Philosophy Today
Volume 68, Issue 2 (Spring 2024): 263–288
DOI: 10.5840/philtoday202444524

A Systems Theoretic View of Speculative Realism

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ABSTRACT: Recent developments in Continental philosophy have included the emergence of a school of "speculative realism," which rejects the human-centered orientation that has long dominated Continental thought. Proponents of speculative realism differ on several issues, but many agree on the need for an object-oriented ontology. Some speculative realists identify realism with materialism, while others accord equal reality to objects that are non-material, even fictional. Several thinkers retain a focus on difference, a well-established theme in Continental thought. This paper looks at speculative realism from the perspective of systems theory. Many of the tenets of speculative realism have long been features of systems metaphysics and are expressed clearly in a systems framework. However, some views of some speculative realists differ substantially from systems theoretic ideas.

KEY WORDS: speculative realism, realism, Continental philosophy, systems theory, systems metaphysics, metaphysics, ontology, object-oriented ontology, difference

A. INTRODUCTION

A.1. Speculative Realism and Systems Metaphysics

A school of thought under the name "speculative realism" has emerged in Continental philosophy, which explicitly rejects the latter's long-dominant anti-realism. Characterizing this development, Bryant, Srnicek, and Harman (2010b: 3) describe the classic works in the Continental tradition as follows: "Humanity remains at the centre of these works, and reality appears in philosophy only as the correlate of human thought. In this respect phenomenology, structuralism, post-structuralism, deconstruction, and postmodernism have all been perfect exemplars of the anti-realist trend in continental philosophy." Bryant, Srnicek, and Harman (2010b: 3) then contrast this classic orientation with

 ISSN 0031-8256

the views of speculative realists who, while they do not all agree on many issues, "all of them, in one way or another, have begun speculating once more about the nature of reality independently of thought and of humanity more generally."

One might call the prevailing anti-realist orientation of Continental philosophy "human-centered"[1] as opposed to the "world-centered"[2] orientation that typifies science, and in these terms speculative realism embraces a "world-centered" orientation.[3] Another way of expressing the relation between human- and world-centeredness is to say that it roughly maps onto the relation between epistemology and ontology. World-centered realism privileges ontology. Human-centered anti-realism privileges epistemology. While one cannot completely separate ontology from epistemology—as Brassier (2010: 49) notes, "just as epistemology without metaphysics is empty, metaphysics without epistemology is blind"—one of the components of this ontology-epistemology dyad[4] is usually favored and dictates the character of the other. A world-centered ontology calls for an appropriate epistemology;[5] correspondingly, a human-centered epistemology requires or implies some appropriate ontology.

Speculative realists often characterize the dominant position of Continental philosophy as oriented towards the "correlation" of subject and object, but the symmetry implied by the word "correlation" is misleading. The focus in this correlation is on the subject, on human access to reality, i.e., on epistemology. As Bryant (2010: 262) points out, "where, for Aristotle, metaphysics was first philosophy, for us Moderns and Post-Moderns, epistemology has become first philosophy." This privileging of epistemology over ontology is plain in Kant's view that the thing-in-itself, the noumenon, is inaccessible, that all we have access to is the thing-for-us, the phenomenon. Kant's thought thus did not really reflect a "Copernican turn," but its opposite; it was, as Hallward (2010: 135, italics added) notes, "a *Ptolemaic* attempt" to shut the door to the "great outdoors," i.e., to world-centeredness, Ptolemaic in that everything once again revolves around us. Padui (2011: 90) expresses this criticism more forcefully: "However, while Kant claims his fidelity to the Copernican decentering of thought, the actual outcome of the *Critique of Pure Reason* is ultimately a betrayal of such a Copernican turn. . . . There is something essentially reactive in the transcendental turn, a counter-revolutionary and ultimately conservative re-centering of human thought at the very moment when thought is able to relate to a de-sacralized and demystified world."

The binaries of realism and anti-realism, world- and human-centeredness, and ontology and epistemology are not equivalent, but they are similar. A binary that is not necessarily similar to these is materialism versus idealism. Speculative realists differ on the relation of realism to materialism, and several authors in the Bryant, Srnicek, and Harman (2010a) book address this issue. For example, Harman (2010: 40) advocates "realism without materialism," while Brown (2010) connects speculative realism to Marxist theory and at least implicitly with its materialism.

This paper argues that speculative realism is aligned with the metaphysics of one research program within science, namely systems theory. But at least two difficulties make this argument not straightforward. First, while speculative realists are roughly united in what they oppose, there is no single vision that they all affirm. Second, systems theory also encompasses a variety of points of view.

In this paper, I address these two multiplicities in different ways. I am a systems theorist myself, so I propose to solve the problem of the multiplicity of views in the systems literature by presenting a single view, namely my own (Zwick 2023a), though I will also acknowledge some differing views of other systems theorists. I will address the diversity of views among speculative realists by selecting a coherent set of ideas from different speculative realists guided by my systems theoretic perspective. What follows is thus one systems theorist's interpretation, synthesis, and reconstruction of speculative realism. Or, since constraints on the length of this paper necessarily limit what it can encompass, it is perhaps more accurate to say that what follows is one systems theorist's *impression* of speculative realism.

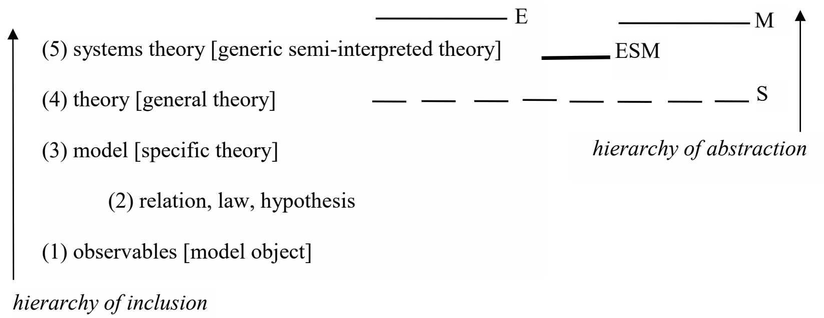
In selecting ideas of speculative realists that have some clear relation to basic systems theory ideas, I emphasize points of similarity, but also note points of difference. I draw heavily on Bryant, Srnicek, and Harman (2010a), which includes articles by many philosophers associated with this school of thought and thus is representative of it. And, for a clear argument that associates Deleuze with this school of thought, I also draw on Kleinherenbrink (2020).

A.2. Systems Theory: Ontology or Epistemology

I regard systems theory as a project within science and thus aligned with world-centered realism. More specifically my conception of systems theory draws heavily on the work of the philosopher of science Mario Bunge (1973), who characterized the systems project as an attempt to construct an "exact and scientific metaphysics" (an ESM), where "metaphysics" means a system of general ideas that constitute a realist ontology, "exact" means expressed mathematically at least as an ultimate goal, and "scientific" means drawing upon and contributing to theories in the sciences. Bunge views the systems project as aiming at ontology, but explains the notion of an exact and scientific metaphysics with the epistemological hierarchy summarized on the left of Table 1 (next page). The table shows this hierarchy fused with a second hierarchy on the right that depicts von Bertalanffy's (1979) view of systems theory as intermediate in abstraction between mathematics and philosophy (E and M) and scientific theories (S).

Level (5) in Bunge's hierarchy, i.e., systems theory, is ESM. Above level (5), at the highest level of abstraction, E refers to mathematics, which confers exactness on ESM, and M refers to philosophy, specifically metaphysics, which confers generality on ESM. Level (4) is aligned with S, whose multiple lines represent multiple theories in the sciences that systems theory draws upon and to which it contributes.

Table 1 Epistemological Hierarchy
Bunge's terms on the left are in brackets; these terms do not include (2), which is why it is indented. On the right is von Bertalanffy's (1979) conception of systems theory.



ESM should in principle also be shown as multiple lines, since systems theory in the singular does not actually exist, but systems theories in the plural abound; for example, network theory, information theory, automata theory, nonlinear dynamics, feedback control theory, game theory, etc. Calling something a "systems theory" here doesn't necessarily imply that the theory was developed by systems theorists, but rather that it has transdisciplinary applicability. For example, thermodynamics, a theory in physics, is fundamental to systems ontology, so I call it a "systems theory."

A model at level (3), which Bunge calls a "specific theory," is a linked set of relations at level (2) that apply a (general) theory at level (4) to an empirical domain at level (1). For example, a model of the solar system is the application of the theory of Newtonian mechanics to relations that describe the observed motions of the planets and their satellites. Kepler discovered a few of these relations empirically but they were only understood when they became derivable from Newton's theory. The definition of a model as a linked set of relations is precisely the classic definition of a system (Hall and Fagen 1956). Those systems theorists who prefer a human-centered orientation adopt the epistemological interpretation of "system" as model. Alternatively, "system" can be given an ontological interpretation as the reality referred to by the model. There is an actual solar system independent of human thought. Models of the solar system represent this actual system only approximately. For example, a Newtonian model of the solar system considers gravity but ignores electromagnetism; a more accurate and complete model would include both.

My own view is to regard the notion of "system" as ontological, but the view that "system" should be understood epistemologically to mean "model" has been held by a number of systems theorists. Lendaris (1986), for example, regarded "system" as being in the eye of the beholder. Another systems theorist, Klir (1985), was also committed to constructivism and saw his own work as epistemology and methodology. Ashby (1956: 98–101) clarified and lent support to the human-centered perspective by demonstrating that two isomorphic descriptions of the same system can have qualitatively different properties. The sociological systems theorist Niklas Luhmann also advocated a version of constructivism (Buchinger 2012). The "second order cybernetics" of von Foerster (1984) and others was an attempt to fuse the world- and human-centered orientations by encompassing both the system being observed and the observer in a single model.

B. Some Core Ideas of Various Speculative Realists

The following is a summary, guided by my own understanding of systems theoretic ideas (Zwick 2023a), of some core tenets held by many speculative realists.

B.1. Object

Many speculative realists advocate an "object-oriented ontology," where objects are entities, things, beings. Deleuze, regarded by Kleinherenbrink (2020: 9) as "both a forerunner and a high point of what is called speculative realism, and more specifically of its 'object-oriented' branch," calls them "assemblages" or "machines." This orientation toward objects rejects prevailing attitudes in Continental philosophy, which were critical of earlier philosophical positions in which the notion of "object" played an important role. As Harman (2010: 22) observes, "it is fascinating to note that almost every available 'radical' option in philosophy has targeted objects as what most need to be eliminated." But in this new philosophical school of speculative realism, the pendulum has swung back towards objects.

Objects join together to produce new objects. Kleinherenbrink (2020: 19) writes, "as Deleuze argues, each newly forged relation is itself immediately an irreducible machine." The constituents of objects are likewise objects. Kleinherenbrink (2020: 118) notes, "it is important to note that the 'heterogeneous elements' constituting machines are simply more machines."

For some speculative realists, objects are necessarily material. Other speculative realists, however, are more ecumenical. Latour is a prominent example.[6] Bryant (2010: 270) also writes, "nonetheless, while I have the greatest admiration for DeLanda's ontology, his individuals seem restricted to the world of nature. Insofar as the Ontic Principle dictates that whatever makes a difference is, it follows that the domain of being must be far broader than natural beings, including signs, fictions, armies, corporations, nations, etc. Natural beings make up only a subset of being."

B.2. Difference

Difference plays an important role in object-oriented ontology. It is also central to Deleuze's (1994) notion of being. Bryant (2010: 263) states this role directly:

"The claim is that 'to be' is to make or produce a difference." There are differences among differences. Bryant (2010: 269) notes that "differences can, of course, be of an inter- or intra-ontic sort. A difference is inter-ontic when it consists in making a difference with respect to another object. A difference is intra-ontic, by contrast, when it pertains to the processes belonging to the internal constitution or essence of the object as a system of ongoing differences."

The difference that has long been of primary concern in Continental philosophy is the subject-object difference. About the focus on subject-object relations and the ignoring of object-object relations, Bryant (2010: 277) writes, "to mark this problem I draw a term from political theory, referring to this unilateralization of translation as the Hegemonic Fallacy. . . . The Hegemonic Fallacy thus consists in treating one difference as being the only difference that makes a difference or as treating one difference as overdetermining all other differences." Privileging the subject-object difference is wrong not only because it downplays other differences, but also because of the priority given to the subject. Despite phenomenological protestations of "to the things themselves," correlationism is really epistemology.

B.3. Irreduction

The irreducibility of objects has at least two aspects: multiplicity of type and equal reality of levels. Different types of objects are irreducible to a single type, and objects at different scales are irreducible to lower level constituents.

Multiplicity of type is asserted in an extreme way by Latour. Bryant, Srnicek, and Harman (2010b: 5) write, "against all forms of reduction to physical objects, cultural structures, systems of power, texts, discourses, or phenomena in consciousness, Latour argues for an 'irreductionism' in which all entities are equally real (though not equally strong) insofar as they act on other entities. While non-human actors such as germs, weather patterns, atoms, and mountains obviously relate to the world around them, the same is true of Harry Potter, the Virgin Mary, democracies, and hallucinations."[7]

As for the equal reality of levels, Bryant (2010: 269) writes, "with DeLanda we affirm the thesis that being is composed of nothing but singular individuals, existing at different levels of scale but nonetheless equally having the status of being real." This non-reductionist or "flat" ontology is an important theme in speculative realism. Shaviro (2010: 281) concurs and writes that "from the viewpoint of causal efficacy all actual entities in the universe stand on the same ontological footing." This rejects the ontic fundamentalism that regards only a bottom level of substance as "real," in part because this bottom level is ever receding. As Harman (2005: 85) notes, "we never reach some final layer of tiny components that explains everything else, but enter instead into an infinite regress of parts and wholes." Another reason to reject such fundamentalism is that an ontology very distant from phenomena of interest cannot ground or be joined to any useful epistemology. In addition, the details of micro-reality are sometimes not essential to macro-reality, a principle that physicists call "universality." Lastly, some phenomena can be instantiated in multiple material ways.

B.4. Relation

For Deleuze relations are external to objects (Kleinherenbrink 2020). This means (i) that involvement of an object's qualities in particular relations is not obligatory and (ii) that the qualities can be distinguished from the unity that binds them together. The relations referred to here are external in two senses: (a) they are exterior, and (b) they are also extrinsic (contingent) and not intrinsic (necessary) to objects and their qualities.

While objects are said to enter into relations with other objects, notions of "object" and "relation," according to Harman, are not actually distinct. Harman (2005: 85) writes that "when two objects enter into a genuine relation . . . through their mere relation, they create something that has not existed before, and which is truly one," and this newly created something is an object. Shaviro (2010: 285), discussing the relation of Harman's views to those of Whitehead, also observes that for Harman "any relation must count as a substance in its own right (a stipulation which, as Harman admits, could just as easily be inverted)."

B.5. Internal Dimension

Harman (2010: 37) writes, "nothing boils down to its relations." Objects are not solely defined in terms of their differences from or their relations with other objects or differences in the qualities that enter into these relations. This is a mild version of the more extreme position held by some speculative realists that defining an object in terms of its (external) relations alone is ultimately empty because the objects to which it is related are defined in the same way, leading to an infinite regress. This extreme position is expressed by Bryant (2010: 271), who writes, "for if every object is its relation to other objects, and if the other objects are, in their turn, their relations to other objects, there turns out to be nothing to relate." Some speculative realists, e.g., Harman (2005), commented on by Bryant (2010: 272), attempt to rectify this ontological insufficiency by positing an internal dimension to objects that is distinct from their external manifestations. Something internal is "withheld" or "held in reserve" from external relations with other objects.

The idea of an internal domain withheld from external relations calls to mind Kant's distinction between phenomena and noumena, which establishes epistemological limits for the human subject. For speculative realists, however, the human subject has no special status. Limits apply also to object-object relations, and these limits are ontological, not epistemological: no object, interacting with another object, encounters the full reality of the other object. As Bryant (2010:

276) writes, "thus when Kant tells us that objects conform to the mind, not the mind to objects, that we can never know things as they are in-themselves, he is absolutely correct with this one qualification: what Kant says of mind-world relations is not unique to mind, but is true of all object-object relations." That an interior dimension of objects is withheld from mind-world relations is the concern of epistemology; that an interior dimension of objects is similarly withheld from object-object relations is the concern of ontology.

B.6. Unity

Entities have intrinsic unity and thus are discrete. As interpreted in Kleinherenbrink (2020), in Deleuze's fourfold ontology of "machines" (plausibly understood as a synonym for "objects"),[8] the external aspect of an object is a twofold, one term of which is unity and the other multiplicity. The internal aspect of an object is also a twofold, a unity and a multiplicity. This is diagrammed in Figure 1. The external twofold is "actual" and relational; the interior twofold is "virtual" and non-relational. Deleuze calls the internal unity a "body without organs" and characterizes it as indivisible, nondecomposable, and unproductive (Kleinherenbrink 2020: 89, citing Deleuze and Guattari 2013: 106). The external unity carries the multiplicity of qualities; the internal unity separates this entity from other entities and assures its individuality.

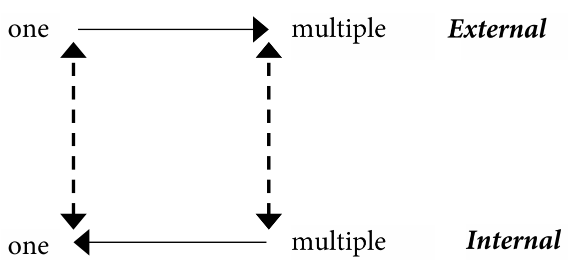


Figure 1: The Fourfold of Deleuze (From Kleinherenbrink 2020: 39)

Unity is also posited by Harman (2005: 85) in his observation quoted above that "when two objects enter into a genuine relation . . . through their mere relation, they create something that has not existed before, and which is truly one."

C. Similar—or Different—Core Notions of Systems Theory

Many core ideas of speculative realism are well established in systems thought. What follows are systems theoretic interpretations or analogues of some of these core ideas, but also some disagreements with these ideas.

C.1. System

Systems ontology centers in the notion of "system," which usually means entity or object, so this world-centered conception of "system" is in accord with the object-oriented ontology of many speculative realists. (The word "system" can also mean process or event,[9] but elaborating on this alternative interpretation is outside the scope of this paper.) The most common definition of a "system" is a set of elements and a set of relations that organize the elements (Hall and Fagen 1956). This is diagrammed below in Figure 2. Figure 2(a) shows a system as a graph: elements A, B, and C are nodes, and relations AB and BC are links between nodes. In section C.4, "Function," below, "attributes"—a systems theoretic term for "qualities," "affects," or "powers"—are added to "elements" and "relations" to expand this definition. "Element" (node) can be interpreted ontologically as object. "Relation" can be left undefined as just a link connecting two or more elements; in this case, a system is a graph or hypergraph.[10] Or, a relation can be defined in various ways. Most simply, it is interpreted as a constraint, defined either set-theoretically or information-theoretically.[11]

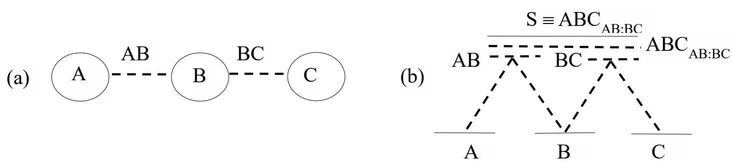


Figure 2: System (Internal View, Omitting Environment). Elements A, B, C are circles in (a); these elements and element S are solid lines in (b). Relations AB, BC, and $ABC_{AB:AC}$ are dashed lines.

Two primary ideas are involved in the notion of "system": (i) order and (ii) distinction. The relations that link the elements together constitute order; that different elements—and also different relations—are distinguished one from another reflects distinction. If the elements were not organized by any relations, they would collectively constitute a "heap" or "aggregate," which could be considered either the opposite of a "system" or its limiting case. The order diagrammed in Figure 2(a) is the internal order of the system. Below, in section C.4, "Function," the distinction between system and environment is introduced and the external order in which the system participates is described similarly in terms of external relations.

Figure 2(b) indicates that relations AB and BC can be summarized as a single relation, shown as $ABC_{AB:BC}$,[12] and that this unitary relation is equivalent to a unitary element labeled system S. Every system is thus a Janus-faced dyad, simultaneously a relation and an element. Looking down (inwardly), relation $ABC_{AB:BC}$ organizes the system's internal elements A, B, and C, each of which is also a (sub)system (whose inner structure is not shown) and Janus-faced element-relation dyad. Looking up (outwardly), element S can be an element in an external (supra)system that, again, is also an element-relation dyad. For example, an atom is a system. Looking down, it is a relation between nucleus and electrons; looking up, it is an element that can be a constituent of a molecule. Systemhood is thus mereological and recursive (Zwick 2018), in accord with Kleinherenbrink's characterization of Deleuze's ontology, which asserts that "machines" are made up of machines and join to form new machines. The principle that a multiplicity of relations can be subsumed in a single relation, taken together with the principle that element and relation are a Janus-faced dyad, also support Harman's (2005: 85) proposition mentioned above that when objects enter into relation, they create something "that has not existed before."

C.2. Distinction

The systems theoretic term for "difference" is "distinction," which should be interpreted as ontological, not epistemological. While the very notion of a system (internally) as a set of elements organized by relations implies distinctions between different elements, between different relations, and between elements and relations, the salient exemplification of the idea of distinction is the (external) distinction between system and environment, diagrammed in Figure 3. In the definition above of "system" as a set of elements and relations, the environment is not explicitly mentioned, but it is implicit in the assertion that the unitary relation organizing the system is equivalent to the system taken as element. This is discussed further below.

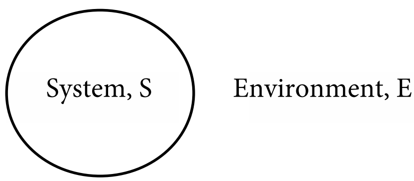


Figure 3: System-environment Distinction

Recall Bryant's (2010: 277) observation, noted above, that for Continental philosophy the subject-object difference is hegemonic while the object-object difference is downplayed. Systems ontology, like speculative realism, primarily addresses the object-object difference, but focuses on one object—the system—and considers its environment only as it affects the system, this symmetry-breaking reflecting the perspectivalism inherent in systems epistemology. Yet, as noted above, for some systems theorists, e.g., second-order cyberneticians, the subject-object difference is also encompassed in their models.

So difference, here called "distinction," is as fundamental to systems ontology as it is to the ontology advocated by many speculative realists. The distinction between system S and environment E in Figure 3 (or some system S′ within E not shown in the figure) is an example of what Bryant (2010: 269) called "inter-ontic" difference. The distinction in earlier Figure 2 between elements A, B, and C internal to the system is an example of what Bryant called "intra-ontic" difference. Below, I call inter-ontic order "function" and intra-ontic order "structure"; these are discussed below in sections C.4, "Function," and C.5, "Structure," respectively.

The significance of distinction to systems thought[13] is articulated mathematically and conceptually by Brown (1972). Difference is also prominent in the work of Bateson (1979), who defined information as "news of difference that makes a difference."[14] Speculative realists such as Bryant (2010: 263) and Deleuze (1994) speak similarly about being as that which makes a difference.

System as (i) order (depicted in Figure 2) and the system-environment (ii) distinction (depicted in Figure 3) are fused together diagrammatically in Figure 4. The figure illustrates the recursive character of the notion of "system": system S is shown in this figure as a simpler two-element (intra-ontic) relation between A and B. S is also an element in (inter-ontic) relation SE with environment E, and SE is also an element, namely suprasystem S. The internal order of E, A, and B and the external order that suprasystem S is part of are omitted and only suggested in the figure by lighter dashed lines.

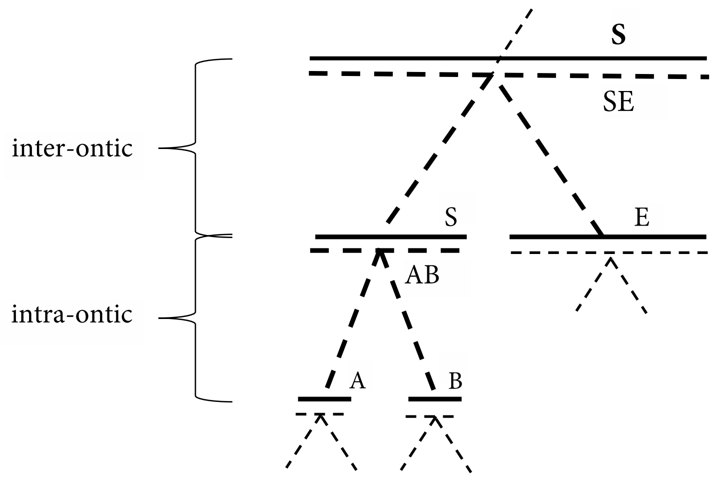


Figure 4: Joining Distinction and Order in the Recursive Character of Systems
Elements, reflecting distinction, are S (system), E (environment), S (suprasystem); and within S, also A and B. Relations, reflecting order, are AB (internal to S) and SE (external to S).

The indefinite regress implicit in the recursive view of systems as composites does not problematize the notion of "system" if one posits a spatial "discount factor" that diminishes the salience of levels above and below the focal level of "system" according to the distance of these levels from the focal level. If this discount factor is large, one needs only three levels (Lendaris 1986) to analyze a system: the focal level of system and environment (S and E), a subsystem level of the system's elements (A and B) and the environment's elements (not shown), and a suprasystem level of SE; these three levels are shown clearly in the figure. But three levels are not always epistemologically sufficient since some systems are inherently multi-scale.

C.3. Anti-reductionism

The anti-reductionism of systems theory also asserts a multiplicity of types and the equal reality of levels.

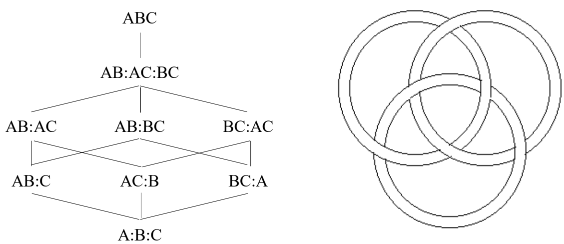
Systems theory distinguishes between different types of system that are irreducible to a single type. Miller (1978), for example, divides system types into concrete, abstracted, and conceptual. This threefold classification allows a wide range of objects and processes to be encompassed while still registering their commonality as "systems." One might also consider this classification as a way of organizing the vast multiplicity of Latour's "actants" whose unrestrained plenitude is criticized by Brassier (2010: 52).

Concrete systems are physical and define the domain of the natural sciences. Since systems theory is rooted in the sciences, much of it concerns concrete systems, for which thermodynamics is fundamental. In thermodynamics, difference often means disequilibrium. The being of a concrete system is grounded in its disequilibrium with, i.e., its difference from, its environment. Disequilibrium is also the basis for becoming when diachronic change is a drive toward equilibrium. Abstracted systems are physically instantiated, but their physical aspects are not focused upon. The social sciences consider such systems. Network theory and game theory are among the systems theories used in this domain, networks being defined by nodes and links between nodes and games being defined by actions of agents resulting in utility payoffs. Networks and agents are in Bunge's (1973) nomenclature "stuff free"; this does not mean they are immaterial, but that they can be instantiated in multiple different materialities. Outside the domain of the social sciences, all informational technologies viewed without regard to physical realization are also instances of abstracted systems. Finally, conceptual systems are not materially instantiated at all and include for example mathematics and toothfairies.

Concrete systems, which are materially instantiated, may also have immaterial aspects. For example, information and utility are categories important to the natural sciences (the latter specific to biology), but as defined by Shannon and Weaver (1949) and von Neumann and Morgenstern (1944), respectively, they do not have physical units, unlike matter and energy. In addressing not only concrete systems but also abstracted and conceptual systems and the nonphysical aspects of concrete systems, systems theory is in accord with the version of speculative realism that posits realism without materialism. Systems theory aims at a genuine "theory of everything." By contrast, a purely physicalist physics, i.e., one restricted to concrete systems, clearly cannot speak about "everything."

Irreduction of level (scale) is illustrated in systems theory by holism: a system is a whole emergent from its parts and different than their "sum." Wholes exist at multiple levels of complexity, and the very notion of "system" carries the implication of their "ontological parity" (Ross 1980). This rejection of reductionism is also asserted by Latour and other speculative realists and is illustrated above by the quotes from Bryant and Shaviro.

Going from a whole to its parts is decomposition, and irreduction means that in decomposition something is lost. (But not always, since some wholes, namely "heaps," are simply the "sums" of their parts.) Systems theory defines "parts" precisely and specifies rigorously what if anything is lost when wholes are decomposed into parts. There are degrees of decomposition. To illustrate, the possible decompositions for a three-element system are summarized in the Lattice of Structures of Figure 5(a), which, like Figure 4, illustrates systems mereology (Zwick 2018).



(a) (b)

Figure 5: Mereology and Holism. (a) The Lattice of (internal) Structures for three-variable systems; (b) Borromean Rings representing a non-decomposable ABC relation.

At the top of the lattice is a non-decomposed ABC system that represents a maximally holistic system. At one level down, the system has lost the inherently ternary relation and consists of three binary relations, AB:AC:BC. (In this notation a colon means "and.") At the next level down, the system has also lost one binary relation and is AB:AC or AB:BC or BC:AC. One further level down, the system has only one binary relation and is AB:C or AC:B or BC:A. Finally, at the bottom level, all internal order has been lost, and elements A, B, and C are completely unrelated to one another. The system is fully decomposed into its elements and is really a heap (aggregate), the opposite of maximum holism.

For a system consisting of relations AB and BC, the earlier discussion of Figure 2(b) noted that these relations can be summarized in a unitary relation $ABC_{AB:BC}$, which can be decomposed without loss into AB and BC. The top structure of the lattice, written as ABC without subscripts, can thus represent a relation that is *not* decomposable without loss. Such an ABC relation is illustrated in Figure 5(b) by Borromean Rings, which are not separable, but which become separable if any single ring is removed. Borromean Rings provide a visual metaphor for maximal holism, where all order is completely lost in the first decomposition step down the Lattice of Structures. One can express this extreme non-decomposability mathematically.

C.4. Function

Aside from its internal order ("structure"[15]), the system participates in an external order ("function"—no connotation of purpose is intended) that involves its environment. Recall that a primary systems theory idea is distinction of the system from its environment. The relations of the system with its environment are external, and this conception partially accords with the externality thesis of Deleuze.

Earlier, a "system" was defined internally in terms of elements and relations that organize the elements. This dyadic definition is now replaced by a triadic definition involving elements having attributes by which relations organize the elements. Figure 6 shows how attributes mediate relations between system and environment, where both are viewed as elements.

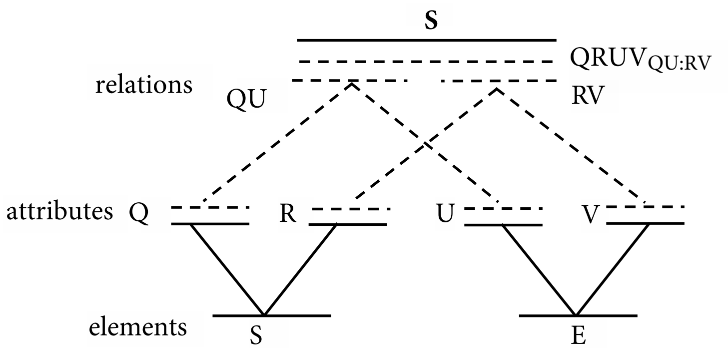


Figure 6: Function. The elements are S, E (system, environment); the attributes are Q,R,U,V; the relations are QU, RV. The unitary relation QRUV$_{QU:RV}$ and unitary suprasystem S are a Janus-faced dyad.

In the figure, system S is an element with attributes Q and R; its environment E is an element with attributes U and V. Relations QU and RV constitute the external order in which the system participates as an element, these relations defining the internal structure of suprasystem **S**. The assertion that elements have attributes needs to be supplemented by the assertion that relations also have attributes. This is shown in Figure 6 by attributes depicted with double lines, a solid line for the attribute as carried by (intrinsic to) the element, a dashed line for the attribute as carried by the relation (and extrinsic to the element). The dual character of attributes is consistent with the externality thesis of Deleuze, which asserts that involvement of attributes in relations is not obligatory. The attribute carried by the element (solid line) may remain inactive because the relation with a corresponding attribute (dashed line) may be absent. The attribute carried by the element is thus prior to involvement in any relation; this agrees with Bryant (2010: 275), who writes, "in each case, the affects that constitute the object are a prior condition of the relations the object is capable of entertaining with other objects." One might also say that an object has its attributes "translated" by the other objects (systems) that it encounters. This translation is not under the control of the system. As Stengers (2009: 40) writes, "nothing has the power to determine how it will matter for others." How systemic attributes Q and R matter to the environment is determined not by system S but by relations QU and RV. One might say that U and V "translate" attributes Q and R, respectively.

The dual character of attributes can introduce complications. Attributes carried by an element (system) and by a relation need not coincide. This possible mismatch is illustrated in Figure 7. This is an important theme in Gestalt psychology, a field that has contributed to systems theory. In Figure 7, what is "expected" for attribute M by relation MO is indeed an attribute of element S, but what is expected by this relation for attribute O is the "opposite" of attribute O of element E, represented symbolically by the arrows pointing in opposite directions. This oversimplifies; there must be some commonality between the dual aspects of attribute O for relation MO to achieve some linkage between S and E. Figure 7 also shows that attributes of elements may remain unengaged by any relation; this is the case for N and P.

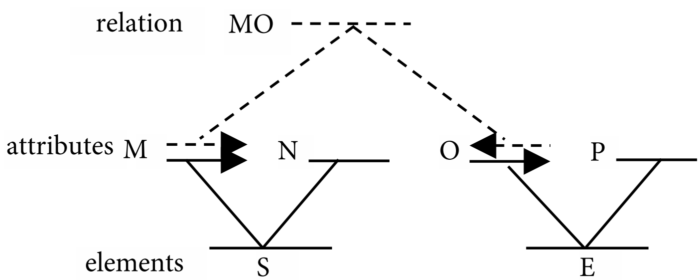


Figure 7: Imperfect mediation of relations by attributes. O in the figure shows the possibility of mismatch between the attribute carried by the element and the attribute expected by the relation. N and P show the possibility of attributes not engaged in any external relation.

It has long been a vexing question whether entities (objects)—here called elements, equivalently systems—are anything more than bundles of attributes that mediate relations with other entities. If one remains within the external domain of function, it is hard to see what else an entity might be. The multiplicity of attributes bound by the system as unity, which illustrate the two external terms of Deleuze's tetrad, can only be understood by considering the order internal to the system. This is discussed below in section C.5, "Structure," but in brief: the attributes carried by the system as elements are upwardly emergent from its internal relations.

The fact that attributes can also carried by relations is illustrated by a network in which one node has a "central" position, so that all pairs of other nodes are connected by links that pass through this center node. This "geodesic" centrality of the center node is not an intrinsic property of the node, but a downwardly emergent property of the network. If this network is a model of a social system in which nodes are human beings, a person with a central position in this network[16] may or may not have the upwardly emergent attributes required by this downwardly emergent role.

C.5. Structure

What the speculative realism of Harman, Bryant, and others posits as "withheld" or "held in reserve" from interactions with other objects is, in systems theoretic terms, simply (internal) structure. Bundling of attributes by the system as a unitary element is the result of upwards emergence from this internal order. This is displayed in Figure 8, which adds the emergent attributes shown in Figure 6 to the representation of Figure 2.

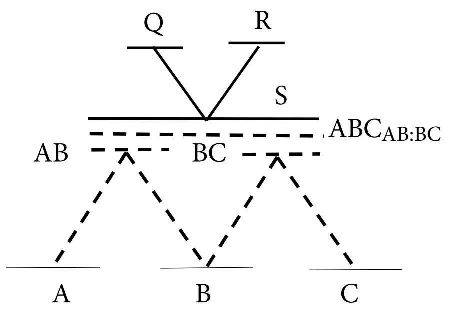


Figure 8: Upwards emergence of attributes. Q and R emerge upwardly as external attributes of S from the internal unitary relation $ABC_{AB:BC}$.

Structure is also no less relational than function, which follows from the recursive character of systems (Figure 4). This disagrees with the non-relationality that Deleuze posits for the inner character of objects (Kleinherenbrink 2020), but it is in accord with Bryant (2010: 273), who writes, "with Harman and traditional substance ontology, we therefore grant that objects must also be thought in terms of endo-relations or their intra-ontic structure as radically independent of their exo-relations or inter-ontic relations." However, from a systems theoretic perspective, Bryant's assertion of radical independence must be qualified. Intra-ontic and inter-ontic relations—in the systems terminology used here, structure and function—are not completely mutually independent, since exo-relations are typically based on attributes upwardly emergent from endo-relations.

The structure-function dyad is symbolically represented in the double-cone diagram of Figure 8. This dyad is as fundamental to systems ontology as it is, for example, to Harman (2005: 74), who states, "the basic dualism[17] in the world lies not between spirit and nature, or phenomenon and noumenon, but between things in their intimate reality and things as confronted by other things," but also corrects this statement by noting that phenomenon and noumenon in fact map onto function (inter-ontic order) and structure (intra-ontic order), respectively, without asserting that there are any noumena that are completely and permanently inaccessible.

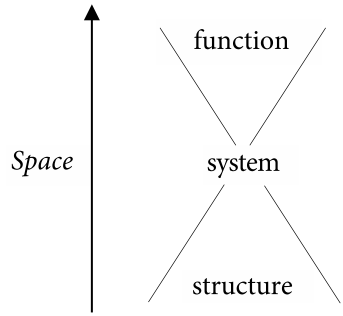


Figure 9: Structure and Function. This double cone figure represents an open system perspective in which structure and function are both constitutive[23] and the system is regarded as the union of or alternatively as an interface between these internal and external orders.

Commonly, structure is viewed as constitutive, as what a system *is*, while function is what a system *does*, and this is in *partial* accord with Deleuze's view that relations—meaning *external* relations—are not intrinsic. But function could also be constitutive,[18] and there are systems for which it is function and not structure that is primarily constitutive—money is a simple example—so from a systems perspective the view that "nothing boils down to its [external] relations" is an oversimplification (Harman 2010: 37). But systems ontology also rejects the opposite default position of many idealist philosophies that everything boils down to its relations, i.e., that function is always constitutive. The systems concept could in principle encompass both limiting cases—where identity is purely structural (the system is a totality that has no environment) or purely functional (the system is elemental and has no structure)—but it focuses instead on what is ubiquitous: systems with both structure and function and for which identity of structure and identity of function can be at odds with one another (Zwick 1984).

In the presentation of systems theory in this paper, structure is discussed after function, because for many speculative realists external relations are taken for granted, and positing an internal domain apparently needs to be argued. Function is the unmarked (default) term. For systems theory, however, the opposite holds: structure is the unmarked term because in the system-environment dyad "system" is privileged, just as in a figure-ground dyad, "figure" is privileged. The view that structure alone is constitutive, what a system is as opposed to what it does, might be called the "closed systems perspective," which doesn't deny the existence of an environment but denies that it is constitutive. The view that function is also constitutive (or, in special cases, is alone constitutive) might be called the "open systems perspective." Von Bertalanffy (1979) contributed to the idea of a general systems theory with his argument for the importance of the open systems view and for the need to develop a thermodynamics appropriate to it. This thermodynamics was in fact later developed by Prigogine and other researchers. The systems project needs both perspectives. The open system perspective is valuable because often systems are small and "weak" relative to their environments and—for concrete but not abstracted or conceptual systems—because the thermodynamics of system and environment is fundamental to both being and becoming. The closed system perspective is valuable because the hierarchy of systems (illustrated by Figure 4) can be generated recursively from a definition of "system" that omits explicit mention of an environment,[19] because of the centrality of autopoiesis[20] (Maturana and Varela 1980) in the phenomenon of life, and because in the dissolution of complex systems the asymmetry between system and environment is plain. Systems are simultaneously open and closed or open in some respects or at some times but closed in other respects or at other times (Zwick 1984).

C.6. Unity

The unity of a system inheres in the fact that a set of (consistent) relations can be integrated into a single relation, which by the Janus principle is equivalent to a single element. Facing inwards, a system is a unitary relation that organizes its constituent elements. Facing outwards, a system is a unitary element that participates in the external order of the environment through relations with other systems. The unitary element that the system presents to the environment and the unitary relation that organizes it internally resemble the outer and inner unities in Deleuze's fourfold. Unity is fundamental for systems ontology, in accord with Augustine (1966: 70), who said "to be is no other than to be one." But unity does not mean complete irreducibility, a total loss of coherence if a system were even slightly decomposed. Most systems are "partially decomposable" (Simon 1981), which means that there may be some aspects of the system that are maximally holistic and thus unitary, while in other aspects the system has separable subsystems. See the earlier discussion of Figure 5.

Also, despite having some degree or type of unity, the system need not interact with its environment as a unitary element as depicted in Figure 4. Rather, as shown in Figure 9, elements of the system can be involved in direct relations with elements of the environment. The possibility of such relations denies the hermetically sealed inner reality posited by Harman, Bryant, and Deleuze. While structure is indeed usually partially concealed in function, no aspect of structure is absolutely and permanently immune to environmental access: what is concealed or revealed depends upon the penetrating power of (objects in the) environment.

Kleinherenbrink (2020: 44) writes, "Bryant holds that no entity ever directly encounters the interior of another being." Harman (2005: 76) says that "in their deepest essence, substances are withdrawn absolutely from all relation." These statements exaggerate. Nothing precludes interaction of part of a system with the external world. While Simon (1981) argued that in hierarchical systems, levels are typically insulated from one another, sometimes, especially in malfunctions,

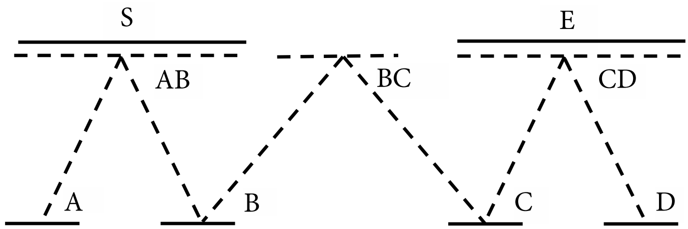


Figure 10: Structure Is Only Partially Concealed By Function. System element B is visible to environment element C but system element A is concealed. Recursions upwards (S and E in relation) and downwards (A, B, C, D as systems) are not shown. Also not shown is the element equivalent to relation BC. This figure depicts systems simply in terms of elements and relations, ignoring attributes.

they are not. Even when a system has a boundary that separates it from its environment, its parts might be accessible. Indeed, it is via upward emergence from below—from structural levels near the apex of the double cone of Figure 9—that systems have the attributes that are involved in interactions (relations) with other entities. One might however argue that much lower structural levels (further from the apex of the bottom cone of Figure 9) are likely to be indeed withheld from external interaction, so Harman is correct in saying that at deep levels substances are withdrawn. But various forms of radiation penetrate to quite deep levels of structure and scientists build large and enormously complex experimental apparatuses to probe into entities at these levels, so what is withheld at lower levels is only provisionally withheld. In nature, objects (systems) do indeed encounter one another as phenomena, but there are no noumena that are a priori and permanently inaccessible. The noumenon is merely a place holder for what has not yet been revealed to and accessible by either other objects or the human subject.

If the single relation representing the entire system cannot be fully decomposed without any loss, as is true for the Borromean Rings in Figure 5(b), then the system has at least some non-decomposable unity. This is represented by the top structure ABC of the Lattice of Structures of Figure 5(a), and this aspect might metaphorically be spoken of, as Deleuze speaks of it, as a "body without organs" (Kleinherenbrink 2020: xi). But Deleuze's characterization of this unity as unproductive ignores the fact that it may precisely be from this internal holistic unity that the external attributes of the system emerge. While some attributes can emerge from lower structures on the Lattice of Structures, some emergence may be maximally holistic, i.e., dependent upon the non-decomposable relation represented by the top of the lattice.

D. Conclusion

D.1. A Further Disagreement

The focus of this paper has been mainly to point to areas of agreement between speculative realism and systems metaphysics, although some disagreements have also been noted.

One major disagreement not mentioned above warrants explicit discussion. This is the unacceptability from the systems perspective advanced here of Meillassoux's (2008) radical notion of contingency, in which "anything is possible from one moment to the next" (Bryant, Srnicek, and Harman 2010b: 8). This notion rejects causality, essential to any scientific world view. To ignore science can be justified to allow a focus on human experience—a human-centered view is an essential complement to a world-centered view—but to deny science while pursuing a realist ontology is surely folly and is speculation gone awry. It should be noted, however, that some speculative realists explicitly and unambiguously reject Meillassoux's contrarian idea of contingency; Johnston's (2010) essay, for example, is a strong critique of it.[21]

Meillassoux's idea of contingency exemplifies Badiou's (2005: 6) thesis that "mathematics = ontology," which if accepted might justify the ontological implications Meillassoux draws from Cantor's open-ended infinities. But mathematics incorporates only the constraint of logical consistency (truth of coherence), not also the constraint of empirical validity (truth of correspondence). Only some aspects of mathematics describe our actual world; other aspects describe only self-consistent possible worlds. Whether any particular aspect of mathematics describes our actual world is a scientific question. Simply assuming that Cantorial infinities do so is unwarranted. In terms of the characterization by Bunge (1973) of the systems project as aiming at an exact and scientific metaphysics, an ESM, mathematics taken as ontology without being grounded in science would be only an EM, a two-legged stool.

Instead of absolute and lawless contingency, systems theory accounts for the novelty that is a salient property of the world by taking seriously the phenomenon of emergence, addressing it with such notions as causal depth (Kampis and Gulyás 2008), the multiplicity of effects (Hardin 1963), and the adjacent possible (Kauffman 2000). Positivist scientific reductionism denies emergence by dismissing it as an epiphenomenon. Meillassoux denies emergence by substituting for it an absolute and acausal contingency. The materialist view that life is an epiphenomenon and Meillassoux's view that life can spring suddenly out of matter without precursors or necessary conditions (a view that strangely seems to revive the old idea of "spontaneous generation," now justified by Cantorian infinities!) are both extreme positions that fail the third, namely the pragmatic, criterion for truth: they are unlikely to be generative of productive scientific research, since they finesse genuine questions rather than addressing them. Both positions sweep the problem of the origin of life under the rug.

D.2. Summary

Many tenets of speculative realism have long been asserted by systems theory. Among the authors of articles in Bryant, Srnicek, and Harman (2010a), DeLanda, in writing about nonlinear dynamic systems, emergence, singularities, and extremum principles, draws substantially from the systems and scientific literatures. Other philosophers in this new school would have much to gain from familiarity with and use of systems ideas.[22] The philosophical work of Mario Bunge would be a good starting point. Conversely, systems theory might be enriched by familiarity with the literature of speculative realism. Finally, the commonalities noted between systems metaphysics and speculative realism demonstrate clearly that the systems project is engaged in constructing a ontology that connects not only to mathematics and scientific theories, but also to metaphysics, for example to this new Continental school.

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Acknowledgments

I thank Doug Donkel for instructing me in Continental philosophy, but obviously I am responsible for the errors that I make about it. I also thank the other members of the Portland Philosophy-Religion-Discussion-Group (John Hammond, Stephen Jolin, and Kirke Wolfe) and also Noa Latham for helpful comments on an early draft of this paper.

Notes

1. "Mind-centered" is an alternative to "human-centered." Absolute idealism might be regarded as not human-centered, or alternatively as human-centeredness projected and writ large. It is the transcendental idealism of Kant and his followers that is plainly human-centered and is the primary target of speculative realism. "Experience-centered" is another alternative to "human-centered."
2. I adapted this "human-centered" versus "world-centered" terminology from the Jewish-German philosopher-theologian Franz Rosenzweig (2005), who spoke of what there is in terms of the three fundamental and distinct "elements" of Human, World, and God. I bracket the third element here.
3. Brassier (2010: 55) offers a succinct characterization of the distinction made here between a "world-centered" scientific view and a human-centered correlationist view: "The scientific stance is one in which the reality of the object determines the meaning of its conception, and allows the discrepancy between that reality and the way in which it is conceptually circumscribed to be measured. This should be understood in contrast to the classic correlationist model according to which it is

conceptual meaning that determines the 'reality' of the object, understood as the relation between representing and represented."

4. I use "dyad" for a binary in which each of the two terms requires the other, i.e., where the terms are necessarily linked and thus both present. I use "dualism" for a binary in which the terms are mutually exclusive and one must usually choose one or the other. The binary of ontology and epistemology is a dyad. The binary of realism and anti-realism is a dualism. The binary of world- versus human-centeredness might be viewed as either a dyad or a dualism.
5. An epistemology appropriate to a world-centered ontology might, for example, be an "evolutionary epistemology" that elucidates how organisms construct internal models of themselves and the world. Such models need not be representational, but could be heuristic and pragmatic.
6. Who is or is not a "speculative realist" is contentious. A reviewer of an early draft of this paper insisted that Latour is not a speculative realist, but several contributors to Bryant, Srnicek, and Harman (2010a) plainly disagree. To borrow a concept from fuzzy set theory, membership of an entity in a set needn't be binary but might perhaps take on any value in the [0,1] interval, and one should not always accept an explicit denial that one is a member of a school at face value. Herbert Simon (1981) famously denied doing "general systems theory," but the strong consensus of the systems community was that Simon's book, *The Sciences of the Artificial*, which contains this denial, is a classic of systems theory. I regard the contributors to Bryant, Srnicek, and Harman (2010a) as having non-zero fuzzy membership in the community of speculative realists at least around the time of publication of this book, and I also accept Kleinherenbrink's judgement that Deleuze can be considered a member of this school.
7. Other entities that speculative realists have mentioned in their lists include computer programs, zebras, apples, conversations, keys, emotions, meteors. An alternative to regarding such ecumenicism as ontological parity or irreduction is to speak of it as "ontological pluralism." Segal (2011) uses this phrase to characterize William James's position, systematized by Whitehead.
8. Scientifically, the word "machine" doesn't work well as a general term for objects, since this word suggests determinism, disallowing stochasticity, and also strongly connotes non-living systems. The word "object" may be flawed by a close partnership with "subject" that suggests correlationism. The word "system" has much to recommend it.
9. These two definitions of "system" accord with what Shaviro (2010: 285) calls "Whitehead's dual-aspect ontology [in which] his entities are also processes or events." For a systems treatment of these ideas, see Zwick 2023b.
10. In graphs, links connect two nodes; in hypergraphs, links can connect more than two nodes. In Figure 5(a), the top of the lattice (ABC) is a hypergraph (or, more precisely, a hyper-relation); all structures beneath it are graphs. As the number of elements increases, the Lattice of Structures contains a progressively increasing proportion of hypergraphs.
11. A non-trivial relation (not a heap) is defined set-theoretically as a proper subset of the Cartesian product of the elements taken as sets of their possible values, i.e., $AB \subset A \otimes B$, and information-theoretically by H(AB), the Shannon entropy of

the relation being less than H(A) + H(B), the sum of entropies of its elements. The interpretation of "relation" as constraint is only one of the simplest interpretations of this word and does not exhaust its possible meanings.

12. The notation $ABC_{AB:BC}$ means that this relation can be decomposed without loss into AB and BC.
13. Systems theoretically, "difference" is insufficient to ground an adequate ontology or epistemology. It needs to be supplemented by the notion of relation, in which elements that differ interact.
14. Bateson's definition of information adds semantic and pragmatic dimensions to the Shannon and Weaver (1949) definition, which is purely syntactic.
15. "Structure" is used in this paper in two different ways: (i) to label a set of relations, e.g., the nine structures of Figure 5(a), and (ii) as part of the structure-function (internal-external) dyad.
16. If the materiality of persons is not under discussion, this network is an example of an abstracted system.
17. In the terminology of this paper, the noumenon-phenomenon binary is a dyad, not a dualism, as is the binary of objects in their intimate reality and objects as they confront other objects. The binary of spirit and nature requires further elaboration to classify it as either a dyad or a dualism.
18. In general, structure and function are insufficient to understand a system. One needs also the diachronic dimension of "history" to supplement the synchronics of structure-function. To supplement being (structure) and behaving (function), one needs becoming (history) (Gerard 1958).
19. This recursion is epistemological, not ontological.
20. "Autopoiesis" means "self-making," to be distinguished from being made by external causes. Autopoietic systems may require matter-energy input from the environment, and may also have informational input, but by definition their essential properties are specified by internal information.
21. Johnston (2010: 107) notes Meillassoux's "startling proximity to strains of idealist religiosity despite his self-presentation as an irreligious materialist," but he does not go far enough: Meillassoux's contingency in fact maps quite well to certain religious views that posit a deity whose absolutely unconstrained actions create the world de novo at every instant.
22. The DeLanda paper in the Bryant, Srnicek, and Harman (2010a) book explicitly discusses some systems themes, but it focuses on Deleuze's notion of the "virtual," and it does not directly address the issues discussed in this paper.
23. "Constitutive" as used here means essential (not contingent) to the composition of the system.

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