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Marxism and the Dialectics of Ecology

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Does Critical Criticism believe that it has reached even the beginning of a knowledge of historical reality so long as it excludes from the historical movement the theoretical and practical relation of man to nature, i.e. natural science and industry?

—Karl Marx and Frederick Engels[1]

The recovery of the ecological-materialist foundations of Karl Marx's thought, as embodied in his theory of metabolic rift, is redefining both Marxism and ecology in our time, reintegrating the critique of capital with critical natural science. This may seem astonishing to those who were reared on the view that Marx's ideas were simply a synthesis of German idealism, French utopian socialism, and British political economy. However, such perspectives on classical historical materialism, which prevailed during the previous century, are now giving way to a broader recognition that Marx's materialist conception of history is inextricably connected to the materialist conception of nature, encompassing not only the critique of political economy, but also the critical appropriation of the natural-scientific revolutions occurring in his day.

What Georg Lukács called Marx's "ontology of social being" was rooted in a conception of labor as the metabolism of society and nature. In this view, human-material existence is simultaneously social-historical and natural-ecological. Moreover, any realistic historical understanding required a focus on the complex interconnections and interdependencies associated with human-natural conditions.[2] It was this overall integrated approach that led Marx to define socialism in terms of a process of sustainable human development—understood as the necessity of maintaining the earth for future generations, coupled with the greatest development of human freedom and potential. Socialism thus required that the associated producers rationally regulate the metabolism of nature and society. It is in this context that Marx's central concepts of the "universal metabolism of nature," "social metabolism," and the metabolic "rift" have come to define his critical-ecological worldview.[3]

Marx's approach in this respect is inseparably related to his ecological value-form analysis. Central to his critique of capitalist commodity production was the contradiction between use value, representing production in general, and exchange value (as value, the crystallization of abstract labor). Moreover, Marx placed great emphasis on the fact that natural resources under capitalism are treated as a "free gift of Nature to capital," and hence they do not enter directly into the production of value.[4] It was on this basis that he distinguished between wealth and commodity value. Wealth consisted of use values and was produced by both nature and labor. In contrast, the value/exchange value of the capitalist commodity economy was derived from the exploitation of human labor power alone. The contradiction between wealth and value thus lies at the core of the accumulation process and is directly associated with the degradation and disruption of natural conditions. It is this ecological contradiction within the capitalist value and accumulation process

that serves to explain the system's tendency toward ecological crises proper, or the metabolic rift. The system in its narrow pursuit of profit—and on ever-greater scales—increasingly disrupts the fundamental ecological processes governing all life, as well as social reproduction.

The rediscovery of Marx's metabolism and ecological value-form theories, and of their role in the analysis of ecological crises, has generated sharply discordant trends.[5] Despite their importance in the development of both Marxism and ecology, neither idea is without its critics. One manifestation of the divergence on the left in this respect has been an attempt to appropriate aspects of Marx's social-metabolism analysis in order to promote a crude social "monist" view based on such notions as the social "production of nature" and capitalism's "singular metabolism."[6] Such perspectives, though influenced by Marxism, rely on idealist, postmodernist, and hyper-social-constructivist conceptions, which go against any meaningful historical-materialist ecology and tend to downplay (or to dismiss as apocalyptic or catastrophist) all ecological crises—insofar as they are not reducible to the narrow law of value of the system. All of this is connected to the persistence of anthropocentrism, human exemptionalism, and capitalocentrism within parts of the left in the face of the present planetary emergency.[7]

In what follows, we provide brief discussions of some of the major breakthroughs in Marx's ecology by examining the conceptual structure of Marx's metabolism theory, its relation to his ecological value-form theory, and some of the consequences in terms of ecological crises. We then offer a critical appraisal of currently fashionable social-monist attempts to reduce Marx's ecological analysis to a "singular metabolism" expressing the internal logic of the market.[8] We conclude with an account of the centrality of dialectics to ecology in the Marxian conception.

The Conceptual Structure of Marx's Metabolism Theory

The complexity that characterizes Marx's metabolism theory is best viewed against what István Mészáros has called "The Conceptual Framework of Marx's Theory of Alienation," which set the basis for all of Marx's thought. For Mészáros, Marx's analysis takes a triadic relationship of *humanity—labor/production—nature*. Human beings necessarily mediate their relationship to nature through labor-production. However, capitalist class society creates a whole set of second-order mediations associated with commodity exchange, resulting in a further alienated triadic relationship: *alienated humanity—alienated labor/production—alienated nature*, which is superimposed on the first. Capitalist political economy focuses on this second alienated triangle, accepting it in its immediacy devoid of any concept of alienation; while natural science within capitalist society, according to Mészáros, focuses principally on the relation of alienated nature to alienated production aimed at the ultimate domination of nature. From this position results the estranged role of natural science in bourgeois society. As Mészáros writes, the "intensified 'alienation of nature'—e.g. *pollution*—is unthinkable without the most active participation of the Natural Sciences in this process."[9]

This same conceptual framework, though viewed ecologically, is evident in Marx's treatment of the universal metabolism of nature, the social metabolism, and the metabolic rift in *Capital* (and in his *Economic Manuscript of 1861–1863*). For Marx, the labor-and-production process was defined as the metabolism of nature and society. Hence, the conceptual framework underlying Marx's thought, in these terms, was a non-alienated triadic relation: *humanity—social metabolism—universal metabolism of nature*. The social metabolism, in this conception, was actual productive activity, constituting an active interchange of humanity via labor with the whole of nature (i.e., the universal metabolism)—though concretely taking specific historical forms and involving distinct processes.

With the emergence of second-order mediations associated with commodity production (the reduction of land and labor to commodity-like status), there is superimposed on this fundamental

metabolic relation, a triangle of *alienation of humanity—alienation of "the interdependent process of social metabolism" (the metabolic rift)—alienation of nature's universal metabolism*.[10] The metabolic rift is therefore at one with what the young Marx, in his "Comments on James Mill's *Elements of Political Economy*," called the "alienated mediation" of "human species-activity" under capitalism.[11]

Bourgeois natural science increasingly takes an ecologically modernizing form, as it is forced to address the rift in the social metabolism brought about by the capitalist political economy and the estrangement of science this engenders. So-called technological "solutions" are generally proposed and employed, such as carbon capture and sequestration, without actually addressing the systemic roots of the ecological problem. However, insofar as capitalism is only able to shift such ecological contradictions around, it eventually creates a wider rift in the universal metabolism of nature, with effects far beyond the immediate processes of production, raising the question of capitalism's absolute limits. It is this framework that constitutes the core of Marx's ecological crisis theory, with its emphasis on the anthropogenic-metabolic rift engendered by the system of production. The result is ever wider and deeper ecological challenges and catastrophes, representing the ultimate market failure of the capitalist system.

This overall framework is concretely illustrated by Marx's discussion of the nineteenth-century soil crisis, which was the context in which he introduced the concept of the metabolic rift. Humanity has necessarily been engaged in agriculture throughout the history of civilization, in the triadic form of *humanity—agriculture—soil*. The history of civilization is dotted with examples of agriculture turning in non-sustainable directions, degrading the soil. However, with the development of industrialized agriculture under capitalism, new commodity relations emerge, disrupting this eternal-natural relationship in qualitatively new ways, resulting in a more systematic and intensive metabolic rift in agriculture, whereby the return of essential nutrients (e.g., nitrogen, phosphorus, and potassium) to the soil is disrupted. This leads to "an irreparable rift in the interdependent process of social metabolism, a metabolism prescribed by the natural laws of life itself."[12]

In response to this disruption of the natural conditions governing the reproduction of the soil—a product of bourgeois society's extreme division between town and country—natural scientists in the nineteenth and twentieth centuries were brought in to develop means of addressing this rift, resulting first in the international guano and nitrate trade, and then in the development of industrial fertilizers. The guano and nitrate trade disrupted whole ecologies and generated wars of imperial domination.[13] The development of industrial fertilizers, while also contributing to the creation of chemicals used in warfare, became more and more a prop for the expansion of capitalism. This technical solution, which ignored the underlying system of alienated nature and alienated society, has resulted in a vast fertilizer run-off, degrading waterways and causing dead zones in oceans worldwide. The development of chemical fertilizer on a global industrial basis thus served to shift the rift in the social metabolism between human beings and the soil to a wider, all-encompassing rift in the universal metabolism of nature, crossing major planetary boundaries and disrupting the fundamental biogeochemical processes of the biosphere.[14]

The Capitalist Law of Value and the Destruction of Nature

All of this can be better understood if put in the context of Marx's ecological value-form theory. In Marx's explanation of the commodity value system under capitalism (and in classical political economy in general), wealth consists of use values, which have a natural-material basis tied to production in general. In contrast, value (based on abstract social labor) under capitalism is derived solely from the exploitation of labor power, and is devoid of any natural-material content. Nature is thus deemed by the system as a "free gift…to capital." This contradiction gives rise to what is known as the Lauderdale Paradox, named after James Maitland, eighth Earl of Lauderdale, an early

nineteenth-century classical political economist. Lauderdale pointed out that the accumulation of private riches (exchange value) under capitalism generally depends on the destruction of public wealth (use values), so as to generate the scarcity and monopoly essential to the accumulation process.[15] Under these conditions, accelerated environmental degradation destroying the commons is an inherent consequence of capital accumulation, and even serves as a basis for further accumulation, as new industries, such as waste management, are created to cope with the effects.

Capitalism is therefore an extreme form of dissipative system; one that is rapacious in its exploitation of natural powers (including what Marx liked to call the "vital forces" of humanity itself). In its constant drive for more surplus value it maximizes the throughput of energy and resources, which are then dumped back into the environment. "*Après moi le déluge!* is the watchword of every capitalist and every capitalist nation."[16] What distinguished Marx's ecological value-form analysis in this respect was the recognition that the degradation and disruption of nature under capitalism were intensified by a system of commodity production that based its value calculations entirely on labor, while treating nature as a realm of non-value.[17]

Marx drew his concept of the universal metabolism of nature, and its relation to social and ecological reproduction, initially from the work of his friend and revolutionary comrade, the socialist physician Roland Daniels. In his 1851 work *Mikrokosmos*, Daniels applied the concept of metabolism in a systems-theory fashion to explain the interconnected relations between plants and animals.[18] Marx built on Daniels's conception, as well as the work of the German chemist Justus von Liebig, to develop his own notion of social-metabolic reproduction and the metabolic rift.[19] In writing *Capital* and in the period that followed, he became more and more concerned with ecological crises. After reading the botanist Carl Fraas's studies of the destruction of the soil and desertification over the long history of class-based civilizations, Marx argued that this process had in many ways only intensified and expanded under capitalism—and had consequently become "irreparable" under the modern system of alienated labor-production. From this he concluded that ecological destruction under capitalism represented an "unconscious socialist tendency"—in the sense that it pointed to the need for a revolutionary break with the system.[20]

In Marx's analysis, therefore, the concept of metabolism becomes the basis of a theory of the ecological aspects of human historical development, pointing to a metabolic rift under capitalism, requiring the "restoration" of a non-alienated social metabolism in the face of capitalist degradation, and the development of a society of substantive equality and ecological sustainability, namely socialism. None of this took away from Marx's political-economic critique of capitalism as a system of exploitation of labor power. Rather, in Marx's conception, capitalism undermined "the original sources of all wealth—the soil and the worker."[21]

Ecology and Social Monism: The Subsumption of Nature

The power of Marx's conception of social metabolism lies in the fact that it anticipated modern ecosystem and Earth system analyses, both of which were based on the metabolism concept—and had concrete links at the formative stage in the development of these ideas within socialist ecology.[22] Marx's general materialist approach anticipated and in some ways influenced many of the great advances in ecology in the late nineteenth and early twentieth century. Moreover, his ecological critique, which was tied to his general political-economic critique of capitalism, is the most developed dialectical-systems theory perspective available to us today for understanding the enormously complex role of capitalism in the degradation of both labor and nature.

Nevertheless, a number of theorists, arising out of Marxian and other left traditions, have sought to take another path, emphasizing the *unifying* role of capitalism with respect to ecology, such that capitalism is seen as constitutive of the web of life itself. This social-monist (and essentially

idealist) approach is justified as an attack on Cartesian dualism. The clear intent is to derail the ecological Marxism associated with the ecosocialist movement, especially its materialist dialectic.

Much of social-monist analysis has its epistemological roots in Western Marxism's categorical rejection of the dialectics of nature—inspired by a famous footnote in Lukács's *History of Class Consciousness* (one he partly contradicted elsewhere in the book and completely disavowed later) in which he questioned Engels's conception of the dialectics of nature.[23] Beginning with Maurice Merleau-Ponty's *Adventures of the Dialectic* and developing in the works of many other authors, this rejection of the dialectics of nature, and with it both nature as an object of analysis and natural science itself, became a defining feature of Western Marxism as a distinct philosophical tradition. This reinforced an idealist, subject-object dialectic confined to humanity, the human world, and the human-historical sciences.[24]

The result was the popularity on the left of abstract-idealist, hyper-social-constructivist, and postmodernist readings of Marxism that defined themselves in opposition to materialism, and particularly dialectical materialism. Turning to the question of the environment—given its growing importance in the Anthropocene epoch—radical thinkers have increasingly promoted an anthropocentric social monism, in which nature is seen as completely internalized by society. Thus leading left geographer Neil Smith refers to capitalism's "real subsumption of nature all the way down." He writes: "Nature is nothing if not social." Social scientists, he contends, should therefore reject natural science's idolatry of the "so-called laws of nature" and decry the "left apocalypticism" and "fetishism of nature" identified with the environmental movement.[25] Extending Smith's logic, world-ecology theorist Jason W. Moore declares that capitalism appropriates and subsumes nature "*all the way down, across, and through*."[26]

For such thinkers, "first nature" (nature as preceding society) has been completely absorbed by "second nature" (nature as transformed by society).[27] Hence, nature no longer exists as a reality in and of itself, or as an ontological referent, but retains only a shadowy existence within socially constructed "hybrids" or "bundles" constructed by the capitalist world-ecology.[28] This view rejects notions of the conflict between capitalism and ecology, the metabolic rift, and the alienation of nature as forms of Cartesian "dualism."[29] Any suggestion that capitalist commodity production necessarily disrupts basic ecological processes is characterized as an apocalyptic vision—an accusation carried over to natural scientists and radical ecologists, perceived as the principal enemies of the social-monist worldview.

A close critical look reveals the deep contradictions associated with this social-monist perspective, including a social determinism that extends to the erasure of nature itself. For example, Moore proposes to counter the "dualism" of nature and society that he attributes to ecological Marxism with a "monist and relational view," whereby the "bundling" of nature and society signifies their unified existence.[30] He contends that "capitalism internalizes—however partially—the relations of the biosphere," while the forces of capital construct and configure "the biosphere's internalization of capitalism's process." Or, as he puts it elsewhere: "Capitalism internalizes the contradiction of nature as a whole, while the web of life internalizes capitalism's contradictions."[31] At every point, nature becomes merely the internal relation of capitalism, effectively ceasing to exist on its own.

In his efforts to avoid dualism—while also evading any open-ended materialist dialectics—Moore proposes that the world consists of "bundles of human and extra-human nature," constituting an abstract "web of life" defined primarily in social-cultural terms.[32] In this largely discursive approach, such bundles are "formed, stabilized and periodically disrupted."[33] Indeed, "all *agency*," he declares, "*is a relational property* of specific bundles of human and extra-human nature."[34] All that exists, as in the philosophy of neutral monism, consists of "bundled" forms.[35]

The big bugbear for such theorists is dualism. Left geographers Neil Smith and Erik Swyngedouw go so far as to claim that Marx was himself a dualist. "Given Marx's own treatment of nature," Smith asserts, "it may not be unreasonable to see in his vision also a certain version of the conceptual dualism of nature." "The social and the natural," Swyngedouw writes, "may have been brought together and made historical and geographical by Marx, but he did so in ways that keep both as a priori separate domains."[36] To overcome what he sees as Marx's dualism of society and nature, Swyngedouw proposes an all-encompassing hybridism in the form of a singular "socionature."

For radical geographer Noel Castree, reflecting on the views of Smith (on whom Castree bases his own analysis), "nature becomes internal to capitalism in such a way that the very distinction implied by using these terms is eroded and undermined."[37] Capitalism holds all power over nature and "seems to swallow up the latter altogether."[38] Hence there is no longer any nature as such, in the sense of the object of natural science. As Moore puts it, "green materialism" was "forged in an era when nature still did count for much"—which, he implies, is no longer the case.[39] As a result, environmentalism lacks any definite referent in nature, and environmental concerns are themselves problematic—a view emphasized above all by anti-left French sociologist Bruno Latour.[40]

The resulting absurdities can be seen in Moore's endorsement of critical geographer Bruce Braun's attack on Marxian ecological economist Elmar Altvater for adhering in his analysis to the second law of thermodynamics, basic to physics.[41] For Moore, in contravention of natural science: "The 'law of entropy'…operates within specific patterns of power and production. It is not determined by the biosphere in the abstract. From the standpoint of historical nature, entropy is reversible and cyclical—but subject to rising entropy within specific civilizational logics."[42] In this strange social-monist view, entropy is subject to society, which is supposedly capable of *reversing* or *recycling* it—thereby turning back or bending the arrow of time.

Such left thinkers go so far as to exempt humanity altogether from nature's laws, arguing that "nature and its more recent derivatives like 'environment' or 'sustainability,' are 'empty' signifiers."[43] Although "'Nature' (as a historical product) provides the foundation, social relations produce nature's and society's history."[44]

From this essentially anti-environmentalist perspective, couched in post-Marxist or postmodernist terms, radical environmentalists (including the entire Green movement) are criticized for perceiving a conflict between nature and capitalist society, and are said to be prone to an "apocalyptic imaginary," feeding "ecologies of fear"—depicted as "clouded in [the] rhetoric of the need for radical change in order to stave off immanent catastrophe."[45] Smith chides climate scientists who "attempt to distinguish social [anthropogenic] vis-à-vis natural contributions to climate change" for contributing to "not only a fool's debate but a fool's philosophy: it leaves sacrosanct the chasm between nature and society—nature in one corner, society in the other."[46]

The general skepticism of Smith and other left thinkers toward discussion and action on climate change amounts to an acquiescence to the status quo, and to the distancing from environmental concerns. Moore attributes what he calls "the metabolic fetish of Green materialism" (a term he uses for ecological Marxists) to its "biophysical" conception of the Earth system. Not only Swyngedouw but even Alain Badiou and Slavoj Žižek argue that "ecology has become the new opium for the masses"—a formulation repeated word for word and strongly endorsed by all three thinkers.[47]

In a turn away from ecological science, Moore warns against the "fetishization of natural limits."[48] Directly contradicting some of the world's leading climate scientists, members of the Anthropocene Working Group, he asserts: "The reality is not one of humanity [i.e., society] 'overwhelming the

great forces of nature.'" Rather he suggests that capitalism has an apparently infinite capacity for "overcoming seemingly insuperable 'natural limits'"—hence there is no real rift in planetary boundaries associated with the Anthropocene, and, implicitly, no cause for concern.[49] At worst, the system's appropriation of nature ends up increasing natural resource costs, creating a bottom-line problem for capital, as "cheap nature" grows more elusive.[50] Capitalism itself is seen as a world-ecology that is "unfold[ing] in the web of life," innovating to overcome economic scarcity whenever and wherever it arises.[51]

Moore adopts the term "web of life" to suggest that he is addressing ecological concerns. However, the phrase is used primarily as a metaphor for capitalism's subsumption of nature. The world in its entirety—natural and social—is depicted as simply a collection of bundled, entwined relationships, in which capital predominates. This position in many ways resembles that of ecological modernization and "green capitalism" scholars, who propose that environmental sustainability can be achieved by internalizing nature within the capitalist economy, bringing everything under the logic of the market.[52]

Indeed, Moore has recently gone so far as to laud the ecomodernist Breakthrough Institute founders Ted Nordhaus and Michael Shellenberger—leading ideologues of capitalist markets, high technology (including nuclear and geoengineering), and accelerated economic growth—as providing a superior analysis of environmental problems. We are told that their ideas represent a "powerful critique" to which ecological Marxists, with their focus on the supposedly "dualistic" concepts of the metabolic rift, the ecological footprint, and the Anthropocene, are "vulnerable." The latter's mistake, Moore argues, echoing the Breakthrough Institute, is a "Green critique" that concentrates on "what capitalism *does* to nature" rather than—as in the work of Nordhaus and Shellenberger (and Moore himself)—on "how nature *works* for capitalism." Indeed, the task before us, he declares, is that of "Putting Nature to Work."[53]

Such an analysis rejects a critique based on alienation of labor and nature and the rift in the social metabolism. It paves over the contradiction between an alienated humanity and alienated nature and normalizes received ideology. Moore substitutes for Marx's complex notion of a "rift in the interdependent process of social metabolism," what he calls a "singular metabolism of power."[54] "The problem," he writes, is not "metabolic *rift*, but metabolic *shift*.… Metabolism becomes a way to discern *shifts* (provisional and specific unifications) not *rifts* (cumulative separation)."[55] The result—in conformity with Smith's notion of "the unity of nature to which capitalism drives"—is an all-out denial of Marx's conception of the "alienated mediation" of the social metabolism of humanity and nature under capitalism.[56]

In the one-dimensional perspective of such social-monist thinkers, there is no reason to analyze the interpenetration, interchange, and mediation of nature-society relations. Natural cycles and processes are not seen as relatively autonomous from society, even by force of abstraction, but are subsumed within society; hence they are no longer seen as legitimate subjects of analysis. In the place of the complex dialectic of nature and society, we are left only with a "dialectical bundling," in which reality is reduced to a series of socially constructed *assemblages* of things or processes.[57] For Moore, the notion of world-ecology simply means capitalism writ large, inscribed in everything. It is itself a "web of life," which is nothing but a collection of bundles (i.e., commodities). The notion of the Earth system simply disappears.

Marx, in contrast, clearly indicated that nature and society are irreducible. One cannot and should not be subsumed within the other. The choice here is not between monism and dualism. Rather, an open-system, materialist dialectic—focused on mediation and totality and taking into account the heterogeneous character of reality and integrative levels—provides the only meaningful critical-realist basis for analysis.[58] Moreover, this cannot be accomplished by mere contemplation but

requires the unification of theory and practice, in the context of the working out of real material relations.

Dialectical Realism and the Reunification of Marxism

Within Marx's critique of political economy resides his deep concern with addressing the alienation of nature. As he wrote in the *Grundrisse*,

It is not the *unity* of living and active humanity with the natural, inorganic conditions of their metabolic exchange with nature, and hence their appropriation of nature, which requires explanation or is the result of historic process, but rather the *separation* between these inorganic conditions of human existence and this active existence, a separation which is completely posited only in the relation of wage labour and capital.[59]

Marx's conceptual framework of the universal metabolism of nature, social metabolism, and metabolic rift provides the means to address this separation. It serves as the basis to develop an open-ended dialectic of nature that accounts for internal and external relations. It also illuminates how the alienation of nature and the creation of a metabolic rift in relation to the universal metabolism of nature are intertwined with the system of capital.

Social metabolism encompasses human labor and production in relation to the larger biophysical world. Labor is, according to Marx, a necessary "metabolic interaction" between humans and the earth.[60] Following Marx, Lukács explained that the foundation of labor "is the metabolism between man (society) and nature," since these relations are "the basis of man's reproduction in society, as their insuperable preconditions."[61] "However great the transforming effect…of the labour process," he observed, "the natural boundary can only retreat, it can never disappear."[62] The interchange between humanity and nature is, for Marx, a permanent condition of life itself and of society. The "labour process is first of all a process between man and nature…the metabolism between [humanity] and nature"—and can never lose that fundamental character.[63]

The rise of capitalism introduced distinct second-order mediations associated with the specific form of commodity production and the ceaseless pursuit of capital accumulation. Private property and wage labor alienated not only humanity and the productive process, but nature itself. As indicated above, this took the form of an alienated mediation, generating a metabolic rift between society and nature. The ecological crisis, or the "irreparable rift in the interdependent process of the social metabolism," can therefore only be fully addressed by means of a critical or dialectical realism.[64]

By the very fact of its active engagement in labor and production, humanity is also involved in the social metabolism of human beings and nature, and in the formation of a "second nature." Nevertheless, the universal metabolism of nature, that is, nature in its wider, dynamic, and universal sense ("first nature") remains. A dialectical-realist perspective requires a comprehensive account of both internal and external relations, rather than confining analysis to only internal dynamics. It raises the crucial question of the distinction between open and closed dialectics. As Fredric Jameson explains,

The notion of the dialectic, with a definite article—of dialectics as a philosophical system, or indeed as the only philosophical system—obviously commits you to the position that the dialectic is applicable to everything and anything…. Western Marxism…stakes out what may be called a Viconian position, in the spirit of the *verum factum* of the *Scienza Nuova*; we can only understand what we have made, and therefore we are only in a position to claim knowledge of history but not of Nature itself, which is the doing of God.[65]

In contrast, a materialist dialectic is inherently open, not closed. It accepts no closure: no human domain completely separate from nature—and no domain of God. From a materialist-realist perspective, it is impossible even to begin to address the dynamics of the environment while following Western Marxism in rejecting the dialectics of nature altogether. In a chapter of his *Ontology of Social Being*, entitled *Marx* (published in English as a separate book), Lukács, attempting to re-unify Marxian analysis, writes:

For Marx, dialectical knowledge has a merely approximate character, and this is because reality consists of the incessant interaction of complexes, which are located both internally and externally in heterogeneous relationships, and are themselves dynamic syntheses of often heterogeneous components, so that the number of effective elements can be quite unlimited. The approximate character of knowledge is therefore not primarily something epistemological, though it of course also affects epistemology; it is rather the reflection in knowledge of the ontological determinacy of being itself; the infinity and heterogeneity of the objectively operative factors and the major consequences of this situation, i.e. that scientific laws can only fulfill themselves in the real world as tendencies, and necessities only in the tangle of opposing forces, only in a mediation that takes place by way of endless accidents.66

Dialectical-critical realism serves as a basis for analyzing material relations, especially those associated with capitalism's "alienated mediation" of humanity and nature. To reject the notion of metabolic rift and substitute bundles, "double internalities," and capitalism's supposed unification of nature is to return Marxian theory to a pre-Hegelian idealism, a speculative philosophy that resembles nothing so much as Leibniz's system, with its windowless monads and static "best of all possible worlds."67 The newly fashionable social-monist and hybridist conceptions take as their basis the fetishism of immediate appearances, which is then used to *re-reify* social theory, arriving at an uncritical actualism. This leads to the error that Alfred North Whitehead called "the fallacy of misplaced concreteness."68

Here it is useful to take note of Lukács's warning against "epistemologically rooted empiricist fetishization" that did not take into account "deeper contradictions and their connections with fundamental laws." He argued that a closed dialectic, akin to the kind now being advanced by today's social monists, invariably rests "on this objectifying and rigidifying fetishization, which always arises when the results of a process are considered only in their ultimate and finished form, and not also in their real and contradictory genesis. Reality is fetishized into an immediate and vacuous 'uniqueness' and 'singularity,' which can thus easily be built up into an irrational myth."69

The irrational myth in question here is the concept of a "singular metabolism" that, in postulating the complete subsumption of nature into society, disregards ecological processes as such, and even natural science itself.70 The accompanying argument, itself dualistic, that the ecological movement must choose between an abstract monism and a crude dualism—associating the dialectic with the former—is a trap that simply affirms bourgeois ideology in a new form. Neither monism nor dualism is consistent with a dialectical method, which necessarily transcends both. In the words of environmental philosopher Richard Evanoff:

Rather than dichotomise humanity and nature (as with dualistic theories) or identify humanity and nature (as with monistic theories), a dialectical realist perspective suggests that while nature does indeed provide the material resources that sustain human life, culture is neither determined by nature nor does it need to subsume the whole of nature to sustain itself. Nature is constituted by human culture in the sense that human interactions transform and modify the natural environment in significant ways, but natural processes nonetheless can and do continue in the absence of human interaction, suggesting that a measure of autonomy for nature can and should be both preserved and respected.71

Referring to Marx's metabolic rift, Naomi Klein rightly observes that the "Earth's capacity to absorb the filthy byproducts of global capitalism's voracious metabolism is maxing out."[72] The capitalist juggernaut is driving the accumulation of greenhouse gases in the atmosphere, creating by this and other means an anthropogenic rift in the metabolism of the Earth system, with far-reaching consequences beyond the immediate conditions of production. Global climate change is contributing to ocean acidification, which has dramatic effects, for example, on marine calcifiers, who must use more energy to produce biogenic calcium for shell and plate formation.[73] These species are the base of an extensive food web, so what happens to them has widespread ramifications on a biospheric scale. Additionally, ocean warming and acidification are contributing to coral bleaching and collapse. These extensive coral ecosystems play a central role in creating a nutrient rich environment and maintaining marine biodiversity.[74] Ocean acidification is recognized as a driver of previous mass extinctions and a contributing factor in the current mass extinction.

Marx's conceptual framework of metabolic analysis serves as a powerful basis to understand this rift in the Earth system associated with capitalism's expansion. Although capitalism attempts to address such ecological rifts through technological fixes, all of this leads to a larger, cumulative structural crisis within the universal metabolism of nature—given the continuing contradictions that constitute the system.[75] Marx warned that human history could be ruined and shortened as a result of an alienated metabolism that undermined the bases of life.[76] Observing the extreme version of the ecological rift being imposed on Ireland by English colonialism, he insisted that under such dire conditions, "ruin or revolution is the watchword."[77]

Within Marx's critique of capital and alienated metabolism resides the affirmative conception of *metabolic restoration*—a non-alienated social metabolism that operates within the "everlasting nature-imposed condition of human existence."[78] Metabolic restoration necessitates confrontation with "the social antagonism between private property and labor," in order to uproot the alienation associated with the system of capital.[79] Such materialist grounding helps facilitate a complex, dynamic analysis, informing how productive activities can be managed in relation to the larger biophysical world. As critical realist Roy Bhaskar wrote, "we survive as a species only insofar as second nature respects the overriding constraints imposed upon it by first nature. From this nature, although it is always historically mediated, we can never, nor will ever, escape".[80]

Already in the nineteenth century, Engels stressed that "freedom does not consist in the dream of independence from natural laws, but in the knowledge of these laws." In fact, "real human freedom" requires living "an existence in harmony with the laws of nature that have become known."[81] A sustainable, co-evolutionary ecology requires that the associated producers rationally regulate the social metabolism of nature and society, in the service of advancing human potential. It is this that constitutes Marx's most developed, most revolutionary definition of socialism.

Notes

1. ↩Karl Marx and Frederick Engels, *Collected Works*, vol. 4 (New York: International Publishers, 1975), 150.
2. ↩Georg Lukács, *Labour* (London: Merlin, 1980).
3. ↩Karl Marx, *Capital*, vol. 3 (London: Penguin, 1981), 949; Marx and Engels, *Collected Works*, vol. 30, 54–66.
4. ↩Marx and Engels, *Collected Works*, vol. 3, 732–33.
5. ↩See John Bellamy Foster, "Marxism in the Anthropocene: Dialectical Rifts on the Left," *International Critical Thought* 6, no. 3 (2016): 393–421.
6. ↩Jason W. Moore, *Capitalism in the Web of Life* (London: Verso, 2015), 80–81; Neil Smith, *Uneven Development* (Athens, GA: University of Georgia Press, 2008).

7. ↩"Capitalocentrism" here refers to attempts on the left to subsume the ecological problem within the internal logic of capitalist accumulation. It can also be seen in attempts to reject scientific categories such as the Anthropocene that address the overall relations of human beings to nature, in favor of narrower concepts such as the Capitalocene, in which the logic of capital sets the parameters for all analysis. For an example of this tendency, see Moore, *Capitalism in the Web of Life*, 169–92.
8. ↩Jason W. Moore, "Toward a Singular Metabolism," in Daniel Ibañez and Nikos Katsikis, eds., *Grounding Metabolism* (Cambridge, MA: Harvard University Press, 2014), 10–19.
9. ↩István Mészáros, *Marx's Theory of Alienation* (London: Merlin, 1975), 99–114.
10. ↩Marx, *Capital*, vol. 3, 949. Given the structure of Marx's thought, it is possible to speak, as he himself did, of a "metabolic rift" in the social metabolism, involving the specific conditions of production. Yet insofar as larger biogeochemical cycles and processes are affected by human production in ways distant from production itself, this involves not simply a rift in the social metabolism but also in the universal metabolism of nature itself. It is this latter rift that defines what scientists now call the Anthropocene.
11. ↩Karl Marx, *Early Writings* (London: Penguin, 1974), 261. We owe this insight to István Mészáros, who referred to Marx's concept of "alienated mediation" in a letter to one of the authors.
12. ↩Marx, *Capital*, vol. 3, 949; *Capital*, vol. 1 (London: Penguin, 1976), 636–39.
13. ↩Brett Clark and John Bellamy Foster, "Guano: The Global Metabolic Rift in the Fertilizer Trade," in Alf Hornborg, Brett Clark, and Kenneth Hermele, eds., *Ecology and Power* (London: Routledge, 2012), 68–82.
14. ↩John Bellamy Foster, Brett Clark, and Richard York,*The Ecological Rift* (New York: Monthly Review Press, 2010), 73–87.
15. ↩Foster, Clark, and York, *The Ecological Rift*, 53–72; James Maitland, Earl of Lauderdale, *An Inquiry into the Nature and Origins of Public Wealth and into the Means and Causes of Its Increase* (Edinburgh: Archibald Constable, 1819), 37–59; Marx and Engels, *Collected Works*, vol. 37, 732–33.
16. ↩Marx, *Capital*, vol. 1, 380–81.
17. ↩In classical value theory, only labor creates capitalist commodity value. Land and natural resources, however, are subject to rents, which constitute a form of redistribution of value, and therefore acquire prices. It should be added that if nature is not incorporated directly into value creation and is instead treated as a "free gift" in capitalist accounting, the same principle also applies to subsistence work and unpaid domestic labor.
18. ↩Roland Daniels, *Mikrokosmos* (Frankfurt am Main: Peter Lang, 1988). We would like to thank Joseph Fracchia for translating parts of Daniels's work. We would also like to thank Kohei Saito for his comments on Daniels's work.
19. ↩On Liebig's ecological views and their relation to Marx, see John Bellamy Foster,Marx's Ecology (New York: Monthly Review Press, 2000), 149–54; Kohei Saito, "Marx's Ecological Notebooks," *Monthly Review* 67, no. 9 (February 2016): 25–33.
20. ↩Marx and Engels, *Collected Works*, vol. 42, 558–59; Saito, "Marx's Ecological Notebooks," 34–39.
21. ↩Marx, *Capital*, vol. 1, 638.
22. ↩John Bellamy Foster, "Marxism and Ecology," *Monthly Review* 67, no. 7 (December 2015): 2–3; Joel B. Hagen, *An Entangled Bank* (New Brunswick, NJ: Rutgers University Press, 1992).
23. ↩Georg Lukács, *History and Class Consciousness* (London: Merlin, 1968), 24.
24. ↩Russell Jacoby, "Western Marxism," in Tom Bottomore, ed., *A Dictionary of Marxist Thought* (Oxford: Blackwell, 1983): 523–26; Maurice Merleau-Ponty, *Adventures of the Dialectic* (Evanston, IL: Northwestern University Press, 1973).
25. ↩Smith, *Uneven Development*, 45-47, 247; "Nature as an Accumulation Strategy," *Socialist Register 2007* (New York: Monthly Review Press, 2006), 23–29.

26. ↩Moore, *Capitalism in the Web of Life*, 152.
27. ↩Smith, *Uneven Development*, 65–69.
28. ↩Moore goes even further, treating the nature that precedes society as "pre-formed," because not yet produced or "co-produced" by society: "Even when environments are in some abstract sense pre-formed (the distribution of the continents, for example) historical change works through the encounters of humans with those environments, a relation that is fundamentally co-productive." See Moore, "Toward a Singular Metabolism," 15.
29. ↩Moore, *Capitalism in the Web of Life*, 4, 19–20, 78, 152.
30. ↩Moore, "Toward a Singular Metabolism," 16; *Capitalism in the Web of Life*, 85. What appears dualistic, when not considered dialectically, is, within dialectical discussion, often the treatment of a contradiction (the "identity of opposites") that can only be transcended at another organizational level. Recognizing this contradiction in almost Marxian terms, Whitehead wrote: "Throughout the Universe there reigns the union of opposites which is the ground of dualism." See Alfred North Whitehead, *Adventures of Ideas* (New York: Free Press, 1933), 245.
31. ↩Moore, "Toward a Singular Metabolism," 12; "Cheap Food and Bad Climate," *Critical Historical Studies* 2, no. 10 (2015): 28; "Putting Nature to Work," in Cecilia Wee and Olaf Arndt, eds., *Supra Markt* (Stockholm: Irene, 2015), 91.
32. ↩Moore, "Toward a Singular Metabolism," 12; Moore, *Capitalism in the Web of Life*, 85, 179.
33. ↩Moore, *Capitalism in the Web of Life*, 46.
34. ↩Moore, *Capitalism in the Web of Life*, 37.
35. ↩See Güberk Koç Maclean, *Bertrand Russell's Bundle Theory of Particulars* (London: Bloomsbury, 2014).
36. ↩Erik Swyngedouw, "Modernity and Hybridity," *Annals of the Association of American Geographers* 89, no. 3 (1999): 446.
37. ↩See Noel Castree, "Marxism and the Production of Nature," *Capital and Class* 72 (2000): 27–28; "The Nature of Produced Nature: Materiality and Knowledge Construction in Marxism,"*Antipode* 27, no. 1 (1995): 20; "Marxism, Capitalism, and the Production of Nature," in Castree and Bruce Braun, eds.,*Social Nature* (Malden, MA: Blackwell, 2001), 204–05; "Capitalism and the Marxist Critique of Political Ecology," in Tom Perreault, Gavin Bridge, and James McCarthy, eds.,*The Routledge Handbook of Political Ecology* (London: Routledge, 2015).
38. ↩Noel Castree, "False Antitheses? Marxism, Nature and Actor-Networks," *Antipode* 34, no. 1 (2002): 131; Bruno Latour,*Politics of Nature* (Cambridge, MA: Harvard University Press, 2004), 58.
39. ↩Jason W. Moore, "The Capitalocene, Part II," June 2014, 34, http://jasonwmoore.com.
40. ↩The nonexistence of nature as a referent is a basic stipulation of Bruno Latour's philosophy, a significant influence on the thinkers criticized here. See Bruno Latour,*Science in Action* (Cambridge, MA: Harvard University Press, 1987), 99, 258. See Alan Sokal's critique of Latour on this point in*Beyond the Hoax* (Oxford: Oxford University Press, 2008), 154–58, 211–16. Latour, whose work is explicitly anti-Marxist and anti-dialectical, advances what is often called a "flat ontology" or neutral monism, in which all entities and objects are equal and intertwined and to be approached as assemblages, bundles, hybrids, or networks. Nevertheless, the extreme relationism of his views, which denies both nature and society as substantive objects, gives rise in the end to a kind of social monism, where the social is smuggled back in or "reassembled" (e.g., through technology and politics), taking the form of a capitulation to the status quo. In his recent work he has advanced a regressive political ecology that has been called "Green Schmittianism," relying on the geopolitics and political theology of the Nazi philosopher Carl Schmitt. Not surprisingly Latour has become a senior fellow of the Breakthrough Institute. See Graham Harman, *Prince of Networks* (Melbourne: re.press, 2009), 73–75, 102, 152–156, 214–15; Bruno Latour,*Reassembling the*

Political (London: Pluto, 2014); *Reassembling the Social* (Oxford: Oxford University Press, 2005), 18, 116, 134–47; "Facing Gaia," Gifford Lectures, University of Edinburgh, February 18–28, 2013.

41. ↩Jason W. Moore, "The Capitalocene, Part I," March 2014, 16, http://jasonwmoore.com; Bruce Braun, "Toward a New Earth and a New Humanity," in Noel Castree and Derek Gregory, ed., *David Harvey: A Critical Reader* (Oxford: Blackwell, 2006), 197–99; Ian Angus and Fred Murphy, "Two Views on Marxist Ecology and Jason W. Moore," *Climate and Capitalism*, June 23, 2016, http://climateandcapitalism.com.
42. ↩Jason W. Moore, "Nature in the Limits to Capital (and Vice Versa)," *Radical Philosophy* 193 (2015): 14.
43. ↩Erik Swyngedouw, "Trouble with Nature: 'Ecology as the New Opium for the Masses,'" in J. Hillier and P. Healey, eds., *The Ashgate Research Companion to Planning Theory: Conceptual Challenges for Spatial Planning* (Burlington, VT: Ashgate, 2010), 304.
44. ↩Swyngedouw, "Modernity and Hybridity," 446. Ironically, in this quote Swyngedouw was purporting to present the conventional Marxist materialist view, which he then proceeded to criticize for placing*too much* emphasis on natural conditions, and indeed for seeing nature as a signifier.
45. ↩Swyngedouw, "Trouble with Nature," 308-09.
46. ↩Smith, *Uneven Development*, 244.
47. ↩Moore, *Capitalism in the Web of Life*, 15; Swyngedouw, "Trouble with Nature: Ecology as the New Opium of the Masses," 309; see also Alain Badiou, "Live Badiou—Interview with Alain Badiou," in*Alain Badiou—Live Theory* (London: Continuum, 2008); Slavoj Žižek, "Censorship Today: Violence, or Ecology as a New Opium of the Masses," 2007, http://lacan.com.
48. ↩Moore, *Capitalism in the Web of Life*, 80.
49. ↩Jason W. Moore, "The End of Cheap Nature Or: How I learned to Stop Worrying about 'The' Environment and Love the Crisis of Capitalism," in Christian Suter and Christopher Chase Dunn, eds., *Structures of the World Political Economy and the Future of Global Conflict and Cooperation* (Berlin: LIT, 2014), 308, "Toward a Singular Metabolism," 14. Moore flatly rejects the concept of the Anthropocene introduced by natural scientists to describe the anthropogenic rift in the Earth system. For a meaningful treatment of the Anthropocene see Ian Angus,*Facing the Anthropocene: Fossil Capitalism and the Crisis of the Earth System* (New York: Monthly Review Press, 2016).
50. ↩Moore, *Capitalism in the Web of Life*, 112–13. Moore's approach to ecological crisis is based on the notion that capitalism does not rely on the exploitation of labor so much as the appropriation of work or energy in a general, physical sense. This requires a post-Marxist deconstruction of Marx's value theory, and indeed of all economic theory. As Moore himself writes: "My argument proceeds from a certain destabilization of value as an 'economic' category." See Moore, "The Capitalocene, Part II," 29. For a critique of Moore's rejection of Marxian value theory, see Kamran Nayeri, "'Capitalism in the Web of Life'—A Critique," *Climate and Capitalism*, July 19, 2016, http://climateandcapitalism.com.
51. ↩Moore, "Toward a Singular Metabolism," 16–17. Although Moore emphasizes capitalism's ability to transcend natural limits, he does argue, in his attack on the "apocalyptic" Green perspective, that the imminent collapse of contemporary civilization would not be "something to be feared"—using as a historical example the fall of Rome, which he says gave rise to a golden age. Quite apart from the extent of human suffering that followed the collapse of Rome, today the social destruction associated with the crossing of planetary boundaries threatens the lives and living conditions of hundreds of millions, even billions, of people, as well as innumerable other species.
52. ↩Paul Hawken, Amory B. Lovins, L. Hunter Lovins,*Natural Capitalism* (London: Earthscan, 2010); Arthur P. J. Mol and Martin Jänicke, "The Origins and Theoretical Foundations of Ecological Modernisation Theory," in Arthur P. J. Mol, David A.

Sonnenfeld, and Gert Spaargaren, eds.,*The Ecological Modernisation Reader* (London: Routledge, 2009).

53. ↩Jason W. Moore, "The Rise of Cheap Nature," in Moore, ed., *Anthropocene or Capitalocene* (Oakland, CA: PM, 2016), 111, "Putting Nature to Work," 69; Ted Nordhaus and Michael Shellenberger, *Break Through: From the Death of Environmentalism to the Politics of Possibility* (New York: Houghton Mifflin, 2007).
54. ↩Moore, "Toward a Singular Metabolism," 11,*Capitalism in the Web of Life*, 83.
55. ↩Moore, *Capitalism in the Web of Life*, 83–84. In substituting the "metabolic shift" for the "metabolic rift," Moore promotes one side of a dialectical process that we in our work with Richard York had earlier described as "rifts and shifts," whereby capitalism's attempt to shift the anthropogenic rifts it creates in the human relation to the environment leads to cumulatively greater rifts, universalizing ecological contradictions. See Foster, Clark, and York, *The Ecological Rift*, 73–87.
56. ↩Smith,*Uneven Development*, 81; Marx, *Early Writings*, 261.
57. ↩Moore, *Capitalism in the Web of Life*, 13, 37, 76, 78. Moore argues that Marx saw capitalism as capable of unifying nature. But to do so, he must distort and misread Marx's language. He writes: "Rather than ford the Cartesian divide, metabolism approaches have reinforced it. Marx's 'interdependent process of social metabolism' became 'the metabolism of nature and society.' Metabolism as 'rift' became [for ecological Marxists] a metaphor of separation, premised on material flows between nature and society" (Ibid., 76; Moore, "Toward a Singular Metabolism," 13, 18). Yet Marx's actual phrase, referring to capitalism's relation to the ecology, was "*the irreparable rift in the* interdependent process of social metabolism" (emphasis added). By omitting these crucial words, Moore inverts the meaning of Marx's statement. Further, the term "metabolism of nature and society" as used by Foster is not a distortion of Marx, as Moore claims, but reflects Marx's own views and language, as when he famously referred in volume 1 of *Capital* to "the metabolic interaction between man and the earth." See Marx, *Capital*, vol. 3, 949; *Capital*, vol. 1, 637.
58. ↩Lukács, *Labour*, 119–24. On integrative levels and their role in Marxian theory, see Joseph Needham, *Time: The Refreshing River* (London: George Allen and Unwin, 1943), 13–20, 233–72.
59. ↩Karl Marx, *Grundrisse* (New York: Penguin, 1973), 489.
60. ↩Marx, *Capital*, vol. 1, 283, 637–38.
61. ↩Georg Lukács, *Marx* (London: Merlin, 1978), 44, 58, 107.
62. ↩Lukács,*Labour*, 34. "As a biological being, man is a product of natural development. With his self-realization which of course even in his case means only a retreat of the natural boundary, and never its disappearance, its complete conquest, he enters into a new and self-founded being, into social being" (Lukács, *Labour*, 46).
63. ↩Marx,*Capital*, vol. 1, 284.
64. ↩Marx,*Capital*, vol. 3, 949–50.
65. ↩Fredric Jameson, *Valences of the Dialectic* (London: Verso, 2009), 3–7.
66. ↩Lukács,*Marx*, 103.
67. ↩Moore uses "Double Internality" as a basic category of his social-monist view. He points to various "bundles," and especially the "double internality" of the capitalist world-ecology. See Moore, *Capitalism in the Web of Life*, 1.
68. ↩Alfred North Whitehead,*Science and the Modern World* (New York: Free Press, 1925), 51. On actualism see Roy Bhaskar, *Plato Etc.* (London: Verso, 1994), 250-51.
69. ↩Lukács, *Marx*, 107.
70. ↩Moore, *Capitalism in the Web of Life*, 86, "Toward a Singular Metabolism."
71. ↩Richard J. Evanoff, "Reconciling Realism and Constructivism in Environmental Ethics," *Environmental Values* 14 (2005): 74.
72. ↩Naomi Klein, *This Changes Everything: Capitalism vs. the Climate* (New York: Simon and Schuster, 2014), 177, 186.

73. ↩N. Bednaršek et al., "*Limacina Helicina* Shell Dissolution as an Indicator of Declining Habitat Suitability Owing to Ocean Acidification in the California Current Ecosystem," *Proceedings of the Royal Society B: Biological Sciences* 281, no. 1785 (2014).
74. ↩Evan N. Edinger et al., "Reef Degradation and Coral Biodiversity in Indonesia," *Marine Pollution Bulletin* 36, no. 8 (1998): 617–30; Pamela Hallock, "Global Change and Modern Coral Reefs," *Sedimentary Geology* 175, no. 1 (2005):19–33; Chris Mooney, "Scientists Say a Dramatic Worldwide Coral Bleaching Event Is Now Underway," *The Washington Post*, October 8, 2015; J. P. Gattuso et al., "Contrasting Futures for Ocean and Society from Different Anthropogenic CO2 Emissions Scenarios," *Science* 349, no. 6243 (2015).
75. ↩István Mészáros, "The Structural Crisis of Politics," *Monthly Review* 58, no. 4 (2006): 34–53.
76. ↩Karl Marx, *Theories of Surplus Value*, vol. 3 (Moscow: Progress Publishers, 1971), 309.
77. ↩Karl Marx and Frederick Engels, *Ireland and the Irish Question* (Moscow: Progress Publishers, 1971), 142.
78. ↩Marx, *Capital*, vol. 3, 959.
79. ↩Mészáros, *Marx's Theory of Alienation*, 113.
80. ↩Roy Bhaskar, *Scientific Realism and Human Emancipation* (London: Verso, 1986), 222.
81. ↩Frederick Engels, *Anti-Dühring* (Moscow: Progress Publishers, 1969), 136–38.