Essay Review: *Scientific Pluralism**

Jordi Cat†

The basic education of philosophers of science during the second half of the twentieth century was founded on the seven Rs: the three basic Rs and the topics of Rationality, Realism, Reductionism, and Relativism. The topic and ideas in this volume are foundational and challenging. They challenge and replace the ancient notion of philosophy as unified knowledge and the corresponding images of the tree of knowledge and encyclopedia forests.

> Stephen H. Kellert, Helen E. Longino, and C. Kenneth Waters, eds., ***Scientific Pluralism***. Minnesota Studies in the Philosophy of Science, vol. 19. Minneapolis: University of Minnesota Press (2006), xxix+248 pp., $50.00 (cloth).

This edited volume is the landmark vehicle of its editors' philosophical manifesto and agenda. If the twentieth century was the century of monism, the twenty-first has fast held high the banner of pluralism. Almost 8 decades after the Vienna Circle Manifesto and its defense of unity of science against metaphysics, philosophers of science have witnessed the rise of the so-called Stanford School and now of the Minnesota School—with Stephen Kellert, Ken Waters, Ron Giere (currently in Indiana), and Helen Longino (currently its envoy at Stanford, where Patrick Suppes is the sole remaining member of the original Stanford group, alongside Hacking, Cartwright, Dupré, and Galison). Now we are being schooled about the values of pluralism and what one may call metapluralism, a view the editors call the *pluralist stance*. Pluralism is a philosophical interpretation of science, and its philosophy (of science) is empirically based

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†To contact the author, please write to: Department of History and Philosophy of Science, Indiana University, 1011 E. Third St., Goodbody Hall 130, Bloomington, IN 47405; e-mail: drjordicat@yahoo.com.

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metascience. This is the important message the volume urges, the pluralist stance as both empirical hypothesis and empiricist standard. One must emphasize the metascientific stance. The editors' stance, they warn, is not necessarily defended or shared by the other contributors to the volume, but it is supported (in a volume on emergence, they would have used the term "emerged"), in some self-consistent requisite way, by their contributed case studies (xiv).

The Minnesota manifesto is self-consciously genealogical as well as geographical. It associates, and contrasts, its pluralist stance with the fin de siècle preoccupation with unity and disunity of science of the 1990s: reconsideration of logical empiricism, Neurath's antifoundationalism, antireductionism and holism, Cartwright's talk of patchwork of laws, dappled world and anti-imperialism, Dupré's promiscuous realism, or the proliferation of local pluralist accounts, especially in physics and biology. Amid all that, there emerged a current of metascientific pluralism identifying and defending the plurality of scientific virtues, standards, or methods: Suppes, Kuhn, McMullin, and Longino.

The metascientific stance about pluralism is based on the distinction between plurality in the sciences and pluralism about the sciences. The distinction is supposed to correspond to the fact/interpretation, sometimes fact/value distinctions in empirical science, or at least in empiricist philosophy of science. Plurality is a feature of actual scientific practice: multiplicity of metascientific concepts and methods, of representations and explanations, questions and strategies for answering them, aims and ways to achieve them. Pluralism is "a view about this state of affairs," an interpretation of the metascientific concepts: incompleteness of particular scientific viewpoints, endless character of scientific inquiry, strategic value of pluralistic sciences, and so on. Now, if the plurality/pluralism distinction mimics or instantiates in good naturalistic fashion the fact/interpretation distinction, the inevitable methodological question is: What keeps the facts and their supporting force free from the challenges to the fact/convention and fact/value distinctions and dichotomies and, as Longino herself has discussed elsewhere, the problem of underdetermination? Moreover, what sort of evidentiary relation supports a stance? Only Giere's discussion of methodological pragmatics offers a few hints (see below). Notably, some of the more abstract reflections in the volume extend the metapluralism implicit in the pluralist stance to a disciplinary pluralism that reaches beyond the narrow confines of analytic philosophy of science (see discussion of Richardson and Kellert, below).

The pluralist stance opposes the pluralism to an interpretation with much older currency, monism. Monism can be generally characterized in terms of the aim of science (e.g., single, complete, comprehensive account of the world based on a single set of fundamental principles), an epistemic

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presumption (e.g., the world can be described or explained by such an account), a methodological presumption (e.g., there exist methods of inquiry that can yield that account), and standards of evaluation of methods and representations (e.g., capacity to yield the account successfully). By these standards, plurality of aims and approaches signals a deficiency. The contrast here is merely conceptual, and readers would benefit from references to actual instances of monism in the history of philosophy or science.

Pluralism rejects the tenets of monism as definitive starting points, or its aim as the end point of inquiry, and plurality as a temporary phase. The pluralist stance, an epistemological stance, is an empirically based interpretation of plurality without a priori basis or metaphysical assumptions. The pluralist stance is "a commitment to avoid reliance on monist assumptions in interpretation or evaluation coupled with an openness to the ineliminability of multiplicity in some scientific contexts" (xiii). It implies the rejection of monism and also fundamentalism—that one of few laws from which all correct accounts can be derived (but no clear distinction or relation is offered).

Part and parcel of the contrast is to expose several self-declared types of modest pluralism as actual instances of modest monism. For instance, nonreductive monism: According to Kitcher's (2001) account, different theories based simply on different conceptual schemes and interests are intertranslatable, equivalent truths. This, the editors point out, rests on metaphysical prejudice: the assumption that one single theory or perspective will account for the relevant part of the world. But is the problem that the assumption is a prejudice, metaphysical or not, because it is not independently supported, and in this case, not empirically based?

Another target is the division of cognitive labor. This form of pluralism, which recalls first Feyerabend's Millian response to Kuhn, advocates a proliferation of monistic approaches aiming at a monistic outcome. Well, that depends on the form of cognitive labor and the shared goals. Social epistemology, as Longino herself has advocated, can support genuine pluralism. In the account presented by Sandra Mitchell (2003), the third target, for every single phenomenon or area of study, the localized, intralevel form of the tenets of monism apply. Yet she actually distinguishes between isolationist—not monist—and interactionist pluralism (disjunctive and conjunctive, respectively) about alternative approaches in ways that are similar to ideas presented by Waters and Kellert (see below).

Another contrast is between the pluralist stance and radical pluralism or radical relativism. Constructivism and promiscuous realism equally propose an unconstrained indefinite number of representational elements equally with or without referential value (Dupré 1993). It is an empirical matter if constraints exist. But Dupré's metaphysical account is explicitly

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an empirically based interpretation, just not a scientific one. The metaphysical nature of his account is not the source of the problem. He finds his critical elbow room precisely in the gap between the scientific and the empirical more broadly.

The empirical basis for the pluralist stance is constituted by the set of case studies that make up most of the contributions to the volume. They identify plurality and complexity in the objects and process of inquiry. Plurality in actual science and practical success (pragmatism) provides evidence for the need of multiplicity of approaches, with no guarantee of the possibility to integrate them without losses, and the unavoidability of tensions, with no guarantee of the possibility of separation of domains—a two-state solution. But what is this primitive complexity identified in phenomena or the world on nature or scientific practice, and how is it identified? Is it a positive transcendental inference only logically prior to the actual plurality of disciplines? (As Rorty asked, which is prior for Kant, is it the acts of synthesis or the manifold of experience? Is the manifoldness a primitive given, a correlate of, or a precondition for synthesis?) Is it a negative inference from the difficulty of a single comprehensive account? Scientific epistemology has not broken free of the framework of analysis and synthesis. In both scientific epistemology and meta-epistemology, the trope of the duality complexity/aspect (or perspective, property, or abstraction) and its analogical extensions are sometimes applied more urgency than critical attention. But such is the nature and value of programmatic manifestos.

In the spirit of the pragmatic standard and any further support it might provide the view, the editors announce that the pluralist stance has important implications for metascience and the public consumption of knowledge. We don't really get any details about the latter. But about the former, these are a few: the best science might not answer metaphysical questions univocally, science cannot be a model for other disciplines of objectivity based on convergence on a single answer, the pluralist stance challenges essentialism about key metascientific concepts (kinds or explanation), and the method of counterexample in philosophical analysis that assumes, similarly, a universally applicable account and that a single counterexample can prove it false. In addition, on pain of collapsing into radical relativism, this is no "anything goes" view. What makes it so? The editors find substandard science linked to monist, antipluralistic programs. The point merits further discussion. A positive account is also missing: What decides the limits on what goes? The trump card of normative naturalism is to declare that this is ultimately an empirical matter about actual scientific goals at hand. But what about standards? Longino herself has pursued the question elsewhere. Both elements require a more serious

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consideration here, if the distinction between pluralism and relativism carries any normative force.

The value of single partial approaches is documented and defended by other contributors in a plurality of scientific disciplines. The plurality of pluralities across disciplines motivates the pluralist stance. What they provide is a plurality of arguments about plurality and its relation to pluralism. They invite the question of what counts as adequate sorts of argument for pluralism and whether the arguments they provide fit the editors' ideal of empirical (naturalistic) inferences. But this science, and metascience, cannot rely on empirical inference alone. As Longino has argued descriptively and critically, empirical inference is a complicated matter.

The motivational force of the examples of plurality comes from the fact that they are plural across different sciences from microscopic to macroscopic, simple to complex, empirical to formal. Next is a quick summary. I offer more detail about three more abstract interpretive contributions by Giere, Kellert, and Richardson. Geoffrey Hellman and John Bell argue that classical and intuitionist logics satisfy the logical consistency requirement, and a plurality of ontologies and approaches to truth and proof equally serve as adequate foundations for mathematics. Michael Dickson argues that mathematical and physical constraints defining quantum theory do not fix the possible several, mutually contradictory dynamics. No one dynamics meets all explanatory constraints such as relativity and stability. But the predictions of each dynamics do not contradict those of the others. This picture exposes an ineliminable plurality at the microlevel that, reminiscent of Bohr's analysis, is resolved at best in the form of complementarity.

In the domain of animal and human behavior, Carla Fehr identifies different explanations of sexual reproductions, focusing on different levels of organization involving different selective pressures. Integrating the different explanations sacrifices the very source of information and insight that each conveys in isolation. Longino focuses on the necessary selection of partial sets of causal factors in the explanation of behavior, each responding to alternative research questions. Each spawns a distinctive approach to the study of behavior: genetics, developmental systems, neurophysiology, anatomy, social/environmental factors. The different and often incompatible assumptions behind each approach pose a challenge to the possibility of integration. The results are unavoidably partial, plural, and provisional. Esther-Mirjam Sent documents recent movements of resistance to the hegemony of marginalist neoclassical economics and the advocacy of economics pluralism in the explanation of a number of social phenomena. From the failure of monistic strategies, she draws support for pluralism in economics. Naturally, the question this argument invites,

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as did Kuhn's account of the value of dogma, is how to rely on empirical data to declare failure, and how to draw the distinction between the case for yet another particular monistic program (think adaptationism and genetic determinism in biology), the case for another kind of program, the case for plurality, and the case for pluralism. This is the logical challenge to standard lines of argument for pluralism, especially empirical ones.

In the biological sciences, Ken Waters argues against the comprehensive, monistic stance of developmental systems theory (DST) in defense of the value of gene-centered partial monocausal approaches. The partial success of genetic models in answering some questions is no basis for fundamentalist programs such as genetic determinism, which DST counters. Wade Savage defends a methodological interpretation of the psychophysical identity principle in neuroscience and philosophy of mind, with an emphasis on empirical identity, compatible with dualism, rather than on logical identity.

Ron Giere discusses the plurality of perspectives that human visual systems and observation instruments offer in interaction with objects, affording partial, incompatible, untranslatable, complementary representations. He extends the cognitive model and analogy to motivate his familiar perspectival model of scientific epistemology. Here one can find more novelty in the premises than in the conclusion. Models select particular aspects of phenomena and, as a result, offer particular partial perspectives on reality. Some may be nonoverlapping and complementary, such as the psychological models discussed by Longino in the volume; others may be conflicting. But each perspective, under the standard of best fit, offers a pragmatic advantage over others and, more importantly, over the monistic ideal of comprehensive perspective from nowhere (34). Giere, like Laudan, Kellert, and others, subscribes to a pragmatist form of normative naturalism, replacing metaphysical dogmas with methodological maxims that best promote the achievement of scientific goals (36). This view opens up a pluralist metaperspective between the Scylla and Charybdis of scientific epistemology, for example, dogmatic metaphysical realism and constructivist relativism (38). The question that cannot be settled is what those scientific goals are, can, and should be. Here normative naturalism and scientific pluralism alike must face their own limitations, or else seek virtue in a modicum of empty formality, the way of Kant's categorical imperative.

Essays by Richardson and Kellert, respectively, open and close the volume on a metascientific level, not just a philosophical level, addressing plurality and pluralism about pluralism. It is at this metalevel of analysis that scientific unities find their rightful normative place, between a priori monism and relativism, inclusive of isolation and interaction. Richardson

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draws out the pluralist lessons of history. He examines the historical disunity within the Unity of Science Movement in a revisionist forensic project that correctly identifies its nature as a movement rather than a doctrine, and its incentive the practical, social, and political role of unity (intersubjectivity; 14–16), the flipside of the problem of demarcation. He then defends the social and political nature and effectiveness of pluralism as a movement (which he effectively sees given impulse by Kuhn rather than the late Carnap) and, as such, developing along a number of suggested projects. History provides the context for scientific pluralism in philosophy of science, the space for (meta)pluralism about pluralism. Richardson worries about the consequences of the way one radical form of pluralism dissolves the demarcation problem and, with it, the authority of scientific judgments and standards; it's the pluralism that supports multiculturalist liberalism and faces the problem of tolerance (18–20). Herein lay once a similar key distinction between the American and the British projects of Puritanism. An alternative is a descriptive project of demarcation that seeks to lay bare the ways different scientific projects can and do cooperate with one another but not with nonscientific ones. Another pluralist and metapluralist project is a reaction not to ideology from outside science, but of hegemony from within; to counter it, Richardson counsels a disciplinary metapluralism of attention to diverse forms of analysis—from sociology of science to Continental philosophy—in order to diagnose this hegemony as a form of power, and a pluralism of attention to minority alternatives to hegemonic practices. In that regard, a pragmatist dimension of pluralism explores the fact that there are many courses of action one can take in science—and not just truths one can believe—because they satisfy us. The pragmatic dimension and minority views bring out the political dimension of pluralism within science itself: with a tradition heralded before the Second World War associating the values of science with those of individual dissent, tolerance, and liberal democracy (Dewey, Popper, Merton, etc.), and another, after the war, which portrayed scientific culture at least in terms of communities and conservative attitudes (Kuhn, Polanyi, Bloor, etc.). Where does he locate on this epistemic-political space Carnap and especially Neurath's combination of some forms of pluralism and socialist, cooperative agendas? What is the better creative and normative, or heuristic, relation between the social-political order and the epistemic order? Which new insights should inspire and modify which? (An instance of cross-disciplinary inspiration from political philosophy to scientific epistemology is my borrowing and extension of Avishai Margalit's account of political conflict and compromises; see Cat 2010.)

Kellert studies pluralism at the metascientific level, articulating an abstract map for disciplinary relations: introducing disciplines broadly con-

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ceived as "knowledge-producing enterprises with some shared problems, some overlapping cognitive tools, and some shared social structure" (218), and introducing a rich topology of relations that distinguishes interdisciplinarity, multidisciplinarity, cross-disciplinarity, and transdisciplinarity (219). They arise as diverse responses to the complexity of phenomena and the partiality of representation afforded by each individual discipline. Kellert asks the key question, "Why does complexity require interdisciplinarity?" (221). Answers will vary, from the theology and metaphysics of monotheism to the pragmatics and interactivity of socialism. Our image of knowledge has mirrored our image of God, world, mind, and purpose (Cat 2007). The risk is to engage in a priori and, worse, uncritical question begging. The comprehensiveness of monistic accounts, for instance, can be neither a virtue nor a vice; more generally, Kellert argues, genuine pluralism "refuses to assume that unity is always possible or synthesis always helpful" (219). General conclusions should be avoided, whether the implicit blanket rejection of the potential value of single approaches, or the blanket dismissal of interdisciplinary work at the cost of lack of specialization, true discipline, and expertise. Kellert argues against both general judgments. The value of integration is a local, contingent, and empirical matter, to be judged by the standard set by its purpose. This is the sense in which, for Kellert, the empirical dimension of pluralism in metascience can be also normative. (Kellert [2008, chap. 2] has developed this analysis of normative naturalism further.) Another dimension of pluralism is normative in a different sense, constitutive rather than instrumental. Kellert identifies a cognitive value in the metaphorical imagery that captures the possible relations between disciplines. Typical examples are geopolitical territorial talk of imperialism, boundaries, and so on, mosaic talk and language talk. But we are not clear how this level of analysis corresponds to the typology and topology of disciplinary relations introduced earlier. In the normative spirit of metapluralism, Kellert decides that the metaphors at hand fail to capture the active nature of disciplines as tools for activities. So he introduces a new one, which he thinks is the proper metaphor for disciplinary pluralism, the sports metaphor of cross-training, with the idea that "one can improve one's performance in a chosen sport by practicing other activities" (223). This normative move is problematic. First of all, so much for the general egalitarian, contingentist, and pragmatist spirits of metapluralism and normative naturalism introduced earlier. Second, if one considers the metaphor as one more approach within the plurality of metaphorical approaches, this metaphor is not without its limitations, as it cannot capture all or most of the possible types of disciplinary relations in the abstract typology mentioned above. Indeed, it might prove even too narrow an image for any. Elsewhere, however, Kellert (2008, 42) explicitly advocates metaphorical

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pluralism and articulates a new and more consistent version of his position, acknowledging the value and limitations of all metaphors.

Like most edited volumes, this one does not establish the parameters, positions, and arguments that define the topic at hand, in this case pluralism (for a general discussion on this forma, see Cat 2011). But the manifesto and the supporting case studies set a methodological standard and a precedent that will become a permanent reference in future discussions.

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