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# DIALECTICAL THERMODYNAMICS

by

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## ABSTRACT

A lugubrious, though highly abstract, proposition about sociocultural systems is suggested by a union of dialectical and thermodynamic concepts: systems are invariably flawed, not only because of poor --or absence of -- design, or ill will, but because the "closedness" of a system necessarily wars on its "openness," and because the actualization of the organizing principle upon which a system is based brings with it the development of its "shadow," its negation. Reconciliation of these contradictions is not assured.

## MOTIVATION

For a sociocybernetics to contribute to improving the "quality of life," it must address important questions. One such question might be: why is it that most, if not all, "ideologies" --that is, coherent systems of thought and practice which have mobilized large numbers of people and which were dedicated originally to the betterment of the human condition --have invariably engendered a great deal of human suffering and have come to embody in many instances the very opposite of those beneficent impulses prominent in their beginnings?

It would be a great deal to ask of a theory of sociocybernetics that it be able to answer this question satisfactorily. Obviously, the issue requires illumination from the humanities and social sciences. Systems theories are intrinsically too abstract to provide in themselves an adequate framework for understanding "sociocultural systems," however much these theories are augmented by knowledge from other fields. Still, abstraction can yield significant contributions to our thinking about questions such as the one just raised. Cybernetic theories offer insights into the universality, the "lawfulness," as it were, of certain difficulties which afflict systems. These insights, which need to be supplemented by more concrete analyses, suggest a relatively new perspective about the essential nature and fundamental causes of certain social problems, a perspective rather different from that held in more traditional disciplines.

What follows are some metaphysical musings, cast in the language of systems theory and cybernetics, inspired in part by the question posed initially. The metaphysics offered here fall short of that spoken of by Bunge, who saw in systems and cybernetics theories, e.g. game theory, automata theory, and the like, attempts to construct an exact and scientific metaphysics. These theories, Bunge suggested, were "metaphysical" in their great generality, "exact" in being mathematical, and "scientific" in having a close connection with specific theories in one or more scientific disciplines. The discussion which follows is structured as a system of metaphysical assertions. While non-

mathematical in form and devoid of scientific detail, it draws heavily upon a wide range of systems-theoretic and related sources. These include classical and non-equilibrium thermodynamics, the cybernetics of Ashby, von Bertalanffy's General System Theory, catastrophe theory, Godel's proof, and Hegelian and Marxian dialectics, and the ideas of Simon, Whyte, Feibleman and Friend, and many others. It would be difficult to disentangle and identify all the individual sources; selected books and articles, and two earlier and relevant papers of the author, are cited in the bibliography.

This analysis seeks to integrate these fairly diverse materials into a single coherent "verbal model," which describes systems and the difficulties faced by systems in very general terms. The underlying motivation is to construct a model rich enough to encompass "socio-cultural systems," and, more specifically, ideologies, but the text makes no use of illustrative examples; these must be supplied by the reader. The advantages --and disadvantages --of such discussion over a more conventional treatment will be considered briefly in the closing commentary.

### METAPHYSICS

#### SYNCHRONICS

Every system is constructed around some organizing principle, and every organizing principle is inherently limited. In the domain of existence of any system, only certain elements can be brought into coherent relation; some elements must be left out. In the impossibility of universality, every system is intrinsically incomplete.

Systems may be structured around more than one organizing principle of relation. However, these relations are either, in turn, organized into a superordinate whole on the basis of a more global principle, or they co-exist independently, unharmonized at a higher level, and therefore, at least potentially, in a state of contradiction.

Dialectically speaking, every system is flawed, inevitably, and necessarily. This condition cannot be remedied. The flaw is not the consequence of a correctable imperfection in the organizing principle, but arises from the fact that any organizing principle is partial in scope. Within a restricted domain, a degree of consistent order can be achieved. But consistency and completeness cannot both be attained. The whole cannot be embraced.

The organizing principle is the identity of the system and the source and inner character of its dynamic activity vis-a-vis its environment. This order, to persist, must to some degree be isolated from disturbing influences. Every system must in some measure be closed. The organizing principle provides for the closedness of the system and is protected by it. Indeed, the organizing principle is the closedness of the system, its integrity and identity.

But to the degree to which and in the manner by which a system is closed, it is vulnerable to a dual risk: it tends either to disintegrate or to rigidify. Disintegration into chaos is foreordained for isolated systems.

This consequence of the inexorable flow of time cannot be avoided, but the actual time period over which disintegration need take place is not prescribed. Through rigidification, this outcome may be postponed, but as a consequence the system is forced to a condition equally dire: the cessation of internal dynamic activity. Though the tendencies of disintegration and rigidification are, strictly speaking, opposites, they are often linked; and isolated systems may, at least for a while, suffer both fates simultaneously.

Complete isolation, however, is only a useful fiction. All systems are open in some way to their environments. In this openness there is the possibility of self-maintenance, i.e., the preservation of internal order and identity. The tendencies within a system towards disintegration and/or rigidification may be checked or brought into balance. External order may be taken in and internal disorder expelled to counter the former tendency; internal disorder may be retained or external disorder taken in to neutralize the second. This is a delicate task. In openness, there is merely the possibility of homeostasis, but not its guarantee. The transactions of the system with its environment, if unbalanced or improperly controlled, can bring about more rapid disintegration than would occur if the system were closed.

Complete openness, like complete closedness, is impossible. The very notion of a "system," distinct from its environment, implies a degree of closedness. This is more than a matter of definition. A system too open suffers the same fate as one too closed. A totally open system reaches equilibrium with its environment, becomes indistinguishable from it, and disappears.

To be clear: openness does not eliminate the dual risk which systems face of movement towards chaos and/or rigidity. These tendencies are inevitable because they originate in two fundamental, yet contradictory, requirements. The existence of the system --of its organizing relation and of the system/environment distinction --depend on order and unity. Yet variety and multiplicity are also necessary for adaptability, i.e., to insulate the internal order of the system against the buffeting disturbances of the environment --disturbances to which the system, necessarily open in part, cannot avoid being exposed. These disturbances must be matched and countered by sufficient internal variety. Variety, however, is in no way different from noise. Variety is beneficial disorder, distinguishable from harmful disorder only by its effects on the system. These effects, and therefore also this distinction, are not permanent, but change with circumstance.

Every system thus necessarily subsists partially open and partially closed, or open on some occasions and closed on others. Moreover, the particular way by which the conflicting needs for both openness and closedness are reconciled is also either part of the system's closedness or openness. That is, either the organizing relation provides explicitly for the transactions which will occur between system and environment, or, more critically, guarantees the protection of some system invariant, in which case the system remains tethered to some quasi-permanent order; or, nothing is held invariant, and the system is capable of being completely altered by its adjustments to and by the impacts of the environment. In the former instance, adaptability is limited but identity is protected; in the latter instance, identity becomes vulnerable, but the possibility of evolution is gained.

What is fundamental is this: all systems need both closedness and openness and both unity and multiplicity. These conflicting requirements constitute inescapable dialectical dilemmas. The viability of any particular solution to these dilemmas is never permanently assured. Balance between opposing needs always remains precarious. Closedness wars on openness. Unity wars on multiplicity. Environments change. Persistence cannot be guaranteed by any strategy whatever.

### DIACHRONICS

In openness, there is not only the possibility of self-maintenance, but also of growth and development. Usually more can be ordered via the organizing principle than what is initially subsumed in the system. The system grows, assimilating elements from its environment and extending its domain of influence.

For a while, the identity and viability of the system are unchallenged, and expansion is sustained in momentum. In this success, however, consequences of the restricted scope of the organizing principle begin to appear. Growth slows, and barriers are encountered to further development. Thus, the dialectical trajectory: the development of the system proceeds from nucleation to expansion to the encountering of limitation.

Limitation appears in many forms: in the exhaustion from the environment of elements suitable for incorporation or transformation; in the difficulty of maintaining coherence while integrating new elements into the system; in the fragility of order already achieved; in conflict generated by subsidiary internal structures not completely subordinate to the original organizing principle; in constraints stemming from the competition of other systems, etc. Circumstances vary, but unimpeded development never occurs.

Generally, limitation derives either from the existence of some alternative and opposing organizing principle --which may be internal or external, or from the dialectical dilemmas inherent in the universal laws of maintenance. These cases are not essentially different. All forms of limitation have, as the prime source of their arising, the necessary partialness of the organizing principle by which the system is constituted. Development invariably gives rise to its own negation. What is omitted wars on what is included.

The fundamental character of limitation is most apparent when it arises internally from the general difficulties of systems maintenance. For example, there may be an intensification of the dilemma which inheres in the opposing needs of the systems for closedness and openness. A tension between these needs characterizes all systems virtually by definition, but requires time in any particular system to become fully manifest. When some degree of successful development has occurred, conflict invariably is engendered between closedness and openness, between that which, for integrity, must be fixed and that which, for adaptability, must vary. Often it is openness which predominates in the early stages of development, fostering the growth of the system and the realization and articulation of the organizing principle. However, with the formation of a complex internal order, the need for the protection of this order against disorder of internal or external origin (even against "useful disorder," namely variety) gradually gains in importance.

Closedness, necessary always to some degree, now becomes more imperative. The system becomes more centralized, and its inner core begins to rigidify.

Simultaneously, there is progressive segregation, complexification via the differentiation of parts and the weakening of global higher order relations. The system becomes partially decomposable; i.e., moves from unity to multiplicity. While the center begins to rigidify, the periphery begins to disintegrate. Tension develops between those factors maintaining the unity of the system and those connected with its need for multiplicity. Unity and closedness are allied, as are multiplicity and openness. Priority between these two constellations of needs cannot be permanently established. Openness and multiplicity are necessary to protect the integrity of the system and should ideally be subordinate to it. Yet, unity is flawed by partialness, and closedness only guarantees ultimate dissolution or rigidification.

The sequence of early stages --nucleation, expansion, and limitation -- is, as it were, nearly foreordained. Development continues, and those factors limiting development also intensify. If the system continues along this trajectory, eventually a critical phase is reached. The unique properties of the system, namely its particular structure, function, and history, now gain in importance over more generic attributes. The fate of the system becomes extremely uncertain. A region of "bifurcation" is entered, within which, for the first time, the ordering principle can be fully replaced by some alternative mode of organization. The actual state of the system comes to coexist, in the realm of the possible, with a second, yet unactualized, state. This latter state corresponds either to a restructuring of the system or to its dissolution. The coexistence of actual and potential states reflects the "principal contradiction" which now characterizes the system and its development. Thesis leads to antithesis, and not by failure but by success.

The principal contradiction is internal or external; involves a competing organizing principle, or is the result of general difficulties inherent in development. Of these possibilities, it is the emergence of a competing order within the system which most acutely reveals the partialness of the organizing principle. If development follows its most natural course, the opposition of the organizing principle and its negation will intensify into conflict. This conflict may lead to the ascendancy of the new order. Normally, the system remains structured for a time in its initial form, but further shifts in dominance towards the new mode of organization makes visible what has been latent. A crisis ensues in which the change, accomplished already in deep structure, manifests also in surface structure. Finally, there is actual transformation: the system turns into its negation.

The struggle of opposites may alternatively result in the triumph of the original principle, but victory is never complete. Those aspects of the system which gained coherence by the alternative mode of organization either remain within the system or are expelled from it. In the former case, contradiction is fixed within the system and introduces a permanent strain in it. Dominance of the old order requires the suppression of the fact of its incompleteness. This suppression can have only temporary success, and an enduring tension develops between the original order and its challenger. In the latter case, the problem is externalized but is not by this means solved. A new competing system is generated, and conflict invariably ensues between the original system and its offspring.

Entry into the domain of bifurcation may be the result of environmental conditions which block further growth. Although openness confers upon the system the theoretical possibility of perpetual self-maintenance, this condition is rarely, if ever, achieved. Even if the organizing principle of the system is protected from environmental disturbances, even if the delicate balance between openness and closedness is preserved, still the pool of assimilable elements in the environment may become depleted, or disorder expelled from the system may poison it. This limitation, while having the character of being "external," stems from the requirement of openness, and ultimately from the incompleteness of any organizing principle. Only part of any environment can serve as a source of order for the system; only part of the results of the internal processes of the system can be beneficially retained by it.

Or, the system, after some expansion of its niche, may find itself faced with competing systems, not arising originally from itself, and organized according to different ordering relations. As with the comparable internal situation, conflict may ensue, with varying possible outcomes for the system and its competitors.

Thus, development leads ultimately to its own negation; thus the partialness of the organizing principle becomes manifest. The difficulties necessarily joined to any degree of successful development can be met only if partialness is accepted. This requires modification of the organizing principle or fundamental change in its status.

Where environmental limitations are the primary obstacle, the system must shift its mode of operation from expansion to homeostasis. In some circumstances, however, steady states are not actually sustainable; in some organizing principles, the assumption of expansion is too deeply embedded to permit abandonment. But even if such a solution is possible, no means exist to guarantee a steady state in perpetuity.

Where difficulties arise from internal or external competition, a synthesis may be possible between the organizing principle and what challenges it. Internally, there may emerge a superordinate order within which the organizing principle and its negation are harmonized. Externally, the system may become linked to other systems by relations which integrate and constrain. The dialectics of reconciliation are demanding and subtle, much more so than the dialectics of victory and defeat. The presence of additional factors are necessary to balance and bind together the contending forces. The existence of these factors and thus of the synthesis may be transitory. Indeed, organizing principles of some systems are the result precisely of such an original synthesis, which in the domain of bifurcation suffers fragmentation.

Faced with internal or external competition or with difficulties of a more general kind, the system may undergo evolutionary change. Dialectical processes are among such evolutionary mechanisms; others, continuous and/or discontinuous are possible. Evolution is not without cost. In true evolution, as distinct from the morphogenetic realization of some organizing principle, identity is altered. To the degree a system is closed or tethered, it cannot evolve. In circumstances where evolution is the necessary form of adaptation, survival requires deep opening and the relinquishing of a perma-

ment and fixed order. This relinquishing is experienced within the system as negation, and is resisted. While evolution may be essential for survival, it is not the original system which survives. From an external perspective, there is perhaps some degree of historical continuity; but to the system itself, evolution ultimately means death, in the sense of loss of identity, a loss not compensated for or made easier by a guarantee of future viability.

Or, the system may follow the archetypal route of organisms. Having reached the full measure of the development possible to it, it ages and finally passes away. It leaves behind it its effects on its environment, which may have been considerable, and which may yet persist. The system itself is not, by reason of this course of events, "unsuccessful," for how can permanence be a criterion of success? Decay is inherent in all composite things, and survival by itself is no mark of merit.

#### COMMENTARY

Edmund Wilson, speaking of the Marxian dialectic, called metaphysics the "poetry of imaginative people who think in abstractions instead of images. The foregoing exposition represents one possible poem, or more accurately, a working draft of one, still to receive some further refinement. No system of the type described in the preceding discussion actually exists. What is portrayed is an "ideal type," (Weber), i.e., an intrinsically idealized and arbitrary theoretical construct which any particular socio-cultural system may more closely or more distantly resemble.

The main virtue of this kind of discourse is also its chief weakness, and this is not unseemly for a discussion so devoted to dialectics. The virtue and the defect are, of course, the high degree of abstraction of the exposition and the inherent non-refutability of an ideal-type analysis. (As Bunge might say, such analyses are "vicariously testable," i.e., testable only when augmented by more detailed specifications.) Nothing is said herein about any specific sociocultural system or any specific ideology which may or may not qualify as a close approximation to the ideal type.

On the negative side, then, the narrative remains elusive and the reader cannot be sure if he or she has understood the ideas which have been proposed. More critically, it is impossible to affirm or deny the analysis by reference to specific cases in the history of ideologies. On the positive side, the analysis is not committed to a definite judgement about any particular ideological system, and thus successfully avoids the passions and interminable controversy usually unleashed in discussions of this subject. In this "non-aggressive" stance, a very abstract exposition resembles one at the opposite pole of the abstract-concrete continuum, for example, an account of some social phenomenon which is nearly totally factual and which abjures even the hint of theoretical analysis. In either case, the text operates mainly by being suggestive and the reader is free to invent exemplifications of the abstract or generalizations of the particular as he or she sees fit. Both types of presentation have thus a measure of impartiality. But this merit should not be exaggerated. Even descriptions which are ostensibly "completely" concrete or abstract (as this one) are usually vivified, and necessarily also biased by some hidden intermediate position, which is protected by being kept out of view, and which selects and structures the elements of analysis.

In summary: while the preceding metaphysical discourse makes no specific assertions, either scientific or moral, about any particular sociocultural



system, it reflects a definite perspective about the origins of certain social problems, one considerably more platonic than those held by most scholars. In this perspective, ideologies are systems, which invariably represent partial truths. They are faced with insoluble dilemmas involved in closedness and openness, order and variety, unity and multiplicity. The dialectical trajectory of their development inevitably brings them into confrontation with their limitations. Reconciliation of contradiction is not assured. In the consequences of contradiction and confrontation with limitation lies the source of a great deal of human misery.

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