, Digital Cultures Research Lab/Leuphana Universität Lüneburg,
Florian.Sprenger@leuphana.de

While the distinction between spiritualism and science was understood affirmatively as a demarcation of true science against pseudo-science, nowadays, after several Science Wars, it is obvious for us that this distinction does not correspond to the actual practices of science but reflects a work of 'purification' typical for modernity in the Latourian sense. In the physico-philosophical surroundings of this boundary epistemological foundations are shaped and modern science is constituted as the primary way to knowledge. Referring to studies on the history of the occult in the early modern period, the article shows that in order to understand the stakes of spiritualism and its technical or personal media we should trace back this boundary to a rarely recognized conceptual transformation of the 'occult'. It shifts between *insensible* and *inexplicable*. Following this leading difference, the article traces its function in the emergence of early occultism, the debate between Leibniz and Newton, and the rise of modern spiritualism and its instrumental repertoire.

Keywords: occultism, spiritualism, media, Leibniz, Newton, Descartes

Why should we, in the context of the nineteenth century spiritualism explored by this issue, reconsider the formation of the boundary between occult and exact knowledge so deeply embedded in the seventeenth century? While this distinction was previously understood as distinguishing true science from pseudo-science, nowadays, after several periods of dispute which are called Science Wars, it is obvious that this line of demarcation does not correspond to the actual practices of science but reflects a work of ‘purification’ typical of modernity as understood by Latour.¹ In the physico-philosophical space surrounding this boundary, epistemological foundations are moulded and modern science is constituted as the primary method for acquiring knowledge. These epistemologies persist in both 19th century science and spiritualism.² Referring to studies on the history of the occult in the early modern period by Keith Hutchison, John Henry, Catherine Wilson and Richard Paul Blum, I wish to show here that in order to understand the stakes of spiritualism – used here to denote very different movements and ideas – and its technical or personal media we should trace this boundary back to a conceptual transformation of the ‘occult’ that often goes unrecognized. The ‘occult’ undergoes a shift from the *insensible* to the *inexplicable*.³

For this reason, I would like to begin with a challenge: We should allow ourselves to be unsettled and alienated by the occult and consequently put our self-understanding and our understanding of the history of science to the test. How is it possible, I ask here, to develop a non-hegemonic approach to the history of the boundary between science and the occult—without understanding the occult as derivative, resistant to enlightenment, an illegitimate truth claim and a threat to the way in which we conceive of ourselves? The description of the historical transformations of the occult shifting between insensible and inexplicable will not lead to a stabilization of our history or lend this history more coherence. Instead, this attempt at a conceptual history or a history of a problem [*Begriffs- oder Problemgeschichte*] can help us to destabilize the borderline between science and non-science in order to make clear the manner in which the categories are mutually dependent. The threat of the occult does not lie in its inexplicability or its insensibility, nor in the legitimacy granted to it by believers.

¹ See Latour, Bruno. *We have never been modern* (Cambridge, Mass.: Harvard University Press, 1993).

² A similar perspective on the 19th century can be found in Egil Asprem’s “Pondering Imponderables: Occultism in the mirror of late classical physics,” *Aries* 11, no. 2 (2011).

³ In the words of Richard Noakes: “These boundaries are the explanandum, not the explanans.” (Richard Noakes, “Natural Causes? Spiritualism, Science, and the Supernatural in Mid-Victorian Britain,” in *The Victorian Supernatural*, eds. Nicola Bown, Carolyn Burdett and Pamela Thorschwell (Cambridge: Cambridge University Press, 2004), 24.)

The subversive power of the occult lies in the fact that it pulls the rug out from under the position from which we are accustomed to telling its history.

This double connotation of ‘occult’ in the seventeenth century has, as far as I can see, not yet been compared in any systemic way with the developments of the nineteenth century. The seventeenth century occult abounds with phenomena based on actions at a distance which contradict common modes of causality. The following remarks revolve neither around the terminological continuities nor discontinuities of concepts, but rather the role of the occult in the constitution of modern science, which is based on endless and dizzying discussions of modes of explanation and causality, of actions at a distance and their media, both instrumental and physical. The concepts of media in spiritualism and in physics both emerge from the common demarcation against the inexplicable occult by investigating the insensible occult. Here I will present a few basic ideas regarding the history of this constitutive distinction, the importance of action at a distance, and the latter’s afterlife in the nineteenth century.

Obviously, occult knowledge was discussed in medieval times, for example in Agrippa of Nettesheim’s *De Occulta Philosophia* and in the writings of Paracelsus. All this most certainly belongs to the prehistory of occultism, as it has been called since Eliphas Lévi introduced the term in the mid-1800s.⁴ The early modern period was awash in reference to ghosts, the belief in miracles and alchemy. In condensed form, the assumption of preoccult occultism was that the essence of things is hidden to and invisible from the outside. Classic or ‘whiggish’ historiography tells us that this knowledge was banned by modern science because it did not conform to the new requirements for exactness. But to continue to write the history of this non-hegemonic knowledge as the Other of anti-occult sciences is merely a way of taking the easy road, which both classic historiography and self-descriptions of occultism have tended to do.⁵ The term ‘occult’ remains ambiguous even taking into account the symmetry of successful and failing theories that David Bloor proposed already in 1976.⁶ With an asymmetric perspective we lose sight of the constitutive role of the demarcation

⁴ Cf. Eliphas Lévi, *La Science des esprits: Révélation du dogme secret des Kabalistes. Esprit occulte des Évangiles. Appréciation des doctrines et des phénomènes spirites* (Paris: Baillière, 1865). For an overview of the occult sciences see Wouter J. Hanegraaff, *Esotericism and the academy: Rejected knowledge in western culture* (Cambridge: Cambridge University Press, 2012), 177.

⁵ See, for instance, Sabine Doering-Manteuffel’s *Das Okkulte: Eine Erfolgsgeschichte im Schatten der Aufklärung; von Gutenberg bis zum World Wide Web* (Munich: Siedler, 2008).

⁶ For an explanation of the principle of symmetry, see David Bloor’s *Knowledge and the Social Imaginary* (London: Routledge, 1976).

for both spiritualism and science. By keeping in mind the double meaning of occult, it becomes obvious that this constitution is repeated in the heart of spiritualism, as spiritualists understand themselves as part of a project of enlightenment with regard to the insensible occult. They share with scientists not only sets of practices, but also a similar understanding of their role. This, again, is bound up with a new conception of instruments and experiments as observing, inscribing and registering tools that help to explore what is hidden to the senses. The boundary between science and non-science thus appears not to delimit threatening knowledge that does not obey the rules, but to provide a structure for asymmetry.

Here I would like to begin by describing the role modern science's relation to the occult plays in the establishment of the so-called scientific revolution and the subsequent processes of mechanization. The commonly held opinion that modern science ostracized the occult in the course of its secularization and continuing emphasis on the scientific method ignores the epistemological core of this very process. The reason for this is not only that science, too, can be occult, but, in a nutshell, that the understanding of the occult and its redefinitions shape what science means. This complex process, far from having run its course, persists even in the present day.

The banishment of the occult happens gradually with the detachment from Aristotelian-Scholastic philosophy, but it is also presupposed by the later concept of a scientific revolution itself. This historiographic entanglement should be kept in mind when dealing with this topic: The occult is a highly political term and affects the manner in which science conceptualizes its own activities. To explore the history of modern science means to investigate the ways in which science has come to be understood as such. Assuming this perspective, we are confronted by enormous conceptual twists—in the end indicative of the ambiguity of the boundary. The well-known transition of occult knowledge to the modern sciences – especially prominent in Newton's interest in alchemy – is a dynamic reforming of a field of knowledge with porous boundaries.⁷

The reductive equation of the occult with the supernatural is also problematic as a historical model of reference. Furthermore, and beyond the scope

⁷ Cf. Simon Schaffer, “Godly Men and Mechanical Philosophers: Souls and Spirits in Restoration Natural Philosophy,” *Science in Context* 1, no. 1 (1987). As Ute Frietsch has shown, those in the early modern period already distinguish between *scientia* and *pseudo-scientia*: Ute Frietsch, “Häresie und ‘pseudo-scientia’: Zur Problematisierung von Alchemie, Chymiatrie und Physik in der frühen Neuzeit,” in *Pseudowissenschaft: Konzeptionen von Nichtwissenschaftlichkeit in der Wissenschaftsgeschichte*, ed. Dirk Rupnow et al. (Frankfurt/Main: Suhrkamp, 2008).

of this article, it obscures another critical aspect of modern science: the importance of practices and instruments that render visible the invisible, such as the telescope, the microscope, detailed theories of smallest bodies and their representations. Their effect is more than a ‘visualization of the invisible’⁸ in the sense of an experimental exploration of worlds beyond the sensual. More than that, they show the radical transformation of a world-view that bound human senses to the will of God and thus opened up new frontiers of knowledge and experimentation. This is the frontier of the occult. For contemporaries, to transgress this meant to investigate the occult instrumentally, and this tied the imaginary to the symbolic.⁹ This process fulfills urgent needs of early modern science. The practices revolving around the discovery of the invisible can only be understood by taking into account the transformations of the occult without subordinating them to secularization.

Occult and occult, insensible and inexplicable

Occult, from the Latin *occultus* for *hidden* or *secret*, has two different meanings in the late Middle Ages: insensible and inexplicable. This primary distinction is nearly lost when occult is taken to mean supernatural or extrasensual. While one should note that these meanings have diverged over time, it is their interplay that renders them intelligible. ‘Occult’ as a term continues to be shaped by its irreconcilable yet entangled meanings.¹⁰

The existence of insensible forces and causes that are imperceptible or, in the words of the time, not manifest, seems trivial to us. We are familiar with radiography, light switches and wireless networks, but for people in the Middle Ages the insensible is highly problematic. Up until the arrival of early modern science at the beginning of the seventeenth century, only sensible phenomena are acknowledged as existing. In this context, occult causes, in the sense of insensible causes, are usually deemed impossible, and when they are nevertheless accepted, their supposed inexplicability is tied to their transcendence of the senses. Each of the two meanings thus implies the other.

⁸ Cf. Lorraine Daston and Katharine Park, *Wonders and the order of nature: 1150-1750* (New York: Zone Books, 1998) and Martina Heßler, “Der Imperativ der Sichtbarmachung: Zur Bildgeschichte des Unsichtbaren,” *Bildwelten des Wissens. Kunsthistorisches Jahrbuch für Bildkritik* 4, no. 2 (2006).

⁹ Cf. Erich Hörl, *Die heiligen Kanäle* (Berlin: Diaphanes, 2005), 107.

¹⁰ The problems of ignoring this distinction are obvious, for example, in G. MacDonald-Ross, “Occultism and Philosophy,” in *Philosophy, its History and Historiography*, ed. A. J. Holland (Dordrecht: Reidel, 1985).

For Neo-aristotelian philosophy, the dominant world-view since the rediscovery of Aristotle in the 12th century, such *qualitates occultae* are narrowly defined. As Richard Paul Blum has shown, they include those phenomena that cannot be explained by the primary qualities of colour, size, taste, form or consistency: the effects of medicine and chemistry, the influences of the sun and moon, and of course magnetism and electricity.¹¹ All of these phenomena are dismissed because they need to be explained by an insensible cause which acts secretly. The common explanations for the attraction of bodies, loadstone or the magnet make reference to inner sympathies—for example identical substances that act at a distance. This in turn undermines the Aristotelian line of argument based on the investigation of the four causes: namely *causa efficiens*, *causa finalis*, *causa formalis* and *causa materialis*. Additionally, occult qualities cast doubt on the premise that the senses are the only source of knowledge. Consequently, what is insensible must be inexplicable. Simply expressed, the assumption of scholars around Thomas Aquinas is that God cannot want us to sense something insensible. And something that God does not want cannot exist. Only natural things, as opposed to the supernatural, can exist, with the exception of the miracle, but this is a problematic solution in and of itself.

As occult, hidden and insensible causes become components of scientific explanations in the seventeenth century, this restriction vanishes. Both meanings are in parallel use during this time. From William Gilbert's *De Magnete*, one of the founding documents of experimental philosophy around 1600, to Isaac Newton's *Philosophiae Naturalis Principia Mathematica*, natural philosophy investigates insensible forces by observing their visible effects. The mission of the new science, also connected to the names of Gassendi, Bacon, Hooke and Boyle, is to show that the insensible is not necessarily inexplicable. For example, Robert Boyle's experimental program explicitly tries to control insensible forces mechanically without speculating on their origin.¹² He attempts to explain all movement with the help of what he identifies as smallest bodies, called effluvia or corpuscles. The movement of these bodies causes everything, even carrying light from the sun to Earth. The underlying assumption is the existence of a world beyond the sphere of the senses, consisting of smallest bodies which can be accessed with the aid of theory and experimentation.

¹¹ See Paul R. 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).

¹² See Barbara Shapiro, "Testimony in Seventeenth-Century English natural Philosophy: Legal Origins and early Development," *Studies In History and Philosophy of Science, Part A* 33, no. 2 (2002).

In the seventeenth century, natural philosophers are confronted with so many insensible phenomena – the surface of the moon, the cell, gravity, magnetism, electricity – that it becomes impossible not to consider occult causes. As Keith Hutchison has shown in his seminal study *What happened to Occult Qualities in the Scientific Revolution?*, it is not the idea of occult qualities as such but the assumption that they are inexplicable which shifts at this time. The natural philosophies of this age, engaged with occult causes in the sense of the insensible, refuse to grant a place to generally inexplicable causes. In the words of Hutchison: “With the acceptance of insensible agencies into the scope of natural philosophy, the word ‘occult’ lost its connotation of ‘insensible’ and henceforth referred solely to the unintelligibility of the world.”¹³ Significant for this process is a shift that at the same time consolidates the investigation of the insensible as a research program, for example with Newton, and prepares the occult and the inexplicable to be banned as unscientific. Both meanings thus enter a new relation to and detach from one another.

Philosophers of the time underline the fact that the new sciences are capable of comprehending occult qualities. René Descartes for example argues that “[...] there are no qualities which are so occult, no effects of sympathy or antipathy so marvelous or so strange, nor any other thing so rare in nature (granted that it is produced by purely material causes destitute of thought and free will), that its reason cannot be given by [the principles of the mechanical philosophy.]”¹⁴ Descartes wishes to investigate occult causes and explain insensible agencies because his mechanistic philosophy leaves no room for unknown causes, though it is open to representations of the insensible and their experimental investigation. It is typical for such theories to restrict their scope to matter and movement as the irreducible principles because only these are describable with *causa efficiens* and thus demonstrable by experiment. Descartes combines *causa efficiens* with *causa materialis* and assigns them universality, while *causa finalis* and *causa formalis* are no longer considered reasonable. How successful such experiments were is another question altogether.

This conceptual shift is most obvious in Isaac Newton’s writings. When he uses the term occult around 1700, he solely refers to insensible causes. They are, though only indirectly, explainable and acceptable. The reason for Newton’s success is his refusal to accept the insufficient explanations of contemporary

¹³ Keith Hutchison, “What Happened to Occult Qualities the Scientific Revolution?,” *Isis* 73, no. 2 (1982): 233.

¹⁴ Unfortunately, the English translation of the *Principia Philosophiae* is useless, as it leaves out central parts of the text. I am thus forced to quote here the translation by Hutchison: *ibid.*, 242.

corpuscularian philosophies. Instead, Newton restricts himself to observation and the induction of universal laws:

These principles I consider, not as occult qualities, supposed to result from specific Forms of Things, but as general Laws of Nature, by which the Things themselves are formed; their Truth appearing to us by Phaenomena, though their Causes be not yet discovered. For these are manifest Qualities and their Causes only are occult.¹⁵

His experimental and mathematical approach allows him to treat insensible occult causes in a reasonable way by experimentally investigating the facts without hypothesizing about their inexplicable origin.¹⁶ This is the popular canonical interpretation of the hard scientist Newton. I will come back to his other side soon.

This epistemological shift in the meaning stressed is fundamentally bound to instruments, the microscope, the telescope, mechanical clocks and the vacuum. They unseal a space which was categorically inaccessible prior to their invention.¹⁷ The transformation of this frontier goes hand in hand with a revaluation of instruments that inscribe or record what is hidden to the senses. Science, we could say, utilizes these new instruments to cut past surfaces, into the inner spheres once taken as occult. As Simon Schaffer and Steven Shapin have shown, the establishment of the experimental sciences rests on a debate about testimony and criteria for credibility.¹⁸ The accumulation of technical innovations makes possible new experiments and thus raises the question of their productivity in the production of knowledge. In the seventeenth century, the observation of what is hidden to the senses is taken over by the microscope and the telescope,

¹⁵ Isaac Newton, *Opticks: Or, A Treatise of the Reflections, Refractions, Inflections & Colours of Light* (New York: Dover, 1717/1952), Reprint: 401.

¹⁶ Cf. I. Bernhard Cohen, *Franklin and Newton: An Inquiry into Speculative Newtonian Science and Franklin's Work in Electricity as an Example thereof* (Philadelphia: American Philosophical Society, 1956).

¹⁷ Cf. Catherine Wilson, *The Invisible World: Early Modern Philosophy and the Invention of the Microscope* (Princeton: Princeton University Press, 1995). Helmut Zander has shown how instruments reformulate to the assumption of a paradise or underworld beyond the sphere of the senses: Helmut Zander, "Höhere Erkenntnis: Die Erfindung des Fernrohrs und die Konstruktion erweiterter Wahrnehmungsfähigkeiten zwischen dem 17. und dem 20. Jahrhundert," in *Trancemedien und neue Medien um 1900: Ein anderer Blick auf die Moderne*, ed. Marcus Hahn and Erhard Schüttelpelz (Bielefeld: Transcript, 2009).

¹⁸ Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle and the Experimental Life*, (Princeton: Princeton University Press, 1989).

and in the nineteenth century, by “self-registering scales, meters for temperature and other ingeniously constructed instruments.”¹⁹ The testimony provided by these instruments extends human organs through new sensibilities of registering, observing and inscribing, where the senses are now only secondary to that of the instrument. Not only human spectators, but also tools of experimentation are granted the ability to observe: They can prove and falsify. They create situations for the judgement of the scientist. They exceed his reliability and precision. They are independent from belief, religion, and politics. They testify to the insensible. In the ideal case, experimental systems allow scientists to set and control all experimental variables in order to observe every change, and knowledge production becomes the difference between what is expected and what actually happens.²⁰ Mechanical testimony becomes an epistemic multiplier.

The arena of this new science is a ‘public space’, as, for example, the standardized registers of the *Royal Society* in London show.²¹ Its members, the Gentlemen, as they call themselves, may decide upon truths because their instruments allow them to make these decisions. The testimony of instruments does not undermine but strengthens the status of the scientist, as he now has to decide upon the reliability of the instrument. Christoph Meinel has shown that the new conception natural philosophers develop of themselves at this time as public, social and credible actors leads to the banishment of occult knowledge. Equipped with undeceivable instruments, the scientist has the power to exclude all that refuses to obey the new rules. The occult, Meinel concludes, becomes enemy territory and is attacked polemically. Thus both concepts, “the occult sciences and the exact sciences, turn out to be what they were originally: polemical and usurpatory concepts without strict systematic demarcation; terms which carry claims, terms of rather dubious value for historical research.”²² While Meinel is surely correct that both terms are not sufficient to describe the boundary defying

¹⁹ Albert Schrenck-Notzing, *Materialisations-Phaenomene* (Munich: Reinhard, 1914), 28. (“selbstregistrierende Waagen, Temperaturmesser sowie sonstige sinnreich konstruierte Instrumente.”)

²⁰ Cf. Hans-Jörg Rheinberger, *Experimentalsysteme und epistemische Dinge* (Frankfurt/Main: Suhrkamp, 2006).

²¹ Cf. Steven Shapin, “Pump and Circumstance: Robert Boyle's Literary Technology,” *Social Studies of Science* 14, no. 4 (1984): 485.

²² Christoph Meinel, “Okkulte und exakte Wissenschaften,” in *Die okkulten Wissenschaften in der Renaissance*, ed. August Buck (Wiesbaden: Harrassowitz, 1992), 21–44. (“vermutlich beide Begriffe, der der okkulten Wissenschaften wie der der exakten, als das heraus, was sie ursprünglich waren: polemisch-usurpatrice Begriffe ohne scharfe systematische Abgrenzung, Begriffe, an die sich Ansprüche knüpfen, kurz, Begriffe von eher zweifelhaftem Wert für die historische Forschung.”)

practices that operate between them, it is important to explore how this boundary is polemically constructed, preserved and occasionally penetrated.

Correspondence at a distance

The reliability and testimony of instruments rests on the assumption that everything that happens has a cause. The principle of *causa efficiens* guarantees that identical experiments have identical results. Only *causa efficiens* suffices to explain experiments because it makes the beginning of movements or changes predictable when two bodies act on each other, insofar as identical causes have identical effects. Predictability becomes an indispensable criterion for successful experimentation in the seventeenth century. Action at a distance is thus excluded as an explanation. With his unexplained laws of gravity and the subsequent introduction of *ethers* and *spirits*, Newton ends up in the middle of this conflict. Focusing on his debate with Leibniz, I want to show how closely the occult, causality and media are connected and how powerful the accusation of occult causes becomes around 1700. At the same time the exploration of the insensible is established as the terrain of science.

In 1716, English theologian Samuel Clarke, acting as a representative of Newton, writes to Gottfried Wilhelm Leibniz:

That one body should attract another without any intermediate means, is indeed not a miracle, but a contradiction: for it is supposing something to act where it is not. But the means by which two bodies attract each other, may be invisible and intangible, and of a different nature from mechanism; and yet, acting regularly and constantly, may well be called natural, being much less wonderful than animal-motion, which yet is never called a miracle.²³

Leibniz answers:

But then what does he mean, when he will have the sun attract the globe of the earth through empty space? Is it God himself that performs it? But this would be a miracle, if ever there was any. This would surely exceed the powers of creatures. Or are perhaps some immaterial substances, or some spiritual rays, or some

²³ Gottfried Wilhelm Leibniz and Samuel Clarke, *The Leibniz-Clarke Correspondence*, with the assistance of Henry G. Alexander (New York: Manchester University Press, 1956), 53. Cf. Gerd Buchdahl, "History of Science and Criteria of Choice," *Minnesota Studies in Philosophy of Science*, no. 5 (1970).

accident without a substance, or some kind of *species intentionalis*, or some other I know not what the means [Medium] by which this is pretended to be performed? Of which sort of things the author seems to have still a good stock in his head, without explaining himself sufficiently. That means of communication [Medium zur Übertragung] (says he) is invisible, intangible, not mechanical. He might well have added, inexplicable, unintelligible, precarious, groundless and unexampled. [...] It must be a perpetual miracle, and if it is not, it is false. It is a chimerical thing, a scholastic occult quality.”²⁴

Already this short excerpt from one of the major documents of physico-philosophical thought in the early 18th century shows the disruption of the foundations of physics occasioned by Newton’s introduction of a supposedly immediate action at a distance. Gravity, Newton implies, acts between bodies without any delay. There is no Δt indicating the temporal duration of forces in Newton’s formula.²⁵ Whether this immediate attraction is a miracle, occult or impossible, as Leibniz argues, or a force that simply has not been explained yet but should be investigated because of its explanatory evidence, as Clarke and Newton suggest, forms the most pressing question in the correspondence. Two very different physical systems that lead to even more different metaphysics are confronted here—despite their protestant proximity.²⁶

Action at a distance contradicts the foundations of both doctrines because something that acts at the same time and without a material connection at two different places violates the nexus of causality and continuity. Action at a distance thus is deemed occult – invisible *and* inexplicable. The temporal order of the new science is a causal order in which cause and effect cohere in the sense of *causa efficiens* in three regards: spatially they must be connected; temporally one has to follow the other; and they have to occur together but not at the same instant.²⁷ The

²⁴ Leibniz and Clarke, *The Leibniz-Clarke Correspondence*, 94.

²⁵ Cf. Nancy J. Nersessian, “Aether/or: The Creation of Scientific Concepts,” *Studies in the History and Philosophy of Science* 15, no. 3 (1984).

²⁶ The political backgrounds are discussed in Steven Shapin’s “Of Gods and Kings: Natural Philosophy and Politics in the Leibniz-Clarke Disputes,” *Isis* 72, no. 2 (1981); and Domenico B. Meli’s “Caroline, Leibniz, and Clarke,” *Journal of the History of Ideas* 60 (1999).

²⁷ In the words of Leibniz: “All the natural forces of bodies are subject to mechanical laws; and all the natural powers of spirits are subject to moral laws. The former follow the order of efficient causes; and the latter follow the order of final causes.” Leibniz and Clarke, *The Leibniz-Clarke Correspondence*, 95. Cf. Martin Carrier, *Raum-Zeit* (Berlin: Walter de Gruyter, 2009), 8; Adolf Grünbaum, *Philosophical Problems of Space and*

cause has to happen before the materially connected effect in the same location. Otherwise it would be impossible to keep them apart. Nonetheless, one must follow the other in such short succession that they can be linked. Therefore, delay is inherent to all causality. Only under these conditions do objects qualify as scientific evidence, subject to experimental exploration. It is only in keeping with these premises, then, that natural laws make sense. But what about gravity, electricity, magnetism—what about occult qualities?

Over the centuries, beginning in Antiquity and discussed later in many different physical and philosophical contexts, several theoretical solutions have been developed to solve these questions. The following precise formulation from the Aristotelian beginning of the early modern period gives an impression of their dimensions: “Omnis actio fit per contactum, quo fit ut nihil agat in distans nisi per aliquid medium.”²⁸ In English: Every effect happens by contact, because nothing acts at a distance without a medium. Consequently, only mediated effects are allowed. Nevertheless, the physical concept of mediation emerging from this constellation attempts to bridge the gaps of causality inherent to matter and is thus often described as immediate. Mary Hesse has distinguished three related historical modes to explain action at a distance:²⁹ The first mode, popular in Descartes’ writings, establishes direct causation by inventing corpuscles or effluvia. These invisible bodies cohere and form a connection between two larger entities in which each corpuscle moves the next. The ultimate role of this mechanical model is to explain the empty space between the corpuscles. Secondly, action at a distance can be described as an ethereal medium. The underlying assumption is the existence of substances that fill all space. The ether closes the gap between cause and effect, but reserves the possibility of action occurring at short distances. In this way, it transmits action at a distance and produces a form of immediacy. The discourses on ethers, therefore, neglect mediation, though they do make references to it. As an “argumentative resource”³⁰ the application of the ether depends on the philosophical or physical

Time (London: Routledge, 1964); and Andreas Hüttemann, ed., *Kausalität und Naturgesetz in der Frühen Neuzeit* (Stuttgart: Steiner, 2001).

²⁸ Eustachius a Sancto Paulo (1614): *Summa Philosophiae*, quoted in Leo Spitzer, “Milieu and Ambiance,” in *Essays in historical Semantics*, 179–316 (New York: Vanni, 1948), 201.

²⁹ Cf. Mary B. Hesse, “Action at a Distance in Classical Physics,” *Isis* 46, no. 4 (1955).

³⁰ G. N. Cantor, “The Theological Significance of Ethers,” in *Conceptions of Ether: Studies in the History of Ether Theories 1740-1900*, ed. G. N. Cantor and Hodge, M. J. S. (Cambridge: Cambridge University Press, 1981), 135–56, 152. Cf. Albert Kümmel-Schnur, “Einleitung: Äther als Medium der Medienwissenschaft?,” in

problems it has to solve. In some cases, these two modes overlap and the ether consists of corpuscles. The third alternative is genuine action at a distance with unknown properties. It may be traceable to unknown but explicable causes or to occult qualities. All three modes have historically implied the introduction of mediating concepts.

The relation of these three possibilities is discussed extensively in the correspondence. In his *Queries*, more or less hypothesizing additions to his works, and in the *Scholium Generale*, a late and hermetic appendix to a reprint of the *Principia* from 1713, Newton allows himself what he strictly forbid to others: He speculates on ethers, actions at a distance and occult causes.³¹ With the help of such active, ethereal forces of gravity and other phenomena, he seeks to show that he is able to do without inexplicable forces in his theories and explanations, instead turning to a medium. Though his former explanations were restricted to matter, movement and force – his motto being *hypotheses non fingo* – he introduces non-mechanical active principles and spirits. Considering the possibility that a corpuscular medium could communicate the forces in question, he revokes the idea of immediate action at a distance.³² Newton is no hardcore-Newtonian. Following Gideon Freudenthal, we can state that Newton employed all three modes: a genuine, inexplicable action at a distance, a mechanical explanation by corpuscles or by ethers and finally the suspension of the question due to its respective unanswerability.³³

Newton must, of course, oppose occult qualities in the scholastic sense. It is, however, still possible, he claims, to observe phenomena and suggest

Äther: Ein Medium der Moderne, ed. Albert Kümmel-Schnur and Jens Schröter (Bielefeld: Transcript, 2008).

³¹ Even when operating with an action at a distance, Newton writes: “It is inconceivable that inanimate brute matter should, without the mediation of something else, which is not material, operate upon and affect other matter without mutual contact, as it must do if gravitation, in the sense of Epicurus, be essential and inherent in it. That gravity should be innate, inherent, and essential to matter, so that one body can act upon another at a distance, through a vacuum, without the mediation of anything else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity, that I believe no man who has in philosophical matters a competent faculty of thinking can ever fall into it.” Letter from Newton to Bentley, 1692, in Isaac Newton, *Isaac Newton's Papers & Letters on Natural Philosophy*, with the assistance of Bernard I. Cohen (Cambridge: Harvard University Press, 1978), 302.

³² Cf. Henry Guerlac, “Newton's Optical Aether: His Draft of a Proposed Addition to his Optics,” *Notes and Records of the Royal Society of London* 22, 1/2 (1967).

³³ Cf. Gideon Freudenthal, *Atom und Individuum im Zeitalter Newtons: Zur Genese der mechanistischen Natur- und Sozialphilosophie* (Frankfurt/Main: Suhrkamp, 1982), 95.

underlying insensible forces: “But the reason of these properties of gravity I could not deduce from phaenomena, and I do not devise hypotheses. For whatever is not deduced from phaenomena, is to be called an hypothesis; and hypotheses, whether metaphysical or physical, or of occult or mechanical qualities, have no place in experimental philosophy.”³⁴ From Newton’s point of view, natural laws cannot be deduced from hypothetical forces, but only from observation. This is precisely the case with gravitation, magnetism and electricity.³⁵

And the Aristotelians gave the Name of occult Qualities, not to manifest Qualities, but to such Qualities only as they supposed to lie hid in Bodies, and to be the unknown Causes of manifest Effects: Such as would be the Causes of Gravity, and of magnetick and electrick Attractions, and of Fermentation, if we should suppose that these Forces or Actions arose from Qualities unknown to us, and uncapable of being discovered and made manifest. Such occult Qualities put a stop to the Improvement of natural Philosophy, and therefore of late Years have been rejected.³⁶

‘Such occult qualities’ are inexplicable *and* insensible. Despite the limitations posed by the inexplicable, it is necessary for the advancement of Newtonian

³⁴ Isaac Newton, *The Principia: Mathematical Principles of Natural Philosophy*, with the assistance of I. B. Cohen (Berkeley: University of California Press, 1999), 943. In another text Newton is even more rigid: “Some I know disapprove this conclusion [the law of gravity] and mutter something about occult qualities. They continually are cavilling with us that gravity is an occult property, and occult causes are to be quite banished from philosophy. But to this the answer is easy: that those are indeed occult causes whose existence is occult, and imagined but not proved, but not those whose real existence is clearly demonstrated by observations. Therefore gravity can by no means be called an occult cause of the celestial motions, because it is plain from the phenomena that such power does really exist. Those rather have recourse to occult causes who set imaginary vortices of a matter entirely fictitious and imperceptible by our senses to direct those motions. But shall gravity be therefore called an occult cause and thrown out of philosophy because the cause of gravity is occult and not yet discovered?” Quoted in: Isaac Newton, *Mathematical Principles of Natural Philosophy*. With the assistance of Florian Cajori. (Berkeley: University of California Press, 1687/1934), XXVII.

³⁵ Cf. Henry, John, “Occult Qualities and the Experimental Philosophy: Active Principles in pre-newtonian Matter Theory,” *History of Science* 24, 335-381 (1986): 362. See also Freudenthal, *Atom und Individuum im Zeitalter Newtons*; and Michael Friedman, “Kant and Newton: Why Gravity is Essential to Matter,” in *Philosophical Perspectives on Newtonian Science*, ed. Philipp Bricker and R. I. G. Hughes (Cambridge: MIT Press, 1990).

³⁶ Newton, *Opticks*, 401.

science to envisage the investigation of the insensible. Against this backdrop, Newton's hypothetical speculation about ethers, spirits and effluvia do not appear as the contradictory, dark side of the hard scientist. They can be explained, rather, by his understanding of 'occult'.³⁷

It is at exactly this juncture that Leibniz detects the danger of miraculously introducing media where nothing exists and of explaining miracles mechanically, because the supposed spirits form a connection that makes something act where it is not. Leibniz's metaphysical argument asserts that Newton's conception of gravity and the medium introduced by Clarke grant too much legitimacy to miracles and spirits. For Leibniz, a miracle is an event that cannot be explained by the nature of things because it demands infinite power. It does not obey the principle of sufficient reason, and has a *causa finalis*, but no *causa efficiens*. It can only be accomplished by God and only for reasons of grace, but not to sustain the universe. Every act of God is a threat to the perfectly stabilized order of the world. The principles governing the universe also apply to God and manifest his omniscience, because they don't enhance or have to be enhanced. There is no loss in the world because every cause has a corresponding effect and God does not need to act. If he acts there must be a reason. This leads to a chain of causality in which forces are transmitted infinitely and without loss from causes to effects. Newton's assumption of heavenly intervention is not necessary. Leibniz does not maintain that divine actions at a distance exist; he states that there are no actions at a distance, but if there were, they would necessarily be divine because only God could cause them.

For the English physicists, natural laws are bound to God's interventions and consequently miracles do not constitute a contradiction, even if they imply action at a distance.³⁸ God must sustain the universal order. Action at a distance could thus be an unproblematic act of God aimed at just this, but it could also hint at yet undiscovered causes. It would, then, seem miraculous while still abiding natural laws. When Clarke replies to Leibniz's accusation that his conception of gravity is scholastic, he claims that even though the causes might be occult, the

³⁷ On another occasion, Hutchison remarked that mechanistic philosophy made the occult and supernatural acceptable and developed an understanding of science as a project which gives the occult a place in the world: "Indeed, I propose that an important function of the new view of matter was to protect a radically supernaturalistic ontology against the naturalism of the Renaissance. The mechanists' conception of matter as totally barren was used to offer a guarantee that supernatural activity was ever-present in the universe." See Keith Hutchison, "Supernaturalism and the Mechanical Philosophy," *History of Science* 21 (1983), 297.

³⁸ Cf. Carolyn Iltis, "The Leibnizian-Newtonian Debates: Natural Philosophy and Social Psychology," *British Journal for the History of Science* 6, no. 4 (1973).

observable and measureable effects are still worth exploring, presupposing that occult does not mean inexplicable. Consequently, it is possible to explain effects of the insensible.

In his last letter, Leibniz is forced to move away from the position that gravity is a miracle and thus a mistake. The application of the laws is too evident. Instead, he wrenches an admission from Clarke: His theology has to refrain from a force passively inherent to matter and assume an active principle affecting bodies from the outside.³⁹ Their immediate action at a distance acts at two places at the same time. This, of course, is opposed by Newton and Clarke. But Leibniz wants to push them to assume active principles in order to attack their position. For his principle of sufficient reason, only matter can act on matter, but not, as he writes to Clarke, “some immaterial substances, or some spiritual rays, or some accident without a substance, or some kind of *species intentionalis*, or some other I know not what the means”⁴⁰. Like Descartes, Leibniz assumes that small swirling particles trigger attraction and repulsion. All action thus must have a mechanical cause. Newton in turn argues against action at a distance because it would be inherent to matter. With this physical argument accompanying the metaphysical, he explicitly comes to the conclusion that forces only act through the relation of bodies. These active principles are not thought of as occult qualities, but as natural laws.⁴¹ Unfortunately, the correspondence stops at this point. Clarke’s fifth letter did not reach Leibniz, who died in November 1716.

As these preliminary remarks have shown, the correspondence can be read as a discussion about the margins of media and communication. In this regard, Leibniz’s most important point is this: Structurally, the function of introducing media into an argument is to effortlessly elicit the appearance of a judgement. In fact, in cases such as Newton’s spirits, a miracle has simply been redefined as a medium. For Leibniz, Newton’s universe lacks reason, because with *spirits* and *ethers* he explains what he cannot explain otherwise. Occult qualities can be called media, and thus appear as nothing more than effects of their rhetorical application. They help to gloss over open questions and theoretical gaps and consequently have a productive function. At stake is not just the persuasiveness of arguments or the commitment of philosophers. At stake is the ultimate. In a Leibnizian world, God would be different than in a Newtonian world. All this is

³⁹ Cf. Michael Friedman, “Kant and Newton: Why Gravity is Essential to Matter,” in *Philosophical Perspectives on Newtonian Science*, ed. Philipp Bricker and R. I. G. Hughes (Cambridge: MIT Press, 1990).

⁴⁰ Leibniz and Clarke, *The Leibniz-Clarke Correspondence*, 94.

⁴¹ Cf. Renate Wahsner, *Das Aktive und das Passive: Zur erkenntnistheoretischen Begründung der Physik durch den Atomismus* (Berlin: Akademie, 1981).

discussed as a problem of mediation that reaches into the heart of physics and shows the dependency of the concepts of media and communication on the occult.

Spiritualism and science in the Nineteenth century

Because the immediacy of action at a distance is forbidden for theological and philosophical reasons, physics has to investigate an in-between that tends to be negated. Actions at a distance close all distances, delays and gaps. Media, in this sense, connect and separate at the same instant. The in-between vanishes when they are described as immediate. The Neokantian philosopher Otto Liebmann gets right to the point of this proximity of causality and the occult in a discussion of the inexplicability of Newtonian forces in 1876: “Forces are ghosts of causality, but they are real and not imaginary. Take an iron key in the hand and approach a strong electromagnet to a distance of a few inches, then you will feel the ghost. It is there! And if you slide a strong partition between key and magnet, for example an oak board or a glass plate of an inch – it does not matter – this puzzling, mystical *actio in distans* still acts.”⁴² What Liebmann describes as a ghost of causality is the insensible causality of a force that acts in inexplicable ways. It is simply there. In this sense, and referring to the old double meaning, every causation over a distance is of occult origin. Ghosts of causality, spirits, ethers and effluvia loom where science is confronted with gravitational, electric or magnetic phenomena and their aporetic constellations of absence and presence. They appear where bodies or forces are in places where they should not be, like the ghosts evoked by spiritualism and occultism. At the time of Liebmann’s writings, spiritualists begin to investigate ghosts with the same experimental configurations scientists use to observe their forces—with instruments that are supposed to distinguish between miracles and natural events, but that tend to produce these events. With their implemented causality, they are thought to be immune to occult qualities and actions at a distance.

To come to an end, I want to draw two conclusions regarding the engagement with nineteenth century spiritualism. It is well known that many spiritualists understand the movement as modernistic and progressive, even though this might, in the words of Erhard Schüttelpelz, “not be the modernity we

⁴² Otto Liebmann, *Zur Analysis der Wirklichkeit* (Straßburg: Trübner, 1876), 269. “Kräfte sind Kausalgespenster, aber reale, nicht imaginäre. Man nehme einen eisernen Schlüssel in die Hand und nähere sich damit bis auf einige Zoll Distanz einem kräftigen Elektromagneten, da wird man das Gespenst schon fühlen und spüren. Es ist eben da! Und wenn man zwischen Schlüssel und Magnet eine starke Scheidewand einschiebt, etwa ein Eichenbrett oder eine zolldicke Glasplatte – gleichgültig! – jener rätselhafte Zug, jene mystische *actio in distans* wirkt nach wie vor.”

would retrospectively expect from the nineteenth century.”⁴³ My first point is, not very surprisingly, that the ambitions of spiritualists run parallel to early modern and also contemporary scientists. When, for example, Alfred Schrenck-Notzing rejects “every theory for my own observations in all forms,”⁴⁴ he follows Newton’s *hypotheses non fingo* exactly. As Richard Noakes has shown, the debates of Psychical Research revolve around the question of whether the observed phenomena empirically elude natural laws or depend on laws not yet known.⁴⁵ These researchers, while distinguishing themselves from spiritualists, draw the same lines of demarcation and understand their work as a program of empirical investigation without hypotheses. “We must not mix up the exact and the inexact, culminating in the development of parapsychology. The supremacy of accuracy must be absolute.” These are the words of Oliver Lodge, who clearly distinguishes his work from “pseudo-scientific spiritualist[s]”⁴⁶. Carl Du Prel uses a similar formulation: “Though occultism shows natural forces that we don’t know, still causality prevails here as in a physical laboratory.”⁴⁷ Though Du Prel assumes an evolutionary development of human consciousness parallel to the advancement of scientific-spiritualistic knowledge, his argument has the same intention as those that became prevalent in the seventeenth century, follows the same lines of causality, and uses the concept of a medium for the same reasons.

From these few examples, we can draw the following implications: The authorizing gestures and distinctions occupying spiritualism are similar to those of science, as they both argue against the occult. In this sense, spiritualism, too, opposes the inexplicable occult while concurrently investigating the insensible occult. In other words, the constitution of science is repeated in the heart of spiritualism. But as a historical process the importance of this transformation becomes only intelligible when taking into account the manner in which the insensible and the inexplicable become differentiated. The insensible becomes the realm of instruments: They serve to banish the occult through the observation and

⁴³ Erhard Schüttelpelz, “Mediumismus und moderne Medien: Die Probe des europäischen Medienbegriffs,” *Deutsche Vierteljahrsschrift* 86, no. 1 (2012): 130. My translation.

⁴⁴ Alfred von Schrenck-Notzing, *Materialisations-Phänomene* (Munich: Reinhard, 1914), 82.

⁴⁵ Cf. Richard Noakes, “Natural Causes? Spiritualism, Science, and the Supernatural in Mid-Victorian Britain,” in *The Victorian Supernatural*, ed. Nicola Bown, Carolyn Burdett and Pamela Thurschwell 42 (Cambridge: Cambridge University Press, 2004).

⁴⁶ William Crookes, “Spiritualism in the Light of Modern Science,” in *Researches in the Phenomena of Spiritualism*, 1–8 (London: Burns, 1874), 4.

⁴⁷ Carl Du Prel, *Der Tod, das Jenseits, das Leben im Jenseits* (Munich: Selbstverlag des Verfassers, 1899), 78.

inscription of hidden causalities, and in this function they are available to both scientists and spiritualists.

If the way in which science conceptualizes its own activities since the seventeenth century depends on the testimony of instruments; if this testimony of inscriptions and recordings observes the occult in the sense of the insensible while at the same time banishing the occult in the sense of the inexplicable because it is not causally ascertainable; and if in this historical process the strict boundary between science and non-science is introduced; then what does all this mean for the varied forms of spiritualism that appear in the nineteenth century? They understand themselves as scientific, share their premises with science, and nonetheless appear to transgress a border constitutive for science.

Perhaps, and this is my second conclusion, we should introduce a new differentiation or perspective here and inquire about the respective concepts of causality and about the dedicated function of action at a distance. We should look for alternative models for the discussion of causality in the nineteenth century—alternatives to the dominant *causa efficiens* model. These causalities are the epistemological basis of spiritualism. They influence the concepts of instruments and experiments and the concept of mediation. Asking these questions in an attempt to articulate a strict boundary between science and non-science allows us, on the one hand, to grasp different uses of instruments, as the instrument's function is to guarantee causality in the sense of *causa efficiens*, even where it is most improbable and action at a distance denies causality—but is open to other causalities.

On the other hand, we can draw a historical line from spiritualism to the crisis of science around 1900, when non-Newtonian physics, non-Euclidian geometry, and non-Aristotelian logic unsettle the foundations of science that separated it from spiritualism.⁴⁸ Perhaps the destiny of spiritualism around 1900 is bound too closely to that of science, and the modern way in which it understand its own role and its mode of causality are radically thrown into question with the rise of multimodal logic, the theory of relativity and quantum mechanics. After these upheavals, the old frontline between mechanical confirmability, sensibility, and speculation can no longer be sustained to reinforce the manner in which

⁴⁸ Around 1900, authors as diverse as Gaston Bachelard, Oliver Reiser and Gotthard Günther argue, the seemingly unshakeable foundations of occidental thought begin to quake due to the upheavals in logics, physics and geometry. Cf. Gaston Bachelard, *The New Scientific Spirit* (Boston: Beacon Press, 1987); Oliver L. Reiser, "Non-Aristotelian Logic and the Crisis in Science," *Scientia Poetica*, no. 61 (1937); and Gotthard Günther, *Beiträge zu einer operationsfähigen Dialektik* (Hamburg: Meiner, 1976). For a closer investigation see Hörl, *Die heiligen Kanäle*.

scientists and occultists that see themselves as scientists comprehend their activities. In this process, the line of demarcation developed in the seventeenth century had to be rewritten. With this crisis, the contingency of all causality becomes visible.

Science and spiritualism are both engaged in this crisis at the end of the nineteenth century. But the crisis also plays into the hands of spiritualism, because it transforms what apprehension and causality mean and what is explicable. It shifts the meaning of 'occult' once again, while the validity of action at a distance is revoked, as, for example, in quantum mechanics, C.G. Jungs ideas on synchronicity⁴⁹ or the immediacies of media theory—but with this horizon, we already enter the territory of the 20th century. Then – and also now – Leibniz's warning still holds: we should not mistake media for miracles, occult qualities or spirits that act as if there were media but turn out to be immediate.

⁴⁹ Condensed in Carl G. Jung, *Synchronizität, Akausalität und Okkultismus* (Munich: DTV, 1990).

Bibliography

- Asprem, Egil. "Pondering Imponderables: Occultism in the mirror of late classical physics." *Aries* 11, no. 2 (2011): 129–165.
- Bachelard, Gaston. *The New Scientific Spirit*. Beacon Press: Boston, 1985.
- Bloor, David. *Knowledge and the Social Imaginary*. London: Routledge, 1976.
- Blum, Paul R. "Qualitates occultae: Zur philosophischen Vorgeschichte eines Schlüsselbegriffs zwischen Okkultismus und Wissenschaft." In *Die okkulten Wissenschaften in der Renaissance*. Edited by August Buck, 45–64. Wiesbaden: Harrassowitz, 1992.
- Bown, Nicola, Carolyn Burdett, and Pamela Thurschwell, eds. *The Victorian Supernatural* 42. Cambridge: Cambridge University Press, 2004.
- Bricker, Philipp and R. I. G. Hughes, eds. *Philosophical Perspectives on Newtonian Science*. Cambridge: MIT Press, 1990.
- Buchdahl, Gerd. "History of Science and Criteria of Choice." *Minnesota Studies in Philosophy of Science*, no. 5 (1970): 204–245.
- Buck, August, ed. *Die okkulten Wissenschaften in der Renaissance*. Wiesbaden: Harrassowitz, 1992.
- Cantor, G. N. "The Theological Significance of Ethers." In *Conceptions of Ether: Studies in the History of Ether Theories 1740-1900*. Edited by G. N. Cantor and Hodge, M. J. S., 135–56. Cambridge: Cambridge University Press, 1981.
- Cantor, G. N. and Hodge, M. J. S., eds. *Conceptions of Ether: Studies in the History of Ether Theories 1740-1900*. Cambridge: Cambridge University Press, 1981.
- Carrier, Martin. *Raum-Zeit*. Berlin: Walter de Gruyter, 2009.
- Cohen, I. B. *Franklin and Newton: An Inquiry into Speculative Newtonian Science and Franklin's Work in Electricity as an Example thereof*. Philadelphia: American Philosophical Society, 1956.
- Crookes, William. *Researches in the Phenomena of Spiritualism*. London: Burns, 1874.
- "Spiritualism in the Light of Modern Science." In *Researches in the Phenomena of Spiritualism*, 1–8. London: Burns, 1874.
- Daston, Lorraine, and Katharine Park. *Wonders and the order of nature: 1150-1750*. New York: Zone Books, 1998.

- Doering-Manteuffel, Sabine. *Das Okkulte: Eine Erfolgsgeschichte im Schatten der Aufklärung; von Gutenberg bis zum World Wide Web*. Munich: Siedler, 2008.
- Du Prel, Carl. *Der Tod, das Jenseits, das Leben im Jenseits*. Munich: Selbstverlag des Verfassers, 1899.
- Freudenthal, Gideon. *Atom und Individuum im Zeitalter Newtons: Zur Genese der mechanistischen Natur- und Sozialphilosophie*. Frankfurt/Main: Suhrkamp, 1982.
- Friedman, Michael. "Kant and Newton: Why Gravity is Essential to Matter." In *Philosophical Perspectives on Newtonian Science*. Edited by Philipp Bricker and R. I. G. Hughes, 185–202. Cambridge: MIT Press, 1990.
- Frietsch, Ute. "Häresie und 'pseudo-scientia': Zur Problematisierung von Alchemie, Chymiatrie und Physik in der frühen Neuzeit." In *Pseudowissenschaft: Konzeptionen von Nichtwissenschaftlichkeit in der Wissenschaftsgeschichte*. Edited by Dirk Rupnow et al. 1st ed., 77–99. 1897. Frankfurt/Main: Suhrkamp, 2008.
- Grünbaum, Adolf. *Philosophical Problems of Space and Time*. London: Routledge, 1964.
- Guerlac, Henry. "Newton's Optical Aether: His Draft of a Proposed Addition to his Optics." *Notes and Records of the Royal Society of London* 22, 1/2 (1967): 45–57.
- Günther, Gotthard. *Beiträge zu einer operationsfähigen Dialektik*. Hamburg: Meiner, 1976.
- Hahn, Marcus and Erhard Schüttpelz, eds. *Trancemedien und neue Medien um 1900: Ein anderer Blick auf die Moderne*. Bielefeld: Transcript, 2009.
- Hanegraaff, Wouter J. *Esotericism and the academy: Rejected knowledge in western culture*. Cambridge: Cambridge University Press, 2012.
- Henry, John. "Occult Qualities and the Experimental Philosophy: Active Principles in pre-newtonian Matter Theory." *History of Science* 24, 335-381 (1986).
- Hesse, Mary B. "Action at a Distance in Classical Physics." *Isis* 46, no. 4 (1955): 337–353.
- Heßler, Martina. "Der Imperativ der Sichtbarmachung: Zur Bildgeschichte des Unsichtbaren." *Bildwelten des Wissens. Kunsthistorisches Jahrbuch für Bildkritik* 4, no. 2 (2006): 67–79.

- Holland, A. J., ed. *Philosophy, its History and Historiography*. Dordrecht: Reidel, 1985.
- Hörl, Erich. *Die heiligen Kanäle*. Berlin: Diaphanes, 2005.
- Hutchison, Keith. "What Happened to Occult Qualities the Scientific Revolution?" *Isis* 73, no. 2 (1982): 233–253.
- "Supernaturalism and the Mechanical Philosophy." *History of Science* 21 (1983): 297–333.
- Hüttemann, Andreas, ed. *Kausalität und Naturgesetz in der Frühen Neuzeit*. Stuttgart: Steiner, 2001.
- Iltis, Carolyn. "The Leibnizian-Newtonian Debates: Natural Philosophy and Social Psychology." *British Journal for the History of Science* 6, no. 4 (1973): 343–377.
- Jung, Carl G. *Synchronizität, Akausalität und Okkultismus*. Munich: DTV, 1990.
- Kümmel-Schnur, Albert. "Einleitung: Äther als Medium der Medienwissenschaft?" In *Äther: Ein Medium der Moderne*. Edited by Albert Kümmel-Schnur and Jens Schröter, 13–32. Bielefeld: Transcript, 2008.
- Kümmel-Schnur, Albert and Jens Schröter, eds. *Äther: Ein Medium der Moderne*. Bielefeld: Transcript, 2008.
- Latour, Bruno. *We have never been modern*. Cambridge, Mass: Harvard University Press, 1993.
- Leibniz, Gottfried Wilhelm, and Samuel Clarke. *The Leibniz-Clarke Correspondence*. With the assistance of Henry G. Alexander. New York: Manchester University Press, 1956.
- Lévi, Eliphas. *La Science des esprits: Révélation du dogme secret des Kabalistes. Esprit occulte des Évangiles. Appréciation des doctrines et des phénomènes spirites*. Paris: Baillière, 1865.
- Liebmann, Otto. *Zur Analysis der Wirklichkeit*. Straßburg: Trübner, 1876.
- MacDonald-Ross, G. "Occultism and Philosophy." In *Philosophy, its History and Historiography*. Edited by A. J. Holland, 95–116. Dordrecht: Reidel, 1985.
- Meinel, Christoph. "Okkulte und exakte Wissenschaften." In *Die okkulten Wissenschaften in der Renaissance*. Edited by August Buck, 21–44. Wiesbaden: Harrassowitz, 1992.
- Meli, Domenico B. "Caroline, Leibniz, and Clarke." *Journal of the History of Ideas* 60 (1999): 469–486.

- Nersessian, Nancy J. “Aether/or: The Creation of Scientific Concepts.” *Studies in the History and Philosophy of Science* 15, no. 3 (1984): 175–212.
- Newton, Isaac. *Opticks: Or, A Treatise of the Reflections, Refractions, Inflections & Colours of Light*. New York: Dover, 1717/1952. Reprint.
- . *Mathematical Principles of Natural Philosophy*. With the assistance of Florian Cajori. Berkeley: University of California Press, 1687/1934.
- . *Isaac Newton's Papers & Letters on Natural Philosophy*. With the assistance of Bernard I. Cohen. Cambridge: Harvard University Press, 1978.
- . *The Principia: Mathematical Principles of Natural Philosophy*. With the assistance of Bernard I. Cohen. Berkeley: University of California Press, 1999.
- Noakes, Richard. “Natural Causes? Spiritualism, Science, and the Supernatural in Mid-Victorian Britain.” In *The Victorian Supernatural*. Edited by Nicola Bown, Carolyn Burdett and Pamela Thurschwell, 23–43. Cambridge: Cambridge University Press, 2004.
- Reiser, Oliver L. “Non-Aristotelian Logic and the Crisis in Science.” *Scientia Poetica* 61, (1937): 137–150.
- Rheinberger, Hans-Jörg. *Experimentalsysteme und epistemische Dinge*. Frankfurt/Main: Suhrkamp, 2006.
- Rupnow, Dirk, Veronika Lipphardt, Jens Thiel, and Christina Wessely, eds. *Pseudowissenschaft: Konzeptionen von Nichtwissenschaftlichkeit in der Wissenschaftsgeschichte*. Frankfurt/Main: Suhrkamp, 2008.
- Schaffer, Simon. “Godly Men and Mechanical Philosophers: Souls and Spirits in Restoration Natural Philosophy.” *Science in Context* 1, no. 1 (1987): 53–85.
- Schrenck-Notzing, Alfred v. *Materialisations-Phänomene*. Munich: Reinhard, 1914.
- Schüttelpelz, Erhard. “Mediumismus und moderne Medien: Die Probe des europäischen Medienbegriffs.” *Deutsche Vierteljahrsschrift* 86, no. 1 (2012): 121–144.
- Shapin, Steven. “Of Gods and Kings: Natural Philosophy and Politics in the Leibniz-Clarke Disputes.” *Isis* 72, no. 2 (1981): 187–215.
- . “Pump and Circumstance: Robert Boyle's Literary Technology.” *Social Studies of Science* 14, no. 4 (1984): 481–520.
- Shapin, Steven, and Simon Schaffer. *Leviathan and the Air-Pump: Hobbes, Boyle and the Experimental Life*. Princeton: Princeton University Press, 1989.

- Shapiro, Barbara. "Testimony in Seventeenth-Century English natural Philosophy: Legal Origins and early Development." *Studies In History and Philosophy of Science, Part A* 33, no. 2 (2002): 243–263.
- Spitzer, Leo. *Essays in historical Semantics*. New York: Vanni, 1948.
- "Milieu and Ambiance." In *Essays in historical Semantics*, 179–316. New York: Vanni, 1948.
- Wahsner, Renate. *Das Aktive und das Passive: Zur erkenntnistheoretischen Begründung der Physik durch den Atomismus*. Berlin: Akademie, 1981.
- Wilson, Catherine. *The Invisible World: Early Modern Philosophy and the Invention of the Microscope*. Princeton: Princeton University Press, 1995.
- Zander, Helmut. "Höhere Erkenntnis: Die Erfindung des Fernrohrs und die Konstruktion erweiterter Wahrnehmungsfähigkeiten zwischen dem 17. und dem 20. Jahrhundert." In *Trancemedien und neue Medien um 1900: Ein anderer Blick auf die Moderne*. Edited by Marcus Hahn and Erhard Schüttelpelz, 17–56. Bielefeld: Transcript, 2009.