Matter, History, Critique

Engels after Frankfurt

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WPSA 2021

Abstract. Amid their effort to reorient European Marxist thought after the First World War, the Institute for Social Research in Frankfurt facilitated the first publication of Frederick Engels's unfinished *Dialectics of Nature* manuscripts in the 1920s. Yet the subsequent work of the Institute's most influential members almost entirely turned away from the approach to natural science that Engels had advocated. The result: an indispensably incisive critique of social domination, and a deepening pessimism about natural-scientific contributions to the construction of the postcapitalist alternative. To understand how technological development and scientific research can underpin the destruction of freedom, we cannot do without the diagnosis of the simultaneity of progress and regression that *Dialectic of Enlightenment* advanced; but to determine how science and technology can be brought back into the task of critique rather than be reduced to the status only of its polemical target, we would do well to reread Adorno and Horkheimer alongside the writings of Engels that they themselves prematurely dismissed. For in an era that is at once Anthropocene and Information Age, critical theory cannot afford to cede the battle over the meaning of technoscientific practice to those who would—whether by design or by misapprehension—turn its methods and its achievements toward the domination of the world.

Acknowledgments. For incisive conversations on the concerns of this essay, I am grateful to Chris Chambers, Matthew Claudel, Ange Clayton, Gideon Cohn-Postar, Nishin Nathwani, Paul North, Clara Picker, and especially Alicia Steinmetz, as well as an engaged audience at the 2020 Critical Theory Roundtable, Michigan State University.

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The Frankfurt School lived first among dinosaurs. Before the Institute for Social Research had a building of its own, its members briefly occupied the cavernous rooms of the Senckenberg Museum of Natural Science. There, as Felix Weil recalled, they worked 'among open moving boxes filled with books, on improvised desks made of boards, and under the skeletons of a giant whale, a diplodocus, and an ichthyosaurus.'[1] Much has been made of the putative irony of the modernist style chosen for the structure that would soon become the Institute's permanent home; few have remarked on the significance of their swift departure from the hall of the fossils.

As the study of what there was, palaeontology stalks ontology, the theory of what there is. In the nineteenth century, the new science of the fossils assumed unexpected significance in the philosophical and political confrontation between idealism and materialism. The success of palaeontology revealed a world that pre-existed the genesis of human reason itself. In his polemic against Eugen Dühring, Frederick Engels portrayed the rise of such research as decisive for the vindication of Darwinian evolutionary theory—the theory that Marx himself had called, despite its still nascent form, 'the basis in natural history for our view.'[2] Engels's *Dialectics of Nature* manuscripts, unfinished and unpublished in his lifetime, outlined what Darwin and his contemporaries had achieved. The historical sciences of nature—palaeontology, geology, astronomy—opened a radical 'breach' in human knowledge. The last remnants of classical teleology were banished, for 'it is now firmly established that matter in its eternal cycle moves according to laws which at a definite stage—now here, now there—necessarily give rise to the thinking mind in organic beings.'[3] In a new way, it was imaginable that materialism could work

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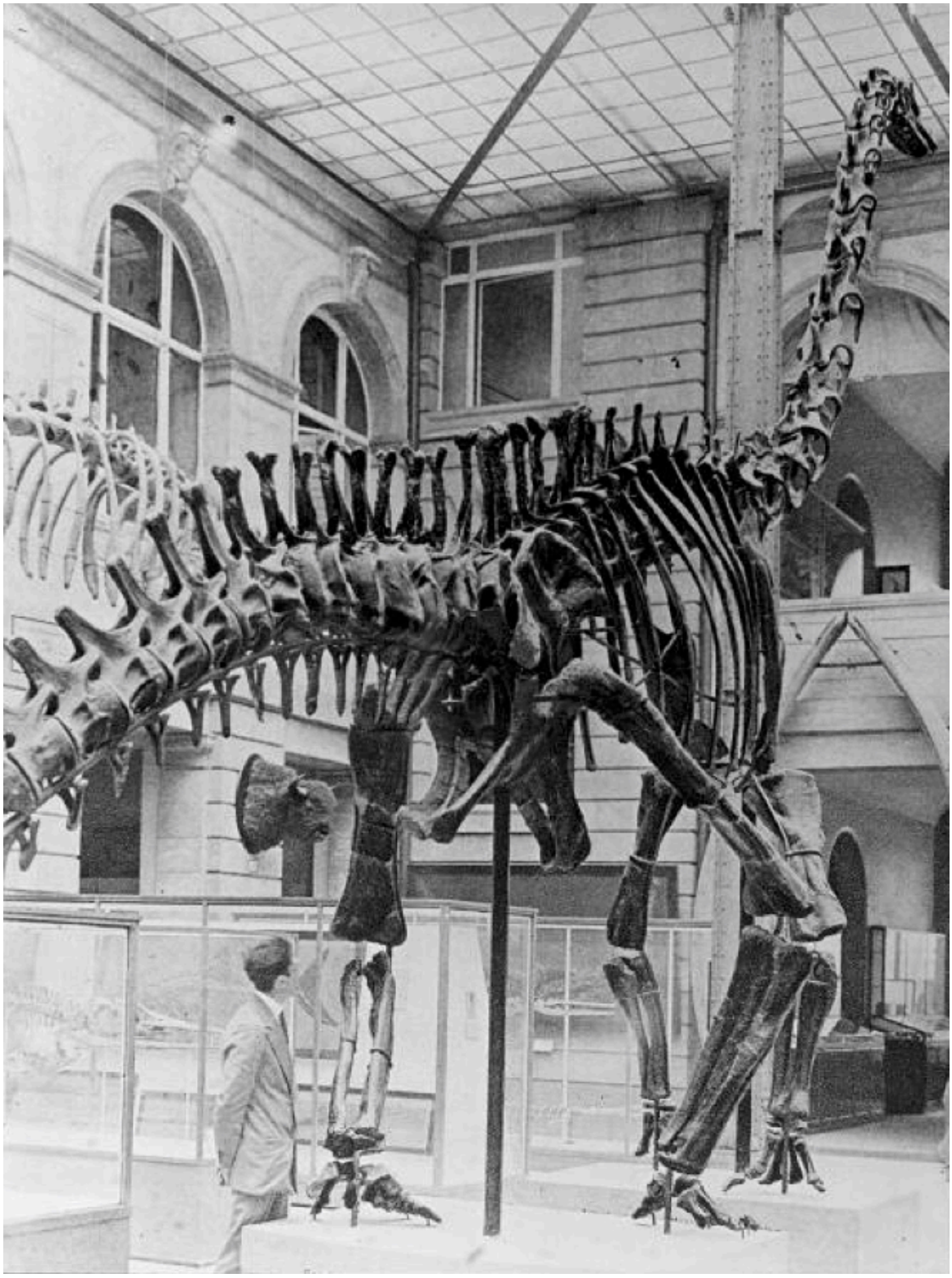
[1] Quoted in Martin Jay, *The Dialectical Imagination,* 2nd ed., Berkeley 1996, p. 11.
[2] Engels, *Anti-Dühring*, in *Marx-Engels Collected Works,* vol. 25, p. 69 (henceforth 'MECW'); Marx, letter to Engels, 19 December 1860, in MECW vol. 41, p. 232.
[3] *Dialectics of Nature*, in MECW vol. 25, pp. 475-6 (henceforth 'DN').



"…under the skeletons of a giant whale, a diplodocus, and an ichthyosaurus."
The Senckenberg Museum of Natural Science, c. 1930.

for the comprehension of the universe in its entirety, from the movement of electricity to the circulation of commodities.

In 1924, the early members of the Institute moved into their gleaming new building and left the fossils behind. Their work in the years to come would carry on that materialist task of interpreting the world as a whole. Especially under the leadership of Max Horkheimer, they hoped to surpass the old opposition between the natural or physical and the social or cultural sciences. In this they did not succeed. Had palaeontology returned to ontology—had the dialectic of enlightenment been comprehended within the dialectics of nature—had the fossils not been forgotten—the Frankfurt School might have surpassed this contradiction between nature and society, which they critiqued but never quite overcame.

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The usual story is that Engels left behind some uselessly inchoate notes on natural science, which the critical theorists of the Institute wisely discarded as they developed new and incisive forms of social inquiry. Martin Jay gave this perspective its canonical form in his claim that the 'Frankfurt School did not wish to revive Engels's crude dialectic of matter.'[4] Such caricature distorts the character of Engels's scientific writings and obscures the Frankfurt School's complex relationship to them. The early members of the Institute were uniquely well equipped to grasp the real sophistication of Engels's work on nature, for they directly facilitated its first publication. In the 1920s, the German Social Democratic Party (SPD), despite their retreat from the cause of proletarian revolution, maintained a large collection of unpublished manuscripts of Marx and Engels. Loath to work too directly with representatives of the USSR itself, the SPD nonetheless made these materials available indirectly, through the respectable channels of international academia. Left intellectual life in the Soviet Union of these years—the all too brief *Dämmerung*

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[4] Jay, *Dialectical Imagination*, p. 267.

between the tumult of revolution and the decay into Stalinism—flourished with a vibrant and unprecedented freedom that is today mostly passed over in dismissive silence where it is not forgotten entirely.[5] In Moscow, D. B. Rjazanov's new Marx-Engels Institute coordinated an ambitious program of publication and research, an 'eastern' counterpart to Frankfurt's 'western' Marxism. It fell to the Institute for Social Research to serve as the intermediary between the SPD's archivists and Rjazanov's staff, reproducing the party's holdings and shipping the copies to Moscow for editorial scrutiny and eventual publication.[6] This aspect of the Institute's early work has not seen much comment in the anglophone secondary literature (meriting barely a mention in Jay's agenda-setting history of the Frankfurt scene, *The Dialectical Imagination*), but its results transformed the socialist scholarship of the day.[7] In Moscow, Rjazanov began a first attempt at the Collected Works, and his institution's serial publications brought the texts to wider audiences along the way: various volumes 'contained the "Theses on Feuerbach," the first section of the *German Ideology*, and all of Engels's *Dialectics of Nature*.'[8] Back in Frankfurt, a publishing arm of the Institute for Social Research reissued selections from this material, in editions that achieved international—even American—reception.[9] Thus in 1927, Engels's *Dialectics of Nature* appeared in print in Germany for the first time.

Eluding summary exposition, Engels's manuscripts demand creative reconstruction. Few

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[5] For a moving account of the brief flowering of this intellectual environment and of its destruction in Stalinist terror, see Helena Sheehan, *Marxism and the Philosophy of Science,* New York 2017, Ch. 4.
[6] Bud Burkhard, 'D. B. Rjazanov and the Marx-Engels Institute', *Studies in Soviet Thought* 30, 1985, p. 42.
[7] See Jay, *Dialectical Imagination,* p. 13. Rolf Wiggershaus gives a less in-passing description of this work in *The Frankfurt School: Its History, Theories, and Political Significance,* trans. Michael Robertson, Cambridge, MA 1995, pp. 31–2.
[8] Burkhard, 'D. B. Rjazanov…', p. 42. *Dialectics of Nature* appeared in the USSR in 1925 under Rjazanov's editorship in a bilingual Russian-German edition. This was the first publication of almost all the manuscript materials, other than small selections that had earlier appeared separately (most notably, the incomplete essay 'The Part Played by Labor in the Transition from Ape to Man'). See Burkhard, 'Bibliographic Annex to D. B. Rjazanov and the Marx-Engels Institute', *Studies in Soviet Thought* 30 ,1985, p. 76, and editorial notes to MECW vol. 25, p. 663.
[9] Wiggershaus, *The Frankfurt School*, p. 33. See Burkhard, 'Bibliographic Annex', pp. 79ff., for a detailed listing of the contents of the volumes published in Frankfurt. For the American reception, see 'Review of *Marx-Engels Archiv*', *American Historical Review* 33 (1928), pp. 871–72. In the Frankfurt reissue, the nature manuscripts appeared in D. Rjazanov, ed., *Marx-Engels Archiv. Zeitschrift des Marx-Engels Institut in Moskau.* Frankfurt a.M. 1927.

component essays exhibit anything like a finished form; much of the work consists only of notes and fragments, the uneven radiance of a solar system of thoughts orbiting a sun itself hidden from view—the gravitational 'centre of possibility' known only from the imperfect movement of the matter spinning wildly around.[10] Taken as a whole, the writings display both a theoretical vision for scientific practice and a philosophical perspective on the transformation of scientific knowledge over time. Engels attacks both the absolute idealism of the Hegelian tradition and the tidy charms of the mechanical materialists; both succumb to the force of the fundamentally *historical* character of nature itself. His manuscripts are a final counterpart to a likewise unfinished program formulated at the beginning of his collaboration with Marx. In a draft of the *German Ideology,* they had proclaimed that they knew 'only a single science, the science of history', refusing any sharp disjunction between 'the history of nature and the history of men'.[11] That text never made it to the press, but the drama of natural science in the nineteenth century would vindicate its unrealised ambition: the developmental quality of matter burst into view in Darwin's theory of biological evolution, in Lyell's discovery of deep geological time, and in Laplace's account of the nebular origin of the planets themselves.[12]

The universe evolves over time. It consists not of finished things but of roaring process, for the world exists in—and in virtue of—ceaseless motion and change. Engels refuses to identify the category of motion with merely mechanical movement, insisting that it 'comprehends all changes and processes occurring in the universe', from the collision of atoms to the chaos of human thought.[13] Everything moves in interaction with everything else; the natural totality emerges from a dense network of reciprocal variation and interconnected transformation. Motion is how matter exists, and the endless zones of nature work across space

[10] The phrase (and lesson on method) is borrowed from Kōjin Karatani, *Marx: Towards the Centre of Possibility,* trans. Gavin Walker, New York 2020 [1974].
[11] Marx and Engels, *The German Ideology,* in MECW vol. 5, p. 28.
[12] On this see Engels, *Ludwig Feuerbach and the End of German Classical Philosophy,* in MECW 26, p. 370.
[13] DN, p. 362; cf. p. 527.

and time to 'unfold the whole wealth of this motion'.[14] Matter itself exhibits no dullness, no exhaustibility; it displays always 'infinitely many qualities', differentiated in kind and not just in degree, just like the forms of motion in which matter takes shape.[15] Engels denies that any 'matter as such' or 'motion as such' can be found; 'words like matter and motion are nothing but *abbreviations*' for the boundless diversity of their forms.[16] This picture of natural matter has been widely misunderstood. Years before the Bolshevik Revolution, the early Russian Marxist G. V. Plekhanov had already popularised a view of Marx and Engels as modern philosophical monists, revolutionary inheritors of Spinoza's radical ideas. Yet the perspective of *Dialectics of Nature* would be better described as infinitist than monist; its vision of the universal interconnection of an endlessly differentiated world is more a materialist reconfiguration of Leibniz's monadology than of Spinoza's singular substance.[17]

For Engels, dialectics is a 'science of universal interconnection', of interrelations between shifting things and of their transformations into each other.[18] What were in the idealism of Hegel the most mystifying ideas become in Engels's materialism almost jarringly straightforward tools for apprehending the physical world. (That 'identity contains difference within itself', for example, emerges as a natural tendency evident even in the growth of plants, the 'incessant molecular changes which make up life', as surely as in any dynamics of freedom or production in human history.)[19] Dialectical principles cannot be formulated in thought *a priori* and applied in

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[14] DN, p. 332.
[15] DN, p. 512.
[16] DN, p. 515, emphasis original.
[17] For Plekhanov on materialism and Spinozism, see his *Fundamental Problems of Marxism,* trans. Julius Katzer, New York 1969 [1908], pp. 80ff, and the editor's preface therein, 13ff. Engels offers a materialist counterpart to Leibniz's insistence that everything in nature differs from everything else and that all that exists is changing without end (see 'Monadology' §§9–10). Ernst Bloch stands almost alone among later Marxists in recognising the significance of Leibniz's philosophy for any adequate materialism: 'Instead of the mechanistic cosmic bustle in which, apart from cosmic necessity, there is no meaning at all, Marx kept alive an historical evolutionary humanism which derived from Leibniz, and which was mediated to him through Hegel' (*On Karl Marx,* trans. John Maxwell, New York 1971, p. 114; cf. also his *Avicenna and the Aristotelian Left,* trans. Loren Goldman and Peter Thompson, New York 2019 [1963], p. 33, p. 54).
[18] DN, p. 313.
[19] DN, p. 495. The dynamic is not limited to living matter: 'Continual change, i.e., sublation of abstract identity with itself, is also found in so-called inorganic nature. Geology is its history. On the surface, mechanical changes …. [and] on a large scale—upheavals, earthquakes, etc. The slate of today is

advance to the world, but must be drawn out reflectively from the changing structure of the natural and social world across time.[20] The discovery of the historical character of nature itself can be properly understood only in such dialectical terms; the developmental character of the world in totality and in particularity, grasped through the world's systematic interconnection as process, destroys the coherence of the apparently stable 'metaphysical' categories which at first suffice to point us toward the knowledge of that world at all. 'Hard and fast lines are incompatible with the theory of evolution… Among lower animals the concept of the individual cannot be established at all sharply', and 'part and whole, for instance, are already categories which become inadequate in organic nature.'[21] Our most fundamental conceptual categories deform beneath the weight of the material they lift up to our view. The material situation itself demands dialectical forms of comprehension—categories of inner tension and constitutive connection, principles that can only be discovered in the world through the forms of natural-scientific inquiry that make these processes visible, from the organic to the cosmic and everywhere across and between. In nature, as in society, it is material change that renders our concepts inadequate to our tasks.

This account of dialectics has been often misrepresented. In an influential Lukácsian critique of Engels's perspective decades later, the philosopher Alfred Schmidt argued that when applied to actual natural-scientific research, Engels's dialectic amounts to nothing more than 'a collection of commonplaces, long familiar to the empirical investigator, though in a different form.'[22] Here, despite himself, Schmidt comes closest to understanding Engels's most significant aim. What seem to be (and in Hegel's hands indeed are) mysterious abstractions become in Engels's materialism nothing more than clarificatory characterisations of 'the general laws of

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fundamentally different from the ooze from which it is formed, the chalk from the microscopic shells that compose it,' etc. (p. 496).

[20] DN, p. 356.

[21] DN, pp. 493–4. On the contrast with 'metaphysical' categories, see p. 352; cf. his *Feuerbach,* p. 384ff.

[22] Schmidt, *The Concept of Nature in Marx,* trans. Ben Fowkes, New York 1973, p. 297 n122.

motion' of the natural world and of human activity within it.[23] This is Engels's explicit conceptualisation of dialectics, his direct confrontation with Hegelian idealism. The dialectic is not an *a priori* principle out of which world and mind inexorably develop; it is the structure of universal interconnection, the logic of the infinitely complex relations stretching across all matter in all its motion. Any model of such interconnection, of such 'general laws', can only be assembled from the discoveries of the specific kinds of inquiry that study the manifold forms of the world's motion and change, from the atomic to the interstellar. It is no surprise that the dialectical formulation of the assembled results appears at first as a 'collection of commonplaces, long familiar to the empirical investigator, but *in a different form.*' That different form reconstitutes the apparent commonplaces at last not as isolated facts, mere instances of classes, but as parts of a process developing dynamically with all the other commonplaces known to other empirical investigators but likewise by them comprehended only in apparent isolation. Schmidt misconstrues Engels's fundamental strength as his greatest weakness.

The manuscripts do not simply collapse the logic of society into the dynamics of nature. Engels does not claim that 'nature' is 'dialectical' in the *same way* as society, any more than Lukács views the novel as dialectical in the same way as economic production. But Engels does claim that without an underlying structure of contradiction and interconnection in the material world—without nature having, in itself, a historical character—the developmental logic of contradiction and interconnection that characterises human life could never have arisen in the first place. Engels vehemently rejects any crude reductionism, whether ontological or methodological. He rules out the attempt to explain the world simply in terms of some single underlying principle like mechanical motion, a schematising ambition 'handed down from the pre-chemical eighteenth century' that obscures more than it could ever illuminate.[24] Reductionistic simplification is all the more ridiculous in the social sciences; he expresses deep

[23] Engels, *Feuerbach*, p. 383; cf. DN p. 396, p. 492.
[24] DN, p. 527.

disdain for the totalising epistemic hubris that would attempt such projects as the assimilation of economics to physics, a prospect much in vogue in his day.[25] Engels's view of the relation between such different levels of complexity in the world is best understood as one of emergence, rather than reducibility. The world develops. Each zone of matter dynamically intertwines with every other, from the geological to the industrial; yet none is determined completely by any one of the others in turn.[26]

This critique of reductive analysis shapes the manuscripts' account of scientific knowledge—the epistemological theory. Interpretative care is necessary here. Engels occasionally indulges in formulations that can suggest a kind of 'reflectionist' theory of knowledge. A naive account of truth as simply a mirror in thought of the external world does recur within subsequent strands of Marxist epistemology, some of which claimed Engels for inspiration; Lenin's position in *Materialism and Empirio-Criticism* is often taken as a classic statement of such an approach.[27] That certain of Engels's own notes seem sometimes amenable to interpretation along such lines has contributed to the idea that he himself remained too close to a vulgar or mechanistic materialism. The plausibility of such a view does not stand much scrutiny; Engels's epistemology is better understood in 'interactionist' terms, and its fundamental category is *practice*. Thought itself has its foundation not in the passive contemplation of a purely exterior nature but in the human transformation of natural matter.[28] The truth of reason does not consist in the reductive reduplication of a stable structure outside the mind; it emerges from engaged action. We learn about the world by changing it. This account of practical activity as the basis of

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[25] DN, p. 391; cf. pp. 584ff.
[26] For 'emergence', see John Bellamy Foster, *Marx's Ecology,* New York 2000, p. 230; and cf. Paul Blackledge, *Friedrich Engels and Modern Social and Political Theory,* Albany 2019, p. 238.
[27] Perhaps unfairly. See Sheehan, *Marxism and the Philosophy of Science,* pp. 132ff. The term 'reflectionist', and its counterpart 'interactionist' (below), are borrowed from her discussion. In different terminology, Horkheimer gives an incisive analysis of such problems in his 1935 essay 'On the Problem of Truth'.
[28] DN, p. 511. 'Natural science, like philosophy,' Engels writes, 'has hitherto entirely neglected the influence of men's activity on their thought; both know only nature on the one hand and thought on the other.' The parallel to Marx's first thesis on Feuerbach is all the more striking in that Engels did not discover the *Theses* until some years later.

knowledge and consciousness, in continuity with the whole perspective of Marx and Engels alike since at least the 'Theses on Feuerbach', provides not only methodological guidance for research but also explanatory insight into the development of scientific knowledge over time. In the history of science, it was practice, not just analysis, that resolved such famous problems as the convertibility of mechanical motion and heat.[29] Scientific knowledge grows not through cumulative expansion but in qualitative revolutions, in a mode almost exactly analogous to Marx's 'inversion' of Hegel. In the overturning of the phlogiston theory of fire, for example, older empirical findings were not simply negated but also 'persisted, only their formulation was now inverted', and expressed in these new terms, the old results 'retained their validity' in a different way.[30]

Engels's epistemology is no crude pragmatism of the kind that would present mere workability as the guarantee of truth. The emphasis on practice is regulated by a constitutive critique of any anti-theoretical empiricism. A very long (notoriously tedious) chapter on electricity exemplifies this sensibility; Engels's substantive analysis here has been superseded by later discoveries—the electron itself remained unknown in his time!—but his critical investigation of the outstanding debates within the new field illuminates the dangers to any research when 'a one-sided empiricism prevails'.[31] Theoretical reflection cannot be made obsolete, no matter how advanced one's technical apparatus, for only such reflection can lift the eyes of the experimenter above the foreshortened horizon of the already in view. We come to know the world only by changing it, but we can change it effectively only in knowing its ways. Through such reflexive practice, we can resist both the confusions of nascent scientific fields and the illusions of pseudoscientific fad. One of the liveliest essays in the manuscripts, 'Natural

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[29] DN, p. 400.
[30] DN, p. 343–4. Cf. Engels's preface to the first German edition of *Capital* vol. II, in which he again likens Marx's work to the overcoming of phlogiston-theory—except here the relevant antecedent being sublated is not idealist philosophy but bourgeois political economy: 'Marx stands in the same relation to his predecessors in the theory of surplus value as Lavoisier stood to Priestley and Scheele' ('Preface to the First German Edition,' in MECW vol. 36, p. 19).
[31] DN, p. 403.

Science in the Spirit World', examines how experimental empiricism without theoretical self-reflection will lead the most rational scientist to the wildest conclusions. In just this way, none other than Alfred Russell Wallace, who discovered the theory of evolution at the same time as Darwin, eagerly publicised his apparent encounters with spirits. Engels reports some ghostly experiments of his own: the results left him unconvinced.

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Max Horkheimer despised unreflective empiricism as vehemently as Engels had, and in an essay of 1937, he cited 'Natural Science in the Spirit World' in his own critique of the positivist claim that thought can teach us nothing more than whatever we directly observe.[32] Horkheimer's essay, published first in the Institute's *Zeitschrift für Sozialforschung* and eventually translated as 'The Latest Attack on Metaphysics', reveals the complicity of such extreme forms of positivist empiricism with the grimmest expressions of modern domination. Here the target is the programmatic effort of the Vienna Circle to subordinate philosophy to the purportedly immediate evidence of sense. Horkheimer's argument measures the meaning of such a view for a 'world whose magnificent exterior radiates complete unity and order while panic and distress prevail beneath', unseen by and unknown to simple, unthinking observation. 'Autocrats, cruel colonial governors, and sadistic prison wardens have always wished for visitors with this positivistic mentality', this sensibility which dismisses in advance the search beneath appearance for the violent power that brings apparent calm into view.[33] Unless we integrate experiment and observation with careful thought and theoretical deliberation, we cannot hope to pierce the illusions that structure our everyday experience of an orderly yet irrational world. Horkheimer's brief reference to Engels's critique of spiritualist pseudoscience suggests the grave consequences of unreflective empirical credulity: we will receive the false proclamation of a prosperous

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[32] Horkheimer cites the essay as it appeared in *Dialectics of Nature* in the volume published by the Institute in 1927. See 'Die neueste Angriff auf die Metaphysik', *Zeitschrift für Sozialforschung* VI.1, 1937, p. 34 ('The Latest Attack on Metaphysics', in *Critical Theory: Selected Essays,* New York, 1972, p. 167).
[33] Quotations from Horkheimer, 'The Latest Attack on Metaphysics' [1937], in *Critical Theory: Selected Essays,* p. 151.

tranquillity with the eagerness of the guest at the séance welcoming the spirit's signal from beyond the tomb.

Horkheimer had taken over the leadership of the Institute for Social Research in 1931, at the conclusion of Karl Grünberg's long tenure. Questions about the study of nature haunted his work from the beginning. In his inaugural address as director, he advocated a program of collaborative inquiry that could have developed along the lines Engels had proposed. Horkheimer proclaimed that old truisms about the opposition between philosophy and social-scientific inquiry were 'being superseded by the thought of an ongoing dialectical permeation and evolution of philosophical theory and empirical-scientific praxis.'[34] He invoked the relationship between the 'philosophy of nature and the natural sciences' as a favourable model for these developments, and he endorsed a picture of such work in which philosophical problems would be integrated into empirical inquiry.[35] His subsequent early writings remained optimistic about the prospects for such an endeavour, and in 1933, he compressed these hopes into a programmatic formulation: 'materialism requires the unification of philosophy and science.' Only the concrete development of the natural sciences 'has a say on what matter is', and in the end there will be no stable distinction between such scientific practice and the reflexive philosophy that orients us toward the material world of society itself.[36]

Horkheimer wanted to surpass the old oppositions between scientific and philosophical, empirical and conceptual forms of inquiry. By the end of the decade he would settle on *critical theory* as the name for the Institute's collaboration toward this end. As the 'heir…of philosophy as such', critical theory was to advance by 'relating matter—that is, the apparently irreducible facts which the scientific specialist must respect—to human production.' Investigating the interconnection between the putatively natural and the irreducibly social, critique would pursue a

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[34] Horkheimer, 'The Present Situation of Social Philosophy and the Tasks of an Institute of Social Research' [1931], in Bronner and Kellner, eds., *Critical Theory and Society*, New York 1989, p. 31.
[35] Horkheimer, 'The Present Situation…', pp. 31–32.
[36] Preceding quotations: Horkheimer, 'Materialism and Metaphysics' [1933], in *Critical Theory: Selected Essays,* p. 34, p. 35.

'more rational organisation of human activity': knowledge about capitalist life, knowledge for socialist practice.[37] Horkheimer's 1937 essay 'Traditional and Critical Theory', probably his most famous, details the program; it has come down to us today as the young Frankfurt School's most rigorous and systematic statement. Yet the way in which that essay distinguishes critical theory from its alternatives fundamentally undermines the earlier aim of Horkheimer's materialism itself—the unification of science with philosophy, whose tasks critique inherits.

The essay both reconstructs a traditional Cartesian picture of the work of theory and declares the arrival of the *critical* theory that can overcome its limits. Both traditional and critical theory start 'with abstract determinations', but they proceed differently from this apparently shared beginning. 'Facts are individual cases, examples, or embodiments of classes' in traditional theory; for critical theory, 'the relation of the primary conceptual interconnections to the world of facts' is qualitatively different. Each fundamental category with which critical theory operates—from its account of the relationship between nature and human life to its periodisation of historical time, and including especially its self-representation of its own activity—emerges from a 'radical analysis, guided by concern for the future, of the historical process.' In logic and in method, this is what distinguishes critical from traditional theory.[38]

In principle, it might seem that both these approaches to the data of an intellectual inquiry—the one in which the facts are conceived as instances of classes, the other in which they are apprehended in their connection to a whole 'historical process'—could alike encompass any kind of content. The two forms of theory diverge in how they conceptualise their objects, but they are not obviously distinguished by what zones of the material world they can take in as objects of inquiry in the first place. Yet Horkheimer identifies the logical structure of traditional theory pre-eminently with the research of the natural sciences—physics, biology—and with

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[37] Horkheimer, 'Postscript' [1937], in *Critical Theory: Selected Essays,* pp. 244–5.
[38] Preceding quotations: Horkheimer, 'Traditional and Critical Theory' [1937], in *Critical Theory: Selected Esssays,* pp. 224–5. On Descartes, see p. 189.

social-scientific disciplines that aspire to the self-presentation modelled by physics and its kin (such as bourgeois economics). Meanwhile, he identifies the logical structure of critical theory exclusively with a particular approach to the reflexive study of *society*. At the first moment in the essay when critical theory is named as the emancipatory alternative to traditional inquiry, it is presented as 'a human activity which has society itself for its object.'[39] In Horkheimer's view, traditional theory remains properly suited to the study of the objects of the natural sciences (and will retain this function even under socialism), while critical theory exclusively works to comprehend society as a historical process in the interest of its future.

This is Horkheimer's mistake. He refuses to apply critical theory to 'nature'—and his refusal is justified not by a contingency of the division of intellectual labour, but by a deeper disanalogy between social analysis and natural science itself. On Horkheimer's view, the relationship between inquiring subject and investigated object assumes a fundamentally different character in the two areas of study. The natural scientist deals with objects whose essence remains unchanged by the incorporation of the encounter into the theory that results: 'Subject and object are kept strictly apart'. But critical theorists necessarily change the object they examine: society does not stably perdure with independent energy, for human action within and reflection upon society transforms its substance and form in every moment of its ceaseless historical change. In natural science, treating facts as instances of classes, subject and object remain apart. In society, comprehended as the continuous result of a historical process, the subject and the object reshape each other without pause.[40]

Horkheimer here concedes to positivism itself the validity of its account of the objects of the natural sciences and of the scientist's relationship to them. The positivist perspective insists that no object of natural-scientific investigation admits of constitutive entanglement with the subjectivity of the researcher who fixes it in place. Yet across the history of such research, the

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[39] 'Traditional and Critical Theory', p. 206.
[40] Preceding discussion recapitulates 'Traditional and Critical Theory', p. 229.

character of the subject-object relation in the domains treated most typically by the natural sciences has always been a contested, in some times and some areas even an open, question. In some fields the claim of the separation of subject and object is almost certainly false (ecology provides a clear example). In others, the character and meaning of the subject-object split remains a matter of controversy; the bitter fights over the interpretation of quantum mechanics, still not fully resolved, demonstrate that the structure of the subject-object relation in the natural sciences is established—discovered—not settled in advance.

That 'subject and object are kept strictly apart' in the world known through the natural sciences can only be demonstrated through scientific research and critical reflection within it, if at all; such a conclusion cannot be posited *a priori,* in advance of the historical process of scientific activity itself. It is traditional theory which proceeds from this assumption of absolute disjunction and positivism which identifies this separation with scientific methodology in general. The split is not simply given in the very structure of the scientific encounter with the world: scientific practice comes to know that world at first by changing it, only afterwards perhaps to attempt the abstraction from engaged intervention. Perhaps it will indeed turn out that some objects of natural-scientific inquiry persist in the separation from the investigating subject that 'traditional theory' in Horkheimer's sense attributes to them; but this can only be demonstrated, not assumed, and insofar as its demonstration involves a historical process of its own, it is in no way clear why such an area of inquiry should be one from which a 'critical theory' in Horkheimer's technical sense would remain so sharply disjoined. Horkheimer grants to positivism the truth of its identification of natural science with traditional theory when there is no philosophical necessity that he do so. For all the incisive clarity of Horkheimer's analysis of the differing logics and the opposed social functions of traditional and critical theory, his setting of the questions of 'nature' on the one side and those of 'society' on the other remains premature—and this conclusion grants to positivism precisely the matter that should be disputed, the character of natural-scientific inquiry itself.

Horkheimer should not have introduced critical theory as 'a human activity which has society itself for its object'; he should have called it a human activity which has *the world itself* for its object. In his failure to do so, Horkheimer abandoned the approach that *Dialectics of Nature* had modelled and which his own earlier work had likewise seemed to pursue. (In an essay of 1932, Horkheimer had written that the fetishization of an 'unchanging relationship between subject and object' had for its origin 'not science itself but the social conditions which hinder its development and which are at loggerheads with the rational elements immanent in science.')[41] Cordoning off the world as a whole from society as such, Horkheimer in the end conceded to positivism its own account of what natural science is and can be. The materialist 'unification of philosophy and science', which he had once announced as his ambition, became impossible.

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The Frankfurt School's greatest theoretical work, *Dialectic of Enlightenment,* illustrates the equivocal implications of Horkheimer's shifting view of the meaning of scientific activity. Written collaboratively by Horkheimer and Adorno, the 'philosophical fragments' of this book confronted the degeneration of European society into the horrors of fascism, arguing that the totalitarian character of Hitler's program emerged from tendencies latent within the apparent progress of enlightenment reason itself.

The book advances a twofold claim. The domination of nature turns back into the domination of human beings, the mastery of the one transmuting into the oppression of the other; progress and regression intertwine with each other in the history that arises from such originary domination, freedom and exploitation enduring in a contradictory unity. Rooted in a Marxian critique of political economy whose categories animate every page even as they lurk, half-hidden, beneath the surface of their rhetorical forms, the argument of Adorno and Horkheimer resituates the terrors of the twentieth century within the material history of thought

[41] 'Notes on Science and the Crisis' [1932], in *Critical Theory: Selected Essays,* pp. 5-6.

itself.[42] As 'world domination of nature turns against the thinking subject', the tools of scientific research, technological practice, and mathematical abstraction undermine the very capacity for thought that they purport to secure.[43] 'Adaptation to the power of progress furthers the progress of power', and the 'curse of irresistible progress is irresistible regression.'[44] Enlightenment intensifies unfreedom, yet it also makes freedom possible in qualitatively new forms; every civilizational development simultaneously reinforces domination and presents new prospects for its abolition.[45] But in the orderly horror of the twentieth century, 'sacrificing thought…enlightenment forfeited its own realisation', and through intensified exploitation and mechanised destruction, authoritarian fascism and monopoly capitalism bring the destructive logic submerged in enlightenment reason into the open at last.[46]

In this analysis of the simultaneity of progress and regression, Adorno and Horkheimer remark very early that 'on their way toward modern science human beings have discarded meaning.'[47] In the vast complex of modern scientific activity, little escapes their critique. Mathematics becomes the paradigm of a universal destruction of the qualitative: justice and commerce submit to the same equations, and anything resistant to quantification decays into mere poesy.[48] Technology likewise obliterates. As thought loses its capacity for self-reflection, the machinery that reason designs damages and destroys the very human beings it was built to serve.[49] Even the art and entertainment of industrialised mass culture 'confirm the victory of

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[42] On *Dialectic of Enlightenment* as a 'natural history of reason', see Seyla Benhabib, *Critique, Norm, and Utopia,* New York 1986, p. 187, p. 217.
[43] Horkheimer and Adorno, *Dialectic of Enlightenment,* trans. Edmund Jephcott, Stanford 2002 [1944/1947/1969], p. 20.
[44] *Dialectic of Enlightenment*, p. 28.
[45] *Dialectic of Enlightenment*, p. 30, p. 32.
[46] *Dialectic of Enlightenment*, p. 33. This line of critique extends earlier ideas in Horkheimer's essays 'The End of Reason' and 'The Authoritarian State' (both 1941). As early as 1939 Horkheimer offered, in 'The Social Function of Philosophy', what could almost be regarded as the slogan of *Dialectic*: 'Rationalism in details can readily go with a general irrationalism' (in *Critical Theory: Selected Essays,* p. 260). Strikingly, however, in that essay he still cautioned against an overly 'pessimistic conception of scientific progress'.
[47] *Dialectic of Enlightenment*, p. 3.
[48] *Dialectic of Enlightenment*, pp. 4-5.
[49] *Dialectic of Enlightenment*, p. 29.

technological reason over truth.'[50] Lest we hope that such perverse developments mark only the excesses of the scientific enterprise rather than its fundamental character, Adorno and Horkheimer submit that the very 'notion of the self-understanding of science conflicts with the concept of science itself', for 'science is a technical operation', and nothing more.[51]

In what amount to parenthetical asides, Adorno and Horkheimer sometimes suggest that they oppose only a particular, perhaps newly dominant understanding of science—they inveigh against the 'blindness and muteness of the data to which positivism reduces the world', or they refer to science 'in its neopositivist interpretation', or they describe the object of their polemic as 'current science', in only implicit contrast to some other kind.[52] Such formulations preserve the fading echo of a wish that scientific activity could escape its positivist complicity with domination, even if it cannot hope to be unified with philosophy (an ambition no longer anywhere expressed). Yet such qualifications are few. They appear as gestures of concession to the possible intelligibility of a position the authors themselves no longer find plausible. The effect of their rhetorical manoeuvres—whatever their intention might have been—is again to identify science as such with the positivistic vision of it that they critique.[53]

In our technological present, caught between the computerised manipulations of the 'Information Age' and the ecological crises of the 'Anthropocene', the polemical clarity of Adorno and Horkheimer has lost neither force nor significance. Yet for all its historical insight, their argument is insufficient, their diagnosis inadequate for the dilemmas of our time—a necessary tool, an incomplete resource. Conceding to positivism its vision of what science is,

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[50] *Dialectic of Enlightenment*, p. 110.
[51] *Dialectic of Enlightenment*, p. 66.
[52] *Dialectic of Enlightenment*, p. 134, p. 13, p. 65, respectively.
[53] In this way they end up following the lead of the early Georg Lukács, whose influential *History and Class Consciousness* had similarly conceded to positivism the validity of its vision of scientific practice. Cf. Roy Bhaskar, writing in *Reclaiming Reality* (New York 1989): 'Lukács inaugurates a long tradition within Marxism with confounds science with its positivistic misrepresentation and starkly counterposes dialectical to analytical thought' (p. 139); and John Bellamy Foster, in *Marx's Ecology*: '…the theoretical legacy of Lukács and Gramsci…denied the possibility of the application of dialectical modes of thinking to nature, essentially ceding that entire domain to positivism' (p. vii).

their analysis of the simultaneity of progress and decline, of freedom and domination, treats the work of the sciences as though it were entwined only with the destructive movement of that dialectical contradiction and not also with its emancipatory dynamic as well. As the industrialised horrors of the world wars made clear, the meaning of science in society in this period was no merely conceptual question. Positivism was only one camp in the conflicts of the day over technoscientific practice and its political significance.[54] But Adorno and Horkheimer, by the 1940s, decided no longer to fight that battle at all. They ceded the entire field to the positivist enemy, withdrawing to higher ground to fortify a different kind of position against the onslaught. Perhaps this characterisation exaggerates the intention of their claims; but it captures the *effect* their text produces. To unveil the terrors of scientific research turned to domination was a task of preeminent importance in their time, and it remains so today. Yet to identify the regression is not enough. The possibilities for freedom must be clarified as well. Adorno and Horkheimer investigated the intractability of the dialectical interrelation of progress and decline, but in their account of natural science—in the end a remarkably one-sided account—they fell short of this aim, seeing only unfreedom and nowhere the opposite with which it is ever interwoven.

To recognise the insufficiency of *Dialectic of Enlightenment* in this respect becomes more poignant when one recognises also the unnecessary, contingent character of their conclusion; their equation of science with positivism resulted from a disregard of the development of scientific knowledge in their day. Because Adorno and Horkheimer retreated so fully from any real engagement with the state of research in natural science and mathematics in these years, they were not equipped to see how fully its always provisional advance could have reinforced their own philosophical and political ambitions. In these very decades, fundamental transformations within the most basic scientific disciplines were undermining the ambition of schematic,

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[54] The best history of such mid-century debates from the perspective of Marxist engagement with them is Helena Sheehan's *Marxism and the Philosophy of Science,* Ch. 4.

totalising systematicity that Adorno and Horkheimer rightly opposed. As the British Marxist critic Christopher Caudwell demonstrated in the 1930s, the development of physics, and in particular the shape of the theoretical contradiction between general relativity and quantum mechanics (which remains to this day unresolved), could be interpreted as powerful confirmation of a dialectical and materialist sensibility about the history of science, the character of the natural world, and the place of human society within it.[55] Likewise—in ways that still today need desperately to be dug out of their encrusting of cliché—the revolutionary demonstrations of Kurt Gödel in formal logic were radically challenging all older attempts at unifying mathematics itself on some single set of axioms. The world of formal logic fell open even more drastically than that of geometry had a century before, in the discovery of the alternatives to Euclid. In the twentieth century, the apparently most mature of the apparently most abstract sciences—fundamental physics and formal mathematics—confronted from within the persistent impossibility of completed totalisation or final schematisation. There were those, particularly in the positivist camp, who held on to such ambitions nonetheless. Adorno and Horkheimer need not have allowed them the dream.

Sebastiano Timpanaro cautions against orientations toward the study of nature that 'would lapse, ultimately, into a total indifference to the natural sciences, which would then make the construction of communist society impossible.'[56] *Dialectic of Enlightenment* risks making such an orientation seem inevitable, and this apparent inevitability resounds far too widely today. Divorced from the dialectics of nature, the social analysis pioneered by Adorno and Horkheimer spread across the humanities in the post-war decades. 'Critical theory' ranged widely beyond Frankfurt, maintaining in some quarters a certain fidelity to the tradition of historical materialism but shifting and extending in new encounters with poststructuralism, cultural studies, and other forms of left thought. Ever more capacious, the term became synonymous with orientations

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[55] Christopher Caudwell, *The Crisis in Physics,* New York 2017 [1939].
[56] *On Materialism,* trans. Lawrence Garner, New York 1975, p. 71.

toward discourse, social practice, cultural change, and political action that had at times as little to do with each other as with the materialist dialectics that had nurtured the first growth of such critique. The insights were as powerful as the results uneven. The missteps and controversies sometimes threatened to discredit, unjustly, the enterprise as a whole. New ways of thinking about the natural sciences—ways in which Engels did not figure—came to prominence in the humanities transformed by critical theory in this broader sense, and the so-called 'science wars' of the last years of the twentieth century brought the possibilities—and the limitations—of such developments all too sharply into the public eye.

For all the limitations and distortions of our view, the world visible in the modern sciences—from fundamental physics to cosmological astronomy, from molecular genetics to evolutionary ecology—is an astoundingly beautiful world, infinite in its intricacy and bottomless in its depth. That the study of this world could be so often, and so casually, dismissed as antithetical to the task of critique is a grievous loss indeed. Against a merely aesthetic naturalism or an ultimately reactionary romanticism, the costs of such alienation must be understood to be social and historical: the question of our relation to matter and its study remains a political one today, as it was for Engels in his time. In a moment determined simultaneously by the digital mediation of all public life and by the ecological collapse of our planetary home, critical theory cannot afford to cede the meaning of technological and scientific practice to those who would, whether by design or misapprehension, turn its methods and its achievements toward the domination of the world.

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A renewed historical materialism must preserve the social critique that Horkheimer and Adorno advance while working to make their scientific pessimism inapposite to our own political possibilities. Engels's perspective offers a model. An explanatory lacuna undermines what is otherwise the most important argument of *Dialectic of Enlightenment*: Adorno and Horkheimer describe the social decay that results from the mutation of the domination of nature into the

domination of human beings, but they do not give us an account of *why* that mutation occurs, because they do not, in the end, give us any account of nature itself. In 'tracing the genesis of the self back to the history of its interaction with nature', Seyla Benhabib has suggested, they 'also assume that they can explain the genesis of social relations of domination…It is unclear what sort of causal or other sort of connection is being established here.'[57] Their retreat from immanent critical engagement with natural science left a gap in the story of how the mastery of nature turns back against the freedom of the human species. Had Horkheimer and Adorno not turned from the approach to science that Engels had begun to develop, they might have found in the *Dialectics of Nature* the mechanism of inverted domination that Benhabib suggests they could not describe.

To see reason's eclipse in matter's dynamics—to unify the dialectics of enlightenment and of nature alike: this is the 'centre of possibility' of Engels's fragments. Kōjin Karatani, in his rereading of Marx, advances this phrase as a name for the 'form of meaning or signification that is there despite not being explicitly described in the text.'[58] Sometimes an act of eisegesis is needed for exegesis to be possible at all. When a text circles an insight whose expression can only be seen elsewhere, to rearrange its incomplete formulations around that later apprehension can lend them the shape they never quite find on their own. *Dialectics of Nature* is such a text, and the simultaneity of progress and regression is its fundamental object of critique. When the precision given to this social contradiction by Horkheimer and Adorno is brought back into Engels's own ideas, the problems of nature and matter that they themselves could never resolve unfold at last within our view.

Confronting the natural environment, the human being 'makes it serve his ends, *masters* it'; this ambition to control the external world, Engels suggests, is the aim that defines humanity's self-understanding. But we should not think too highly of our apparent triumphs

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[57] Benhabib, *Critique, Norm, and Utopia,* p. 218.
[58] Karatani, preface to the English translation of *Marx: Toward the Centre of Possibility,* p. xxxii.

over the workings of matter, for even when we attain at first what we seek to achieve, as the consequences accumulate and interact beyond our foresight, the secondary effects all too easily frustrate the ends we have seemingly secured. (Engels's examples range from the calamitous results of deforestation in antiquity to the human devastation of the potato blight in Europe). We cannot escape our inability to 'rule over nature like a conqueror over a foreign people, like someone standing outside nature', for instead 'we, with flesh, blood and brain, belong to nature, and exist in its midst'; our apparent power to bend the world to our will amounts to nothing more than a capacity to learn its own laws, to see how they enable—and limit—our ability to transform it without end. The destructive character of our always so imperfect yet always so confident action upon nature reproduces itself directly in the destructive character of all that passes for progress in the development of capitalist life.[59]

This, though in the texts unnamed, is the dialectic of enlightenment. Engels sees clearly the involution of the domination of nature into the domination of human labour. In a world of imperfect control of the effects of our deeds, we can achieve little better than such a unity of progress and decline. Yet Engels examines also how this self-destructive dynamic of modern social relations itself issues from what might be termed the natural-historical character of human existence under capitalist production. We might wish to distinguish history proper—the history of human society—from the natural history of animal life by emphasising that human history is made by human beings deliberately, with intention. If animals 'have a history' at all, it is one that unfolds 'without their knowledge and desire.' The human being can plot in advance; the animal remains subject to chance and environment and the chaos of unplanned life. But this distinction dissolves when rigorously applied to human history in its actually existing disorder. Even in the most seemingly sophisticated societies of our time, Engels writes, we find that there remains 'a colossal disproportion between the proposed aims and the results arrived at, that unforeseen

[59] Preceding quotations: DN, pp. 460-1, emphasis original.

effects predominate, and that the uncontrolled forces are far more powerful than those set into motion according to plan.' It can be no other way as long as the social production of the economic means of human existence—the fundamental historical practice that seemingly sets our species apart from all other life—remains outside of 'conscious organisation'.[60]

The irrational character of modern capitalist production, in which all our advances serve only to ensure our deeper degradation, is the perverse afterlife of the animal condition, the natural-historical mode of subjection to unanticipated and uncontrolled external forces, persisting now in human history in a form even less endurable and less justifiable, for we possess consciousness enough of our incomplete exit from animal unfreedom to see all the more clearly and feel all the more deeply the abyss that divides what is from what could be. This condition is less a return of the repressed than a satirical negation of the negation, the recuperation of an abandoned unfreedom now again in a *lower* form. Having passed far beyond primitive communism at last into capitalist civilization, we find ourselves reduced to what would seem a Darwinian struggle for mere survival, but in circumstances where we can see the human origin—yet not the human end—of our immiseration. In *The Eighteenth Brumaire,* Marx wrote that 'men make their own history, but they do not make it just as they please; they do not make it under circumstances chosen by themselves, but under circumstances directly encountered, given and transmitted from the past. The tradition of all the dead generations weighs like a nightmare on the brain of the living.'[61] Engels's incomplete manuscripts deepen and transform this insight, rewriting the *Brumaire*'s description of agency in history within a longer story of agency in the universe as a whole. For human history is part of natural history—'the whole of nature is also now merged in history'—the fossils themselves weigh on the bodies of the living today.[62]

Social and historical activity arises continuously from, yet cannot be simplistically

[60] Preceding quotations: DN, pp. 330–1.
[61] In MECW vol. 11, p. 103.
[62] DN, p. 516.

reduced to, the contradictory character of evolutionary development as a whole. Always anti-reductionist, Engels insists that we cannot read social dynamics directly from the categories clarified in the study of biological change over time.[63] What we call the 'struggle for existence'—even in Darwinism an inadequate phrase—is itself transformed by the role of *production* within the human relation to biological reproduction in the metabolism with nature. Because of the structuring significance of production as a human activity, we face neither a Hobbesian war of all against all nor a Malthusian population bomb: the so-called 'struggle for existence' instead takes on a class character.[64] Society's change outpaces the development of the biological species as such. Yet human development still unfolds within the overarching motion of nature, and though the emergence of new zones of material complexity with their own distinctive forms of motion makes reductive simplifications impossible, we nevertheless cannot escape the interconnection between these various modes of existence in the material world. The still partly natural-historical character of human society itself testifies to such continuities, however complex. Not exactly in the last instance, but still somewhere deep down in the logic of this change, we find 'that each advance in organic evolution is at the same time a regression, fixing *one-sided* evolution and excluding the possibility of evolution in many other directions.[65] The prototype of the dialectic of enlightenment lies in evolution itself. Prototype, not replica: evolution sets out no plan in advance, pursues no teleological end.[66] We must here understand 'regression' not in the

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[63] As Sebastiano Timpanaro suggests, the relation between human history and natural history is similar in certain respects to the relation between cultural superstructure and economic base in capitalist society (see *On Materialism*, pp. 43ff.). The one emerges from, and depends on, the other—but in relations of material interaction that do not admit of processes at the 'higher' level being directly reduced to those at the 'lower'. Timpanaro emphasises that there are facts about the human relationship to nature that are prior even to the economic base, and that any materialism worthy of the name must take such facts seriously. His position is an important corrective to accounts of the nature-humanity relationship that proceed no further than their mutual interrelation in the mediation of labour (e.g., that of Alfred Schmidt); but he risks reifying the concept of 'nature' itself in a way that would reinscribe the very anthropocentrism he opposes. On this, see Raymond Williams, 'Problems of Materialism', NLR I/109, May–June 1978.

[64] DN, pp. 584–5.

[65] DN, p. 583.

[66] As Engels himself emphasises, e.g., at DN, p. 475. Cf. Marx's letter to Lassalle of 16 January 1861: in Darwin's work, "'teleology" in natural science is not only dealt a mortal blow but its rational meaning is empirically examined' (MECW vol. 41., p. 247).

normative sense that we can with more justice, perhaps, apply to human history; rather, every particular development forecloses certain prior possibilities, and when such development and foreclosure remain uncontrolled, the consequences of the newly fixed direction can be neither predicted certainly nor mitigated reliably. Sometimes species do, after all, evolve themselves into extinction.

What is to be done? All too often, empirical researchers cannot gain 'clear insight into the simplest things' because they fail to remember and to comprehend that 'nothing takes place in isolation'; all that exists shapes and is shaped by everything else that there is.[67] We too, we human beings who never in the end can 'rule over nature like a conqueror over a foreign people'—we belong to this nature, we ourselves stretch across its dense net of ties. In diagnosing the self-destructive character of our imperfect mastery of nature, Engels therefore does not conclude that we must perfect that domination in more expert and seamless forms. Such ambitions will always fail. For the simultaneity of advance and decay in biological evolution, giving rise both to the highest complexities of human thought and to the innumerable dead ends of obliterated kinds, reflects the character of the motion of matter in all its qualitative differentiation at the most magnificent scales of the universe itself in space and time.

Engels here adopts a rhetorical form that can seem misleading: he writes of the 'eternal cycle in which matter moves'.[68] It would be too easy to read such a phrase as little more than a crassly literal eternal return of the same, an abysmal thought of cosmic time as the stage of looping repetition, any seeming progress revealed as illusion when it all comes back around. Certain formulations in the unfinished manuscripts—particularly in their most moving and eloquent prosody—lend themselves to such an interpretation, if taken on their own. But the most plausible readings of such passages, and the force of Engels's project as a whole, weigh strongly against this view. To construe his writing in this way would be to redirect his fragments

[67] DN, p. 459.
[68] DN, p. 334.

toward the one conclusion he most vehemently rejects—the old idea that nature does not finally change.

When Engels considers matter's 'eternal cycle', he speaks of 'however often, and however relentlessly, this cycle is completed in space and time'—completed, not repeated.[69] For the 'whole of nature' is not only 'cyclical course' but 'eternal flux' as well.[70] The fundamental error of the French *mechanical* materialists of the eighteenth century had been their failure 'to comprehend the world as a process, as undergoing uninterrupted historical development'; they believed that the 'eternal motion' of nature 'turned just as eternally in a circle' and 'produced the same results over and over again'.[71] The logic of a materialism dialectical rather than mechanical revolts against such a conclusion. To affirm the indestructibility of motion, that most fundamental of physical principles, must be to affirm also 'that the world exists as infinite progress', understood again not in normative terms but as a question of 'whether this process is an eternal repetition—in great cycles—or whether the cycles have descending and ascending branches.'[72] The image is of a spiral movement of matter, a simultaneity of progress and decline. Engels concludes that this is 'no repetition, but a development, an advance or regression, and thereby it becomes a necessary form of motion.'[73] Eternal flux is the everlasting impossibility of an end to the new. In the development of human history under partial conscious control this dynamic accelerates into what amounts to a blinking moment in cosmological time. But the entwining in society of progress and regression, which as it shapes the workings of reason and thought develops into the dialectic of enlightenment itself, has its possibility, even its necessity, in these very possibilities and necessities of cosmic matter in all its forms, which develop through inner tensions as well.

Engels insists that we cannot hope to subordinate such dynamics to our human will, as

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[69] DN, p. 335.
[70] DN, p. 327.
[71] Engels, *Feuerbach,* p. 370. Cf. Marx & Engels, *The Holy Family,* in MECW vol. 4, pp. 124ff.
[72] DN, p. 516.
[73] DN, p. 517.

though we were 'someone standing outside of nature'. Complete mastery of the world will always elude us; its pursuit will lead us only to self-destruction. The task instead is the *renunciation* of mastery as a goal, in the recognition of the profoundly illusory, fundamentally ideological character of the antithesis between nature and humanity. As our knowledge of the world and its laws deepens, we will comprehend more fully our 'oneness with nature, and the more impossible will become the senseless and unnatural ideal of a contrast between mind and matter, man and nature, soul and body, such as arose after the decline of classical antiquity in Europe and obtained its highest elaboration in Christianity.'[74] Here in the *Dialectics of Nature* Engels delivers on the provisional promise of the likewise unpublished text of the *German Ideology,* where he and Marx assessed how 'the antithesis of nature and history is created' as an ideological erasure of the true position of our species in the world.[75] The antithesis vanishes, not in the perfection of human domination of nature but in the surrender of domination as such—and with it the very intelligibility of the conceptual opposition itself.

To relinquish the dream of dominating nature, while bringing the effects of our actions under conscious control, 'requires something more than mere knowledge'; we must undertake 'a complete revolution in our hitherto existing mode of production, and simultaneously a revolution in our whole contemporary social order.'[76] Only material transformation can allow us to surpass the inadequacy of our reasoned understanding. If the domination of the material world leads to the domination of the human species in turn, human beings must be free if the world is not to be destroyed. In such freedom, 'natural science will experience an advance that will put everything preceding it into the deepest shade.'[77] The renunciation of the mastery of nature enables scientific inquiry beyond positivist delusion, for only in this way can we study the material world without the distortions induced by the false sense of our own insulation from its

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[74] DN, p. 461.
[75] *The German Ideology*, MECW vol 5, p. 55.
[76] DN, p. 462.
[77] DN, p. 331.

constant change. Engels's manuscripts model the comportment toward the sciences that *Dialectic of Enlightenment* requires if Frankfurt critique is not to withdraw from nature itself, from all its motion and change. In his analysis of unreflective empiricism, his opposition to crude reductionism, his sensitivity to qualitative richness and endless interconnection, Engels's perspective on scientific practice shows its necessity for progress and not only its complicity in regression.

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Between the two world wars, the British biologist J. B. S. Haldane, among the most influential natural scientists of his day, wrote the preface to the first English translation of *Dialectics of Nature*, a dozen years after its publication in Frankfurt. Looking back over his own decades of activity in the European scientific scene, he reflected on the range of dilemmas in twentieth-century research that could have resolved more swiftly had Engels's ideas been more widely known—from the 'transformations of our ideas on physics' to his own earlier 'muddled thinking' on Darwinism. Engels's approach to scientific inquiry seemed to Haldane to be a model not only for studying the natural world but for confronting social catastrophe as well; writing at the dark dawn of the second world war, he suggested that 'a study of Engels will warn us against some of the facile solutions which are put forward today, and help us to play an intelligent and courageous part in the great events of our own time.'[78]

This was Haldane in November, 1939, looking out over the piling catastrophe of liberal Europe degenerating into fascism—a few years before *Dialectic of Enlightenment* would be written. We face still today the promise and the peril of what Adorno and Horkheimer understood as the simultaneity of progress and decline. 'Every advance', indeed, 'is also a regression'. Few have diagnosed the social consequences of that contradiction with more insight than the founders of the Frankfurt School; but now we need more than the identification of how science and

[78] Haldane, 'Preface', in Engels, *Dialectics of Nature,* trans. & ed. Clemens Dutt, London 1940, p. xiv, pp. xv-xvi.

technology can destroy the forms of freedom that make them possible. We need also an account of what role they might play in freedom's defence—in defence of the very possibility of freedom for future generations, not less than for our own. The antithesis between critical theory and natural-scientific research must be overcome; critical theory must reclaim the study of the world itself from the positivist reductionism so eager to speak in nature's name. The task today is the same as that which Horkheimer announced in 1933: the unification of natural science and philosophy in an emancipatory materialism.

For us, as for Haldane, the fragmentary reflections that Engels offered can warn against some of the more facile solutions to the crises of our times. Amid accelerating environmental disaster, it is all too tempting to retreat from the hubris of anthropocentrism into its apparent opposite, an ethos of ecocentrism. The force of the demand to 'protect nature', to preserve its purity wherever it can be found and to recuperate its damaged plenitude wherever the ravages of industrial civilization might still be undone, cannot easily be denied. Yet denied it must be. To simply invert the traditional idea of the 'domination of nature' by reasserting the earth's final authority over humankind cannot achieve the goals which motivate the articulation of such a demand, nor can the only apparently less moralistic imperative to redescribe the status of nature on its own terms, rather than in those of human activity, achieve the greater clarity of analysis and explanation it would promise. The ecocentric and the anthropocentric do not, in the end, diverge; they are dialectically intertwined, sliding wildly back and forth across a shared conceptual terrain. The two terms express the same worldview: the belief that there is Man, and that there is Nature, and that each opposes the other across all of space and time. The 'preservation of nature' is merely the conservative optimism to which the progressive cynicism of the 'domination of nature' corresponds; each value appears as the perfect inversion of the other because they present the world and the activity of the human species within it in exactly corresponding ways. Engels exposed the poverty of such terms of dispute. It is the very concept of nature which is the problem—or rather, which is the symptom of the problem, for the

'antithesis between nature and humanity' remains merely the ideological effect of the oldest transformation in human society's modes of economic production and exchange. Ecocentrism presumes a picture of human nature that is—like all pictures of human nature—an illusory reification within of a reified nature without; anthropocentrism presumes a picture of cosmic ontology that is—like all nondialectical ontologies, and too many dialectical ones as well—a projected alienation of alienated humanity's emptiness within. Anthropocentrism as a political force in history produces ecocentrism as its already inborn response, but ecocentrism too will always in the end cast humankind in the role of nature's saviour, even if only by abstention—a political theosis shifting too easily back into the anthropocentrism for which it purports to atone. Only a materialism that aims at a future in which the very concept of nature no longer has meaning (and in which the concept of human nature, too, is obliterated) could bring to the morass of 'environmental' disaster a clarity of analysis conducive to the real alternative. Even the formulation, in Marxism, of 'human metabolism with nature' comes too close to the reinscription of the antithesis it must overcome; so, too, the idea that humanity is nature's consciousness of itself. But these formulations, if the one can be purged of its residual image of a pure nature and the other of its anticipatory echoes of a humanist triumphalism, at least point toward the new material relations that alone can fulfil the less inadequate concepts we still so desperately need.