Complexity, Critical Realism, and the Strategic-Relational Approach: Some Comments on the Critique of Political Economy in the Age of Globalization

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> "all science would be superfluous if the outward appearances and essences of things directly coincided" (Marx, 1971, *Capital*, vol III, p. 817).
>
> 'Complicationes non sunt multiplicanda praeter necessitatem' (Rescher 1998: 62, by analogy with Occam's razor).[1]

This paper presents a preliminary account of the mutual implications of complexity and critical realism and indicates how this account can be applied by offering some critical realist comments on the growing complexity of contemporary capitalism. In proceeding in this way I aim to avoid complexity becoming a 'chaotic conception' (Marx 1857; cf. Sayer 1992) that can serve neither as a coherent research object nor as a coherent explanatory principle. Thus I distinguish between complexity in general and specific modes of complexity and also argue against the use of complexity simply as a metaphor without regard to its modalities in particular contexts. The five main sections of the paper address the following problems: (a) the nature of complexity as an alternative to Bhaskar's transcendental[2] justification of critical realism; (b) the implications of critical realism for the analysis of complexity; (c) the implications of complexity for the possibility of naturalism in the social sciences; (d) complexity and its implications for rethinking some key concepts of the Marxist critique of political economy; and (e) a critical realist, third generation regulationist account of capitalism in the era of globalization.

Complexity and Critical Realism

Complexity is complex. There are many ways to define complexity and not all are relevant to critical realism; thus my first task is to reduce the complexity of complexity in order to connect it to critical realism rather than to another topic. Indeed such an act of simplification is an inevitable task for any agent (or operating system) in the face of complexity. My proposed route into this issue is to provide an alternative to

Bhaskar's transcendental proof of the need for critical realism. In brief, this proof proceeds through philosophical reflection on the conditions of possibility of scientific experimentation leading to the conclusion that these conditions imply a distinction between the real, the actual, and the empirical (Bhaskar 1975). In more detail, he assumes the intelligibility of science and then poses the retroductive question of what the world must be like for *experimental activities* and *scientific development* to be possible. In this context he suggests that experiments rest on the distinction between a real world pregnant with many possibilities and an experimental world in which certain results are realized. This presupposes in turn a distinction between a real world of causal mechanisms, tendencies, counter-tendencies, etc., and an actual world of experimentally produced events. Transcendental realism argues that one condition of possibility of scientific enquiry is that certain *intransitive* objects (natural causal mechanisms) exist independently of their investigation and identification through such enquiry. It also implies a *transitive* dimension to science, i.e., the social practices of scientists involved in discovering causal mechanisms and developing science. Bhaskar concludes that science develops according to a threefold schema: 'science identifies a phenomenon (or range of phenomena), constructs explanations for it and empirically tests its explanations, leading to the identification of the generative (i.e., causal) mechanism at work, which now becomes the phenomenon to be explained, and so on. In this continuing process, as deeper levels or strata of reality are successively unfolded, science must construct and test its explanations with the cognitive resources and physical tools at its disposal, which in this process are themselves progressively transformed, modified and refined' (Bhaskar 1989b: 12).

Bhaskar's argument is mainly concerned with the conditions of possibility of the experimental natural sciences. I want to suggest that focusing on the nature of complexity in the natural and social worlds would enable us to generalize his argument to all forms of scientific inquiry; and indeed that such a focus would also enable us to present a case for the overall mind-independence of the real world. Accordingly I will identify different forms of complexity, assess their implications for the possibility of knowledge, argue that the natural world is mind-independent, and, in a later step (section 3), suggest that the social world, whilst inevitably socially constructed, has emergent properties which can also be seen as mind-independent -

- especially from the viewpoint of non-participant observers. I begin with descriptive complexity.[3]

Rescher argues that 'the number of true descriptive remarks that can be made about a thing -- about any concrete element of existence and, in specific, any particular physical object -- is theoretically inexhaustible. … there is no inherent limit to the number of distinct descriptive kinds or categories to which the things of this world can belong. As best we can possibly tell, natural reality has an infinite descriptive depth. It confronts us with a law of natural complexity: *There is no limit to the number of natural kinds to which any concrete particular belongs*' (Rescher 1998: 28). Heinrich von Rickert (1902/1986) had already developed a similar argument at the turn of the nineteenth century and extended it to the social world (as had Windelband and, no doubt, others before him). He too argued that the world is an infinitely extensive set of objects, each of which is infinitely subdivisible, so that we confront an "extensively" as well as "intensively" infinite "manifold" of particulars. It follows, he continued, that our knowledge cannot be anything like a copy or a reproduction of reality; indeed, we cannot know any object or event in all of its aspects. From this, he drew significant implications for the social as well as natural sciences (on which, see Rickert 1986: 61-137, and below). More generally, Rescher states that:

> It is the very limitation of our knowledge of things -- our recognition that reality extends beyond the horizons of what we can possibly know or even conjecture about -- that most effectively betokens the mind-independence of the real. A world that is inexhaustible by our minds cannot easily be seen to be a product of their operations' (Rescher 1998: 52).

Such arguments clearly derive from the *descriptive* complexity of entities and their relations with other entities in the real world. Thus they could perhaps be dismissed as concerned more with epistemic than ontological complexity. I will argue later that there is a connection between these two forms of complexity (without reducing one to the other or treating them as identical) and that this link has major implications for critical realism in the social sciences. But let me first turn to ontological complexity. Following Rescher once again, we can distinguish three modes of ontological complexity (each with two or more subtypes): compositional, structural, and operational (see appendix 1). Each of these modes of complexity poses the same

cognitive problem noted above, namely, that the world is too complex ever to be fully grasped by the human mind (or, indeed, any mind). But here the problem is not so much one of the cognitive capacities of the mind (or, better, of science in its transitive dimension) as the ontological (or intransitive) features of complex entities that are at stake.

There are two such ontological features worth noting here:

(a) 'entities and their relations in the real world not only have more properties than they ever will overtly manifest, but they have more than they possibly can ever manifest. This is so because the dispositional properties of things always involve what might be characterized as *mutually preemptive* conditions of realization. … The perfectly possible realization of various dispositions may fail to be mutually *compossible*, and so the dispositional properties of a thing cannot ever be manifested completely -- not just in practice, but in principle. Our objective claims about real things always commit us to more than we can actually ever determine about them' (Rescher 1998: 38). This point is closely linked, of course, to the critical realist distinction between the real and the actual and so, *pace* Rescher,[4] should not be tied too tightly to the question of experience or even experientiability at the cost of careful consideration of the actual.

(b) the scope for interaction among complex entities, the emergence of new entities and processes therefrom, the simplifications that are introduced by operating agents or systems to reduce complexity to manageable limits, and the emergent effects of such simplifications all tend to mean that complexity becomes self-potentiating. In short, complexity breads complexity.

> Complex systems generally function so as to engender further principles of order that possibilize additional complexities. Complex organisms militate towards complex societies, complex machines towards complex industries, complex armaments towards complex armies. And the world's complexity means that there is, now and always, more to reality than our science -- or for that matter our speculation and our philosophy -- is able to dream of' (Rescher 1998: 28).

What do complexity and its self-potentiation imply for analyses of the real world? It is worth distinguishing three sets of implications here: ontological, epistemological, and methodological. ***Ontologically***, as we have just seen, complexity refers to the compositional, structural, or operational nature of events, phenomena, or other relational objects in the real world. Such complexity applies to the natural and social worlds. Social as well as natural events, phenomena, or relational objects can have the naturally necessary features that characterize (one or more of) compositional, structural, or operational complexity. Since complex entities and their interactions have many naturally necessary potentialities that may not be realized and/or cannot be co-realized, there is a necessary impredictability and indeterminacy about their operation. I have tried to capture this with the concept of 'contingent necessity'. The seeming *contradictio in adjecto* in this concept disappears if one recognizes that contingency and necessity have different referents: for the notion of contingent necessity indicates the *de facto* causal determination (necessity) of events and phenomena with their *ex ante* indeterminability (contingency). In other words, events and phenomena are the product of the non-necessary interaction among different causal chains to produce a definite outcome that first became necessary through the contingent articulation of various causal chains (Jessop 1982, 1990, 1996).

As a feature of the real world, contingent necessity clearly implies that world's ontological complexity. Indeed, if the development of the real world involves an infinite succession of contingently interdependent as well as contingently necessary 'contingent necessities', then it must also be infinitely complex. This poses a series of questions about how one can best grasp the 'complexity of complexity' in the real world and simplify it in dealing with that world. Inter alia, this means that: '(a) the same causes can lead to different and/or divergent effects; (b) different causes can produce the same effects; (c) small causes can entrain very big effects; (d) big causes can produce quite small effects; (e) causes are followed by contrary effects; (f) the effects of antagonistic causes are uncertain' (Schriewer 1999: 91, citing Morin). This excludes any simple algorithm to generate explanations of complex phenomena. Contingent necessity implies the infinite complexity of the real world and the infinite complexity of the real world implies contingent necessity. This requires us to pursue complexity reduction (i.e., to adopt methodological simplificationism) as well as to adopt methodological relationalism (on the former,

see Rescher 1998; on the latter, see Bourdieu and Wacquant 1992). To comprehend reality is thus to simplify and to transform it in the light of a cognitive strategy.

Epistemologically, if the real world is infinitely complex, it cannot be exhausted analytically. This excludes any copy theory of knowledge such that the result of an inquiry is just to reproduce the world in all its complexity. Instead it requires that we select simplifying entrypoints into that complexity and recognise that all knowledge is partial, provisional, and incompletable (cf. Resnick and Wolff 1987; Gibson-Graham 1996). One of the differences among disciplines is their focus on different aspects of reality and their adoption of different entrypoints into its investigation. However, as objects change, disciplinary boundaries, divisions of labour, and entrypoints may become less relevant. This could lead either to further disciplinary subdivisions, transdisciplinarity, or post-disciplinarity. In addition, if 'contingent necessities' really exist, adequately to explain them requires one to combine concepts, assumptions, and principles of analysis from different theoretical domains and to link them to a given, theoretically defined explanendum. Thus an explanation is only more or less satisfactory relative to a given explanendum that has been isolated (and thus 'constructed') by an observer out of that infinite complexity. Weber spoke of the practical impossibility (and, in many cases, theoretical redundancy) of following causal relationships down to the microscopic level of necessary connections among the elementary constituents of reality (Ringer 2000: 71-2). These points apply regardless of the relatively macro-micro nature of the problem[5] and/or the generality of the historical developments and outcomes to be explained. In all cases the key issue is to explain specific explanenda in terms of specific causal antecedents, suggesting how specific causal processes or causal intersections from many others to show how they intervened to produce something that would not otherwise have happened. This points to the need to combine concepts, explanatory principles, etc., from different disciplines; and, perhaps, to the validity of the distinction between *Gesetzes*- and *Wirklichkeitswissenschaften*. While the former (i.e., the nomological sciences) abstract from the real world to discover general laws and lawlike regularities that are low in substantive content, the latter (i.e., disciplines concerned with reality)[6] are concerned with their interest in the singularity of specific events and processes, whether these be relatively micro- or macro- in nature.

Moreover, since explanations cannot fully explain a specific event or process in all its complexity, the investigator must consider 'the degree of generalization and abstraction necessary -- and defensible -- in the "comparison" between imagined and actual antecedents, causal sequences, and outcomes' or, again, think about 'how best to conceptually isolate the set of antecedent conditions that more or less strongly "favor" the result to be explained' (Ringer 2000: 66 and 67). This implies that ''causal "moments" are not simply given in immediate experience' (Ringer 2000: 71) and, hence, 'the inescapably "abstract" character of causal analysis' (Max Weber). This means in turn that knowledge of a complex world can at best only achieve something akin to "reasonable approximation". Another implication is that '[o]ur conceptions of things always present a *moving* rather than a *fixed* object of consideration, and this historical dimension must also be reckoned with. It is thus not only instructive but ultimately essential to view our knowledge of the properties of things in a temporal perspective' (Rescher 1998: 33-4). In other words, '*we expect to have to change our minds about their nature and modes of comportment*' (Rescher 1998: 34).

Methodologically, a method is required that respects contingent necessity and complexity. A method of articulation is appropriate here. This involves the dual movement from abstract to concrete along one plane of analysis and from simple to complex as more analytical planes are introduced in order to produce increasingly adequate explanations (Jessop 1982: 213-19; Jessop 2001). This will often involve serious forensic problems of causal attribution in the face of many competing explanations and resolving these problems could well involve a resort to counterfactual and/or comparative reasoning (Ringer 2000: 169). Ragin is one of several methodologists who have attempted to specify case- and variable-oriented methods of comparative analysis in order to provide more substantive bases for such counterfactural reasoning (Ragin 1984, 1999). There is a major role for counterfactual reasoning in causal analysis in identifying the relative significance or rank order of different causes in producing a given effect.

As the preceding paragraphs have suggested, these ontological, epistemological, and methodological aspects of complexity are closely related. But we must still take

care to distinguish them -- both to avoid possible misunderstandings and to exploit their connections in developing a critical realist philosophy of the social sciences.

Critical Realism and Complexity

Critical realism also has some implications for complexity. These can be summarized briefly in terms of (a) the importance of analyzing complexity in terms of the distinction between the real, the actual, and the empirical; and (b) the relevance of the concept of contingent necessity to the analysis of complexity. The first point is important because analyses of complexity sometimes still work with a relatively flat ontology (see, for example, Mach's interpretation of Occam's razor to the effect that 'scientists must use the simplest means of arriving at their results and exclude everything not perceived by the senses', cited by Gibbs and Hiroshi 1997) and even with notions such as constant conjunctions (e.g., Ragin 1984). In this context one could perhaps suggest that ontological complexity is especially relevant to the first two levels (real and actual) and formulaic complexity to the second and third levels (actual and empirical). The second point requires attention to the distinctive features of 'contingent necessity'. This term, with its seeming *contradictio in adjecto*, refers to the nature of 'real-concrete' phenomena. It rests on the assumption that everything that happens in the real world must happen, i.e., is in some sense 'necessary'. Rejecting this assumption would render much scientific enquiry pointless. It is the precise meaning of necessity, however, that is at stake in 'contingent necessity'. For it need not, does not, and cannot mean that whatever happens in the real world is due to a *single* causal mechanism. Instead the concrete actualization of events results from the *interaction* of diverse causal tendencies and counter-tendencies. Now, whilst it may be tempting to argue that this interaction itself can serve as the single causal mechanism which necessarily generates the necessary happening, this is invalid because such interactions cannot be attributed to the operation of any single causal mechanism. For they too result from interaction among diverse causal tendencies and counter-tendencies. This opens the route to an infinite explanatory regress into the path-dependent past. To avoid this, events are best studied 'genealogically' (cf. Foucault 1975) in terms of their provenance as *necessary* products of *contingent* interactions among different sets of causal mechanisms. Contingent necessity also implies an unbounded surplus of (unmanageable, often

mutually exclusive) future possibilities, thereby ensuring that the world has an 'open' structure (cf. Luhmann 1979: 6, 13). Note: this section needs further development as, no doubt, dear reader, you have already guessed!

Complexity in the Natural and Social Sciences

Bhaskar develops an anti-positivist naturalism in his approach to the possibility of naturalism. This means that he rejects both the reductionist view that the phenomena of the social world can be reduced to those of the natural world and the scientistic view that there is no difference in the methods of the natural and social sciences. Instead he argues that the natural and social sciences share certain ontological, epistemological, and relational considerations but that there are also significant differences between them due to the importance of meaning in action.

If we reconsider the distinction between the natural and social sciences through the perspective of complexity, however, Bhaskar's argument needs to be redefined. For the operation of all living systems could be said to involve meaning, i.e., the drawing of system-environment boundaries, selective attention to events within the system and its environment, and capacities for selective learning. This suggests that it may be more useful for certain purposes to distinguish two modes of observing natural and social systems rather than between natural and social systems as such. This is also reflected, of course, in the development of cognitive or information approaches to the natural world; and attempts to build a natural science of society alongside interpretive, hermeneutic, and phenomenological approaches to social action.

The two modes of observing complex natural and social systems examine the complexity of operations and the complexity of meaning respectively. In the first case, the scientist seeks to describe and explain the structuring of specific complex systems, i.e., the existence of asymmetrical probabilities that all the logically possible relations among the elements of a system come to be realized. A related question is to explain why certain possible properties of the system rather than others come to be realized in specific circumstances. This mode of observation directs attention towards the selective bias (or limited selective capacity) in the operation(s) of the system under investigation. In this context one could define the structure of a system

characterized by 'organized complexity' as involving the rules governing the selection of possible configurations of its elements. In the second case, the problem concerns the complexity of observation, i.e., the fact that the world is pregnant with many possibilities for action (or inaction). This problem concerns uncertainty about the conclusions to be drawn from actual observations in a situation where one cannot observe everything (Luhmann 1990: 81-2). It follows that:

> 'Meaning always involves focusing attention on one possibility among many. ... There is always a core that is given and taken for granted which is surrounded by references to other possibilities that cannot be pursued at the same time. Meaning, then, is actuality surrounded by possibilities. The structure of meaning is the structure of this difference between actuality and potentiality. Meaning is the link between the actual and the possible; it is not one or the other' (Luhmann 1990: 83).

Thus meaning is a means to cope with complexity under the unavoidable condition of enforced selectivity. I.e., the inability to observe everything in a complex world, let alone to do so contemporaneously and to act on those observations in real time. Since observation takes time, rules tend to evolve for selecting what to select for observation; and, where action is called for, for selecting which causal mechanisms to attempt to activate or, at least, to control, in order to produce specific effects. Here again, then, we encounter the question of enforced selectivity. This also applies to 'observation' of the real world itself. For, since observation occurs in the real world, it is open to (self-)observation. By observing their own observations, observers can reflect on the contingent necessity (situatedness) of their own concepts and categories. Such (self-)observation and (self-)reflection in turn generates the paradox that complexity reduction mechanisms and practices add to the complexity of the real world (cf. Poggi 1979; Luhmann 1983).[7] This is yet another example of the self-potentiation of complexity.

This distinction between two modes of observing complex systems provides one way to resolve the 'structure-agency' problem in the social sciences. For, if the complexity of their operations and their meaning systems can be seen as complementary foci in observing social systems rather than as opposed claims about their essence, one

can relate structure action, action to structure. Structuration theory proposes to do this by bracketing either structure or action and focusing on the other term of the structure-agency duality. The strategic-relational approach (hereafter SRA) provides a means to deal with this duality without resort to bracketing. Thus structures are treated analytically as strategic in their form, content, and operation; and actions are treated analytically as structured, more or less context-sensitive, and structuring. Applying this approach involves examining how a given structure may privilege some actors, some identities, some strategies, some spatial and temporal horizons, some actions over others; and the ways, if any, in which actors (individual and/or collective) take account of this differential privileging through "strategic-context" analysis when choosing a course of action.[8] In other words it involves studying structures in terms of their structurally-inscribed strategic selectivities and actions in terms of (differentially reflexive) structurally-oriented strategic calculation.

This approach can be illustrated from the strategic selectivity of the state. Thus, in analyzing the strategic selectivities of the state as a social relation, its bias as a strategic site of political action must be connected to specific strategies pursued by specific forces (or specific sets of such forces) with specific identities in order to advance specific interests over specific spatial and temporal horizons relative to specific other forces, each advancing their own interests through their own strategies over their own spatial and temporal horizons. Particular forms of state privilege the access of some forces over others, some strategies over others, some interests over others, some spatial and temporal horizons of action over others, and some coalition possibilities over others. This suggests in turn that a change in the self-identity of political forces, the pursuit of different interests, the development of different strategies, the adoption of different spatial and/or temporal horizons of action, or the building of different blocs, strategic alliances, or temporary coalitions could well lead to different outcomes, making it easier or harder to achieve specific objectives in and through a given type of state, a given state form, or a given form of regime. It also suggests that reorganizing the state – its modes of representation, its internal articulation, its modes of intervention, its social bases, the currently dominant state project or mode of political legitimation, or, where relevant, the state's broader hegemonic project for the wider society – will change its strategic selectivities.

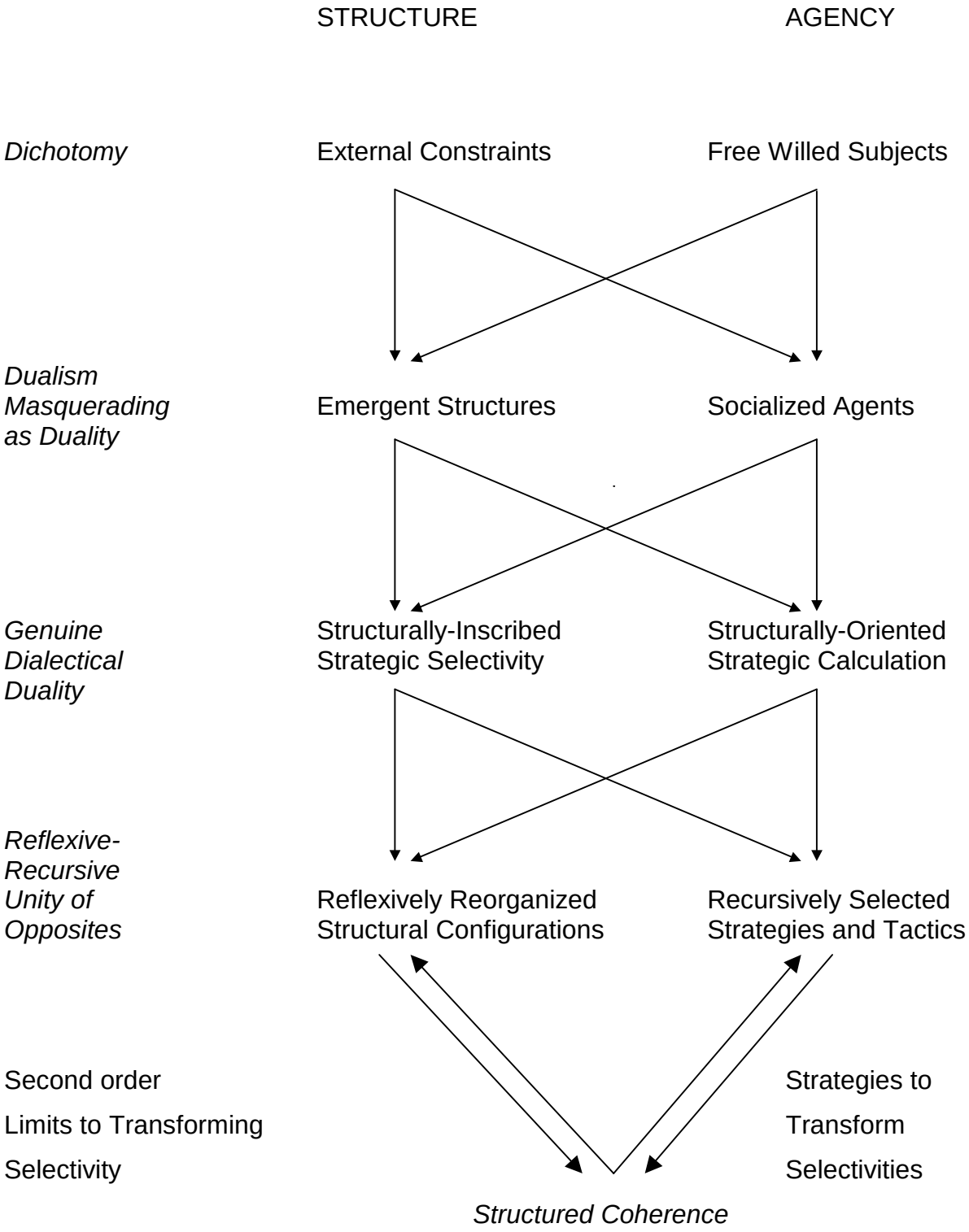

Figure 1: A Strategic-Relational Approach to Structure and Agency

Continuing interaction over time between the reflexive reorganization of the state's strategic selectivities and the recursive selection of specific strategies and tactics oriented to those selectivities can result in a relatively durable degree of 'structured coherence' in the operation of the state and the wider political system (see figure 1). It is this emergent coherence that justifies talking about specific structures of state power and their dynamic (for example, liberal parliamentary states, authoritarian interventionist states, military dictatorships, or dependent developmental states; or, to give another example, male breadwinner and dual breadwinner welfare regimes). It also offers a basis for identifying the weaknesses and strengths of a given type of state, state form, or political regime, their crisis tendencies as well as their capacities to counteract these tendencies, and so on.

This emphasis on selectivity is quite consistent with the notion of complexity. Luhmann expresses this well in the following statement:

> Complexity thus means that every operation is a selection, whether intentional or not, whether controlled or not, whether observed or not. Being an element of a system, an operation cannot avoid bypassing other possibilities. Only because this is the case can we observe an operation selecting a particular course to the exclusion of others. And only because operations can be observed, self-observation becomes possible (be it necessary or not as a requirement of the operation itself). Enforced selectivity is the condition of the possibility for both operation and observation. Further, enforced selectivity is the core problem that defines complexity as a problem for both operations and observations. The latter statement is at the basis of my contention that *meaning is nothing but a way to experience and to handle enforced selectivity*' (Luhmann 1990: 82).

A strategic-relational analysis can be taken further yet if we allow for self-reflection on the part of individual and collective actors about the identities and interests that orient their strategies. Individuals and organizations can be reflexive, can reformulate within limits their own identities, and can engage in strategic calculation about the 'objective' interests that flow from these identities in particular conjunctures. And if we examine how specific structures and structural configurations selectively

reinforce specific forms of action and discourage others. Combining these concerns leads one to study the continuing interaction between the reflexive reorganization of strategic selectivities and the recursive selection and retention (or evolutionary stabilization) of specific strategies and tactics oriented to those selectivities. In some circumstances this interaction can result in a relatively durable degree of “structured coherence” (or stability) in a given institutional complex.

The strategic-relational approach reveals the oversimplifications involved in the structuration approach. For it draws attention to the complexity of social systems by highlighting the connection between descriptive and computational complexity of the selectivity of social structures and the recursiveness of social meaning and action (for definitions, see appendix 1). It does so by highlighting the need to calculate the strategic selectivities of structures for different identities, interests, spatio-temporal horizons, strategies, tactics, and so on, even where the same actor is concerned, let alone for different actors. Conversely, as structures are formulaically, ontologically, and epistemically complex, actors are forced to cope with the complexity of meaning and thus obliged to choose, consciously or unconsciously, how to interpret the world as an horizon of possibilities.

Complexity and Marxism

In this section I suggest three ways in which a Marxism inspired by critical realism can build on the analysis of complexity to further develop Marx's critique of political economy. As such this section is intended to illustrate how these general comments on complexity can be applied to a specific domain of analysis. This does not imply that Marxism is the only entrypoint into the complexities of political economy – although I would argue that its few competitors are to be found in other forms of institutional and evolutionary economics and/or in similar approaches to political ecology. Nor does it imply that there are only three ways in which complexity theory can contribute to the critique of political economy. -- merely that these are three among many possible contributions that I have selected for discussion. These are: (a) ecological dominance as a way of re-interpreting economic determination in the last instance; (b) complexity and globalization, and (c) class politics and class struggle. Each of these can be presented within a strategic-relational approach.

Ecological Dominance

Marxist analysis commonly presupposes the primacy of the relations of production over the forces of production[9] in the mutual development of technologies and the economy. Affirming this does not commit one, however, to the notorious principle of determination in the last instance of the extra-economic by the economic. Indeed, in the last instance, this is a theoretically incoherent notion. For production relations[10] can be regarded as primary only in the economy and not in the wider society. But one could defend such a principle of determination if it were couched in systems-theoretical terms, i.e., in terms of the economy's 'ecological dominance' vis-à-vis other systems in its environment.

The idea of ecological dominance emerged in work on plant and animal ecosystems, where it refers to the capacity of one species to exert an overriding influence on others in a given ecological community. Here I suggest that this idea can be usefully extended to social systems once allowance is made for their specificities as communicatively- or discursively-mediated systems and for the capacity of social forces to reflect and learn about their own evolution and engage in attempts (successful or not) to guide it. Thus one could study social systems as bounded ecological orders formed by the co-presence of operationally autonomous systems and the lifeworld – with the structural coupling and co-evolution of these systems and the lifeworld mediated by various competitive, co-operative, and exploitative mechanisms. Ecological dominance would then refer to the capacity of a given system in a self-organising ecology of self-organising systems to imprint its developmental logic on other systems' operations through structural coupling, strategic co-ordination, and blind co-evolution to a greater extent than the latter can impose their respective logics on that system.

Such ecological dominance is always a relative, relational, and contingent feature of operationally autonomous systems. Thus a given system can be more or less ecologically dominant, its dominance will vary in relation to other systems and spheres of the lifeworld, and it will depend on the overall development of the ecosystem as a whole. It follows that there is no 'last instance' in relations of

ecological dominance. Instead it is a contingently necessary rather than a naturally necessary aspect of a given operationally autonomous system. In other words, we are dealing with an ecological relation wherein some systems may be dominant, but not where one dominates (Morin 1980: 44). Later I propose that the economy is the ecologically dominant system in contemporary societies (especially in its globalizing form) but I first elaborate the general concept.

Luhmann suggested that the functional sub-system that attains the highest degree of organized complexity and flexibility will tend to dominate the wider societal system in which it is located. For its dynamic will then have a greater influence on the performance of other sub-systems than they do on it (Luhmann 1974, 1981). This can be taken further in regulationist terms by identifying five analytically distinct, but empirically interrelated, aspects[11] of an operationally autonomous system that affect its potential for dominance. These are: (1) the extent of its internal structural and operational complexity and associated in-built redundancies, i.e., alternative ways of operating and communicating information, and the resulting degrees of freedom this gives it in how a given outcome may be achieved; (2) its ability to continue operating, if necessary through spontaneous, adaptive self-reorganization, in a wide range of circumstances and in the face of more or less serious perturbations; (3) its capacities to distantiate and compress its operations in time and space in order to exploit the widest possible range of opportunities for expanded self-reproduction; (4) its capacity to resolve or manage its internal contradictions, paradoxes, and dilemmas, to displace them into its environment, or defer them into the future; and (5) its capacity to get actors in other systems and the lifeworld to identify its own operations as central to the reproduction of the wider system of which it is merely a part – and thus to subordinate their own operations to their understanding of its particular reproduction requirements. These aspects can be decomposed into many, more specific features attributable to complex, operationally autonomous systems and there have been many suggestions regarding the best criteria for identifying and operationalizing them (see, for example, Ashby 1958; Bendor 1985; Cilliers 1998; Grabher 1994; Luhmann 1986; Morin 1980; Thompson 1994; Willke 1996).

Overall, where one system has superior capacities in these respects than the other systems in its environment, it will tend to be ecologically dominant. This does not

exclude reciprocal influences on the ecologically dominant system. Nor does it exclude resistances to such dominance or attempts to brake or guide it through various forms of strategic co-ordination and meta-governance (see below). Indeed, one of the distinctive features of social systems is their capacity to engage in self-reflexive attempts to alter their environments, to guide their (co-)evolution, and even to change the forms in which (co-)evolution occurs (cf. Willke 1996: 48-51).

Ecological dominance is an emergent relationship between systems rather than a pre-given property of a single system and, as such, it depends on specific structural and conjunctural conditions. First of all, it presupposes the operational autonomy of the ecologically dominant system vis-à-vis other systems. This in turn presupposes clear boundaries between organizations or other social forces and/or a high degree of functional differentiation in macro-social formations. Pre-capitalist economies could not have been ecologically dominant, for example, because they were deeply embedded in wider social relations and lacked an autonomous operational logic.[12] Only with the generalization of the commodity form to labour-power does the capitalist economy acquire a sufficient degree of operational autonomy. But even when capitalism has gained its distinctive self-valorising dynamic, ecological dominance is one of its contingent and historically variable features rather than one of its generic, naturally necessary properties. For it depends on the specific qualities of particular accumulation regimes and modes of regulation, the general nature of the other systems in its environment, and specific conjunctural features.

We should note here the considerable historical and conjunctural variability in the structural and operational complexity and equifinality of capitalist economies; in their capacity for self-reorganization; in their power to stretch and compress economic relations in time and space; in their ability to handle contradictions, paradoxes, and dilemmas; and their capacities to secure support for the primacy of accumulation over other principles of societalization. And we should note, conversely, that other systems vary in their capacity to limit or resist the commodification of social relations and to contain the scope of different economic processes within specific territorial boundaries. Indeed the ecological dominance of capitalism would seem closely related to the extent to which its degrees of freedom, opportunities for self-reorganization, scope for time-space distantiation and compression, externalization

of problems, and hegemonic capacities can be freed from confinement within limited ecological spaces policed by another system (such as a political system segmented along Westphalian lines into mutually exclusive sovereign territories). This is where globalization, especially in its neo-liberal form, becomes significant for the relative ecological dominance of the capitalist economic system.

Moreover, even when the conditions do exist for the capitalist economy to become ecologically dominant in the long-term, crises elsewhere could well lead to other systems acquiring short-term primacy. This is inherent in the fact that no subsystem represents, or can substitute for, the whole. For, as noted above, each autopoietic system is both operationally autonomous and substantively interdependent with other systems. It follows that even an ecologically dominant system depends on the performance of other systems and that primacy may even shift to a system that is normally non-dominant in specific conjunctures. This would happen to the extent that solving crises affecting them and/or solving more general crises that require their distinctive contributions becomes the most pressing problem for the successful reproduction of all systems – including the capitalist economy. For example, during major international or civil wars or preparations for such events, national states may seek to subordinate economic activities to politico-military requirements. This can be seen in both World Wars in the twentieth century and in the activities of national security states during the Cold War. After such states of emergency (note the term), however, considerations of accumulation are likely to re-assert themselves. This does not exclude, of course, path-dependent traces of such exceptional conditions within the normally dominant system (e.g., the distinctive features of peacetime war economies or the legacies of total war on post-war economic trajectories). But the ecologically dominant system will still have a larger impact on other systems' development in the multilateral process of structural coupling and co-evolution than these other systems do on it.

In general terms, one could argue that the economic system is internally complex and flexible because of the decentralized, anarchic nature of market forces and the role of the price mechanism both as a stimulus to learning and as a flexible means of allocating capital to different economic activities. More specifically, as capitalism develops, different organizations, institutions, and apparatuses tend to emerge to

express different moments of its contradictions, paradoxes, and dilemmas and these then interact in an unstable equilibrium to compensate for market failures. Capital also develops its capacity to extend its operations in time and space (time-space distantiation) and to compress its operations, making it easier to follow its own logic in response to perturbations (time-space compression). Through these and other mechanisms it develops the capacity to escape the structural constraints and control attempts of other systems. This can occur through its own internal operations in time (discounting, insurance, risk management, futures, etc.) or space (capital flight, relocation, extra-territoriality, etc.) or through attempts to subvert these systems through personal corruption or colonization by the commodity form. This is truer of the exchange-value moment of the capital relation with its capacity to flow through time and space – and less true of capital considered in its substantive aspects. For capital in its substantive aspects is itself always already strongly overdetermined by its embedding in other social orders and its coupling to other systems (see below). In addition to its greater complexity and flexibility, the capitalist economy has a greater capacity for perturbing other subsystems and also makes greater demands on their performance as preconditions of its own reproduction.

Globalization and Complexity

Globalization powerfully reinforces this always-tendential ecological dominance of the capital relation in at least five interrelated ways. Before specifying these, however, we should note that globalization is not a single causal process but is itself the complex, emergent product of many different forces operating on various scales. The first aspect is that globalization is associated with an increasing complexity of the circuits of capital and an increasing flexibility in its response to perturbations. Second, globalization enhances capital's capacity to defer and displace its internal contradictions, if not to resolve them, by increasing the scope of its operations on a global scale, by enabling it to deepen spatial and scalar divisions of labour, and by creating more opportunities for moving up, down, and across scales. These enhanced capacities are associated with a marked reinforcement of uneven development as the search continues for new spatio-temporal fixes within which to provisionally displace and defer its contradictions. This search is closely related to time-space distantiation and time-space compression. Third, it reinforces the

emancipation of the exchange-value moment of capital from extra-economic and spatio-temporal limitations. This extends the scope for capital's self-valorization dynamic to develop in a one-sided manner at the expense of other systems and the lifeworld. Fourth, it magnifies capital's capacity to escape the control of other systems and to follow its own procedures in deciding how to react to perturbations. This is particularly associated with its increased capacity for discounting events, its increased capacity for time-space compression, its resort to complex derivative trading to manage risk, and its capacities to jump scale. Fifth, it weakens the capacity of national states to confine capital's growth dynamic within a framework of national security (as reflected in the 'national security state'), of national welfare (as reflected in social democratic welfare states), or some other national matrix.

The tendential ecological dominance of the capitalist economy does not mean that its influence on other systems and the lifeworld is unilateral and uniform. It is, on the contrary, asymmetrical and variable. The political system, which is currently materialized above all in the institutional architectures of national states and international relations and linked to the lifeworld through public opinion, also has important reciprocal influences on the development of the capitalist economy. Indeed it poses the biggest challenge to the latter's ecological dominance. For, whilst the state system is responsible for securing certain key conditions for the valorization of capital and the social reproduction of labour power as a fictitious commodity, it also has overall political responsibility for maintaining social cohesion in a socially divided, pluralistic social formation. The always-problematic relationship between these functions generates risks and uncertainties for capital accumulation as does state failure in either regard. This is why there is typically a strong structural coupling and co-evolution between the economic and the political in accumulation regimes and their modes of regulation. It is also why struggles over political power are so crucial to the reproduction-régulation of capital accumulation and why the state is so central to securing the spatio-temporal fixes in and through which relatively stable accumulation becomes possible. And it is why globalization, especially in its neo-liberal form, represents such a challenge to the actually existing institutional architecture of the political system. For it tends to weaken the typical form of the national state in advanced capitalist societies as this developed during the period of

Atlantic Fordism and to disrupt the spatio-temporal fixes around which both accumulation and the state were organized.

Other systems are typically less likely to attain the relative ecological dominance of the political system, let alone that of a globalizing economy, as they depend more on the performances of the political and economic systems than the latter do on them. Nonetheless, even though the relations between operationally autonomous but substantively interdependent systems may be more or less strongly asymmetrical, there will always be structural coupling and co-evolution among them. This can be explained through the usual trio of evolutionary mechanisms: variation, selection, and retention (Campbell 1969). Variation in activities in each system will prove more or less perturbing to the self-organization of other systems. Thus, where operationally autonomous but interdependent systems share the same social space, their development tends to become structurally coupled through mutual adaptation to the changes in their environment generated by the operations of the other systems – adaptations which are governed by each system's own operational code or organizational logic. If a particular pattern of interaction reveals a damaging incongruence in *mutual* expectations, it will either be suspended or expectations will be varied. Those variations will get co-selected that least interfere with the distinctive autopoiesis of the different interacting systems and they will then be co-retained as these selections become suitably sedimented in the programmes, organizational intelligence, strategic capacities and moral economies of the various co-existing systems. Although attempts are often made to co-ordinate or steer co-evolution in social systems, no consensus is needed for this sedimentation to occur. Indeed, it would be impossible to guide such a complex process – any attempts at design are always located within broader processes of blind co-evolution. All that is necessary for such sedimentation to occur is a long-run congruence between individual system autopoiesis and inter-systemic interaction.

Class Politics

This section is still to be written. Its essential argument is that class struggle is a complex phenomenon, that there can be no one-to-one correlation between one's position in class relations, class identity, class interests, and class politics. There is a

complex series of mediations between these aspects of class struggle (competition, cooperation, etc.) that are intelligible only in and through a strategic-relational analysis that also pays attention to questions of identify formation, narrativity, learning, reflexiveness, and recursivity. The analysis is illustrated through a critical account of Marx's well-known text on *The Eighteenth Brumaire of Louis Bonaparte*. In this text Marx reveals the interrelated problems of formulaic, ontological, and epistemic complexity involved in the analysis of class politics as well as the path-dependent and discursively-mediated nature of political representation.

Conclusions

Nigel Thrift has remarked that '[c]omplexity theory is ... a scientific amalgam. It is an accretion of ideas, a rhetorical hybrid. ... the chief impulse behind complexity theory is an anti-reductionist one, representing a shift towards understanding the properties of interaction of systems as more than the sum of their parts. This is, then, the idea of a science of holistic *emergent* order; a science of qualities as much as of quantities, a science of "the potential for emergent order in complex and unpredictable phenomena" (Goodwin, 1997: 112), a more open science which asserts "the primacy of processes over events, of relationships over entities and of development over structure" (Ingol, 1990: 209)' (Thrift 1999: 33). I have no quarrel with Thrift's remarks but it does hint that complexity theory risks becoming 'chaotic' insofar as it is an eclectic amalgam of ideas and metaphors. It follows that we need to develop not only a more rigorous account of complexity in general terms but also to explore the specificities of different complex systems and the specificities of paradigms for identifying/observing complexity. This situation is analogous to that in critical realism, where we need to distinguish between critical realism in general and its application to specific fields of inquiry. For, on the one hand, it is one thing to provide a general transcendental justification of the superiority of critical realism as a general account of the nature of the world and the conditions of its scientific investigation; it is quite another to justify a particular ontology, epistemology, and methodology within a general critical realist framework and show its superiority to other particular critical realisms. In this sense one is tempted to paraphrase Marx to the effect that there is no such thing as critical realism in general, only particular versions of critical realism and the totality of critical realisms. One could also argue

that there is no such thing as complexity in general, only particular modes of complexity and the totality of complexities.

This paper has made some preliminary remarks on problems posed by complexity in the natural and social world(s) and to relate them to critical realism. These remarks on complexity were then supplemented by reflections on the dialectic between the complexity of operations and the complexity of meaning and its implications for the structure-agency problem in the social sciences. In particular I have argued that ontological complexity enforces selection on natural and social systems and that one way to interpret such systems is in terms of how selections are selected. This leads to a concern with the selectivity of systems and the reflexivity of agents. It also raises the issue of the dialectic between the complexity of the real world and the manner in which the real world comes to be interpreted as complex. This has encouraged some commentators to suggest that complexity is a property of relationship between a system and its observer, not an inherent property of any system itself (e.g., Fioretti 1998: 288). Whilst sympathetic to this suggestion (especially its corollary that, when distinguishing a system from its environment, observers may choose to identify it as more or less simple or complex), it does seem to tend towards a simple constructivist view that ignores the need for at least the minimal degree of requisite complexity to facilitate the purposes in hand (cf. my comments on the adequacy of explanations or the notion of 'reasonable approximation'). The final steps in the paper involved me in applying some of these ideas to the complexities of the Marxist critique of political economy and, especially, to the complexities introduced by globalization and their implications for the ecological dominance of the capital relation.

DISPLAY 1.1
Modes of Complexity

Epistemic Modes

Formulaic Complexity

1. *Descriptive Complexity:* Length of the account that must be given to provide an adequate description of the system at issue.
2. *Generative Complexity:* Length of the set of instructions that must be given to provide a recipe for producing the system at issue.
3. *Computational Complexity:* Amount of time and effort involved in resolving a problem.

Ontological Modes

Compositional Complexity

1. *Constitutional Complexity:* Number of constituent elements or components (Compare, for example, tricycles, automobiles and jet aircraft.)
2. *Taxonomical Complexity (Heterogeneity)*: Variety of constituent elements: number of different *kinds* of components, in their physical configurations. (Consider again the preceding example, or compare the domain of physical elements which come in some 100-plus types with that of insects of which there are many thousands of species.)

Structural Complexity

3. *Organizational Complexity*: Variety of different possible ways of arranging components in different modes of interrelationship. (Compare jigsaw puzzles with their two-dimensional arrangements with LEGO bricks with their three-dimensional modes of assembly.)
4. *Hierarchical Complexity*: Elaborateness of subordination relationships in the modes of inclusion and subsumption. Organizational disaggregation into sub-systems. (For example: particles, atoms, molecules, macrolevel physical objects, stars and planets, galaxies, galactic clusters, etc.; or again, molecules, cells, organs, organisms, colonies, etc.). Here the higher-order units are, for this very reason, always more complex than the lower-order ones.

Functional Complexity

5. *Operational Complexity*: Variety of modes of operation or types of functioning. (Primates have a more complex lifestyle than moluscs. The processual structure of chess is vastly more elaborate than that of checkers.)
6. *Nomic Complexity*: Elaborateness and intricacy of the laws governing the phenomena at issue. (Steam engines are more complex in this manner than pulleys.)

Source: N. Rescher, Complexity: A Philosophical Overview, 1998: p. 9

Endnotes

[1] William of Occam's razor was formulated as follows: 'Pluralitas non est ponenda sine necessitate. Frustra fit per plura quod potest fieri per paucoria' (see Gibbs and Hiroshi 1997).

[2] The common feature of transcendental arguments is that they seek to respond to scepticism about the existence of a given phenomenon by showing that the phenomenon in question is a precondition for the scepticism to make sense. Transcendental arguments in Kantian tradition usually start with a supposition about our thoughts (e.g., we have thoughts of a particular kind) and then consider the necessary preconditions for having such thoughts, the necessary preconditions for these preconditions, etc.. The circle of argument is closed if these preconditions are shown to involve existence of what sceptic claims to doubt exists. Thus scepticism is seen to be meaningless or false. Strictly speaking, my argument is not an alternative transcendental argument but an alternative to a transcendental argument. Bhaskar's transcendental argument could be called into aid to supplement the more general argument presented here.

[3] Descriptive complexity, as defined by Rescher, is one of three forms of epistemic or formulaic complexity (see appendix 1).

[4] For example: 'the preceding considerations show that real things always have more experientially manifestable properties than they can ever actually manifest in experience. … All real things are necessarily thought of as having hidden depths that extend beyond the limits, not only of experience, but also of experientiability' (Rescher 1998: 39).

[5] 'Micro-macro' is a relative rather than absolute distinction. Thus the meaning of the 'microscopic' will therefore change with context.

[6] This distinction derives from Georg Simmel; it is not the same as the distinction between the natural sciences (*Naturwissenschaften*) and the cultural sciences (*Geisteswissenschaften*).

[7] Thus 'the reduction of complexity through the formation of ever more numerous, differentiated, and sophisticated systems [is] a phenomenon which necessarily generates ever new complexity, and thus feeds upon itself' (Poggi 1979: xii).

[8] On strategic context analysis, see Stone (1994).

[9] The forces of production include social skills and forms of social organization as well as technical means of production (tools, machines, informatics).

[10] Relations of production must be understood here as 'social relations of economic production'. It is always possible to extend this notion to equivalent relations in other fields of social practice (political, military, legal, etc.) but this deprives the notion of economic determination of any meaning since relations of production then become a feature of all social practices and they lose any specificity.

[11] Only the first two aspects are explicitly theorized in autopoietic systems theory; the others derive from more general work on complexity and chaos theories.

[12] Cf. Polanyi's contrast between an 'instituted economy' embedded in wider social relations and a 'market economy' structurally coupled to a market society (1957).

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