

## KNOWLEDGE INTEGRATION STRATEGIES

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### Summary

The impulse to integrate knowledge is born of a unified vision of reality. In the western philosophical tradition, this impulse has had two main expressions, which for historical reasons are called “instantiationism” and “emergentism.” However, the twentieth century has complicated matters so as to blur many of their differences. This blurring is discussed in relation to the much publicized “postmodern condition,” which prefers “open sciences” like evolutionary biology over “closed sciences” like high-energy physics. Ultimately, knowledge integration should be understood as a social process. Consequently, the “social epistemology” of the instantiationist and emergentist approaches are discussed in terms of recent debates between “realism” and “constructivism.”

Then the historical conditions for knowledge integration are discussed more specifically, including accounts of those who have held integration to be a “natural” and an “artificial” feature of the development of knowledge. More space is given to the artificial integrationists, since they seem to define the terms of the contemporary debate. Here the university’s role in organizing the natural dispersion of inquiry is highlighted, as well as the difficulties universities face in the post-Cold War, neoliberal environment, where it seems to be in no one’s interest to engage in the project of knowledge integration. Some ways around this problem include academic participation in “consensus conferences” and the introduction of traditional academic values in corporate settings.

## 1. The Two Great Metaphysical Strategies: Instantiation and Emergence

The earliest precedents for discussions of knowledge integration can be found in ancient metaphysics. The pre-Socratic Greek philosophers set the terms of the most fundamental debate, though their explicit concern was not with the integration of knowledge but the constitution of reality. In this context, they generated two recurrent metaphysical strategies: *instantiation* and *emergence*, which can be found throughout the history of philosophy. The instantiationist God creates according to a preordained plan, whereas from the emergentist God comes half-formed creatures endowed with the freedom to complete themselves. In the one case, humans have a fixed essence; in the other, their essence is defined precisely by its unfixed character. Someone who believes that rather different things—humans, animals, computers—can possess a “mind” in the same sense of the term by sharing certain formal properties is probably an instantiationist; whereas someone who defines mentality in terms of the presence of certain physical conditions—say, a threshold of neural complexity—is probably an emergentist. Richard Dawkins’ notorious “gene’s eye-view of the world” is instantiationist because it locates the motor of biological evolution in a gene-based drive to self-reproduction, whereas the emergentist would argue that higher-level interactions (say, between the individual organisms carrying genes) do more to determine the overall direction taken by evolution.

In technical philosophical terms, the instantiation strategy portrays the individual as a spatio-temporal region in which several properties are jointly realized. Without such spatio-temporal moorings, these properties would be “indeterminate,” in the sense of *unbounded*. In contrast, the emergence strategy regards each property as what Hegelians call a “concrete universal” that consists of individuals organized in a distinct way. For example, political theorists have periodically spoken of each person as literally part of a “body politic” or a “social organism.” Accordingly, to be a “human” is *not* to possess a property that every other human being has individually; rather, it is to possess a property jointly with other individuals interacting in an appropriate fashion. Without this interaction, the identity of each individual human would be “indeterminate,” in the sense of *incomplete*.

The classic metaphysical conundrum for the instantiationist is *the one and the many*: How can the same property, say, “humanity,” belong to an indefinite number of individuals? Why does a property not diminish as it participates in the definition of each new individual, rather than enhance its ontological status? These instantiationist questions are implicitly answered in legal systems that accord individuals just enough freedom to enable everyone to enjoy the same amount of freedom. In contrast, the emergentist regards “being” as completely vacuous, since the term fails to distinguish among entities. Informing this judgment is that the truly deep metaphysical problem is *the part and the whole*: How can the activities of spatio-temporally separate individuals be arranged so as to enable the emergence of some higher order unity? Given the inherently partial nature of individuals, why do they not constantly interfere with or simply ignore each other, instead of interacting in a fashion that is not only mutually beneficial but “good” in a sense that transcends their aggregated interests?

The sets of questions suggested by these two metaphysical strategies imply two

radically different conceptions of inquiry. Put in terms an economist could appreciate, the instantiation strategy defends itself as a more efficient way of carrying out the emergence strategy, whereas the emergence strategy responds by revealing the hidden labor costs of the instantiation strategy. According to the instantiation strategy, inquiry is an intensive, perhaps even microscopic, search for the essential properties into which an individual can be analyzed without remainder and which together can be used to synthesize the individual without cost. By contrast, the emergence strategy works by differentiating a whole into its proper parts—but at a cost, since it is not clear that the process can be reversed, so as to allow the parts to be reintegrated into the original whole.

### **1.1 These Strategies Applied to Knowledge Integration: Universalism versus Globalism**

The classical philosophical debate over the constitution of reality mirrors today's concerns about the relationship between the individual knower and the collective body of knowledge. Is it one-many or part-whole? In other words, should the individual be seen as one of many similarly equipped knowers whose similarity marks them as members of one community, or as the possessor of a unique knowledge base that complements the unique knowledge possessed by the community's other members? This question recalls Emile Durkheim's original sociological formulation of the distinction between instantiationist and emergentist metaphysical strategies in terms of "mechanical" and "organic" solidarity as successive stages in the evolution of the division of labor. Indeed, one explanation for the rise of modern science in an otherwise economically backward and politically disorganized Western Europe can be cast in these terms. Unlike the great Eastern empires, an even ancient Greece and Rome, class distinctions could not be rigidly enforced, which allowed a sense of organic solidarity to emerge from the free exchange of academics and craftsmen, as institutionalized in the experimental testing of theoretical hypotheses on specially designed machinery.

In contemporary discussions of the organization of knowledge, the instantiation-emergence distinction appears most clearly in, respectively, *universalist* versus *globalist* knowledge policy strategies. The former aims for law-like regularities that apply in all societies, whereas the latter aims for a unique narrative that accounts for the one world-system in terms of relationships among its constituent social formations. Before considering the implications of this contrast for knowledge policy as such, it is worth examining the vivid versions of universalism and globalism that may be found in both Marxist and capitalist accounts of economic history.

In terms of Marxism, Lenin followed Marx's own practice of treating his theory as a transnationally repeatable blueprint for economic change, whereby leaders like Russia would show the rest of the world the way to the proletarian revolution. In contrast, Trotsky drew on Marx's Hegelian roots to hold that there is no such blueprint, only a gradually emergent global process, which therefore renders nonsensical the idea of socialism in one country. An updated version of such globalist Marxism is Manuel Castells' recent characterization of the contemporary world as a "network society." By this expression, he does not mean the ascendancy of information technology as a mode of production that recurs across many nations. This would be congruent with the

universalist perspective. Rather, Castells means the transnationally variable ways in which information technology has reconfigured the entire world-system. This includes deliberate backlashes against computer networks, the use of computers in unintended and perverse ways, as well as the unwanted disparities in wealth that the networks have produced at a global level.

In terms of capitalism, consider, on the one hand, Walt Rostow's stage-based model of economic growth; on the other, Alexander Gerschenkron's thesis on the relative advantage of backwardness. The former is universalist and the latter globalist. Rostow's "non-communist manifesto" followed Marx in believing that the path to economic progress is indefinitely reproducible, whereas Gerschenkron grounded his own anti-Marxist stance on the fact that the economic success of one nation may serve to prevent other nations subsequently succeeding by the same means. Thus, whereas Rostow saw latecomers to capitalism as more efficiently repeating the same stages as their predecessors, Gerschenkron cast the latecomers as innovators forced to overcome the phenomenon of "path-dependent" development. The growth of capitalism in Japan reveals interesting differences in emphasis between the two approaches. A universalist would stress how the Japanese overcame cultural differences with the West to embark on accelerated capital accumulation, while the globalist would focus on the ways they capitalized on those very differences.

The contrasting accounts offered by universalist and globalist economic history suggest that these two perspectives can be distinguished by the effect of scale and scope on social relations. According to the universalist conception, societies can expand indefinitely without changing their fundamental nature, and many societies can share the same fundamental nature, often by one imitating another. Constraints, such as there are, come from the outside, most crudely, as a selection environment that curtails population growth. When the mass exportation of free markets, a technological innovation, or a scientific paradigm is treated unproblematically, the universalist mentality is usually at work. Unsurprisingly, the failure of these foreign exports to be integrated in native environments is usually described in negative terms, such as ideologically inspired "local resistance" to something that *ought* to be universally available. In contrast, according to the globalist conception, an expansion or contraction of the parts necessarily alters their interrelation, which in turn changes the nature of the whole that the parts constitute. This throws into doubt the idea that either individuals or societies can ever simply "imitate" each other: Something is both lost and gained in the process. Predecessors either crowd out successors or unwittingly instruct them on how to improve on their achievement. As economists might put it, the universalist conception "exogenizes" changes in scale and scope, whereas the globalist conception "endogenizes" it.

In terms of knowledge policy, universalism and globalism are expressed, respectively, as *interdisciplinarity* and *transdisciplinarity*. Interdisciplinarity presupposes the existence of disciplines that between them carve up reality into distinct domains of inquiry, each governed by laws, which in some combination can be used to provide ever-richer understandings of a particular phenomenon, which is taken to be an instantiation of those laws. In contrast, transdisciplinarity presupposes that reality escapes any combination of disciplinary perspectives, which are themselves treated as

little more than an artifact of the last 150 years of the history of the Euro-American university system. Thus, in the case of tropical disease, one may adopt either an interdisciplinary approach that brings together specialists from biomedical and environmental science and public health policy or a transdisciplinary approach that treats tropical disease as a domain of scientific inquiry in its own right that requires expertise that is not reducible to a combination of existing disciplinary practices.

This example epitomizes the problems facing academic administrators and research managers in the “periphery” of the world’s knowledge-system: Try to reproduce “core” Western research institutions in the periphery, or develop alternative and perhaps complementary institutions that succeed on their own terms? The dilemma is acute because the world’s knowledge-system now seems to be constituted so as to make it marginally more advantageous for peripheral knowledge producers to imitate, however unsuccessfully, core research trajectories than to innovate native ones. A key indicator here is the *Science Citation Index*, which is more likely to include peripheral knowledge producers who publish in core journals than in peripheral ones.

## 1.2 The Postmodern Condition as a Challenge to These Strategies

In the nineteenth century, the difference between the two strategies was marked by the inanimate–animate divide. At that time, instantiationism was associated with Newtonian mechanics and Platonic metaphysics. Emergentism corresponded to vitalist biology and Aristotelian metaphysics. However, since the twentieth century, this divide has come to be blurred, as theories on the instantiationist side of the divide have mutated and migrated to the emergentist side, producing the *postmodern condition* diagnosed by, among others, Jean-François Lyotard. This development captures most of the dominant movements in twentieth century science, all of which have emphasized the “irreversibility” of temporal change but have stopped short of conferring purposefulness on the emergent direction of change. Examples include the neo-Darwinian theory of evolution, dissipative structures in thermodynamics, indeterminist interpretations of quantum mechanics, catastrophist mathematics, and chaos and complexity theory.

A general explanatory framework common to these theories has emboldened the Gulbenkian Commission convened by Immanuel Wallerstein to call for a radical transformation of the social sciences. The Commission observed that these theories explain irreversible change, roughly, in terms of the effects of a local disturbance reverberating throughout an entire system. At the very least, phenomena conforming to this pattern challenge a methodological dictum common to Aristotle and Newton, namely, the proportionality of cause and effect. Put another way, the postmodern condition in science highlights the distinction between *propagation* and *reproduction*.

For example, an organism passes its genetic material to an offspring without thereby ensuring that the offspring will be identical to itself. It thus propagates without strictly reproducing itself. Therefore, it would be misleading to speak of the two generations of organism as “instantiations” of the same species. Yet it equally does not follow that the new organism is an improvement on its parents, as modern versions of the emergentist strategy have often supposed (for example, Lamarckianism, Hegelianism). In evolutionary biology, this “non-emergent non-instantiation” is explained by

distinguishing between *how* genes are selected (namely, the conditions by which a particular organism survives in an environment) and *what* is selected (namely, the possible identities of the surviving organism's offspring). The relevant jargon is "phenotype" versus "genotype."

To be sure, there is precedent in the history of the human sciences for the disproportionality of cause and effect: so-called "invisible hand" accounts of the emergence of a stable social order as the unintended consequence of aggregated self-interested actions. However, the Gulbenkian Commission invoked a more negative, Marx-inspired interpretation of the invisible hand metaphor. Whereas the Scottish Enlightenment originators of the metaphor—such as Adam Smith and Adam Ferguson—tended to envisage a country *benefiting* from the invisible hand at work, the twentieth-century Commission treats the entire globe as a system that, on the whole, *suffers* from what are essentially accidents of history coming to be treated as laws of nature, simply on the basis of their persistence. Wallerstein's own world-system theory most explicitly develops this point, as suboptimal local patterns of production and trade are said to have forced medieval Europeans to embark on an expansionist campaign that eventuated in the modes of world domination characteristic of the modern era.

### 1.3 From Instantiation and Emergence to Closed and Open Sciences

Although the postmodern condition has blurred the instantiation–emergence distinction, the Gulbenkian Commission has resurrected the distinction in terms of, respectively, a *closed* from an *open* conception of science. Specifically, an instantiationist metaphysics lends itself to a closed social science, in the sense that the social world—much like the physical world in Newtonian mechanics—is portrayed as "closed" under a set of laws that apply for all space and time. In contrast, an emergentist metaphysics lends itself to an open social science, because the social world is portrayed as continually generating novel consequences from the interaction of known tendencies, including those associated with the inquirer's frame of reference.

As observed in section 1.1, even a system of laws that seems to contain a strong developmental component can be said to be "closed" in the relevant sense. Take the stages in Marx's dialectical materialist account of history, Jean Piaget's stages of cognitive development in the child, or Thomas Kuhn's stages of scientific change through normal and revolutionary phases. All of these accounts are universal in scope, and hence apply in case after case. In particular, the laws described in these accounts remain unchanged by the number or kind of cases to which they are applied. There is no feedback from the applications to the laws. For example, the transition from capitalism to socialism is supposed to be the same regardless of the country's specific history; the transition from concrete to abstract operations is the same regardless of the child's gender or birth order; the phases in the growth of scientific knowledge are the same regardless of discipline.

In contrast, in an open conception of social science, there are several respects in which the inquirer participates in constituting the objects of inquiry. The most obvious ones concern the inquirer's background value commitments, but no less important are more objective features of the inquirer's location in space and time. From the standpoint of an

open social science, the status of Marx's laws of history depend on whether the social scientist is located in, say, Europe or Africa, late nineteenth or late twentieth century, etc. What may have seemed an inevitable trajectory prior to the Bolshevik Revolution looks at best like a politically propelled idealization after the reversal and perversion of various socialist projects inspired by Marxism. This reflects the fact that Marxism is not simply an account of history but itself a part of history.

Emblematic of the ascendancy of emergentist over instantiationist thinking in our times is the decline of that preeminent closed science, physics, as the intellectual vanguard and financial leader of all the sciences. In the nineteenth and twentieth centuries, physics was the cornerstone of the instantiationist perspective, especially as the standard-bearer of *positivist* and *reductionist* ideologies (more about them in section 3), whereby disciplines would prove their progressiveness by repeating salient stages in the development of theories and methods in physics.

It had helped that physics was traditionally a laboratory-based subject that not only sought laws for closed systems abstracted from locally variable effects, but also largely managed to insulate its own activities from their real world political consequences. The success of the US atomic bomb project in World War II is an example of the synergy resulting from this dual sense of autonomy. Indeed, it inspired Vannevar Bush's influential 1945 essay, "Science: The Endless Frontier," which helped establish the U.S. National Science Foundation. The dual autonomy of physics constitutes an "idealization" that has had both positive and negative import. Positively, the history of physics can be more easily told as a sequence of self-generated problems and solutions—the basis of Kuhn's paradigm-based theory of scientific change—than the history of, say, chemistry, biology, or the social sciences, where it is difficult to avoid the role of nonscientific influences on the research trajectory. Negatively, physics came to be overadapted to a state-protected funding environment that is gradually disappearing with the end of the Cold War.

In the "free market" of today's open science, it is much more persuasive to claim utility than autonomy, as illustrated in the race to map the human genome. The ability of physicists to demonstrate that just one more (and bigger) particle accelerator will answer age-old questions that only elites have been empowered to pose has been overtaken by biologists who claim that funding their research will enable ordinary people to customize their offspring. This shift from a vertically organized, theory-driven conception of science to one that is horizontally organized and driven by practical concerns marks science as undergoing a *secularization* comparable to that which Western Christendom underwent starting with the Protestant Reformation in the sixteenth century. The formal separation of church and state initiated a period of religious evangelism, in which churches were forced to tailor the faith to fit their potential constituency on whom they had to directly rely for material support. So too with the post-physics, post-academic world of science.

As heir to the emergentist tradition, contemporary biology has exhibited a dual sense of "integration" that has made it "adaptive" in both a positive and a negative sense. On the one hand, biological research has increased our knowledge of the full adaptive capacities of humans and other species. On the other, biology's own research trajectory

has been perhaps too adaptable to the interests of its host societies, which has resulted in a skewed knowledge base. Consider the Human Genome Project. Here, a large financial and cultural investment is predicated on fundholders believing that difficult problems in social policy can eventually be solved—and maybe even preempted—by prenatal genetic manipulation. Alteration of the physical environment or the interests of those who already populate it—say, in order to foster greater biological diversity—is presumed to be sufficiently complicated and expensive to be given secondary status in the research agenda.

In sum, the transition from closed to open sciences is epitomized by a major shift in the sense of “control over the environment” that is constitutive of scientific progress. From a preoccupation with predictive accuracy, scientists are now increasingly concerned with expanding the range of human adaptivity to fundamentally unpredictable situations. In the physics-driven world of closed science, the main normative danger was that the artificiality of the laboratory would be used as a springboard for coercive social policies. However, in the biology-driven world of today’s open science, the main danger is the tendency to confer too much value on statistically normal behavior occurring in stable environments, so that robust survival ends up being amplified into some higher virtue like truth, goodness, and justice.

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### **Biographical Sketch**

**Steve Fuller** (born 1959, New York City) is Professor of Sociology at the University of Warwick, UK. Originally trained in the history and philosophy of science (Ph.D., 1985, University of Pittsburgh), he is the founder of the research program of social epistemology. It is the name of a quarterly journal he founded with Taylor & Francis in 1987, as well as the first of his six books: *Social Epistemology* (Indiana University Press, 1988), *Philosophy of Science and Its Discontents*, 2nd edn. (Guilford Press, 1993), *Philosophy, Rhetoric and the End of Knowledge* (University of Wisconsin Press, 1993), *Science* (Open University Press and University of Minnesota Press, 1997; translated into Japanese, 2000), *The Governance of Science: Ideology and the Future of the Open Society* (Open University Press, 2000), *Thomas Kuhn: A Philosophical History for Our Times* (University of Chicago Press, 2000). His latest book is *Knowledge Management Foundations* (Butterworth-Heinemann, 2001), a critical examination of the knowledge management field. Fuller has organized two global cyberconferences for the UK’s Economic and Social Research Council: one on public understanding of science (1998), and another on peer review in the social sciences (1999). He has spoken in over 25 countries, often keynoting professional academic conferences, and has been a Fellow of the Royal Society of Arts since 1995. He sits on the advisory board of the Knowledge Management Consortium International and the Council of the Society for Social Studies of Science.