

THE MAKING OF THE HUMANITIES – VOL. III

The Making of the Humanities

Volume III:
The Modern Humanities

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In memory of John Pickstone (1944-2014)

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I.4 The Best Story of the World

Theology, Geology, and Philip Henry Gosse's

Omphalos

VIRGINIA RICHTER

I

In the first half of the nineteenth century, philological readings of the Scriptures and new approaches in geology – set down, most importantly, in Charles Lyell's *Principles of Geology* (1830-1833) – uncovered the various strata of the Book of Books and the Book of Nature, respectively. The result of applying the historical-critical method to the Scriptures was precisely the discovery of its historicity: as philologists and – mainly Protestant – theologians such as Friedrich Schleiermacher and David Friedrich Strauss – whose *The Life of Jesus, Critically Examined* (1835-1836) was disseminated in Britain in George Eliot's influential translation (1849) – could show, the various books of the Bible had been composed at different points in time and by different authors.¹ The empirical study of geological formations resulted not only in the realization that the age of the earth by far surpassed the six thousand years allotted by the Bible, but also that geological processes were dynamic albeit often infinitesimally slow.² As Lyell stated, 'this planet' could no longer be regarded 'as having remained unaltered since its creation', since modern geologists had 'proved that it had been the theater of reiterated change, and was still the subject of slow but never ending fluctuations.'³ Neither the earth nor the Scriptures were static, neither had emerged through a single act of creation or revelation; rather, both were the result of slow processes of loss (erosion, textual corruption) and accretion (sedimentation in a geological as well as a philological sense). In a parallel process in the humanities and the sciences, divine authority was undermined by the emergence of new methodologies: the Book of Nature was found to be author-less; natural phenomena emerged under the influence of secondary causes; any reference to a first mover had become dispensable. The authorship of the Book of Books, conversely, now appeared as decentered, not revealed by the Holy Spirit, but composed by various human authors.

This story of the emergence of the modern disciplines has been told, for example, by Lyell himself, as a linear history of progress:

By degrees, many of the enigmas of the moral and physical world are explained, and, instead of being due to extrinsic and irregular causes, they are found to depend on fixed and invariable laws. The philosopher at last becomes convinced of the undeviating uniformity of secondary causes, and, guided by his faith in this principle, he determines the probability of accounts transmitted to him of former occurrences, and often rejects the fabulous tales of former ages, on the ground of their being irreconcilable with the experience of more enlightened ages.⁴

One of the aims of this paper is to show that the emergence of new methodologies, new epistemic virtues and institutionalized disciplines as we still know them is more complex and contradictory than Lyell's statement suggests. Not only was the relationship between the natural sciences and the humanities much more dialogic than a retrospective construction of the 'two cultures' implies; additionally, the notion of a continuous, progressive advancement of knowledge was challenged by competing efforts to tell a different story about the natural world, a story based on the apparently repudiated view of an unchanging creation. Nineteenth-century historicism was thus questioned by an alternative temporal concept which suggested breaks – caused by divine intervention – in the unidirectional flow of time.⁵ While in retrospect, the 'victors' of this epistemological debate – Charles Lyell, Charles Darwin, Thomas Henry Huxley – can be identified with a high degree of confidence, for their contemporaries the differentiation between 'true' and spurious science was by no means always clear. And even if it was, as in the case of Philip Henry Gosse's theory of 'prochronic creation' discussed below, such interventions were not without effect. At the very least, they forced their opponents to strive for ever better foundations of what they tried to establish as the only valid scientific stance.⁶

Drawing on the work of historians and theorists of knowledge sometimes subsumed under the label New or Comparative Epistemology,⁷ a more heterogeneous, dynamic and recursive picture emerges than the story of linear progress. Ludwik Fleck, one of the founding fathers of this school of thought, describes science as a social practice in terms of a complex web constantly undergoing subtle transformations, in contrast to a view of the history of science in terms of scientific revolutions and epistemic breaks, as suggested by Thomas S. Kuhn and Michel Foucault. What is understood as knowledge in a given historical period and culture, according to Fleck, is not grounded in 'objective facts' or qualities inherent in natural phenomena, but is the result of shared preconceptions and prac-

tices within a community or, in Fleck's term, a 'thought collective' (*Denkkollektiv*); in other words, scientific knowledge is socially produced and, in consequence, inseparable from a prevalent 'thought style' (*Denkstil*).⁸ Crucially, this means that from an internal point of view, from within a thought collective, its own 'knowledge' cannot be discerned as invalid: what knowledge is depends on the particularities of a given thought style. Conversely, other, incompatible thought styles are perceived as 'mysticism': 'Der fremde Gedankenstil mutet als Mystik an, die von ihm verworfenen Fragen werden oft als eben die wichtigsten betrachtet, die Erklärungen als nicht beweisend oder danebengreifend, die Probleme oft als unwichtige oder sinnlose Spielerei'.⁹

Applied to the nineteenth-century debates on geology, the question of divine agency bracketed off by Lyell, and finally laid to rest by Huxley's introduction of 'agnosticism' as the only acceptable stance of the scientist disregarding his personal beliefs,¹⁰ remains crucial for theologians such as Darwin's critic Samuel Wilberforce. In Fleck's epistemological model, the collective systems of knowledge are relatively stable. They are gradually transformed through intercollective transactions, due to the fact that individuals never belong to only one collective, and through the generative function of language which not only reproduces knowledge but transforms it through processes of transmission and misrecognition; the word serves as 'an intercollective means of transport' (*interkollektives Verkehrsgut*).¹¹ According to Fleck, the transformation of knowledge is neither linear nor directed; it is socially produced and to a degree contingent. Finally, this concept allows us to perceive a-synchronicities within a historical period and culture: while one thought style (for instance, 'mechanical objectivity') will be dominant, and synchronous exchanges between specific thought collectives (for instance, philology and geology) do occur and produce something like a coherent albeit not monolithic *epistēmē* of a period, a-synchronic pockets of seemingly obsolete thought styles (such as the 'delusion as to the age of the world', the biblical six thousand years, denounced by Lyell¹²) can persist and unfold discursive efficacy. For some participants in the debates on modern geology and, later, evolution theory, the belief in the validity of the Scriptures as an explicative framework for natural history continued to persist and was even hitched to a self-declared modern and enlightened notion of proper scientific knowledge. My main example, Philip Henry Gosse's *Omphalos* (1857), shows the relevance of such a-synchronic pockets in the negotiations of authority, epistemological validity and the discursive rules of scientific communities.

In sum, a notion of knowledge production based on Ludwik Fleck's epistemology allows us to perceive contemporaneous but contradictory narratives as the manifestations of the continuous discursive and pragmatic interactions within the history of knowledge, rather than as a progressive overcoming of obsolete approaches

by more modern, more scientific ones. Fleck developed his epistemological model on the basis of his own microbiological and medical research. However, as Barbara Hernstein Smith has pointed out, his emphasis on 'conceptual-discursive systems that both enable and constrain the process of cognition',¹³ that is, systems embedded in and effective through language, renders Fleck's model pertinent for a history of knowledge that encompasses the humanities as well as the sciences. In particular, the constitution of the modern disciplines in the nineteenth century is the result of epistemological negotiations across various fields, of the competition to tell the best story about the emergence of the world and the creatures inhabiting it. Importantly, this debate did not take place exclusively within the confines of the natural sciences – which emerged in the modern sense only as a result of this process of intra- and intercollective exchange – but at the intersection between natural history/science, the humanities and individual concerns about faith.

The difference between 'knowledge' and 'mysticism' emerges as the result of an ongoing and often contradictory, nonsynchronous process of practices and negotiations, a process increasingly studied in comparative epistemology. However, from the point of view of the humanities, there remain several desiderata: the history of knowledge is still centered on the natural sciences; the lab is the primary setting of studies in the wake of Fleck, Kuhn and Latour. Other sites of knowledge production – such as the discussion-based seminar, instituted at German universities after Wilhelm von Humboldt's reform of higher education, and soon adopted by American universities – would yield a different picture regarding academic filiation and the formation of thought styles. In addition, reciprocal methodological exchanges between the sciences and the humanities require greater attention. To such an exchange, the humanities can contribute their hermeneutic and philological competence, specifically analytic skills such as the study of metaphors, of rhetorical devices and of linguistic modes, which has already been fruitfully applied to Darwin's works.¹⁴ It is not by chance that Darwin's style of writing – personal and engaging, narrative and metaphorical, and, as Beer and Levine have shown, deeply influenced by literary patterns – has attracted the attention of literary scholars. Similar studies need to be extended to less accommodating figures, and to fields that lend themselves less easily to narrativization. Last but not least, the history of knowledge needs to become truly comparative. While studies on, for instance, Louis Pasteur have yielded important insights into the workings of science as a network of diverse forces and interests,¹⁵ the implied concepts of knowledge production and implementation would gain in complexity from a consideration of the humanities. Fleck's 'intercollective means of transport', language, forges connections between these different fields of enquiry. Ultimately, the making of the sciences cannot be separated from the making of the humanities.

II

In the early nineteenth century, the readings of the Book of Books and the Book of Nature are compatible; in both, God's presence is revealed.¹⁶ A prime example of this, then still unproblematic harmony between theology and science is William Paley's widely read *Natural Theology* (1802).¹⁷ Paley's leading metaphor is the watch found in a country lane from which the existence of a watchmaker is necessarily deduced: without an artificer, there would not, could not be a watch. By analogy, the world and human beings, these intricate artifacts, could not exist without a creator. The hypothetical discovery that the watch contains a reproductive mechanism, in analogy to living organisms, would further heighten our belief in and admiration of the artificer:

The conclusion which the *first* examination of the watch, of its works, construction, and movement suggested, was, that it must have had, for the cause and author of that construction, an artificer, who understood its mechanism, and designed its use. This conclusion is invincible. A *second* examination presents us with a new discovery. The watch is found, in the course of its movement, to produce another watch, similar to itself [...]. What effect would this discovery have, or ought to have, upon the former inference? What, as hath already been said, but to increase, beyond measure, our admiration of the skill, which had been employed in the formation of such a machine? Or shall it, instead of this, all turn us round to an opposite conclusion, viz. that no art or skill whatever has been concerned in the business, although all other evidences of art and skill remain as they were, and this last and supreme piece of art be now added to the rest? Can this be maintained without absurdity? Yet this is atheism.¹⁸

Within the thought style represented by Paley, it is not absurd to equate the mechanism of a watch with organic nature. Further, it is not absurd to imagine a watch that is capable of giving birth to baby watches. But it *is* absurd to imagine a world without a creator. The complexity, harmony and productivity of nature imperatively point to a higher intelligence, a creator and a plan of creation without which there would be only disorder and chaos. The postulate of purely naturalistic explanations of the phenomena, put forward shortly after by Lyell, is for Paley unthinkable. A world without a primary act of creation and without a telos is unthinkable. Atheism is not only wrong but also absurd, or, in Fleck's term, it is 'mysticism'.

This self-evident frame of reference was soon to be challenged by the historical criticism of the Bible on the one hand, and by the empirical-inductive methodology in the sciences on the other. Lyell begins the *Principles of Geology* with

an overview of the history of his discipline, presented as a directed movement from speculation to the systematic collecting of empirical facts, from 'vision' to consistent method: 'By acting up to these principles with consistency, they in a few years disarmed all prejudice, and rescued the science from the imputation of being a dangerous, or at best a visionary pursuit'.¹⁹ In consequence, geology was established as the leading science, opening up – quite against Lyell's original intention – the temporal and methodological framework for Darwin's transmutation hypothesis. The emergence of a new geology constituted the move from the fantastic to the scientific, from the fabulous tales of medieval travelers to the exact observation of the Enlightenment – or again, from mysticism to true science. What is now rejected as fabulous includes not only stories of unicorns, cycnocephali and other unlikely creatures, but also, for example, the story of Noah's flood, shortly before cited as an explanation for the fossils of extinct species. In a relatively short time, the epistemological foundations of the study of the earth and the organisms living on its surface, and preserved as fossils in the different geological strata, had undergone a fundamental change.²⁰ However, this does not mean that the transition from natural history, in which the Book of Nature and the Book of Books revealed God's authorship, to natural science, in which these two ways of reading became systematically divorced, went uncontested. One of the most strenuous efforts to keep together what other scientists had put asunder, to reconcile Paley with Lyell, was made by Philip Henry Gosse.

In the 1840s and 1850s, Gosse was a respected naturalist specializing on littoral flora and fauna, well-known for his books addressed to a popular as well as a learned audience, but also a devout Christian, a member of the particularly strict Plymouth Brethren – a position that was only tenable within the framework of natural theology which justified the study of nature as a way of discovering and praising the harmony of God's creation.²¹ He saw the propositions of Lyellian geology as a contradiction to the superordinate teachings of the Bible: 'the dicta, which its [geology's] votaries rest on as certitudes, are at variance with the simple literal sense of the words of God'.²² In the late 1850s, Gosse belonged to a circle of naturalists who were discretely consulted about Darwin's as yet unpublished hypothesis of evolution through natural selection. This confrontation with evolution theory triggered a deep spiritual crisis. As a way to reconcile the now suddenly incompatible positions that constituted his identity as a Christian and a naturalist, Gosse proposed his theory of 'prochrony' according to which there exist two temporal orders in creation. In diachronic creation, signs of maturation and aging, such as the growth rings of a tree or the wrinkles on a human face, develop in time; they are reliable indicators of the age of an organism or other natural object. Within the diachronic framework, geological formations that require long stretches of time to build up equally reliably point to the age of the earth; here,

Lyell's principles of uniformitarianism, actualism and the steady-state earth – the constant and uninterrupted workings of natural laws – apply. Gosse devotes a sizable chunk of his book (pp. 30-101) to a detailed description of the recent advances in geology. It is not his aim to dispute the validity of these observations – he even explicitly confirms that the antediluvian theory is no longer tenable – but to offer an alternative hypothesis that would render science again compatible with the 'simple literal sense of the words of God'.

This hypothesis is prochrony, a temporal order in which natural laws are suspended: signs of maturation come into being at the moment of creation, just as Adam had been created as a grown man on the sixth day of creation. Not born of a woman but formed from clay, Adam still has a navel, the *omphalos* of Gosse's title. The idea of prochrony is based on an alternative model of time, challenging the prevalent nineteenth-century notion of time as linear and directed, moving uniformly and incessantly from the past to the future. By contrast, life to Gosse is cyclical, and God is free to start the cycle of life at whatever point he chooses; He can create the chick or the egg, and consequently, the existence of a full-grown hen is no proof for the prior existence of an egg. In geology, the material evidence that seemingly points to a long prehistory, and incidentally, the fossil evidence that supports the idea of transmutation, is subject to the law of prochrony: Just as He created Adam as an adult, God may have created an 'old earth', with signs of erosion, fossils and all.

As no direct empirical proof of prochrony is possible, Gosse uses a juridical metaphor to validate his thought experiment. In an imaginary trial, witnesses on both sides are examined; but, of course, there are no living witnesses for the evolutionary party, only circumstantial evidence:

No witness has deposed to actual observation of the processes above enumerated; no one has appeared in court who declares he actually saw the living *Pterodactyls* flying about, or heard the winds sighing in the tops of the *Lepidodendra*. [...] Strong as is the evidence, it is not *quite* so strong as if you had actually seen the living things, and had been conscious of the passing of time while you saw them live. It is only by a process of reasoning that you infer they lived at all.²³

Gosse indirectly points to an epistemological weakness in Charles Darwin's argumentation that would not escape his critics on the publication of *On the Origin of Species* two years later. Darwin uses cumulative circumstantial evidence that, according to Gosse and other critics, only *suggests* that there exists empirical proof of evolution. The actual transition of one species into another could not be conclusively proven until the discovery of the *Archaeopteryx* and similar intermediary fossils.²⁴ The emerging disciplines of paleoarcheology and comparative anatomy drew their

conclusions on the basis of a fossil record that Darwin himself referred to as incomplete and barely readable: 'the natural geological record' is 'a history of the world imperfectly kept, and written in a changing dialect.'²⁵ Darwin here takes up the ancient topos of the Book of Nature, but disputes its readability. The study of nature shows how geological and biological 'dialects' are transformed over time. In analogy to the linguistic study of the Indo-European languages, the fossils first discovered in Europe and the Americas, including dinosaurs, cumulatively suggest that extant species had similar but extinct ancestors, and that some species died out without leaving behind similarly formed relatives.²⁶ The fossils thus tell a different story than the Bible, a contradiction that is acknowledged by Gosse: 'the records which *seem* legibly written on His created works do flatly contradict the statements which *seem* to be plainly expressed in His word.'²⁷ However, as Gosse argues, two principles are axiomatic: that matter was created, i.e., that 'the Eternal God [...] called the universe into being out of nothing',²⁸ and that the species were created immutable. Consequently, the conclusions drawn from fossils *must* be a fallacy. The only interpretation which allows us to overcome the discrepancy between the 'stone book'²⁹ and the revealed word is precisely the law of prochrony. Taking into account God's unlimited creative power, the unquestioned primary condition of Gosse's argument, fossils do not point to antecedent species; bones are no proof of previous life:

If I could show, to your satisfaction, that a skeleton might have existed; still more, that a skeleton *must* have existed; still more, if I could prove that myriads of skeletons, precisely like this, must have existed, without ever having formed parts of antecedent living bodies; you would yourself acknowledge that your conclusions were untenable.³⁰

Having formulated this hypothesis which is mainly based on the petitioning of the very principles under negotiation (creation and the absence of evolution), Gosse takes us, his readers, by the hand and leads us through the classes of the plants, invertebrates, vertebrata and finally man – who forms a class, and gets a chapter, of his own. Gosse asks the readers to imagine a full-grown exemplar from various species – a sturdy oak, a majestic stag, an adult man – and then, further to imagine that this apparently mature organism has been created on this very day. The oak's year rings, the stag's antlers, the man's wrinkles and grizzled hair, all the signs of growth and aging are prochronic, they have come into being at the moment of creation, on this very day. Unlike the circumstantial evidence of the fossils, these acts of prochronic creation are confirmed by, albeit fictitious, eye-witnesses. We, his implied readers, have seen them with our mind's eye. Better than that, the most eminent witness imaginable, God himself, has deposed His evidence in writing, in the story told in Genesis.

The rhetorical structure of Gosse's argument consists in an apparently systematic accumulation of hypothetical statements, which through reiteration acquire empirical weight, or so the author hopes. This rhetoric is not dissimilar to Darwin's, who also relies heavily on anecdotal evidence, analogy and seriality. In Darwin's writing, the piling up of examples creates an aura of empiricism without always constituting an impeccable chain of evidence. However, the grammatical trajectory appears to be reversed in the two authors. In Gosse's presentation of arguments we find a constant slippage from the subjunctive to the affirmative, from might to must, as in the example above. Whereas Darwin stresses the tentative and often preliminary nature of his theory formation, but uses this epistemic modesty as a strategy of self-authorization, as can be seen in the opening paragraphs of *On the Origin of Species*, Gosse strings together his imagined scenes of creation to form declarative statements that finally flow into rhetorical questions:

Who will say that the suggestion, *that the strata of the surface of the earth, with their fossil floras and faunas, may possibly belong to a prochronic development of the mighty plan of the life-history of this world* – who will dare to say that such a suggestion is a self-evident absurdity?³¹

Of course, everyone dared to say this. Gosse's suggestive declaratives and rhetorical questions failed to convince both his lay readers and his fellow scientists. With the publication of *Omphalos*, Gosse took up an a-synchronic position in relation to the dominant epistemic virtues of his time, and thus effectively isolated himself from the scientific community of which he had been a respected member, as his son Edmund Gosse describes in his memoirs:

In the course of that dismal winter, as the post began to bring in private letters, few and chilly, and public reviews, many and scornful, my Father looked in vain for the approval of the churches, and in vain for the acquiescence of the scientific societies, and in vain for the gratitude of those 'thousands of thinking persons', which he had rashly assured himself of receiving.³²

The thought collective that had gathered around Lyell, Darwin, Huxley and the botanist Joseph Hooker from the 1840s onward, while internally divided on the question of evolution theory,³³ were clearly in agreement on the discursive rules that facilitated the distinction between true science and mere speculation. The principle rule, as Huxley was to stipulate later, consisted in the epistemological privileging of naturalism – the observance of natural laws – against received authority including the Bible; in consequence, 'the assertion which outstrips evidence is not only a blunder but a crime.'³⁴ On the basis of this rule, writers indulging in

insufficiently founded scientific speculation such as Gosse, Robert Chambers, the author of the evolutionary *Vestiges of the Natural History of Creation* (1844), or Alfred Russel Wallace, the codiscoverer of natural selection but in his later life an adherent of spiritualism, were excluded from the circle of leading British scientists.

III

Debates in the 1850s and 1860s about the best story in science, the most plausible explanation of the natural world and man's position in it, hinged on what Lorraine Daston and Peter Galison have called 'a distinct code of epistemic virtue',³⁵ a code which had changed significantly since the days of natural theology. In order to be perceived as valid, a scientific theory had to adhere to this code, and its author had to position himself accordingly to gain acceptance by the dominant thought collective. If he failed to do so, criticism of his work was correspondingly devastating. In the following review, the author is criticized harshly for his faulty methodology: his theory is fantastic, fabulous, a relapse into the unenlightened times before the rise of modern science. According to the reviewer, the anecdotal procedure and the deviation from established principles of scientific enquiry lead the author straight back into the times of miracles and wonders:

Under such influences man soon goes back to the marvelling stare of childhood at the centaurs and hippogriffs of fancy [...]. The whole world of nature is laid for such a man under a fantastic law of glamour, and he becomes capable of believing anything; to him it is just as probable that Dr. Livingstone will find the next tribe of negroes with their heads growing under their arms as fixed on the summit of the cervical vertebrae; and he is able, with a continually growing neglect of all the facts around him, with equal confidence and equal delusion, to look back to any past and to look on to any future.³⁶

This, of course, is not taken from a review of Gosse's *Omphalos* but of Darwin's *Origin of Species*, written by one of the most vociferous opponents of evolution theory, Samuel Wilberforce. This quotation is not meant to suggest that the scientific validity of Gosse's theory of prochrony and Darwin's evolution theory is interchangeable. What I have tried to show throughout this paper, however, is that the delimitation between the iterable and the absurd in the history of knowledge depends on a situated logic which is co-emergent with the discursive acts themselves. For Paley, the absurd is something else than for Lyell; for Gosse, it is something else than for Darwin; for Wilberforce, something else than for Huxley.

From today's perspective, Gosse's theory of prochrony appears as a clear-cut case of bad science. However, as this case study has tried to show, Gosse made every effort to adapt his proposition to the discursive strategies and epistemic virtues of his time: he laid the basis for his argument by recapitulating extensively the findings of geology and paleoarcheology, and by admitting, up to a point, their validity. It is not so much his way of reasoning that departs from the thought style of the Lyell-Darwin-Huxley-Hooker nexus, but his axiomatic premise – God created the world and every living creature as stated in Genesis – and hence, his deduction – God also created the fossils, as fossils – that resulted in the general rejection of his theory. Gosse's attempt to reconcile science with revealed religion was doomed to fail not only because the scientific part of his argument was so outrageous, but because his theology was old-fashioned, or too radical, by the standards of mainstream theologians of his day. By ignoring the philological turn in Bible studies and insisting on a literal reading of the word of God, he broke the connection with the dominant thought collectives in both fields, theology as well as natural science. By insisting that God still matters in scientific theories, Gosse repudiated the agnostic and naturalistic stance proposed by Huxley as the best, and only, stance within the emerging framework of modern disciplines. As a result of his infringement of epistemic codes that had only recently been established, and still believing himself on firm epistemic ground, Gosse positioned himself beyond the pale of 'true science' and was discarded like one of the fossils he had studied on England's beaches.

Notes

- 1 On the rise of philology and comparative religious studies in the late eighteenth and early nineteenth centuries, see Hans G. Kippenberg, *Die Entdeckung der Religionsgeschichte. Religionswissenschaft und Moderne* (Munich: C.H. Beck, 1997), esp. 60-79; Sascha Müller, *Die historisch-kritische Methode in den Geistes- und Kulturwissenschaften* (Würzburg: Echter, 2010), esp. 45-58; and Joep Leerssen, 'The Rise of Philology: The Comparative Method, the Historicist Turn and the Surreptitious Influence of Giambattista Vico', in Rens Bod, Jaap Maat, and Thijs Weststeijn (eds.), *The Making of the Humanities*, vol. II, 23-35.
- 2 See Peter Schnyder, 'Die Dynamisierung des Statischen. Geologisches Wissen bei Goethe und Stifter', *Zeitschrift für Germanistik. Neue Folge* 19 (2009), 540-555.
- 3 Charles Lyell, *Principles of Geology: An Attempt to Explain the Former Changes of the Earth's Surface, by Reference to Causes Now in Operation* (Cambridge: Cambridge University Press, 2009 [orig. 1830]), vol. 1, 73.
- 4 *Ibid.*, 76.
- 5 Nineteenth-century concepts of linear and cyclical time, and Lyell's position which is more complex than can be sketched here, are discussed in Stephen Jay Gould, *Time's Arrow, Time's Cycle: Myth and Metaphor in the Discovery of Geological Time* (Cambridge, MA, and London: Harvard University Press, 1996), esp. 115-178.

- 6 As Lorraine Daston and Peter Galison have shown in *Objectivity* (New York: Zone Books, 2007), the dominant scientific stance of the late nineteenth century was 'mechanical objectivity'. However, in genres of science writing other than the atlases analyzed by Daston and Galison, a much more personalized and even emotional embodiment of the scientist, and less regulated patterns of scientific practice, can be perceived. This is not least true of Charles Darwin, who combined an empirical scientific style with self-authorization on the grounds of personal credibility; see my analysis of Darwin's appellative style in *On the Origins of Species*: Virginia Richter, 'Anschauung des Unsichtbaren. Rhetoriken des Nicht-Wissens im Umfeld des Darwinismus', in Michael Bies and Michael Gamper (eds.), *Literatur und Nicht-Wissen. Historische Konstellationen in Literatur und Wissenschaft, 1750-1930* (Berlin: Diaphanes, 2012), 359-377. Darwin's 'literariness', a style of writing that entails a stance different from the objectivity postulated by Daston and Galison, has been analyzed by: George Levine, *Darwin: The Writer* (Oxford: Oxford University Press, 2011).
- 7 This has become a vast field that cannot be surveyed in full here. Some of the most important contributions to New Epistemology include: Bruno Latour, *We Have Never Been Modern* (Cambridge, MA: Harvard University Press, 1993 [French original 1991]); Barbara Herrnstein Smith, *Scandalous Knowledge: Science, Truth and the Human* (Durham, NC: Duke University Press, 2006); Isabelle Stengers, *The Invention of Modern Science* (Minneapolis and London: University of Minnesota Press, 2000 [French original 1993]).
- 8 Ludwik Fleck, *Entstehung und Entwicklung einer wissenschaftlichen Tatsache. Einführung in die Lehre vom Denkstil und Denkkollektiv*, intro. by Lothar Schäfer and Thomas Schnelle (Frankfurt a. M.: Suhrkamp, 1980), esp. 52-70. Fleck was a Polish microbiologist specialising in infectology. He published his epistemological writings in German; *Entstehung und Entwicklung* was first published in 1935 in Basel. To this day, his work has remained little known in the English-speaking world (the first English translation of his book was published in 1979), but his influence on Thomas S. Kuhn's concept of scientific communities has been acknowledged, rather in passing, by the latter in the preface to *The Structure of Scientific Revolutions*, 4th ed. (Chicago and London: University of Chicago Press, 2012), xli. For a fuller discussion, see Babette E. Babich, 'Kuhn's Paradigm as a Parable for the Cold War: Incommensurability and Its Discontents from Fuller's Tale of Harvard to Fleck's *Unsung Lvov*', *Social Epistemology* 17.2-3 (2003), 99-109. Fleck's 'thought styles' are linked to sociologically clearly demarcated 'thought collectives', and in this, they differ from A.C. Crombie's similarly sounding 'styles of scientific thinking', which are more broadly defined methods of scientific inquiry and argumentation within European natural philosophy and related fields. See A.C. Crombie, *Styles of Scientific Thinking in the European Tradition: The History of Argument and Explanation Especially in the Mathematical and Biomedical Sciences and Arts*, 3 vols. (London: Duckworth, 1994).
- 9 Fleck, *Entstehung und Entwicklung*, 143.
- 10 Thomas Henry Huxley, 'Agnosticism' (1889), in *The Major Prose of Thomas Henry Huxley*, ed. Alan Barr (Athens and London: University of Georgia Press, 1997), 253-282.
- 11 Fleck, *Entstehung und Entwicklung*, 143.
- 12 Lyell, *Principles of Geology*, 76.
- 13 Smith, *Scandalous Knowledge*, 5.
- 14 Since Gillian Beer's seminal study *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot and Nineteenth-Century Fiction*, 3rd ed. (Cambridge: Cambridge University Press, 2009), literary Darwin studies have developed into a vibrant field. Recent book-length publications include George Levine, *Darwin and the Novelists: Patterns of Science in Victorian Fiction* (Chicago: Chicago University Press, 1991); David Amigoni, *Colonies*,

- Cults and Evolution: Literature, Science and Culture in Nineteenth-Century Writing* (Cambridge: Cambridge University Press, 2007); Gowan Dawson, *Darwin, Literature and Victorian Respectability* (Cambridge: Cambridge University Press, 2007); Virginia Richter, *Literature after Darwin: Human Beasts in Western Fiction, 1859-1939* (New York and Basingstoke: Palgrave Macmillan, 2011).
- 15 Bruno Latour, *The Pasteurization of France* (Cambridge, MA: Harvard University Press, 1993).
 - 16 Peter Harrison analyses the long history of interdependence between these two readings of Nature and the Bible, and in particular the catalytic effect of Protestant biblical scholarship on the study of the natural world; see Harrison, *The Bible, Protestantism, and the Rise of Natural Science* (Cambridge: Cambridge University Press, 1998).
 - 17 For a contextualization of Paley within the history of natural theology, and in relation to the emerging evolutionary concepts of the nineteenth century, see Stuart Peterfreund, *Turning Points in Natural Theology from Bacon to Darwin: The Way of the Argument from Design* (New York and Basingstoke: Palgrave Macmillan, 2012).
 - 18 William Paley, *Natural Theology, or Evidence of the Existence and Attributes of the Deity, Collected from the Appearances of Nature*, ed. Matthew D. Eddy and David Knight (Oxford: Oxford University Press, 2008), 15. Emphasis in the original.
 - 19 Lyell, *Principles of Geology*, 71-72.
 - 20 On the controversies about Lyellian geology, in particular in relation to the then prevalent catastrophism, see Michael Ruse, *The Darwinian Revolution: Science Red in Tooth and Claw*, 2nd ed. (Chicago and London: University of Chicago Press, 1999), 36-48.
 - 21 On Gosse as a littoral biologist and a representative of natural theology, see Jonathan Smith, *Charles Darwin and Victorian Visual Culture* (Cambridge: Cambridge University Press, 2006), esp. 79-84.
 - 22 Philip Henry Gosse, *Omphalos: An Attempt to Untie the Geological Knot* (London: John Van Voorst; Paternoster Row, 1857; repr. Milton Keynes: Nabu, 2010), 4.
 - 23 *Ibid.*, 103-104.
 - 24 The Archaeopteryx was found in 1861; see Paul Chambers, *Bones of Contention: The Archaeopteryx Scandals* (London: Murray, 2002).
 - 25 Charles Darwin, *The Origin of Species*, ed. Gillian Beer (Oxford: Oxford University Press, 1996), 251.
 - 26 On the relevance of fossil discoveries for evolution theory, see Donald A. Prothero, *Evolution: What the Fossils Say and Why It Matters* (New York: Columbia University Press, 2007), esp. 50-90; on Gosse's *Omphalos*, *Ibid.*, 8-10.
 - 27 Gosse, *Omphalos*, 5, emphasis in the original.
 - 28 *Ibid.*, 111.
 - 29 *Ibid.*, 6.
 - 30 *Ibid.*, 107.
 - 31 *Ibid.*, 347, emphasis in the original.
 - 32 Edmund Gosse, *Father and Son* (1907), ed. Michael Newton (Oxford: Oxford University Press, 2009), 64.
 - 33 See Ruse, *The Darwinian Revolution*, 137-142 and 202-228.
 - 34 Thomas Henry Huxley, 'Science and Culture' (1889), in *The Major Prose of Thomas Henry Huxley*, ed. Alan Barr (Athens and London: University of Georgia Press, 1997), 224-238, 233.
 - 35 Daston and Galison, *Objectivity*, 18.
 - 36 William Wilberforce, 'Review [of *On the Origin of Species*]' (1860), in L.S.B. Leakey, Jack Prost, and Stephanie Prost (eds.), *Adam and Ape: A Sourcebook of Discoveries About Early Man* (Cambridge, MA: Schenkman Books, 1982), 21-35, 35.