Svensk Teologisk Kvartalskrift 100 (2024), 199–224
p-ISSN 0039-6761 e-ISSN 2003-6248
DOI: https://doi.org/10.51619/stk.v100i3.26535

Imagining Science

Ancient Religion, Modern Science, and How We Talk About History

BRENT NONGBRI

Brent Nongbri is Professor of History of Religions at
MF Norwegian School of Theology, Religion and Society.

brent.nongbri@mf.no

Talking about religion in antiquity is tricky business.[1] This, at any rate, was my experience both in writing *Before Religion* and then in seeing the variety of reactions to it.[2] In the decade since the publication of the book, discussions about the applicability of the concept of religion for the study of the premodern world have moved in different directions. Some have argued

1. The material in this article has diverse origins. The proximate cause for writing was to engage with Schilbrack's critique of *Before Religion*. Kevin and I had a very enjoyable seminar together with colleagues from Lund in Ystad in September 2022, and what follows is a much-revised version of the material I presented there. Thanks especially to Jayne Svenungsson and Magnus Zetterholm for the invitation and to Jonathan Morgan for kind bibliographic assists. I had put together some of the material on early twentieth-century physics in preparation for the Religionswissenschaftliches Seminar at the University of Zürich in 2019. I thank Mattias Brand for the invitation and the participants for their feedback. Some of the thoughts about historiography were first formulated in response to Vaia Touna's critical reflections on *Before Religion* in 2016. A revised version of the Sweden presentation was sharpened by the participants in the seminar on Current Issues in Religious Studies and Western Esotericism at the University of Amsterdam in December 2022. I am grateful to Dylan Burns and Gerard Wiegers for the invitation and to all those who attended for the lively discussion. The written version has benefitted from the critical eyes of Mary Jane Cuyler, Hege Cathrine Finholt, Liv Ingeborg Lied, Paul Linjamaa, Ariadne Kostomitsopoulou Marketou, Candida Moss, Filip Rassmussen, and Vaia Touna. I am very grateful for all their insights. Finally, Stan Stowers, who read this article and strongly disagreed with most of it, has nonetheless been, in his customary manner, a generous and inspiring conversation partner.

2. Brent Nongbri, *Before Religion: A History of a Modern Concept*, New Haven, CT 2013, https://doi.org/10.12987/yale/9780300154160.001.0001.

that religion hopelessly distorts "ancient realities" and that ancient historians should thus avoid the concept completely.[3] Others have pointed out that any proposed "ancient realities", religious or otherwise, are part of the past and thus lost to us; any writings we produce about the past are completely determined by our own interests here in the present.[4] Kevin Schilbrack's corpus is a special case. His extensive engagement with both my own work and that of several other colleagues who have wrestled with similar issues has reframed the entire debate. Schilbrack resolutely defends a Critical Realist approach to the study of religion.[5] In the course of that defense, he has recast these conversations as a dispute between realist and antirealist positions.[6] Schilbrack has criticized my own work and assigned it a place on the antirealist side of this divide.[7] Schilbrack's arguments are thought-provoking, but I am unsure whether a realist/antirealist dichotomy is the most helpful approach to moving this dialogue in a productive direction.[8]

In this article, I aim to engage (hopefully in a fruitful way) some of Schilbrack's criticism by offering a few reflections on his appeals to (or rhetorical gestures towards) the natural sciences as an analogue for thinking about historiography. I think the use of examples from the natural sciences may offer the potential for progress in this discussion, though in ways that differ from Schilbrack's deployment of examples from the sciences. This article will thus proceed in three parts. The first part clarifies some of the positions outlined in *Before Religion*, as I read these a bit differently than Schilbrack does. The second part queries Schilbrack's references to the natural sciences by examining the histories of the concepts of phlogiston and the electron.

---

3. See Carlin A. Barton & Daniel Boyarin, *Imagine No Religion: How Modern Abstractions Hide Ancient Realities*, New York 2016.

4. See Vaia Touna, *Fabrications of the Greek Past: Religion, Tradition, and the Making of Modern Identities*, Leiden 2017, https://doi.org/10.1163/97890043486l5.

5. The bibliography on Critical Realism is massive. For a concise and informative overview, see Philip S. Gorski, "What is Critical Realism? And Why Should You Care?", *Contemporary Sociology* 42 (2013), 658–670, https://doi.org/10.1177/0094306113499533. I choose to capitalize Critical Realist to identify that I have in view here a well-defined group of adherents to a particular philosophical orientation and not scholars who are simply critical about realism.

6. It is not always clear that those whom Schilbrack classifies as "antirealist" would accept that identification.

7. Kevin Schilbrack, "Imagining 'Religion' in Antiquity: A How To", in Nickolas P. Roubekas (ed.), *Theorizing "Religion" in Antiquity*, Sheffield 2019, 59–78. I note in passing that other readers who operate from a Critical Realist perspective have read the conclusion of *Before Religion* as a kind of prelude to a Critical Realist investigation rather than an antithesis to such an investigation. See Philip Gorski, "The Origin and Nature of Religion: A Critical Realist View", *Harvard Theological Review* 111 (2018), 289–304, https://doi.org/10.1017/S0017816018000093.

8. Schilbrack appears to use the terms "antirealist" and "nonrealist" interchangeably. I will stick to "antirealist" unless I am directly quoting Schilbrack's work.

The third section suggests an alternative relationship between the natural sciences and historiography.[9]

Before Religion and Schilbrack's Critique

Schilbrack places *Before Religion* among a series of recent works that seek to "debunk" the concept of religion, that is, "to argue that it is analytically useless and has no referent".[10] This is not how I understand the overall argument of *Before Religion*. Rather, on my reading, the book makes a two-part case. First, it argues that the isolation of religion as a sphere of life that is ideally distinct from other areas, like science, international relations, law, and so on, is a relatively recent development in human history. In antiquity, gods were involved in all aspects of life from the most mundane quotidian social interactions to declarations of war. It is only in the era of the Protestant Reformation and European colonial expansion that the concept of religion coalesced with the meanings that it generally has today, a part of human belief and practice ideally distinguished from other, secular aspects of life. To put it another way, the idea of carving up the world into a space in which some things are religious and other things are not religious is not something that characterizes pre-modern cultures.[11] As such, talking about "religion" in antiquity has the potential to be quite misleading. Thus the second argument of the book: If we are going to try to use religion as an *analytical* term, such use, which *Before Religion* recommends, requires a degree of caution and self-consciousness. Using the concept of religion in relation to, for instance, ancient Hebrew sources can be somewhat confusing, since it is generally agreed that there is not an ancient Hebrew word or concept that is usually translated as "religion" in modern languages. Yet, we may nevertheless *want* to discuss the various practices and beliefs that *modern* people tend to group together as religion, to the degree that we find these individual practices and beliefs in these ancient sources.

The approach adopted in *Before Religion* was to distinguish quite sharply between *descriptive* uses of the word "religion" to refer to ways people describe themselves and *redescriptive* uses of the word "religion" that are

9. There is much more to say about Schilbrack's overall approach, but an in-depth discussion is outside the scope of this response. For recent critical engagements with Schilbrack's broader project, see Filip Rasmussen, "The Realism of Discourse: Critical Reflections on the Work of Kevin Schilbrack", *Method and Theory in the Study of Religion* 35 (2023), 1–12, https://doi.org/10.1163/15700682-bja10103; Russell T. McCutcheon, *Fabricating Religion: Fanfare for the Common e.g.*, Berlin 2018, 95–120, https://doi.org/10.1515/9783110560831.

10. Schilbrack, "Imagining 'Religion' in Antiquity", 61. Schilbrack's grouping includes myself, Russell T. McCutcheon, and Timothy Fitzgerald.

11. Or, to phrase it in an inverted way, "the existence of the religious/secular division is part of what constitutes the modern world". Nongbri, *Before Religion*, 12.

applied by scholars to people who do not use that term or an equivalent to describe themselves. In the latter case, *Before Religion* suggested that in order to avoid confusion or slippage between these two uses, scholars should be explicit in acknowledging that the use of the concept was an imposition on the ancient evidence:

> The problem with using "religion" to talk about the ancient world is not anachronism. All of our concepts are modern and hence anachronistic when applied to the ancient world. The problem is that we so often suffer from a lack of awareness that we are being anachronistic. Informed and strategic deployment of anachronism, on the other hand, can have unexpected and thought-provoking results. Thus, I do think the use of religion as an explicitly second-order or redescriptive concept has a place in the study of antiquity.[12]

To try to find a way to talk about ancient sources that was less likely to suggest that, say, ancient Romans, clearly distinguished between what modern people would call "religion" and other areas of life (politics, economics, law, science, and so on), *Before Religion* advocated a stance that tried to emphasize the concept's historically situated origins while at the same time maintaining the concept as a part of an analytical toolbox for talking about antiquity:

> If we want to go on talking about ancient Mesopotamian religion, ancient Greek religion, or any other ancient religion, we should always bear in mind that we are talking about something modern when we do so. We are not naming something any ancient person would recognize. In our current context, we organize our contemporary world using the concepts of religious and secular. Furthermore, we carve up the religious side of that dichotomy into distinct social groups, the World

12. Nongbri, *Before Religion*, 158. When he was not specifically engaged in the realist/antirealist argument, Schilbrack has outlined a position that I read as similar to what is articulated in *Before Religion*. See Kevin Schilbrack, "The Social Construction of 'Religion' and its Limits: A Critical Reading of Timothy Fitzgerald", *Method and Theory in the Study of Religion* 24 (2012), 103, https://doi.org/10.1163/15700681 2X634872, where he writes: "I recommend that one accept the idea that the modern western scholar who uses 'religion' for pre-modern or nonwestern examples *is* imposing a foreign, etic concept. Imposing foreign concepts is simply part of what it means to interpret human behavior. To impose a concept that the people one studies do not recognize, however, is not to assume that one's concept captures the essence of things or the metaphysical nature of things (two phrases Fitzgerald uses regularly for the positions he rejects). It is merely to claim that the concept is fitting and that, for one's own purposes, it is interesting." I suppose the difference between our outlooks would hinge upon what exactly is meant by the word "fitting" in the last sentence.

> Religions. Intentionally or not, when we bring this vocabulary to ancient sources, baggage comes along with it. I am advocating that we admit to and embrace this fact. Religion is a modern category; it may be able to shed light on some aspects of the ancient world when applied in certain strategic ways, but we have to be honest about the category's origins and not pretend that it somehow organically and magically arises from our sources. If we fail to make this reflexive move, we turn our ancient sources into well-polished mirrors that show us only ourselves and our own institutions.[13]

Schilbrack characterizes this stance as "nonrealist" and rejects it in no uncertain terms:

> Nongbri draw[s] the nonrealist conclusion [...] and so he holds that scholars can use the term "religion" to redescribe aspects of antiquity only if they do not claim that the term corresponds to something that is really there. A heuristic view like this is a problematic one for historians. It implies that one's redescriptions of the past reflect one's own interests but do not grasp any real patterns or causes in the societies studied. Given this heuristic view, one can argue that one's categories are useful for one's own purposes. But unless one commits to speaking of real structures in the society, that is, structures that operate independent of one's labels, one cannot argue that one's redescription of it is illuminating, explanatory, accurate, or true.[14]

I would not say that *any* redescription is (or could be) explanatory, accurate, or true, but I do think redescriptions can be illuminating without being characterized by any of those other terms.[15] I read Schilbrack here as gesturing towards what another Critical Realist has called the threat of "debilitating relativism" that allegedly looms unless one commits to the idea that words refer directly to pre-existing real things.[16] For Schilbrack, to talk

13. Nongbri, *Before Religion*, 153.

14. Schilbrack, "Imagining 'Religion' in Antiquity", 66.

15. I use "illuminating" here in the sense of helping us to think about a topic in a clearer way, not in the sense of coming closer to any "True" sense of a thing. Thanks to Candida Moss and Filip Rassmussen for pointing out the potential confusion.

16. Christian Smith, *What is a Person? Rethinking Humanity, Social Life, and the Moral Good from the Person Up*, Chicago 2010, 159. I find this view deeply misguided for a number of reasons, the most important of which is the observable process by which words gain and lose meanings through social consensus. We can see this process at work constantly in controversies over the contested meanings of words.

about religion in ancient sources that themselves lack the concept is "to discover" ancient religions.

In a more recent article that discusses the views of several historians who have weighed in on the applicability of religion for studying antiquity, Schilbrack argues that the simple *existence* in ancient sources of the various practices and beliefs encompassed by modern definitions of religion is sufficient to say that religion existed in that culture, even absent any evidence of internal connection between these practices and beliefs in the sources themselves:

> None of these historians argues that people in antiquity did not believe in gods or other spiritual beings, did not seek to interact with them with sacrifices and other rituals, did not create temples or scriptures, and so on. If one uses [Edward Burnett] Tylor's definition of *religion* as belief in spiritual beings or [William] James's definition of *religion* as adjusting one's life to an unseen order – *or any of the other definitions considered in this entry* – then religion *did* exist in antiquity.[17]

We do indeed find descriptions of these kinds of practices and beliefs in some of our sources, but my point is to stress that *we as historians* group these together as "religion" and that this act of grouping is a result of our own peculiar set of interests and is not intrinsic to the ancient sources. To me, Schilbrack's approach yields confusion. It is a type of confusion I explicitly tried to avoid in *Before Religion*:

> Consider the following statement from the anthropologist Benson Saler: "The testimony of various ethnographies affirms that people do not need a category and term for religion in order to 'have' a religion or be religious in ways that accord with notions of religiosity entertained by anthropologists." This is a very tricky statement. The end of the sentence shows that Saler is using religion as a redescriptive concept (religion is "notions of religiosity entertained *by anthropologists*"). The quotation marks around the word "have" are thus quietly doing an impressive amount of work for Saler. It is not the case that the people who are the subject of these ethnographies describe themselves as "religious" or "secular" or talk about "their religion". Rather, they "have" religion only insofar as anthropologists are free to impose their own framework for the purpose of study.[18]

17. Kevin Schilbrack, "The Concept of Religion", *Stanford Encyclopedia of Philosophy*, 28 March 2022, https://plato.stanford.edu/entries/concept-religion/. Italics in original.

18. Nongbri, *Before Religion*, 22.

I understand the descriptive/redescriptive distinction as an attempt to recognize and respect that different groups of people organize themselves and their worlds in different ways, while at the same time acknowledging the possibility (and desirability) of comparison and translation between different groups of people. Schilbrack's effort to establish a kind of substantial "reality" of redescriptions strikes me as counterproductive in this regard. If it is we historians who are picking out this-and-not-that from ancient sources in order to discuss "ancient religions", then it is *we* who are generating (not "discovering") the "ancient religion" in question. It is exactly this *bundling* of some sets of beliefs and practices in our sources and not others, this *classification*, that is the issue. Jonathan Z. Smith (1938–2017) can be helpful here. He commended the act of making generalizations, "understood to be a mental, comparative, taxonomic activity which directs attention to co-occurrences of selected stipulated characteristics while ignoring others". Applied to the study of religion, this approach meant that "our object of interest would then be 'religion' as the general name of a general anthropological category, a nominal, intellectual construction, surely not to be taken as a 'reality'. After all, there are no existent genera".[19] It is by applying the concept in this way that I think we can sensibly talk about religion in antiquity.

I think it is clear from the preceding discussion that part of Schilbrack's discomfort with *Before Religion* has to do with its stance on how the word "concept" is used. The approach to concepts in *Before Religion* followed the later work of Ludwig Wittgenstein (1889–1951), who pointed out that when we analyze a concept in practice, we generally analyze "the use of a word".[20] Thus, if a language lacks the word "religion" or an easily translatable analogous term, any use of the word "religion" as an analytical concept would be, in this framework, a redescriptive use. Schilbrack approaches concepts quite differently, connecting religion to "transhistorical reality":

> Nongbri raises precisely the question whether "you need the word to have the thing", and he argues that if a society lacks the word "religion", then it is not plausible to suggest that its members have the concept of religion, since concepts do not float free of language. He also argues that if a society lacks the concept of religion, then it is not plausible to suggest that its members have the experience of religion, since

19. Jonathan Z. Smith, "A Twice-Told Tale: The History of the History of Religions' History", *Numen* 48 (2001), 141–142, https://doi.org/10.1163/156852701750152636.

20. In the most recent English translation, "die Anwendung eines Worts" is rendered as "the application of a word". See Ludwig Wittgenstein, *Philosophical Investigations*, 4th ed., Chichester 2009, I.383.

> experience does not float free of concepts. But the account I am offering is not that "religion" refers to a transcultural and transhistorical concept or experience, but that it refers to a transcultural and transhistorical reality. The anachronistic objection assumes, fallaciously, that any given society is exhausted by what its members think of themselves.[21]

Responding to this reading involves digging a bit into what Schilbrack means by "transhistorical reality". Throughout his writings, when Schilbrack refers to the reality of religion, he is careful to distinguish between what he calls "natural kinds" or "physical facts" on the one hand and "social facts" or "social kinds" on the other. "Natural kinds" are said to exist independently of human cognition and include things like stars, volcanoes, mountains, lightning, frogs, cell nuclei, amino acids, molecules, carbon, and gravity. "Social kinds" are said to be dependent upon human cognition and include things like traffic laws, marriages, governments, private property, politics, economics, and religion.[22] If I read him correctly, Schilbrack argues that religion is a historically emergent concept that still can be applied transhistorically to capture a reality in antiquity that ancient people themselves may not have recognized.

I should say at the outset that I am among those who are not entirely comfortable with this overall distinction between natural kinds and social kinds, and much of what follows flows from that discomfort. Is

---

21. Kevin Schilbrack, "A Realist Social Ontology of Religion", *Religion* 47 (2017), 171, https://doi.org/10.1080/0048721X.2016.1203834. Elsewhere, Schilbrack elaborates this critique by asserting the transhistorical reality of more emotionally loaded concepts. For instance, he has written "religions, like dinosaurs and sexism, have existed even without the term". Kevin Schilbrack, "Religions: Are There Any?", *Journal of the American Academy of Religion* 78 (2010), 1125, https://doi.org/10.1093/jaarel/lfq086. The invocation of more highly charged concepts (such as sexism, racism, and homophobia) raises the stakes of these debates. There seems to be a question implied: Do you mean to say that cultures without these terms (or easily translatable analogues) did not have these phenomena? Did sexism not exist until the word was invented? It is clear that historical records (and current news reports) present us with cases of groups of people being marginalized and abused because of a variety of different characteristics. Yet, every culture encodes acts of marginalization and abuse differently. (Why do anglophones have rac-*ism* but homo-*phobia*?) It seems to me that it is worthwhile to acknowledge and think about these differences instead of glossing them over by insisting that concepts from one particular culture and era must be universally applicable in all places and times. At the same time, if we wish to assess aspects of our ancient sources using modern European concepts of racism and so on, we should certainly be free to do so.

22. These examples are drawn from several of Schilbrack's works mentioned elsewhere in these footnotes and also Kevin Schilbrack, *Philosophy and the Study of Religions: A Manifesto*, Chichester 2014. For a streamlined history of the idea of "natural kinds", see Ian Hacking, "Natural Kinds: Rosy Dawn, Scholastic Twilight", *Royal Institute of Philosophy Supplements* 61 (2007), 203–239, https://doi.org/10.1017/S1358246100009802.

"a mountain" *really* a natural kind? What are the boundaries of a mountain? How far do they extend in each direction? Do they continue below sea-level? (And how and when do we calculate sea-level?)[23] How can a mountain be differentiated from a very large hill or a so-called "extinct" volcano? The establishment of these natural kinds seem to be equally dependent upon human classification, though in less immediately obvious ways than the so-called social kinds.

Although Schilbrack makes this division, he often invokes "natural kinds" and examples from the physical sciences as analogies or illustrations in order to demonstrate the relationship between concepts and the real things they are said to designate.[24] Here is one example:

> The concept of "DNA", for example, has a history. The concept of a long molecular string that carried the blueprint of an organism's genetic information was hammered out over the twentieth century by contending biochemists. But the fact that the molecule to which the term "DNA" allegedly referred was first imagined as a single string, then modeled as a triple helix by Linus Pauling before it was re-imagined as a double helix by James Watson and Francis Crick does not imply that *the molecule itself* changed from a single helix to a triple helix to a double helix, much less that *the referent of the concept* was invented by Watson and Crick.[25]

Schilbrack's language here seems to imply access to "the molecule itself" and "the referent of the concept".[26] And in fact this kind of language characterizes his critique of what *Before Religion* has in his view neglected: "*real* patterns or causes in the societies studied", "*real* structures in the society, that is, structures that operate independent of one's labels", "*real* patterns

23. In practical terms, geologists use the concept of a geoid, a kind of approximation of a global mean sea level based on gravitational measurements, in order to measure elevations. But of course, this is simply a convention agreed upon by the scientific community.

24. As he phrases it, the "independence of the natural world from human concepts also holds when one is speaking of the social world". Schilbrack, "Imagining 'Religion' in Antiquity", 68.

25. Schilbrack, "Imagining 'Religion' in Antiquity", 66–67. My italics.

26. I was genuinely puzzled by this language and said as much in my brief comments in my own contribution to that volume. Brent Nongbri, "The Present and Future of Ancient Religion", in Nickolas P. Roubekas (ed.), *Theorizing "Religion" in Antiquity*, Sheffield 2019, 1–7, at p. 6: "On most points, Schilbrack's chapter is admirably clear, but I must admit that it remains unclear how exactly the critical realist gains this privileged access to the 'real structure' or 'actual character of the world', and how these 'real structures' can somehow adjudicate between competing, secondary conceptions of these structures by something other than the (socially determined, linguistically based, and thoroughly human) rules of the historical or interpretive enterprise."

in the world", and finally the "*actual character* of the world".[27] In order for such critiques to make sense, it would seem to be the case that Schilbrack and other Critical Realists have direct access to what those *real* patterns and *real* structures are, access to *the actual character* of the world. Yet, the chief spokespeople for Critical Realism push back against such an idea, generally acknowledging the limits of human knowledge. For instance, Roy Bhaskar (1944–2014), the founding figure of Critical Realism, has written: "We have explicitly to differentiate the independently existing (intransitive) world from our (transitive) socially produced and fallible claims to knowledge of it."[28] It seems to me that such a distinction would prevent one from speaking authoritatively about such things as "the referent of the concept" of DNA or "the molecule itself". One would need to say something like "our current understanding of the structure of DNA" or "what we now think of as the referent of this concept". Yet, introducing that kind of indeterminacy into the relationship troubles the whole idea of words and concepts being referential to real things.[29]

But I want to stay with these analogies from the natural sciences. There is something here that is worth pursuing. It may well be helpful for historians to draw analogies from the natural sciences, but I think the analogies drawn by Schilbrack and other Critical Realists employ an idiosyncratic view of how science proceeds as a practice and what kind of knowledge these practices produce. Without getting too tied up in definition of the term "concept", I want to think a bit about what it means to say that "the *referent of the concept* exists in the world" in the realm of the natural sciences. The examples of phlogiston and electrons should illustrate some of the problems and potentials.

Thinking with the Sciences – Phlogiston and Electrons as Concepts and Things

Schilbrack is open to the critique of concepts and offers an example taken from the sciences: "One can critique a given concept – or even reject it entirely as misconceived, as with 'phlogiston' – without denying that there is a real world, both human and extra-human, independent of our concepts."[30] Even though Schilbrack mentions phlogiston only in passing, it is worthwhile to dwell for a moment on both its place in histories of science and the

27. These references are found in Schilbrack, "Imagining 'Religion' in Antiquity", 66, 75–76. My italics.

28. Roy Bhaskar, *Enlightened Common Sense: The Philosophy of Critical Realism*, London 2016, https://doi.org/10.4324/9781315542942, 7. For clarification of Bhaskar's distinction between "transitive" and "intransitive", see also p. 47.

29. In other words, from what Archimedean point is a concept judged to be a better or worse approximation of the referent?

30. Schilbrack, "Imagining 'Religion' in Antiquity", 69.

characterization of it as a "misconceived" concept.[31] Schilbrack can casually use the word phlogiston without further explanation because readers can be expected to recognize it as a traditional example of a scientific concept that has been rightly rejected.[32] Yet, it is also generally accepted that the phlogiston theory set the conditions for the development of the concept of oxygen, a concept that appears much more familiar and acceptable to us today. A closer look at these eighteenth-century sources will, I think, complicate the easy use of "misconceived" to describe superseded scientific concepts.

The figure most closely associated with the theory of phlogiston is Georg Ernst Stahl (1659–1734).[33] Stahl argued that a substance called phlogiston could explain combustion and the production of metals from ores. From the standpoint of this system, combustible materials contained a common component, phlogiston, that was released when the combustible material burned. When ores were heated with charcoal, they absorbed phlogiston from the charcoal and became metals.[34] The phlogiston-based explanations of these processes were convincing to many throughout the first half of the eighteenth century and were eventually taught at universities. The system had loose ends but was, by the standards of the time, reasonably tidy. In the words of one historian (with tongue only somewhat in cheek, as I read him), "everything fitted together very well".[35]

Working firmly within this system, Joseph Priestley (1733–1804) is generally credited with discovering oxygen, the type of air that is best for breathing, through experiments in the 1770s that involved heating various substances and collecting the "air" they emitted.[36] In the context of our discussion, it will be useful to note carefully how Priestley characterized this discovery:

31. Elsewhere Schilbrack has written that sometimes "categories that are unreflectively taken to refer to something real actually fail to do so". The example he provides, again, is phlogiston. So, "misconceived" seems to mean "fails to refer to something real" in a correspondence theory of truth. See Schilbrack, "A Realist Social Ontology of Religion", 164.

32. Recent studies have, however, questioned or at least complicated, this standard story. See, for instance, Hasok Chang, *Is Water H_2O? Evidence, Realism and Pluralism*, London 2012, 1–65, https://doi.org/10.1007/978-94-007-3932-1.

33. Georg Ernst Stahl, *Zymotechnia fundamentalis*, Halle 1697, 80. Stahl built upon the earlier work of Johann Becher (1635–1682). See Johann Becher, *Actorum laboratorii chymici monacensis, seu Physicae subterraneae libri duo*, Frankfurt 1669, 146–168, on "combustible earth" (*terra pinguis*).

34. Stahl, *Zymotechnia fundamentalis*, 121: "In fact, I can show by various other experiments how phlogiston from fat and charcoal enters most readily into the metals themselves and regenerates them from burnt lime into their molten, malleable, and blendable consistency." ("Possum quidem variis aliis experimentis, hoc monstrare, quomodo φλογιστόν, ex pinguedinibus, carbonibus, in ipsa metalla promptissime ingrediatur, eaque regeneret, ex calcibus exustis, in fusilem suam, et malleabiliem, atque amalgamabilem, consistentiam.")

35. James Bryant Conant, *The Overthrow of the Phlogiston Theory: The Chemical Revolution of 1775–1789*, Cambridge, MA 1964, 14.

36. The technical literature of course distributes credit for the innovation more broadly,

> The most remarkable of all the kinds of air that I have produced by this process is, one that is five or six times better than common air, for the purpose of respiration, inflammation, and, I believe, every other use of common atmospherical air. As I think I have sufficiently proved, that the fitness of air for respiration depends upon its capacity to receive the *phlogiston* exhaled from the lungs, this species may not improperly be called, *dephlogisticated air*.[37]

Further experimentation in dialogue with Priestley's findings led Antoine Lavoisier (1743–1794) to rechristen Priestley's dephlogisticated air: "I will henceforth designate the dephlogisticated air or eminently breathable air in the state of combination and fixity, by the name of *acidifying principle*, or, if one prefers the same meaning under a Greek word, by that of *oxygine principle*."[38] Lavoisier's choice of the neologism *oxygine* ("acid maker") reflected his supposition (an incorrect supposition, from the standpoint of modern chemistry) that this substance was present in all acids. Lavoisier would go on to carry out experiments – and an extensive publicity campaign – that played a key role in the scientific community's ultimate rejection of the phlogiston-based system of explaining combustion in favor of his own system.[39] His *oxygine* thus became divorced from "dephlogisticated air", though it remained embedded in a system of thought very much dependent on substances now viewed skeptically by modern chemistry, such as

---

but in popular accounts, Priestley usually receives the bulk of the accolades. See, for instance, Victor K. McElheny, "Chemists Salute Priestly, 1774 Discoverer of Oxygen", *New York Times*, 3 August 1974, 25, 50. For doubts about the very idea of a specific moment of "discovery" of oxygen, see Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 4th ed., Chicago 2012, 53–57.

37. Joseph Priestley, "An Account of Further Discoveries in Air", *Philosophical Transactions of the Royal Society of London* 65 (1775), 384–394. Quotation at p. 387.

38. Antoine Lavoisier, "Considérations générales sur la nature des acides et sur les principes dont ils sont composés", *Histoire de l'Académie royale des sciences* (1778), 535–547. Quotation at p. 536: "Je désignerai dorénavant l'air déphlogistiqué ou air éminemment respirable dans l'état de combinaison & de fixité, par le nom de principe acidifiant, ou, si l'on aime mieux la même signification sous un mot grec, par celui de principe oxygine." In this era, the word "principle" could be used in the way we would now use the word "substance" or "material".

39. Antoine Lavoisier, "Réflexions sur le phlogistique, pour servir de développement à la théorie de la Combustion et de la Calcination, publiée en 1777", *Histoire de l'Académie royale des sciences* (1783), 505–538. For Lavoisier's promotional activities, see Arthur Donovan, *Antoine Lavoisier: Science, Administration and Revolution*, Cambridge 1996, especially 157–187. The supporters of the phlogiston theory continued to try to bring their theory into agreement with the latest experiments for decades. See the four-part study of J.R. Partington & Douglas McKie, "Historical Studies on the Phlogiston Theory", *Annals of Science* 2 (1937), 361–404, https://doi.org/10.1080/00033793700200691; *Annals of Science* 3 (1938), 1–58, https://doi.org/10.1080/00033793800200781; *Annals of Science* 3 (1938), 337–371, https://doi.org/10.1080/00033793800200951; *Annals of Science* 4 (1939), 113–149, https://doi.org/10.1080/00033793900201171.

caloric (heat conceived as a material fluid). For Lavoisier, combustion involved the *oxygine* giving up its caloric.[40] At this point, it may be helpful to pose a series of questions: Is Priestley's dephlogisticated air "the same thing" as Lavoisier's caloric-laden *oxygine*? Or is either of them the same thing as any of the allotropes of oxygen recognized by modern physics and chemistry? If we say that phlogiston is "misconceived", would we say that dephlogisticated air, dependent as it is on the concept of phlogiston, is also misconceived? If dephlogisticated air is misconceived, would not Lavoisier's *oxygine* also be described as misconceived? So, perhaps the central question is: From a Critical Realist standpoint like Schilbrack's, at what point does a concept cross the line from being "misconceived" to being a concept that has a "real" referent?[41] And by what standards does one make that distinction? Ian Hacking (1936–2023) has proposed a widely cited criterion for determining when a concept passes this threshold: the ability to manipulate something means that it necessarily has a real referent.[42] Yet, despite the common-sense appeal of such a view, the history of science regularly casts doubt on such claims. The history of phlogiston is itself illustrative here. Before the concept of phlogiston was completely abandoned, Torberg Bergman (1735–1784) performed measurements that (seemingly) quantified the phlogiston content of various metals.[43] It is easy to mistake the ability to *control* or *manipulate* with the ability to *understand* or *know* in a fundamental way.

The non-reality of the concept of phlogiston (its failure to refer, in Schilbrack's terms) complicates the idea of a real referent for the concept of *oxygine*. The history of physics demonstrates that a similar set of complications

40. Lavoisier, "Réflexions sur le phlogistique", 535: "Combustion itself is nothing other than the effect which takes place in the moment when the *oxygine* principle abandons the caloric matter to engage in a new combination." ("La combustion elle-même n'est autre chose que l'effet qui a lieu dans le moment où le principe oxygine abandonne la matière de la chaleur pour s'engager dans une nouvelle combinaison.") A similar formulation appears in Lavoisier's textbook first published in 1789: "The oxygen which forms the base of this gas is absorbed by, and enters into, combination with the burning body, while the caloric and light are set free." Antoine Lavoisier, *Elements of Chemistry, in a New Systematic Order*, Edinburgh 1790, 414. For the original, see Antoine Lavoisier, *Traité élémentaire de chimie, présenté dans un ordre nouveau*, vol. 2, Paris 1789, 478: "La combustion n'est autre chose, d'après ce qui a été exposé dans la première Partie de cet Ouvrage, que la décomposition du gaz oxygène opérée par un corps combustible. L'oxygène qui forme la base de ce gaz est absorbé, le calorique & la lumière deviennent libres & se dégagent."

41. In practice, the "crossing of the line" for the realist moves in the opposite direction, repeated experimentation demonstrates (or does not demonstrate) that a concept *thought* to have a real referent in fact has no real referent. I am grateful to Paul Linjamaa for the observation.

42. See Ian Hacking, *Representing and Intervening: Introductory Topics in the Philosophy of Natural Science*, Cambridge 1983, 22–24, https://doi.org/10.1017/CBO9780511814563.

43. See, for example, the chart based on Bergman's work in "Chemistry", *Encyclopædia Britannica*, vol. 4, 3rd ed., Edinburgh 1797, 374–635, at pp. 406–407.

also accompanies concepts of subatomic particles like electrons, which are often invoked in debates about realisms.[44] It is therefore worthwhile to dip into the history of the idea of electrons to try to articulate some of these complications.

To have a clear discussion of electrons involves talking about atoms, but where do we begin the story of atoms? Narratives of the development of atomic theory usually start in the fifth century BCE with the highly fragmentary remains of the writings of Leucippus and Democritus (c. 460–c. 370 BCE), who conceived of the world as being made up of small indivisible bodies (*atoma somata*).[45] Another starting point could be the Roman philosopher Lucretius (c. 99–c. 55 BCE), whose exposition of an Epicurean version of atomic theory survives much more fully than any Greek account in the form of a Latin poem of about 7,400 hexameter lines.[46] Or again, we could commence with Poggio Bracciolini (1380–1459), who discovered a manuscript of Lucretius in 1417 and reintroduced Lucretian atomic theory to Europe.[47] Or we might begin the story at the turn of the nineteenth century with the work of John Dalton (1766–1844), who is often lauded as the founder of modern chemistry, with his proposals that elements are formed from atoms of different weights that can combine in whole-number ratios to form compounds.[48] All of these figures have their place in modern textbook histories of the atom.

But we could begin the story equally well with scientific discussions that occupy less space in modern science textbooks. In the second half of the nineteenth century, one of the competing theories of matter held that atoms were not really particles at all but instead swirling vortices in a frictionless fluid sometimes identified as luminiferous ether.[49] Schilbrack's language about "the referent of the concept" existing in the world comes to mind here. Did luminiferous ether and vortex atoms exist in the world? Modern scientists would say no, but some scientists at the time acted *as if* vortex atoms and ether did exist. They conducted experiments and

44. See Paul Boghossian, *Fear of Knowledge: Against Relativism and Constructivism*, Oxford 2006, 38–39, https://doi.org/10.1093/acprof:oso/9780199287185.001.0001.

45. For the views of Leucippus and Democritus, we depend on later authors who were often hostile in their summaries. See, for example, Aristotle, *De caelo* 303a.

46. See David Sedley, *Lucretius and the Transformation of Greek Wisdom*, Cambridge 1998, https://doi.org/10.1017/CBO9780511482380.

47. For an engaging account of atomic theory in the Renaissance, see Stephen Greenblatt, *The Swerve: How the World Became Modern*, New York 2011.

48. See John Dalton, *A New Theory of Chemical Philosophy*, London 1808–1827, especially vol. 1, part 1, 211–216.

49. For a good overview, see George M. Fleck, "Atomism in Late Nineteenth-Century Chemical Philosophy", *Journal of the History of Ideas* 24 (1963), 106–114, https://doi.org/10.2307/2707861.

made calculations with that assumption. One of those scientists was J.J. Thompson (1856–1940), whose first book explored vortices in general and offered thoughts on vortices in chemical combinations.[50] Several years later, Thompson would publish the results of a series of experiments with cathode rays that led to the conclusion that atoms were particulate but in fact *not* indivisible, as had previously been supposed by particulate atomic theorists. Instead, he determined that they most likely contained even smaller, negatively charged particles that he called simply "corpuscles".[51] Already by 1902, Thompson's "corpuscles" were assimilated to the word that was then being used to designate the negative electric charge itself, the "electron" or "atom of electricity".[52]

In 1907, still employing the vocabulary of corpuscles, Thomson elaborated a "corpuscular theory of matter", producing a new view of the atom, which he described in the following way:

> In default of exact knowledge of the nature of the way positive electricity occurs in the atom, we shall consider a case in which the positive electricity is distributed in the way most amenable to mathematical calculation, i.e., when it occurs in a sphere of uniform density, throughout which the corpuscles are distributed.[53]

Thus, the atom was presented as a positively charged sphere, throughout which negatively charged particles were scattered. We may again ask Schilbrack's question: Did the referent of this concept exist in the world?

---

50. J.J. Thomson, *A Treatise on the Motion of Vortex Rings*, London 1883.

51. J.J. Thomson, "Cathode Rays", *The London, Edinburgh and Dublin Philosophical Magazine and Journal of Science* 44 (1897), 293–316, https://doi.org/10.1080/14786449708621070. Later in his life, Thomson reflected on the importance of his early interest in the idea of vortex atoms. See J.J. Thomson, *Recollections and Reflections*, New York 1937, 95: "The investigation [...] like most problems in vortex motion, involved long and complicated mathematical analysis and took a long time. It yielded, however, some interesting results and ideas which I afterwards found valuable in connection with the theory of the structure of the atom, and also of that of the electric field." And indeed, Thomson's way of speaking about corpuscles illustrates this development of thought: "We might regard the mass of a corpuscle as the mass of the ether carried along by the tubes of electric force attached to the corpuscle as they move through the ether. An example taken from vortex motion through a fluid may make this idea clearer." J. J. Thomson, *The Corpuscular Theory of Matter*, New York 1907, 162.

52. See Shelford Bidwell, "Magnetism", *The New Volumes of the Encyclopædia Britannica*, vol. 30, 10th ed., Edinburgh 1902, 452: "These particles, which were termed by their discoverer *corpuscles*, are more commonly spoken of as *electrons*, the particle thus being identified with the charge which it carries. [...] The application of this term [electron] to Thomson's corpuscle implies, rightly or wrongly, that, notwithstanding its apparent mass, the corpuscle is in fact nothing more than an atom of electricity."

53. Thomson, *The Corpuscular Theory of Matter*, 103.

Thomspon's honest presentation of his method gives us the answer: He said that he would, "in default of exact knowledge", proceed *as if* a certain model were the case in order to conduct further experiments. In practical terms, this is the way that all good science works. It is just that Thomson is refreshingly clear and forthright about it.

Just four years later, Ernest Rutherford (1871–1937), working with the results of a series of experiments that involved the scattering of alpha particles by extremely thin metal foils, posited still another model of the atom, now with "a central charge supposed concentrated at a point" and an "opposite compensating charge supposed distributed uniformly throughout" the spherical atom.[54] At the time, Rutherford proposed no more specific structure for the atom but instead referred to the work of Hantaro Nagaoka (1865–1950), who had suggested a model of the atom consisting of negatively charged electrons arranged in rings around a positively charged particle, with the stipulation that the electrons "must be very small compared to the attracting centre, in order that the ring may not collapse".[55] These ideas lie behind the common image of the atom as something like a solar system, with a dense positively charged nucleus orbited by much smaller negatively charged electrons. Just over a year after Rutherford's paper, Niels Bohr (1885–1962) argued in a set of articles that appeared in 1913 that electrons must orbit a positively charged centre (now the nucleus) in shells of particular energy levels and could change levels, emitting or absorbing energy when doing so.[56] Bohr's model did not, however, propose a means for exactly *how*

54. Ernest Rutherford, "The Scattering of α and β Particles by Matter and the Structure of the Atom", *The London, Edinburgh and Dublin Philosophical Magazine and Journal of Science* 21 (1911), 669–688, https://doi.org/10.1080/14786440508637080. Just as the conceptions of electrons and atoms change through time, so also the terms "alpha particles" and "beta particles" have been understood in quite different ways in the period since Rutherford coined the terms "alpha radiation" and "beta radiation" in 1899. See Ernest Rutherford, "Uranium Radiation and the Electrical Conduction Produced By It", *The London, Edinburgh and Dublin Philosophical Magazine and Journal of Science* 47 (1899), 116, https://doi.org/10.1080/14786449908621245. For context, see Roger H. Stuewer, "The Nuclear Electron Hypothesis", in William R. Shea (ed.), *Otto Hahn and the Rise of Nuclear Physics*, Dordrecht 1983, 19–67, https://doi.org/10.1007/978-94-009-7133-2_2.

55. Hantaro Nagaoka, "Kinetics of a System of Particles Illustrating the Line and Band Spectrum and the Phenomena of Radioactivity", *The London, Edinburgh and Dublin Philosophical Magazine and Journal of Science* 7 (1904), 451, https://doi.org/10.1080/14786440409463141.

56. Niels Bohr, "On the Constitution of Atoms and Molecules", *The London, Edinburgh and Dublin Philosophical Magazine and Journal of Science* 26 (1913), 1–25, https://doi.org/10.1080/14786441308634955; *The London, Edinburgh and Dublin Philosophical Magazine and Journal of Science* 26 (1913), 476–502, https://doi.org/10.1080/14786441308634993; *The London, Edinburgh and Dublin Philosophical Magazine and Journal of Science* 26 (1913), 857–875, https://doi.org/10.1080/14786441308635031.

electrons made these hypothesized "quantum jumps", as they came to be called.

The First World War brought a pause to these rapid developments, but just over a decade after Bohr's article, a quick series of important studies appeared.[57] In 1924, Louis de Broglie (1892–1987) proposed that electrons, like light, may be conceived as both particles and waves.[58] In 1925, Werner Heisenberg (1901–1976) pioneered matrix mechanics to provide a mathematical foundation for Bohr's quantum view of atoms.[59] Almost simultaneously, building on the insights of de Broglie, Erwin Schrödinger (1887–1961) produced a mathematical equation to describe the behaviour of quantum systems in terms of probabilities.[60] A new picture of the atom thus emerged in which electrons did not move in orbits but behaved as waves and existed in clouds around the nucleus, such that the position of an electron could not be known but instead must be expressed in terms of probabilities. In 1928, Paul Dirac (1902–1984) derived a wave equation that made the quantum view of the atom consistent with Albert Einstein's (1879–1955) theory of special relativity.[61] In the resulting physical models of the subatomic world, electrons are more like vibrations at specific energy levels in a field that occupies all of space that appear as particles only when they are observed.[62] In the writings of all of these scientists, the "reality" of the electron as an object in the physical world thus begins to flicker and sometimes disappear into the mathematics. Dirac put it this way in 1941:

> The mathematical methods at present in use in quantum mechanics are capable of direct interpretation only in terms of a hypothetical world differing very markedly from the actual one. These mathematical methods can be made into a physical theory by the assumption

57. The astonishingly fast pace of shifts in knowledge in the 1920s makes a tidy narrative difficult. This paragraph is is a highly selective and simplified account.

58. Louis de Broglie, "Recherches sur la théorie des quanta", *Annales de physique* 3 (1925), 22–128. For a more general discussion, see Louis de Broglie, *An Introduction to the Study of Wave Mechanics*, London 1930.

59. Werner Heisenberg, "Über quantentheoretische Umdeutung kinematischer und mechanischer Beziehungen", *Zeitschrift für Physik* 33 (1925), 879–893, https://doi.org/10.1007/BF01328377.

60. Schrödinger's papers on the topic were published in 1926 and are translated in Erwin Schrödinger, *Collected Papers on Wave Mechanics*, London 1928.

61. See Paul Adrien Maurice Dirac, "The Fundamental Equations of Quantum Mechanics", *Proceedings of the Royal Society of London, Series A* 109 (1925), 642–653, https://doi.org/10.1098/rspa.1925.0150; Paul Adrien Maurice Dirac, "The Quantum Theory of the Electron", *Proceedings of the Royal Society of London, Series A* 117 (1928), 610–624, https://doi.org/10.1098/rspa.1928.0023.

62. It is worth pausing to reflect on just how different Dirac's electrons are from Thomson's corpuscles. Is there any meaningful sense in which they are "the same thing"?

> that results about collision processes are the same for the hypothetical world as the actual one. One thus gets back to Heisenberg's view about physical theory – that all it does is to provide a consistent means of calculating experimental results.[63]

Furthermore, at what seemed to be the most fundamental level, it turned out that knowledge of the world involved what has come to be known as "the observer effect". As Heisenberg phrased it, at the atomic level, "the interaction between observer and object causes uncontrollable and large changes in the system being observed".[64] Compare the view of Bohr, which is in some ways more radical: "The interaction between the objects under investigation and our tools of observation, which in ordinary experience can be neglected or taken into account separately, forms, in the domain of quantum physics, an inseparable part of the phenomena."[65]

For these physicists, this recognition that the researcher has a determining effect on the phenomena being observed brought about something we might now describe as a reflexive posture. Werner Heisenberg spelled out these implications more fully in 1958:

> Profound changes in the foundation of atomic physics occurred in our century which lead away from the reality concept of classical atomism. It has turned out that the hoped-for objective reality of the elementary particles represents too rough a simplification of the true state of affairs and must yield to much more abstract conceptions. When we wish to picture to ourselves the nature of the existence of the elementary particles, we may no longer ignore the physical processes by which we obtain information about them. [...] For the smallest building blocks of matter every process of observation causes a major disturbance; it turns out that we can no longer talk of the behavior of the particle apart from the process of observation. In consequence, we are finally led to believe that the laws of nature which we formulate mathematically in quantum theory deal no longer with the particles themselves but with our knowledge of the elementary particles. The question whether these particles exist in space and time "in themselves" can thus no longer be posed in this form. We can only talk about the processes that occur

63. Paul Adrien Maurice Dirac, "The Physical Interpretation of Quantum Mechanics", *Proceedings of the Royal Society, Series A* 180 (1942), 17–18, https://doi.org/10.1098/rspa.1942.0023.

64. Werner Heisenberg, *The Physical Principles of the Quantum Theory*, Chicago 1930, 3.

65. Niels Bohr, "The Unity of Human Knowledge", *American Journal of Hospital Pharmacy* 17 (1960), 696, https://doi.org/10.1093/ajhp/17.11.694.

> when, through the interaction of the particle with some other physical system such as a measuring instrument, the behavior of the particle is to be disclosed. The conception of the objective reality of the elementary particles has thus evaporated in a curious way, not into the fog of some new, obscure, or not yet understood reality concept, but into the transparent clarity of a mathematics that represents no longer the behavior of the elementary particles but rather our knowledge of this behavior. The atomic physicist has had to come to terms with the fact that his science is only a link in the endless chain of discussions of man with nature, but that it cannot simply talk of nature "as such".[66]

The view from these physicists of the middle of the twentieth century encourages humility about the kind of knowledge that the physical sciences *as a practice* can produce. Heisenberg put it this way: "In science, also, the object of research is no longer nature in itself but rather nature exposed to man's questioning, and to this extent man here also meets himself."[67] Niels Bohr made a similar point in a speech delivered in 1960: "Indeed, from our present standpoint, physics is to be regarded not so much as the study of something *a priori* given, but rather as the development of methods for ordering and surveying human experience."[68]

The views of Heisenberg, Bohr, and Dirac are of course not the only interpretations of the quantum turn in physics. Einstein never accepted their position, intuiting that despite its promise, the quantum mechanics developed in the 1920s simply could not be "complete". Already in 1935, Einstein and two colleagues published a provocative paper challenging Bohr's position by pointing out that certain correlations resulting from one quantum system interacting with another (the phenomenon now known as entanglement) result in the counterintuitive conclusion that the measurement of one particle affects the state of another particle even if it is very distant from the first.[69] Until his last days, Einstein remained troubled by these "spooky

66. Werner Heisenberg, "The Representation of Nature in Contemporary Physics", *Daedalus* 87 (1958), 95–108. Quotation at pp. 99–100.

67. Heisenberg, "The Representation of Nature", 105.

68. Niels Bohr, "The Unity of Human Knowledge", in Aage Bohr (ed.), *Niels Bohr: Essays 1958–1962 on Atomic Physics and Human Knowledge*, Suffolk 1963, 8–16. Quotation at p. 10. On the fate of Bohr's quotation on the internet, see N. David Mermin, "What's Wrong With This Quantum World?", *Physics Today* 57 (2004), 10–11, https://doi.org/10.1063/1.1688051.

69. Albert Einstein, Boris Podolsky & Nathan Rosen, "Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?", *Physical Review* 47 (1935), 777–780, https://doi.org/10.1103/PhysRev.47.777. It is perhaps worth noting that when Schrödinger coined the term "entanglement" for this phenomenon, he referred not to the particles themselves, but "that which I have called the *entanglement* of our knowledge of the two bodies". Erwin Schrödinger, "The Present Situation in Quantum Mechanics", *Proceedings*

actions at a distance".[70] Objections also came from Schrödinger, who designed his famous cat illustration to express what he viewed as the absurdity of the probabilistic aspects of quantum theory when applied to macroscopic objects (like cats).[71]

Despite these and other reservations, the discipline of physics continued to build on the insights of quantum mechanics, eventually incorporating it into quantum field theory, which now forms part of the foundation of the Standard Model of physics. And the cluster of views associated with Bohr and Heisenberg remains influential.[72] There has been no shortage of efforts to supplant that interpretation – superstring theories, many-worlds theories, loop quantum gravity theories, objective collapse theories, and more.[73] But none of these has yet proven persuasive to a majority of physicists. In terms of where "the science" stands now, we may quote the view of two prominent physicists and critics of the Standard Model: "In its standard formulation and interpretation, quantum mechanics is a theory which is excellent (in fact it has an unprecedented success in the history of science) in telling us everything about *what we observe*, but it meets with serious difficulties in telling us *what there is*."[74]

I want to draw out three points from this discussion. First, I think electrons are great. I'm a fan. Today's scientific community accomplishes amazing things and provides us with technologies that we can all appreciate. As I was in the process of writing this paper, I was also completing a report on the results of radiocarbon analysis of several ancient Greek and Latin manuscripts. I am a grateful user of the technologies produced by modern science. And I am happy to treat its models and theories *as if* they represent reality. But, if the history of science serves as a guide, these models and theories can and will change.[75] Thus, to suggest that there are "real" referents to these particular concepts *du jour* seems to me to be hasty and somewhat

of the American Philosophical Society 124 (1980), 323–338. Quotation at p. 332.

70. The phrase ("spukhafte Fernwirkungen") comes from a letter Einstein wrote to Max Born dated 3 December 1947 and published in Max Born, *Natural Philosophy of Cause and Change*, Oxford 1949, 122.

71. Schrödinger, "The Present Situation", 328.

72. I avoid the term "Copenhagen interpretation" of quantum mechanics in deference to the growing consensus that it conflates too many conflicting views to be useful. See Don Howard, "The Copenhagen Interpretation", in Olival Freire Jr. (ed.), *The Oxford Handbook of the History of Quantum Interpretations*, Oxford 2022, 521–542.

73. For a good overview of the present state of affairs, see Carlo Rovelli, *Reality is Not What it Seems: The Journey to Quantum Gravity*, London 2017.

74. Giancarlo Ghirardi & Angelo Bassi, "Collapse Theories", *Stanford Encyclopedia of Philosophy*, 15 May 2020, https://plato.stanford.edu/entries/qm-collapse/. Italics in original.

75. This is simply an observation of scientific practice without a value judgement, not to be confused with the argument sometimes known as pessimistic induction.

hubristic, not to mention out of keeping with the continuous process of revision that is characteristic of scientific practice.[76]

This leads to my second point, namely that the easy, almost common-sense reference to the simple "reality" of molecules, atoms, and subatomic particles ("the referents of the concepts", to use Schilbrack's terminology) seems out of touch with realism debates in the physical sciences. By extension, so too is the distinction between natural kinds and social kinds in general. Thus, what Schilbrack and others describe as "natural kinds" might be described as humans' current best efforts to understand and navigate the world. We treat these kinds *as if* they are real until, through random experience or designed experiment, it no longer seems good to do so. Such a view does not deny the reality of a world outside ourselves and our conceptions, but it does recognize the limits of those conceptions. If pressed on the issue, I would consider this kind of position a very much pared down and humble realism, though I would again stress that the realism/antirealism distinction as Schilbrack applies it may not be an especially useful tool in these discussions.[77]

Third, the analogy that Schilbrack uses between concepts and their alleged referents in the natural sciences to talk about concepts and alleged referents in the study of religion is not effective, but it is suggestive of a different kind of analogy. Even if a field like quantum mechanics has "serious difficulties in telling us *what there is*" at a fundamental level, the scientists who work in the field have sets of rules in place that ensure that the practice of science provides us with usable and generally reliable (though fallible) tools for navigating the world. Electrons (and atoms and molecules and mountains) are parts of descriptive systems that scientists use to

76. If one of the competing "theories of everything" turns out to satisfy the mathematical needs and experimental results, do we really imagine that the community of physicists will take off their lab coats, dust off their hands, and say, "We've got reality. Let's call it a day"? It seems unlikely.

77. I am (painfully) aware of the vast bibliography on various "realisms" that is not cited here. I would only point out that there are varieties of scientific realisms that move away from the kind of direct connections between concepts and referents that Schilbrack endorses. For instance, Karen Barad's notion of agential realism "rejects the notion of a correspondence relation between words and things and offers in its stead a causal explanation of how discursive practices are related to material phenomena. It does so by shifting the focus from the nature of representations (scientific and other) to the nature of discursive practices (including technoscientific ones), leaving in its wake the entire irrelevant debate between traditional forms of realism and social constructivism". Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*, Durham, NC 2007, 44–45, https://doi.org/10.1215/9780822388128. For a concise overview of the theory, see Karen Barad, "Agential Realism – A Relation Ontology Interpretation of Quantum Physics", in Olival Freire Jr. (ed.), *The Oxford Handbook of the History of Quantum Interpretations*, Oxford 2022, 1031–1054. I thank Liv Ingeborg Lied for bringing Barad's work to my attention.

navigate and manipulate the world. The community of scientists have rules for what gets to count as knowledge about these systems (what is considered a well-designed experiment, what a good explanation entails, and so on).[78] We might think of historians relating to the past through a similar process.

Lessons for Historiography

We seem to have drifted quite far from the questions of the concept of religion and historiography that Schilbrack raised. But our trip through some of the well-travelled (and less travelled) paths in the history of science can be suggestive for historians, who may find themselves facing analogous challenges and perhaps benefitting from analogous solutions for moving forward.

To begin with some of the basic insights of late-twentieth-century historiography: Historians study surviving traces of the past. The past is the totality of things that have happened.[79] Histories are narratives. The past and history are thus not the same *kinds* of things. Historical accounts cannot be judged against the past because the past is gone and not directly accessible to us in the present. What is accessible are traces left from the past – artifacts and texts. Keith Jenkins has put it in this way:

> No account can re-cover the past as it was because the past was not an account but events, situations, etc. As the past has gone, no account can ever be checked against it but only against other accounts. We judge the "accuracy" of historians' accounts *vis-à-vis* other historians' interpretations and there is no real account, no proper history that, deep down, allows us to check all other accounts against it: there is no fundamentally correct "text" of which other interpretations are just variations; variations are all there are.[80]

But if "the past" is not directly accessible, how then do we judge one historical account as better or worse than another?

---

78. For a recent and highly readable history of this regime of rules, see Michael Strevens, *The Knowledge Machine: How Irrationality Created Modern Science*, New York 2020. For a grittier account of the social practice of science, see Andrew Pickering, *Constructing Quarks: A Sociological History of Particle Physics*, Chicago 1984.

79. I make this statement in the context of a human scale and acknowledge that developments in modern physics may require a rethinking of this "common sense" notion of the past. For two views, see Barad, "Agential Realism", 1048–1049; Carlo Rovelli, *The Order of Time*, London 2018.

80. Keith Jenkins, *Rethinking History*, London 2003, 14, https://doi.org/10.4324/9780203426869.

Like scientists, historians set up rules. Historians establish rules for what constitutes good history and what counts as evidence. These rules are socially constructed and always under revision. Some rules seem fairly stable (for example, "Internal contradictions in historical accounts are bad"). Other rules lose currency (for example, "Good history teaches us about Great Men and the Great Things they accomplished").[81] Historians judge each other by how well we follow the rules (and, on occasion, how convincingly we challenge those rules).

What, then, do we say about those traces of the past that we treat as our sources? Even Jenkins speaks of them as somehow decisive: "Whilst *the sources may prevent just anything at all from being said*, nevertheless the same events/sources do not entail that one and only one reading has to follow."[82] How does such a determinative view of "the sources" relate to Jenkins's earlier assertion that "variations are all there are"? A generous reading would be that "the sources" do not constrain their own interpretation *by themselves*, but in dialogue with the socially determined sets of rules by which historians operate. Historians determine which traces of the past get to count as sources and then *invest* sources with power. This way of thinking about sources is nicely captured by the historian Simon Goldhill's characterization of "things":

> Things require people to make them talk, even and especially within the rhetoric which insists that "things speak for themselves". [...] Things do not have a life of their own, simply awaiting the excavator's spade, but always take shape and meaning within a cultural milieu, a cultural milieu which is reciprocally created and moulded by things. Things take on cultural authority because they can be taken to express value, ideology, history; things can lose their authority because this invisible, soft power is not integral to them.[83]

Things, or perhaps better, traces of the past, do exist but what is meaningful about them are the uses to which we put them here in the present. We might summarize this view of the practice of history as follows:

---

81. An excellent example of this phenomenon can be drawn from some of the material treated in this article, namely the changing narration of the "Chemical Revolution". Older histories lionized Lavoisier as a shining beacon of Truth in a world of ignorance, while more recent studies tend to emphasize his embeddedness in the scientific trends and struggles of the time. See the discussion in Frederic Lawrence Holmes, *Eighteenth-Century Chemistry as an Investigative Enterprise*, Berkeley, CA 1989.

82. Jenkins, *Rethinking History*, 15. My italics.

83. Simon Goldhill, *The Buried Life of Things: How Objects Made History in Nineteenth-Century Britain*, Cambridge 2015, 195, https://doi.org/10.1017/CBO9781316103821.

- Historians *invest* certain sources with power (or determine what things get to be considered as sources).
- The community of historians has a *social* agreement, almost always unspoken, that says we *grant* these ancient artifacts/documents with an authority, that they will in some sense be determinative for assessing better and worse historical readings.
- Thus, our interests here in the present shape all of our interactions with ancient sources.
- Our relationship with these sources and our determination of *what gets to count* as a valid source in the first place are all firmly planted in the contemporary concerns of historians.
- But within the game that historians play, within the sets of rules that historians continuously establish, debate, and revise, we can still talk coherently and convincingly about the past.
- It is, however, a past that is always out of reach. So, historical accounts are always subject to revision, but we can still say: My understanding of the ancient world is better than your understanding of the ancient world, because my reading shows more careful and thorough consideration of the ancient sources.
- The surviving ancient sources have this value in discussions of the past *not* because they *are* the past. Rather, it is because the community of historians have set up the rules of engaging and interpreting sources in this way.

Concluding Thoughts

I will close by offering an extended quotation from one of Schilbrack's essays on realism. It nicely draws together several of the issues discussed in this article:

> Though the invention of the concept of "religion" is recent, the claim that there really is religion in a culture that lacks that concept is analogous to the claim that there really is money, property, royalty, or sports in cultures that lack those concepts. When one applies such labels and redescribes a culture with an etic term, it is true that one may misunderstand or distort it. And it is important not to drop the fact that such redescriptions are never free of the scholar's political interests and biases. Nevertheless, such labels refer to roles, practices, and institutions that structure a given society, and these structures operate before they are redescribed. Societies are not unstructured, like generic white noise or cookie dough, but are structured by the imaginations of their

> members. My proposal, in other words, is that structured forms of life predicated on the belief in superhuman beings – that is, religions – existed even before the label "religion" was invented. The scholar's use of the label does not create the form of life. Map is not territory.[84]

I agree with Schilbrack that we can find evidence in ancient sources for social structures of ancient people. If we follow Schilbrack in accepting that "societies are structured by the imaginations of their members", it still seems to me worthwhile to distinguish between structures that modern people imagine (including religion) and the structures imagined by those groups who lived before the emergence of the concept of religion. Insisting on the "reality" of religion in eras before anyone used that concept overwrites the ancient imagined structures in what seems to me to be an unhelpful way. Cultures can posit superhuman or non-obvious beings and interact with them in various ways without necessarily bundling those interactions together as religion and sequestering them from "secular" domains of life.

I want to draw out a final point from this quotation. Throughout much of that essay, Schilbrack refers to Jonathan Z. Smith and marshals Smith's work for his Critical Realist project. And at this climactic point in his essay, Schilbrack concludes with a statement that, for a certain set of readers, is surely a distinct echo of Smith's famous essay and eponymous book, *Map is Not Territory*. A distinct echo, but, perhaps tellingly, not a full quotation. Smith ended the essay (and book) with that statement, but included a short coda that, if taken seriously, would significantly complicate Schilbrack's project. According to Smith, "map is not territory – but maps are all we possess".[85] That is to say, the "territory" to which Schilbrack refers is, within Smith's framework, just another map. This kind of claim does not, I think, force us to think of Smith as a "nonrealist" in the sense that Schilbrack uses that term. Smith's assertion does not seem to me to be an ontological claim (a denial of the *existence* of things outside our maps) but rather an epistemological claim (a recognition of *the limits of our knowledge* of things outside our maps).[86] Schilbrack makes a valiant effort to claim Smith as an ally to Critical Realism and to wrest his legacy from those whom he regards as antirealists. But the fact that both groups seem to be so ardently drawn to

84. Schilbrack, "A Realist Social Ontology of Religion", 167.

85. Jonathan Z. Smith, *Map is Not Territory: Studies in the History of Religions*, Chicago 1978, 289–309. Quotation at p. 309. Smith here draws on the work of Alfred Korzybski, *Science and Sanity: An Introduction to Non-Aristotelian Systems and General Semantics*, 3rd ed., Lakeville, CT 1950, 55–65.

86. That Smith encourages scholars to "undergo the ordeal of incongruity" when working with sources suggests that he understands them to be invested with a kind of agency, to be something other than reflections of ourselves. Smith, *Map is Not Territory*, 309.

Smith's oeuvre is perhaps an indication that becoming preoccupied by the realist/antirealist dichotomy is not really the best way of proceeding. If the physics of the last century and a half has taught us anything, it is that our most fundamental ideas about the universe – what we think the "real" character of the world might be – can change quite radically in the space of a few decades. Historians should take heed and approach their own engagement with the traces of the past with due humility.[87] ▲

SUMMARY

Disagreement about the trans-cultural applicability of the concept of religion has been a feature of the academic study of religion for decades. In a series of recent essays, Kevin Schilbrack has powerfully reframed these discussions as a debate between realist and antirealist philosophical orientations. Aligning himself with Critical Realism, Schilbrack argues that religion is a transcultural and transhistorical reality and that those who deny this are antirealists. As my own work is among his targets, this article engages Schilbrack's critique. The first part of the article challenges some of Schilbrack's readings of *Before Religion*. The second part queries Schilbrack's use of examples from the physical sciences as analogies for the relationship between concepts and the real things they are said to designate. The third part models an alternative use of examples from the natural sciences to think about historiography, concluding that the realist/antirealist dichotomy is not a useful tool. The physics of the last 150 years has shown that our most fundamental ideas about the universe – what we think the "real" character of the world might be – can change radically in short intervals of time. Historians should take heed and approach their own engagement with the traces of the past with due humility.

87. Even if I am unpersuaded that speaking of "transhistorical realities" will help us as we continue to grasp at the past and use it to make sense of our present, I am grateful for Schilbrack's careful interrogation of my work and that of others. It has encouraged me to think more thoroughly through several important issues and to engage more fully in bodies of literature that I had until now neglected.