The Nature of History: Dialectical Materialism and General Systems Theory

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Look round our World; behold the chain of Love
Combining all below and all above.
See plastic Nature working to this end,
The single atoms each to other tend ...

– Alexander Pope

GREAT CHAINS OF BEING

During the twentieth century, systems theory, in its guise as a philosophy of nature, received its most influential forms in dialectical materialism (Diamat) and general systems theory (GST). GST can in certain respects be viewed as a Western response to Diamat, though it shares many of the theoretical features of the latter. Prominent among these is the concept of nature's exhibiting a hierarchy of systems, each of which integrates a number of systems at a lower level but displays new "emergent" qualities of its own. Despite its nominal materialism, Diamat shares with GST an emphasis on *organization*. Rather than trying to explain the world in terms of an underlying substance common to different things, Diamat and GST attempt to explain the nature and behaviour of things according to the way they are organized. Further, both philosophies espouse the notion of a dialectic of nature, involving the attempt to understand human societies as components of a hierarchy of systems processing energy and evolving according to laws of nature.

The concept of a hierarchy of integrative levels is an updated version of the "Great Chain of Being", a concept that can be traced back to Aristotle, and which, according to Arthur Lovejoy, attained its greatest acceptance in the eighteenth century. The notion of the Great Chain of Being is that of a hierarchy of life forms, extending from the perfection of God through every possible gradation down to the lowliest creature. As Lovejoy notes, when the idea of a static, immutable Chain of Being gave way to an evolutionary view, the Platonistic view of the world was turned upside down: the generating process now began at the

bottom, not at the top, of the chain.[1] Being in all its potential fullness was something the world was evolving toward, over time.

In his "System of Synthetic Philosophy", Herbert Spencer (1820–1903) held that the histories of all concrete processes in the universe are characterized by a principle of evolution. Every order of phenomena is subject to a development that includes the stages of concentration, differentiation, and determination. To begin with, scattered elements combine into a mass distinct from its environment. Within this mass, different nuclei or functional centres are formed: for example, the differentiation of sense organs in the body, or classes in society. Finally, an order of relation develops among the centres. Spencer's definition of evolution ran as follows: "Evolution is an integration of matter and concomitant dissipation of motion; during which the matter passes from an indefinite, incoherent homogeneity to a definite, coherent heterogeneity; and during which the retained motion undergoes a parallel transformation."[2]

The tendency for structures to progress from homogeneity to heterogeneity was for Spencer a consequence of their being subject to external forces, of having to adapt to changing environments. This process could only come to an end when there was a perfect balance of forces between organism and environment. It was Spencer's belief that in the social sphere evolution must eventually produce a state of perfect social organization all over the globe, in which humankind's nature perfectly coincided with the conditions of its existence. However, Spencer did not proclaim a hierarchy of levels of matter, each with its own emergent properties. His view of nature – despite his organic analogies – was essentially derived from physics. He deduced the course of evolution from the principle of the conservation of energy, which he called the "persistence of force". He maintained that all phenomena in the universe, whether astronomical, geological, biological, psychological, or sociological, were subject to the same law of evolution and dissolution.

In the 1920s, C. Lloyd Morgan (1852–1936), following Samuel Alexander (1859–1938), conceived of the hierarchy of systems in nature as a pyramid. "Each higher entity in the ascending series is an emergent 'complex' of many entities of lower grades, within which a new kind of relatedness gives integral unity."[3] Lloyd Morgan distinguished between "intrinsic" and "extrinsic" relatedness, the former referring to the relations within the entity, and the latter to its ways of interacting with other entities. He used the term "natural systems", and called the human

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[1] Arthur O. Lovejoy, *The Great Chain of Being* (Cambridge, Mass.: Harvard University Press, 1964), 325–326.

[2] Herbert Spencer, *First Principles* (London: Williams & Norgate, 1880), 396.

[3] C. Lloyd Morgan, *Emergent Evolution* (London: Williams and Norgate, 1923), 11.

being the highest natural system known to us. He distinguished three types of natural systems: matter systems, life-matter systems, and mind-life-matter systems. Lloyd Morgan also maintained that all natural systems, from atom to human, possessed both physical and psychical attributes, citing Spinoza for this insight. His concept of emergence implied "(1) that there is increasing complexity in integral systems as new kinds of relatedness are successively supervenient; (2) that reality is, in this sense, in process of development; (3) that there is an ascending scale of what we may speak of as richness in reality; and (4) that the richest reality that we know lies at the apex of the pyramid of emergent evolution to date."[4]

Writing about the same time as Lloyd Morgan, Jan Smuts (1870–1950) spoke of "natural wholes" and used the term "holism" to denote a tendency in the universe toward the creation of wholes. Smuts saw the quality of wholeness, in which the mutual interaction of the parts was more than the sum of the parts, deepening as one moved up the evolutionary ladder from physical mixtures, to chemical compounds, to organisms, to minds, and finally to the human personality (a unity of body and spirit). Evolution evinced ever more complex and significant wholes, marked at every stage by greater organic independence and self-regulation. Such evolution, said Smuts, ran counter to the second law of thermodynamics (the tendency toward greater entropy). He did not view human societies as true wholes, though he recognized them, like the universe at large, as having holistic aspects. For Smuts, the spiritually developed human personality appears to have represented the highest embodiment of holistic evolution, and the vehicle through which the holistic evolution of nature came to self-understanding. He distinguished his position from that of Lloyd Morgan in that he (Smuts) took as the fundamental aspect of evolution not merely the fact of emergence, but the tendency toward more intensive and effective wholes. He also rejected Lloyd Morgan's Spinozist position that the psychical factor is correlated with the physical factor at all stages, even the inorganic – finding this "destructive of all real effective 'emergence'."[5]

The notion of emergence is already present in the idea of a whole as being more than the sum of its parts; thus one can say that emergence is an intrinsic aspect of wholes, or systems, as they appear in Diamat or GST. Karel Kosík differentiates the Hegelian or Marxian conception of wholeness from the atomistic notion of a sum of simplest elements, and from the conception which emphasizes the priority of the whole over its parts; for the "dialectical"

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[4] Ibid., 203.

[5] J. C. Smuts, *Holism and Evolution* (New York: Macmillan, 1926), 321, footnote.

conception, the whole forms itself precisely in the interaction of its parts.[6] Diamat shares this dialectical conception with GST. Both philosophies are avowedly anti-reductionist and at the same time reject the vitalist notion that there is a dichotomy between organic and inorganic phenomena.

ENGELS: HISTORY AS NATURAL HISTORY

In Marxism the concept of emergence in nature has its roots in the attempt of Karl Marx (1818–1883) and Friedrich Engels (1820–1895) to lend credibility to their "materialist conception of history" by grounding it in a naturalistic understanding of the world – naturalistic both in the sense that human individuals and societies are seen as integral aspects of the natural universe and hence as being wholly amenable to scientific investigation, and in the sense that the kinds of explanations appropriate to the study of human history are deemed to be not radically different from those appropriate to the natural sciences. The main thrust of Diamat lies in the concept of the evolution of the natural world and the emergence of new qualities of being at new stages of evolution. As Z. A. Jordan notes, "Engels made constant use of the metaphysical insight that the higher level of existence emerges from and has its roots in the lower; that the higher level constitutes a new order of being with its irreducible laws; and that this process of evolutionary advance is governed by laws of development which reflect basic properties of 'matter in motion as a whole'."[7]

Although Marx posited humans as elements of a self-evolving nature, he wrote little or nothing about a general "dialectics of nature", confining himself almost exclusively to human society. The natural world was viewed in terms of how humans had historically interacted with it. Marx's particular dialectic of nature was the process whereby human agents, as integral elements of the natural world, interacted with their surroundings, thus changing both those surroundings and themselves. It was left to Engels and later followers, especially in the Soviet Union, to situate historical materialism within an all-encompassing evolutionary philosophy of nature: dialectical materialism. (Indeed, whether dialectical materialism is a legitimate addition to Marx's theory of history has been a source of much academic contention.)

According to Engels, "The whole of nature accessible to us forms a system, an interconnected totality of bodies, and by bodies we understand here all material existences extending from stars to atoms, indeed right to ether particles, in so far as one grants the existence of the last named. In the fact that these bodies are

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[6] Karel Kosík, *Dialectics of the Concrete* (Dordrecht: Reidel, 1976), 23–24.

[7] Z. A. Jordan, *The Evolution of Dialectical Materialism* (London: Macmillan, 1967), 167.

interconnected is already included that they react on one another, and it is precisely this mutual reaction that constitutes motion."[8]

Engels claimed that Heraclitus was essentially correct in holding that the world exists in a state of ceaseless flux. But as formulated, this early conception was inadequate to the task of explaining the details of the whole picture. The whole as a complex of processes could only be adequately understood *after* nature had first been analyzed into its individual parts and classifications, and this analysis was the important advance accomplished by modern science in the centuries up to the nineteenth. Yet this method of analysis was inadequate precisely because it produced the habit of observing natural objects and processes out of context, and as static rather than essentially variable elements. The progress of natural science, however, eventually made possible the transition from "a *collecting* science, a science of finished things" to what was "essentially a systematising science, a science of the processes, of the origin and development of these things, and of the interconnection which binds all these natural processes into one great whole."[9]

Engels insisted that the interconnection and movement of nature's elements was not a dogmatic, *a priori* thesis, but a hypothesis being increasingly forced to the forefront and confirmed by scientific discoveries. One of the most important advances of his time he saw as the law of the conservation of energy, with its implication of the self-transforming character of matter. Thus he held that it was a mistake for natural science to direct its efforts to seeking out uniform matter as such, to reducing qualitative differences to mere quantitative ones.

In light of the revolution in physics at the turn of the century, Vladimir Lenin (1870–1924) produced *Materialism and Empirio-Criticism* (1908), in which he was concerned with defending Engels' position. "Modern physics is in travail; it is giving birth to dialectical materialism," he wrote.[10] Where the breakdown of the old mechanistic conception of physical elements was leading many persons to declare that matter had "disappeared", Lenin took the new developments as further confirmation of the dialectical-materialist view of nature.

Taking its lead from Engels and Lenin, dialectical materialism does not identify philosophical materialism with any particular physical theory or with the concept of an ultimate set of building blocks of matter, but rather with the dogma of the primacy of matter over consciousness, in the sense that consciousness

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[8] Frederick Engels, *Dialectics of Nature* (Moscow: Progress Publishers, 1972), 70.

[9] Marx and Engels, *Selected Works in One Volume* (London: Lawrence and Wishart, 1968), 610.

[10] V. I. Lenin, *Materialism and Empirio-Criticism* (Peking: Foreign Languages Press, 1972), 378.

cannot exist without matter and is a product of the evolution of matter. Matter is simply an abstract term encompassing the multifarious forms of being that exist objectively, independently of being perceived by us, and that can be "reflected" in consciousness. The term "reflection" indicates a property of sensitivity to its environment that is inherent in every form of matter – human consciousness being the highest known manifestation of this property.

Materialism, then, in its "dialectical" form, is of a rather peculiar character: not only does it reject the idea that there must be some primary level of material reality to which other levels can in principle be reduced, but it might even be interpreted as a kind of panpsychism. In this light, indeed, it may be questioned whether "materialism" is an appropriate designation for this philosophy. Joseph Needham (1900–1995), author of the magisterial *Science and Civilisation in China*, would prefer to call it "dialectical organicism".[11] Needham, a Christian socialist, espoused Marxism in the 1930s because he saw in communism the "moral theology" appropriate to contemporary society, one in which Christian principles were being applied, even if God was "apparently" absent from communist thought. The argument that the concept of God may have been derived from, or modelled on, exploitative social relations Needham saw as inadequate grounds for rejecting religious experience. Thus, though he rejected atheism, Needham embraced Engels' idea of human history's being an emergent manifestation of the "dialectics of nature" – and accepted "the ideas of historical materialism and the class struggle as illuminating the ways in which God has worked during the evolution of society."[12]

For Marx, history was to be understood as the process of human self-development, and the material environment as the medium through which this process occurred. But Marx's view of history does not make matter (whether in the form of geography, natural resources, climate, or human biology) the prime mover of human history. Rather, it focuses on modes of production: the ways human communities are organized to employ their technological resources in order to satisfy human needs.

Indeed, it can be argued that Marxist theory of history, far from being essentially materialist, has not been nearly materialist enough, in the sense that it has tended toward "triumphalism", and has not sufficiently recognized the constraints imposed on human agency by the material world: ecology and biology (including the ways these shape our cognitive processes at a deep level). Sebastiano Timpanaro maintains that "Marxism, especially in its first phase (up

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[11] Joseph Needham, *Moulds of Understanding* (London: George Allen & Unwin, 1976), 278.

[12] Ibid., 267.

to and including *The German Ideology*) is not materialism proper" since the impression is given that humankind enters into relationship with nature only through work; and though the mature Marx – who admired Darwin – was much more materialist, says Timpanaro, he had no time to develop a new conception of the human/nature relationship.[13] Leszek Kolakowski puts it even more strongly: humanity for Marx is defined purely in social terms. "Contrary to social Darwinism and to liberal philosophy, Marx not only does not derive the social tie from biological needs, but represents the latter, and the biological conditions of human existence, as elements of the social tie. 'Socialized nature' is not a metaphor. Everything in man's being is social: all his natural qualities, functions, and behaviour have become virtually divorced from their animal origins."[14]

Marx's position is certainly not incompatible with recognition of humanity's "animal origins" – on the contrary, it posits the most intimate relationship between humanity and nature. "Man *lives* on nature – means that nature is his *body,* with which he must remain in continuous interchange if he is not to die. That man's physical and spiritual life is linked to nature means simply that nature is linked to itself, for man is a part of nature."[15] Humanity, says Marx, has its whole being within nature and can only understand itself and nature within this ecological relationship. The question, though, is to what extent and at what speed humans can refashion their existence in the interaction with their material environments. In Marx little emphasis is given to the non-social obstacles to change.

Here the *Annales* school (and in particular the work of Fernand Braudel and Emmanuel Le Roy Ladurie) provides a materialist correction to the Marxist paradigm. For Braudel and company the structures of history can include everything from geographical and biological constraints, to economic constraints, to enduring mental frameworks. Pointing to the importance of geography, Braudel says, "Look at the position held by the movement of flocks in the lives of mountain people, the permanence of certain sectors of maritime life, rooted in the favorable conditions wrought by particular coastal configurations, look at the way the sites of cities endure, the persistence of routes and trade, and all the amazing fixity of the geographical setting of civilizations."[16] He divides history into a geographical level, a social level, and an individual level – the first

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[13] Sebastiano Timpanaro, *On Materialism* (London: NLB, 1975), 40–41.

[14] Leszek Kolakowski, *Main Currents of Marxism*, vol. 1 (Oxford: Clarendon Press, 1978), 413.

[15] Karl Marx, *Economic and Philosophic Manuscripts of 1844* (Moscow: Progress Publishers, 1974), 67–68.

[16] Fernand Braudel, *On History* (Chicago: University of Chicago Press, 1980), 31.

concerned with what alters little over time, the last with the transitory froth on the ocean of history. Socio-economic processes, at the middle level, are to be seen set within the more-or-less fixed framework of the natural world.[17] To the extent that the *Annales* historians focus on factors of geography and biology, in contrast to the basic Marxist emphasis on modes of production and class struggle, their work could less ambiguously be referred to as a "historical materialism".

The Marxist position, in contrast to the *Annales* school or sociobiology, has tended to deny or downplay the autonomy of biological factors, seeing their influence as strongly conditioned by the socio-economic frameworks within which they are manifest. However, Marx's view of history is grounded in nature, in the sense that it claims that the necessary human link with the material environment provides an objective starting point for historical explanation. And the result of this within Marxist theory has been an unresolved attitude toward the role of "material" factors in history: in the first place regarding the extent to which laws of evolutionary development in nature may be applicable to human history, and in the second regarding the extent to which human technology, as the interface between society and its physical environment, exists as an autonomous driving force of history.

SOVIET PHILOSOPHY OF SCIENCE

Engels' doctrine of emergent evolution was reinforced in Soviet philosophy of science when the Deborinite faction won out over the "mechanist" faction in the late 1920s. A. M. Deborin stressed the concept of quality: matter exists in a hierarchy of organizational levels, each level arising from those below it, yet displaying its own irreducible qualities and regularities. Corresponding to each level of the organization of matter is a particular science that deals with the specific laws of that level; and materialist dialectics provides the universal ontology and methodology. The Deborinites rejected the mechanists' tendency to make reduction the single universal method of science – though David Joravsky sees concealed behind the struggle of the two factions over the question of reductionism another issue: he sees the mechanists' stress on reductionism as reflecting a kind of unacknowledged positivism that rejected the idea that a Marxist philosophy of science should be accepted ready-made from philosophers, and maintained instead that it must be put together on the basis of the results of the various autonomous sciences.[18]

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[17] Fernand Braudel, *The Mediterranean and the Mediterranean World in the Age of Philip II*. 2 vols. (London: Collins, 1972–73).

[18] David Joravsky, *Soviet Marxism and Natural Science: 1917–1932* (London: Routledge and Kegan Paul, 1961).

In 1930 the Deborinites were themselves officially condemned, in this case for failing to submit to the political leadership of the Communist Party. Yet the general philosophy of science that they had propounded survived as the official Soviet position. A Soviet philosophical encyclopedia of the 1960s speaks of the evolution of complexity in nature as follows: "This whole series of forms (mechanical, physical, chemical, biological and social) is distributed according to complexity from lower to higher. This seriation expresses their mutual bonds in terms of structure and in terms of history. The general laws of the lower forms of the motion of matter keep their validity for all the higher forms but they are subject to the higher laws and do not have a prominent role. They change their activity because of changed circumstances. Laws can be general or specific, depending on their range of applicability. The specific laws fall under the special sciences and the general laws are the province of diamat."[19] Each level of matter exists as a type of organization, in which the elements that make up a whole, or system, are marked by a specific type of interconnection.

It was this philosophy, as expounded by the Soviet delegation to the International Congress of the History of Science and Technology in London in 1931, that made a lasting impression on Joseph Needham and a number of other young British scientists present. In his Herbert Spencer Lecture at Oxford in 1937, Needham argued that living wholes in nature maintain an interior equilibrium through regulation of exchanges of energy and materials with their environments, and that evolution displays a succession of levels of organization, up to and including the various levels of human society, in which there is an increase in the number of parts in the wholes, and an increase in the complexity of the structures and interrelations of these parts – the result being an increasing flexibility and autonomy of the actions of these wholes with respect to their environments. In arguing for this concept of "integrative levels", Needham paid tribute to the ideas of Spencer, but maintained that Spencer had failed to follow his own argument to its logical conclusion and to see that the next transition to a higher integrative level must be the advent of the world socialist society. Such an outcome could be inferred from the principle of progressive integration and organization: "It would hardly be going too far to say that the transition from economic individualism to the common ownership of the world's productive resources by humanity is a step similar in nature to the transition from lifeless proteins to the living cell, or from primitive savagery to the first community, so clear is the continuity between inorganic, biological, and social order. Thus, on such a view, the future state of social justice is seen to be no fantastic utopia, no

[19] T. J. Blakeley (ed.), *Themes in Soviet Marxist Philosophy* (Dordrecht: Reidel, 1975), 29.

desperate hope, but a form of organisation having the whole force of evolution behind it."[20]

Although Marxism emphasizes the internal contradictions of systems, a mode of production is precisely the way in which a social system interacts with its material environment in order to sustain itself. This point was made forcefully by Nikolai Bukharin in *Historical Materialism* (1921), a work that sought to present the development of society in terms of the same general principles that could be seen at work in other systems in nature. "Any object, a stone, a living thing, a human society, etc., may be considered as a whole consisting of parts (elements) related with each other; in other words, this whole may be regarded as a *system*. And no such system exists in empty space; it is surrounded by other natural objects, which, with reference to it, may be called the environment."[21]

Society, like any other system, is not a mere summation of its elements, said Bukharin; it is a non-reducible whole constituted through the mutual interaction of its elements. Disturbances in a system may lead to the re-establishment of the system's original state (stable equilibrium), or they may lead to a new equilibrium being established after growth or decline of the system. The decisive factor in the determination of a system's internal state, said Bukharin, is the interaction between the system and its environment; thus the decisive factor in the determination of a human society's internal state is its interaction with nature: that is, the process of (re)production in which society transfers energy from nature to sustain itself. The structure of society therefore depends on the level of development of society's productive forces.

But, continued Bukharin, the structure of society – revealed in the social relations of production – can hinder the development of the productive forces. Here gradual quantitative changes eventually call forth qualitative changes. Just as a gradual rise in water temperature at a certain point suddenly results in the conversion of water to steam, so gradual increases in the productive forces prepare the way for revolutionary change in the relations of production. "A revolution in society means its reconstruction, 'a structural alteration of the system'. Such a revolution is an inevitable consequence of the contradictions between the structure of society and the demands for its development. … [I]n society, as in nature, violent changes do take place; in society, as in nature, these sudden changes are prepared by the preceding course of things: in other words,

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[20] Joseph Needham, *Time: The Refreshing River* (London: George Allen & Unwin, 1943), 235.

[21] Nikolai Bukharin, *Historical Materialism* (Ann Arbor: University of Michigan Press, 1969), 75.

in society, as in nature, evolution (gradual development) leads to revolution (sudden change)…."[22]

By the time Bukharin attended the International Congress of the History of Science and Technology in 1931, dialectical materialism was already well established as a philosophy whose aim it was to examine and compare the findings of the different sciences, and to elaborate general laws of the development of nature and society. One member of the Soviet delegation declared that "The classification of sciences is nothing more than a hierarchy of the forms of motion of matter in accordance with their essential order, in other words, in accordance with their natural development and the transition of one form of motion into another, as accomplished in nature."[23] It might also be pointed out here that in the Soviet Union during the 1920s a forerunner of general systems theory was to be found in the "tectology" of Alexander Bogdanov.[24] Bogdanov's attempt to establish a "universal science of organization" was greeted at the time with suspicion as a potential rival to Diamat, but received recognition from later Soviet philosophers.

A GENERAL THEORY OF SYSTEMS

General systems theory is concerned with the organizational similarities, or isomorphisms, that prevail among different types of systems, regardless of their specific features. According to its founder, Ludwig von Bertalanffy (1901–1972), "Its subject matter is the formulation and derivation of those principles which are valid for 'systems' in general."[25] The belief that there are general laws of organization encompassing diverse types of systems is a defining characteristic of GST. It is maintained that the principle of the isomorphy of concepts, laws, and models in various fields can contribute to the development of explanatory models via analogy, and that this can be especially useful in disciplines whose subject matter is inherently highly complex – for example, the social sciences.

There is some confusion over the term "general systems theory", even among its advocates. Does it refer to a general theory of systems, or to a theory of "general systems", or to something else? Ervin Laszlo argues that GST means *general theory of systems*, and points to Bertalanffy's original German term,

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[22] Ibid., 82.

[23] B. Hessen, "The Social and Economic Roots of Newton's 'Principia'", in N. I. Bukharin and others, *Science at the Cross Roads* (London: Frank Cass, 1971), 202.

[24] See George Gorelik, "Principal Ideas of Bogdanov's 'Tektology': The Universal Science of Organization", *General Systems* 20 (1975): 3–13.

[25] Ludwig von Bertalanffy, *General System Theory* (Harmondsworth: Penguin, 1973), 31.

allgemeine Systemlehre, or as he subsequently called it, *allgemeine Systemtheorie*.[26] GST has to do with mapping and classifying the properties shared by some or all of the concrete systems encountered in the various fields of science, where by concrete system is understood a system that processes energy, matter, or information, and modifies its environment and is in turn modified by its environment.

General systems theorists divide into at least two main types. There are those, like Anatol Rapoport and George Klir, whose main concern is with the mathematization of systems principles. Rapoport says, "The main theme of general systems theory is, I believe, the explicit fusion of the mathematical approach with the organismic. The key task of general systems theory is to show how the organismic aspect of a system emerges from the mathematical structure."[27] On the other hand are those, like Boulding and Laszlo, whose main interest has been in establishing an objective basis for humanist values, deriving from a consideration of a natural systems hierarchy and its evolution. These have seen GST as a world-view with important implications for social and political questions. Laszlo claims that "The general systems concepts and principles of evolution and systemic invariance provide a framework for the interpretation of the broad patterns of history."[28] These two approaches to GST are not mutually exclusive, and Bertalanffy had a foot in both camps. For him, GST was not to be limited to mathematical theory, but was to include, among other aspects, what he called "systems philosophy", being the elaboration of a new scientific paradigm, or new philosophy of nature. Systems philosophy he sub-divided into systems ontology, systems epistemology, and "values", this last being concerned with the relations of humans and the world.

Ontologically, GST posits the integration of systems in successively more complex states. "Reality, in the modern conception, appears as a tremendous hierarchical order of organized entities, leading, in a superposition of many levels, from physical and chemical to biological and sociological systems."[29] For Bertalanffy the concept of the "open" system, which he originally developed in connection with biology, was the key to establishing the possibility of the evolution of ever more complex systems. Open systems exchange energy and matter with their environments; hence, internally, they may avoid the increase in

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[26] Ervin Laszlo, "The Meaning and Significance of General Systems Theory", *Behavioral Science* 20 (1975): 9–24.

[27] Quoted in Richard F. Ericson, "Society for General Systems Research at Twenty-Five", *Behavioral Science* 24 (1979): 230.

[28] Ervin Laszlo, *A Strategy for the Future* (New York: George Braziller, 1974), 33.

[29] Bertalanffy, *General System Theory*, 87.

entropy associated with closed systems – they may avoid "running down" to states where less energy is available for work. The concept of a system's interaction with its environment is crucial in the GST perspective, for an open system cannot be explained simply in terms of its internal state.

The aims of general systems theory go beyond those of systems theory in any one scientific field; by its nature it is trans-disciplinary. GST is a way of approaching scientific problems, or even a way of looking at the world in general. For many of a more philosophical bent, a principal attraction of GST would seem to be precisely its status as a world-view, one encompassing not only a vision of harmony among the sciences, but also a vision of planetary social harmony. Indeed, the very concept of "system" signifies wholeness and interconnectedness, and it is perhaps not surprising that it should become the focus of those wishing to construct an all-encompassing view of nature and society.

TWO VIEWS OF CHANGE

GST's relation to dialectical materialism marks it as an alternative general theory of natural and social development. The most outspoken and persistent advocate of this position was Kenneth Boulding (1910–1993). The evolutionary perspective of GST, as expounded by Boulding in terms of ecological interaction and development, may perhaps include as a minor element or special case those processes such as class struggle and revolution focused on by Marxism. Nevertheless, he says, "The evolutionary vision … must be seen quite clearly as an alternative to Marxism as a general theory."[30]

While GST and Diamat clearly have much in common, they are also marked by a fundamental difference. This may be summed up by saying that GST is a philosophy of evolution, while Diamat is one in which evolution is the complementary aspect of revolution. In the Marxist perspective a given system structure not only canalizes the development of the system's elements, but also sets limits on that development. "Structure" here refers to the "synchrony" of a system, and is the network of couplings, or set of relations, among the elements or parts; thus the structure endows the whole with its specific mode of action, or law of motion. Maurice Godelier has written, "The appearance of a contradiction is, in fact, the appearance of a limit to the conditions of invariance of a structure. Beyond this limit a change in structure becomes necessary."[31] This same idea was expressed much earlier by Bukharin; referring to the relations of production, he wrote, "Within this frame, all possible variations of 'evolutionary nature' may

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[30] Kenneth E. Boulding, *Ecodynamics* (Beverley Hills: Sage Publications, 1978), 21.

[31] Maurice Godelier, "Structure and Contradiction in *Capital*", in Robin Blackburn (ed.), *Ideology in Social Science* (Glasgow: Fontana/Collins, 1972), 362.

take place; but we may pass beyond the frame only with the aid of a revolutionary upheaval."[32]

For Marxism it is virtually axiomatic that not all social systems operate according to the same set of laws. The transition from one set of laws to another set marks a change in structure, the emergence of a new system. The transition from feudalism to capitalism is an instance of such structural transformation. In *Capital* Marx attempted to uncover the structure of the capitalist economy and describe the dynamics of this system, including the trend toward the accumulation and concentration of capital, and the growing proportion of wage workers in the population – and to describe the system's intrinsic limits to growth.

What is important for Diamat is not merely the similarities among different types of systems, but their qualitative and structural differences, including different laws of behaviour. According to Oskar Lange, "In the course of development, individual wholes combine into more complex systems, into wholes 'of higher order' which exhibit new properties and new modes of action hitherto not encountered. Thus, in the course of dialectical development *new properties* (new 'qualities') and new modes of action (new laws of behaviour) come into being."[33] In this regard, for example, the Soviet-Armenian astronomer Viktor Ambartsumian cautioned against attempts to construct models of the universe based simply on known physical principles applying to local conditions.[34]

By contrast, GST attempts to discover common laws governing the persistence and development of systems. For Boulding there appears to be an ideal set of laws for all social systems, and deviations from this norm are evidence that certain systems are wrongly structured (and therefore less efficient at fulfilling their functions, and more prone to collapse). For GST the tendency of systems at all levels of the natural hierarchy to evolve toward higher levels of complexity and integration derives from their being subject to common cybernetic principles concerning adapting to their environments in order to survive. For GST the unique "properties" and "characteristics" which feature at different levels of the systems hierarchy are in general not to be taken as unique laws of system behaviour and development, but rather as *different forms* under which *common laws* operate. In this respect GST has not strayed far from

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[32] Bukharin, *Historical Materialism*, 247.

[33] Oskar Lange, *Wholes and Parts: A General Theory of System Behaviour* (Oxford: Pergamon Press, 1965), 1–2.

[34] Loren R. Graham, *Science and Philosophy in the Soviet Union* (New York: Vintage, 1974), 168–169.

Spencer's position. This tendency of GST, despite its anti-reductionist stance, to emphasize the common principles of development among diverse phenomena, contrasts with the tendency of Diamat to differentiate among laws operating at different levels.

GST writers do speak of "structural" change; for example, Walter Buckley says that "A central feature of the complex adaptive system is its capacity to persist or develop by changing its own structure, sometimes in fundamental ways."[35] But the term "structure" appears to be employed in a positivist, not a realist, sense here: that is, it does not refer to the fundamental and relatively invariant relations that define a given system. Structure from a GST standpoint has been defined by James Miller as follows: "The *structure* of a system is the arrangement of its subsystems and components in three-dimensional space at a given moment of time. This always changes over time. It may remain relatively fixed for a long period or may change from moment to moment, depending upon the characteristics of the process in the system."[36] Now, this is what might be called a surface or observable structure. When a system is said to undergo structural change or reorganization, it is simply being said that the system's observable form is altering, usually growing or diminishing. Old components are being replaced, new components are appearing, the spatial arrangement of components is changing. GST sees in evolution a general tendency for the observable structure of systems to become more complex.

But while there is agreement among GST writers that this evolutionary tendency exists, there is some disagreement on the details of the process. Boulding criticizes Miller's model of living systems for being based too closely on organisms, especially the human body.[37] Boulding holds that there are two basic models applicable to systems: one, the physiological model, and the other, the ecological. Ecology, originally the branch of biology dealing with the relations of organisms to one another and to their environments, has a wide field of application: "Its general principles apply not only to biological systems but also to social systems. Any system, in fact, which can be regarded as a system of interacting populations can be regarded as an ecosystem."[38] Boulding distinguishes three kinds of dynamic processes in interacting populations. One is a (short-run) steady state or "equilibrium", in which populations will return to

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[35] Walter Buckley, *Sociology and Modern Systems Theory* (Englewood Cliffs: Prentice-Hall, 1967), 206.

[36] James Grier Miller, *Living Systems* (New York: McGraw-Hill, 1978), 22.

[37] Kenneth E. Boulding, "Universal Physiology", *Behavioral Science* 25 (1980): 38.

[38] Kenneth E. Boulding, *Beyond Economics* (Ann Arbor: University of Michigan Press, 1968), 63.

their original size after some temporary disturbance. But over a longer period there are irreversible changes in underlying conditions, leading eventually to the establishment of a new equilibrium (e.g., the filling up of a lake or pond). This is the process of ecological succession. Finally, there is genetic mutation, which operates to produce new species, climatic change, and so on. These processes apply to both biological and social evolution.

Ecological succession is the result of cumulative changes. Although Boulding sometimes talks of a "system break" or "mutation", this does not imply the sudden, total transformation of the system except in the case of death and disintegration. Rather, it refers to a sudden and relatively long-lasting change in one of the system's variables (e.g., the birth rate), marking a change in the nonetheless gradual transition from one short-run steady state to another. And just as mutation takes place in nature, so it takes place in society: new machines, new products, new organizations, techniques, and ideas appear. Some assume a permanent place in society, others disappear almost at once, others endure for a time and then disappear. Mutation may open the way to irreversible, but gradual, change in the ecosystem. "We thus see human history as structurally a continuation of the immense drama of evolution."[39] In society the succession of institutions and ideas is governed by the accumulation of capital, the increase in population, and most importantly, by the increase and diffusion of knowledge.

Indeed, for Boulding the very notion of a succession of distinct systems or stages in history is fallacious. Transitions from one type of society to another (such as that into or out of feudalism) are normally so gradual that it is impossible to say where one type ends and another begins. Society is a complex aggregation of numerous elements, and classifications of societies represent largely arbitrary divisions of aggregates which in reality change only gradually in composition. "One hopes, therefore, that [any prospective] universal history will be able to follow these continuous strands in human development rather than maintain the fiction that the fabric of one stage is suddenly transformed into a different fabric of another stage."[40] In other words, Boulding rejects the concept, so fundamental to Marxism, that any society possesses a relatively invariant basic framework whose relatively sudden transformation marks the transition to a new type of society.

For Laszlo, "evolution is the outcome of the interaction of populations of systems and their environments controlled by the adaptive capacities of the

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[39] Kenneth E. Boulding, *The Organizational Revolution* (Chicago: Quadrangle, 1968), xxiv.

[40] Kenneth E. Boulding, *A Primer on Social Dynamics* (New York: Free Press, 1970), 129–130.

former. The basic concepts of random mutations and subsequent natural selection are not discarded, but integrated within the holistic context of evolving systems populations."[41] True, he points to the occurrence of "sudden leaps and deep-seated transformations" in nature but, like Boulding, he is in effect merely noting that the rate of evolutionary change is not constant: periods of little or no change alternate with relatively fast changes, as maintained by the biological theory of "punctuated equilibria".[42] There is no implication here that what we are confronted with during the course of evolution is structural revolution in the Marxist sense.

Because GST assigns no inherent structural limits to a society's capacity for development, the ability to survive is seen primarily as a matter of coping with changes originating *outside* the system. Response to a changing environment, says Laszlo, "constitutes the real test of the viability of a society, since the responding system does not encompass the sources of change, nor does it have control over their development." Coping with change involves offsetting the disturbances introduced into the system either by means of regulative controls ("socio-cybernetics I"), or by more extensive reorganization, generally involving growth and complexification ("socio-cybernetics II") – this latter being described as a change in "structure". Thus, "Modern social systems prove to be ultrastable systems, inasmuch as they are capable of compensating for changes in the environment by changing their structure and behavior (*socio-cybernetics II*)."[43]

Boulding suggests that organization represents an accumulation of information corresponding in some way to the system's environment. In other words, the growth of complexity implies the growth of knowledge about the system's environment. Boulding has expressed the opinion that the concept of the growth of knowledge, in this broad sense, constitutes "the key to the dynamic process in social evolution, and indeed in all evolution...."[44] GST advocates point to the correspondence between the thermodynamic concept of entropy and the concept of information content measured in "bits": information is defined by a term formally identical to negative entropy. At least in principle, says Laszlo, it should be possible to calculate how many bits of information it takes to constitute

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[41] Ervin Laszlo, *Introduction to Systems Philosophy* (New York: Harper Torchbooks, 1973), 92.

[42] Ervin Laszlo, *Evolution: The Grand Synthesis* (Boston: Shambhala, 1987), 76–77. The idea, subscribed to by Laszlo, that "punctuated equilibria" represents a dramatic break with classical Darwinism is rejected by Richard Dawkins in *The Blind Watchmaker* (New York: Norton, 1986), ch. 9.

[43] Laszlo, *Introduction to Systems Philosophy*, 107.

[44] Boulding, *Beyond Economics*, vi.

a given social system from its components.[45] Not surprisingly, it is Laszlo's contention that technological advance is the "engine" of societal evolution, that the historical succession of societal forms "is best conceptualized in terms of the transformation of dominant technological types, and the structural and institutional changes catalyzed by them."[46]

Sheldon Wolin has distinguished two schools of thought concerning the nature of human organizations. On the one hand are those whom Wolin calls the "organicists"; they see a social organization as an organism that has evolved over time, and represents a complex response to its environment and its members. On the other hand are the "rationalists", who stress the conscious and planned aspects of organization, and the power of organization to direct human energy efficiently toward such goals as making goods or making decisions.[47] It is a notable aspect of GST that it combines these two views on organization, through identifying the natural, historical development of systems with their growing capacity to process information and evolve more complex (observable) structure. For GST the increasingly "rational" character of human society is precisely in line with society's being an integral part of the natural world.

The GST idea that the evolution of systems in nature can be correlated with an increase in information content finds its parallel in Diamat. Beginning in the 1950s the question arose in the Soviet Union as to the relation between dialectical materialism and cybernetics. It was maintained by one group of scholars "that information is a property of all matter and that the evolution of matter, from the simplest atoms to the most complex of all material forms, man, may be seen as a process of the accumulation of information."[48] A. D. Ursul, one of the leading proponents of applying the concept of information to all forms of matter, argued at the same time that this concept must be supplemented by an understanding of the dialectical levels of nature. Different levels possess qualitatively different types of information, a fact that must be borne in mind if fallacies of reductionism are to be avoided. He suggested that among the types of information "human" or "social" information must be included. Such an approach seems to be in line with the ideas of GST proponents, and especially with Boulding's ideas on the accumulation of human knowledge as a particular manifestation of negative entropy.

For GST, societal evolution is a matter of conscious human direction, limited only by the extent of society's accumulation of knowledge. For Marx, on the other

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[45] Laszlo, *Introduction to Systems Philosophy*, 110.

[46] Laszlo, *Evolution: The Grand Synthesis*, 98.

[47] Sheldon S. Wolin, *Politics and Vision* (London: George Allen & Unwin, 1961), 409–410.

[48] Graham, *Science and Philosophy in the Soviet Union*, 348.

hand, the relations of production into which people necessarily enter are largely "independent of their will" and form a limiting horizon to conscious human endeavour. It is only when the class character of production relations is finally broken that societal evolution can be consciously directed in a meaningful sense. Where GST equates the possibilities for conscious societal control with the degree of complexity of the social system, from the Marxist standpoint all forms of societal organization are in a sense equally beyond control until the right structural key is found (capitalism supposedly being the mould to make the key, and thus forming the last stage in the "prehistory" of humankind).

Unlike Marx, Boulding does not posit relations of production as a distinct factor, but appears to assimilate them within what he calls the "technological system", in the guise of "roles and organizations" employed in the production process.[49] He also attributes particular importance to society's "integrative system", which deals with such matters as community, identity, status, legitimacy, loyalty, and love. The main dynamic processes of society supposedly depend on the interaction of the integrative and the technological systems, which reciprocally affect each other. But however one views the precise role of Boulding's integrative system (society's supporting ideology?) within the total social system, it does not provide a structural framework for societal development equivalent to that provided by the relations of production in the Marxist schema. What this means is that there is no relatively invariant basic framework that determines the general shape of the social system until such time as it is ruptured and replaced with another framework. For Marxism, evolution and revolution are complementary aspects of a single overall process. For Boulding, the evolution of society does not entail revolutionary transformation. Rather, society evolves continually and gradually in line with its accumulation of knowledge.

Boulding counterposes to Marxist "materialism" his vision of societal development as a process of the growth of knowledge. Interestingly enough, he actually recognizes in one place that philosophical materialism is "irrelevant" to Marx's fundamental tenet that changes in the mode of production underlie societal evolution.[50] But he seems to believe it is Marx who is confused on the issue, for failing to understand the vital role that human knowledge plays in the production process. In referring to the development of the productive forces, Marx says that "the accumulation of the skill and knowledge (scientific power) of the workers themselves is the chief form of accumulation, and infinitely more important than the accumulation – which goes hand in hand with it and merely

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[49] Kenneth E. Boulding, *Collected Papers*, vol. 4 (Boulder: Colorado Associated University Press, 1974), 395.

[50] Boulding, *A Primer on Social Dynamics*, 77–78.

represents it – of the *existing objective* conditions of this accumulated activity."[51] And he refers to the material aspect of technology as "the power of knowledge, objectified".[52] It was with this awareness that Marx stressed the growing importance of science within the productive forces.

CONCLUSION

GST, in Boulding's version or otherwise, does represent an alternative to Marxism, but its distinctiveness lies neither in adopting a systems approach nor in viewing societal evolution as a continuation of natural evolution. A systems approach has always been an essential ingredient of the Marxist dialectic, while Diamat was developed as a philosophy formulating the most general laws of nature, society, and thought, and according to which the same dialectical principles operative in nature can be observed to apply to human society. Instead, the distinctiveness of GST lies in its emphasis on evolution as a process of the complexification of systems, rather than their deep-structural transformation.

Arguably, GST fails to address some of the more important questions about social systems, namely, those relating to the different ways in which systems develop and the limits imposed on development by the structures of systems. The orientation of GST is not toward "diachronic" change (the change from one structure to another) but toward the dynamics of systems (development within a fixed system structure). For GST the emergence of a "new" system does not mean the internal transformation of an existing system, but the integration of several systems to form a higher level of the natural systems hierarchy.

Bertalanffy recognized that GST is susceptible to the totalitarian danger of conceiving of the state or nation as an organism in relation to which individuals are mere cells. His weapon to combat this tendency was the "ultimate percept" that human society "is based upon the achievements of the individual and is doomed if the individual is made a cog in the social machine."[53] But the misuse of theory cannot be prevented simply by attaching an individualist rider to a philosophy whose whole thrust has been to proclaim the importance of context, and in effect to argue, like Marx, that the individual *is* the social being, whose individuality is only made possible within the developed social whole. The threat to individual autonomy does not reside in recognizing the essential sociality of human beings, but in measuring progress according to a restricted notion of sociality (organizational complexity, information content, productive capacity).

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[51] Quoted in G. A. Cohen, *Karl Marx's Theory of History* (Princeton University Press, 1978), 42.

[52] Karl Marx, *Grundrisse* (Harmondsworth: Penguin, 1973), 706.

[53] Bertalanffy, *General System Theory*, 52.

For its part, Diamat's function as ideological support for the Soviet political system limited the acceptance of whatever positive features it had to offer, and illustrates how philosophies of nature often become entangled with political agendas. The connection between science and ideology has a long history. Nevertheless, both Diamat and GST have been significant endeavours to advance our understanding of social systems as evolved and still-evolving natural systems.