STRATEGIES OF KNOWLEDGE INTEGRATION

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Steve Fuller
Professor of Sociology, University of Warwick, Coventry CV4 7AL, UK
E-mail: s.w.fuller@warwick.ac.uk

Biography

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.

Abstract

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 20th 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, neo-liberal 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.

Keywords: closed science, consensus conference, constructivism, deductivism, disunification, emergence, globalism, inductivism, instantiation, interdisciplinary, modes 1 and 2, knowledge management, network failure, open science, postmodern condition, realism, reduction, secularization of science, social epistemology, sublation, transdisciplinary, universalism, university

Contents:

Glossary

Closed Science: The sort of science that exemplifies the instantiationist strategy, e.g. Newtonian physics. Such a science tends to be "closed" in terms of both how it conceptualizes its domain of inquiry and the institutional conditions under which it conducts inquiry (i.e. state protection)

Consensus Conference: A species of deliberative democracy whereby ordinary citizens are sequestered to determine the guidelines within which laws concerning a science-based policy issue should be made. Although participants in these conferences are exposed to many different expertises and interests, the results have always seemed "pleasantly surprising."

Constructivism: The attitude of the knower presupposed by the emergentist strategy.

Deductivism: The version of instantiationism that follows from holding that knowledge integration is natural. It is associated with the positivist philosophical movement.

Disunificationism: The view that the goal of integration is a perversion of the natural course of inquiry because it presupposes a unified view of reality that is either unknowable (Neo-Kantianism) or non-existent (Neo-Kuhnianism)

Emergentism: The metaphysical tradition that regards individuals as parts of a higher-order whole that has properties lacking in the individuals. The main conceptual problem associated with this tradition is epitomized in the phrase "the part and the whole." For example, if "humanity" is a property that individuals have only in social settings, does it follow that the individuals who constitute society are only potentially human?

Globalism: The application of the emergentist perspective to knowledge policy. Generally speaking, it implies that knowledge integration occurs by people (or nations) engaging in different but complementary inquiries

Inductivism: The version of emergentism that follows from holding that knowledge integration is natural. It is associated with the idea that integration occurs like tributaries flowing into a major river.

Instantiationism: The metaphysical tradition that regards individuals as instances of the integration of several universally available properties. The main conceptual problem associated with this tradition is epitomized in the phrase "the one and the many." For example, if many individuals share the property of "being human," does that change what it means to be human?

Interdisciplinarity: The form of knowledge integration favored by universalist knowledge policy analysts

Knowledge Management: A popular movement in the business world that treats knowledge production as a necessary evil -- the more necessary, the more evil. Universities are routinely regarded as "dumb organizations" in this literature.

Modes 1 and 2 Knowledge Production: A false dichotomy currently popular in European science policy circles which divides all knowledge production into the narrowly disciplinary (mode 1) or the expansively transdisciplinary (mode 2) -- with the university being the excluded third possibility.

Network Failure: A phenomenon, to be understood on the model of a market failure, whereby new knowledge fails to benefit more than those who participated in the network: an argument for the university.

Open Science: The sort of science that exemplifies the emergentist strategy, e.g. Neo-Darwinian biology. Such a science tends to be "open" in terms of both how it conceptualizes its domain of inquiry and the institutional conditions under which it conducts inquiry (i.e. free market)

Postmodern Condition: The fact that the leading developments in 20th century science have tended to undermine the instantiation-emergence distinction by e.g. in the case of evolutionary biology denying that species either strictly reproduce or improve themselves over time.

Realism: The attitude of the knower presupposed by the instantiationist strategy.

Reduction: The only kind of knowledge integration that is possible, once human cognitive limitations and instrumental interests are taken seriously. Reductionist programs tend to begin as physicalist and end up as functionalist in orientation.

Secularization of Science: The divestiture of state support from science, a feature of the post-Cold War political economy of science. Analogous to the secularization of Christianity, one would expect the period of "science evangelism" currently associated with private biotechnology firms.

Social Epistemology: The interdisciplinary field concerned with the social conditions under which knowledge is produced and distributed.
Sublation: A knowledge integration strategy favored by 19th century German idealist philosophers, which aims to recover a holistic sense of inquiry by overcoming differences between bodies of knowledge.
Transdisciplinarity: The form of knowledge integration favored by globalist knowledge policy analysts
Universalism: The application of the instantiationist perspective to knowledge policy. Generally speaking, it implies that knowledge integration occurs by people (or nations) engaging in inquiries that are reducible to a common pattern.
University: The only institution in the modern period whose main function is knowledge integration.

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 instantationist 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 threshhold 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. That would be congruent with an 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 19th 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 20th 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-Francois Lyotard. This development captures most of the dominant movements in 20th 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 20th 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 was 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 the same regardless of the child's gender or birth order; the phases in the growth of scientific knowledge is 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 19th or late 20th 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 pre-eminent closed science, physics, as the intellectual vanguard and financial leader of all the sciences. In the 19th and 20th centuries, physics had been the cornerstone of the instantiationist perspective, especially as the standard-bearer of *positivist* and *reductionist* ideologies (more about which 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 US 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 non-scientific 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 16th 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. Its large financial and cultural investment

is predicated on its funders believing that difficult problems in social policy can be eventually solved – and maybe even pre-empted -- by pre-natal 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 adaptiveness 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.

2. The Social Epistemology of Instantiation and Emergence: Realism versus Constructivism

Social epistemology is the interdisciplinary field concerned with the social conditions under which knowledge is produced and distributed. Like the philosophy of science and classical epistemology, social epistemology is mainly normative in orientation; however, unlike these fields, the social epistemologist's norms are constrained by the historical and empirical character of human inquiry, as uncovered by the full range of humanistic, social and natural science disciplines. In short, social epistemology is a kind of abstract science policy, or "knowledge policy," an expression that implies a consideration of *all* the knowledge-producing disciplines, in *both* their research and training capacities. The fundamental questions in social epistemology are (i) what should be the goals of the knowledge system, and (ii) do actual knowledge systems live up to the norms prescribed for them.

Because metaphysical modes of speech tend to conceal the fact that reality must always be "realized," social epistemologists tend to be critical, sometimes even deconstructive, of a binary opposition like "instantiation" versus "emergence," which together presuppose a god-like view of the knowledge system. Instead, the social epistemologist is inclined to interpret this binary in terms of the attitudes they presuppose of the knower: *realist* versus *constructivist*, respectively. Social epistemologists do not merely analyze this distinction but often find themselves on either side of it. Hence, it is useful to speak of what constructivism looks like from the realist point-of-view and vice versa. At the same time, it is important to dispel some misconceptions.

“Realists” do not normally resort to “common sense” for their sense of reality; rather, they are much closer in spirit to Platonism, Cartesianism, and other philosophies that presuppose a stratified view of reality. Realists vary over the best way to characterize and access the “surface” and “depth” of reality. Nevertheless, the deep end of reality – or “fundamental ontology” -- is invariably a restricted realm that requires special methods and training. From the realist point-of-view, the constructivist appears to confuse surface and depth, appearance and reality, belief and knowledge, verification and truth, etc. This is because constructivists hold that what counts as the “surface” or “depth” of reality is itself a construction of the knowledge system, not a representation of something that exists outside the system. In that sense, the constructivist collapses the distinction between the philosophical disciplines of epistemology and ontology, which the realist holds sacrosanct.

For their part, “constructivists” are often mischaracterized as relativists and even nihilists who believe that each culture (or person) is entitled to their own truth. In this misreading, the verb “to construct” means “to make up out of nothing,” as if constructivists were arguing for a view of reality that has no basis outside itself. A more correct interpretation of “to construct” is “to make up out of something,” a phrase that brings out better reality’s processual character as the past provides the raw material out of which the future is made. Consequently, constructivists blur philosophical distinctions that realists want sharpened. In particular, realists draw a strong distinction between the contexts of *evaluating* and *applying* knowledge claims, whereas constructivists treat the two contexts as the same.

The basic idea here is that realists hold that knowledge claims first need to pass a quality control check in a cloistered expert setting -- which may be a laboratory, a circle of peers, or even one's own secure mental space -- before those claims are unleashed on the world. Only in the expert setting can one identify the salient variables, underlying causes, intuited essences, etc. The real is thereby made apparent. However, if the world ends up worse as a result of applying knowledge of this reality, then that will be blamed on the low intellects or corrupt morals of the appliers. In contrast, constructivists do not sharply distinguish between how professional scientists and the rest of humanity access reality. Such public spaces as the agora, the battlefield, or the hospital are equally good as sites to manifest knowledge claims as more cloistered settings. Thus, evaluation and application collapse into each other, and one is never really sure (nor perhaps should one be) whether a given outcome reflects human will or objective reality. "Knowledge" here turns out to be an irreducible mixture of the two.

The social epistemologist regards realism as an ideology designed to absolve scientists from responsibility for the consequences of actions taken on the basis of their authority but without their involvement. The realist holds that the responsibility of scientists ends with the consequences logically entailed by their theories and empirically predicted in their laboratories. However, to avoid the

moral quandary in this way is to conflate the difference between the *intended* and *anticipated* consequences of one's actions. For example, Einstein and Bohr may not have intended for their physics to result in the atomic bomb. But at some point in the history of the atomic physics they could have anticipated that the theory would be put to that use: maybe not in 1910, but certainly by 1945, when the US dropped the atomic bomb on Japan. Once some disturbing precedents are set, there is little excuse to allow those precedents to become normal practice.

Unfortunately, the history is not so philosophically straightforward, since Einstein actually urged Franklin Roosevelt to start the US atomic bomb project. Of course, Einstein and other atomic physicists eventually took responsibility by campaigning against nuclear weapons research. Those who saw this activity as part of their responsibility *as scientists* would be classed as constructivists. In contrast, realists tend to make the idea of "unintended consequences" do too much work, as if we could only learn from our mistakes in our cloistered settings but never in the world outside the cloister. Accordingly, from a constructivist standpoint, scientists are often irresponsible because they pretend to know much less than they do – or could know, if they devoted as much effort to understanding the potential applications of their research as with how their peers will evaluate it. However, realism may discourage precisely this moral impulse because of its strong distinction between the contexts of evaluating and applying knowledge claims.

One of the most historically sustained examples of the realist-constructivist sensibility is the difference between biomedical researchers and practicing physicians. To be sure, this difference is obscured by the emotively charged question: "Would you allow a realist or a constructivist treat you for cancer?" Yet, a realist engaged in biomedical research would probably resist making *any* substantial interventions until the underlying causes are established beyond a reasonable doubt. Indeed, the rhetoric surrounding the people who doubt the connection between cigarettes and lung cancer, HIV and AIDS, and other such attempts to link to cause and effect, is usually very "high realist." In complete accuracy, if not always sincerity, these people warn that we should not mistake correlation for causation. Thus, an excuse is provided for protracting basic research programs and perhaps even multiplying the avenues of research pursued, without doing anything for the people currently suffering from lung cancer or AIDS.

In contrast, practicing physicians who advocate a substantial invasion of people's bodies do not usually think like a pure realist. They are more inclined to blur the contexts of testing and applying knowledge claims. If the patient lives after, say, having undergone chemotherapy, then chemotherapy is "constructed" as the decisive cause; if the patient dies, then the cancer is constructed as the cause that resisted the treatment. However, the outcome cannot be predicted with certainty because there is no necessary causal grounding for it. It is by going

through the treatment that the knowledge claim in question ("chemotherapy cures cancer") is simultaneously tested and applied. In this sense, physicians are practicing constructivists, which is why so much of what they do is tied up with legal and moral issues.

In the history of the West, realism has been a revanchist move that recurs periodically whenever constructivist-inspired activities have had palpably bad effects on society, and society has responded by threatening to curtail free inquiry altogether. In psychoanalytic terms, realism is the "defense mechanism" of the “once burnt, twice shy” inquirer. Put somewhat less charitably, realists try to have their cake and eat it by taking responsibility for the good consequences of their research but refusing responsibility for the bad ones. From that standpoint, constructivists can at least claim the virtue of symmetry, a willingness to take responsibility for *everything* they do.

Thus, an encapsulated history of Western knowledge production would start by noting that Plato's founding of the Academy in the outskirts of Athens was an explicit attempt to shelter inquiry from the politically destabilizing effects of the public exercise of reason by the Sophists, which had culminated in the Peloponnesian Wars. This resulted in the creation of an environment fit for contemplating the ultimate forms of reality. Two thousand years later, "The Hundred Years War" in Europe over alternative interpretations of the Bible resulted in such seminal scientific institutions as the Royal Society of London and L'Academie des Sciences, which were chartered as ideologically neutral zones for the pursuit of knowledge. Another three centuries later, the various idealistic and positivistic schemes for insulating the development of knowledge from other societal developments -- Hegel's and Comte's most notably -- were once again attempts to contain and channel "Enlightenment" impulses which had originally ended in the bloodshed of the French Revolution. This pattern continued in the 20th century, with logical positivism and Kuhn's paradigm-based theory of scientific change featuring as increasingly sophisticated attempts to protect science from external interference, especially given, on the one hand, the Weimar backlash against science following Germany's defeat in World War I and, on the other, increasing public concern in the US about the application of scientific research in the wake of Hiroshima.

3. Historical Conditions for Knowledge Integration

There are two broadly different ways of conceptualizing the historical conditions for integrating knowledge. One presupposes that integration is a *natural* development of scientific inquiry, while the other supposes that it is added *artificially* to inquiry's inherently divergent tendencies. (Here “natural” means no more than a metaphysically enhanced version of “default.”) Moreover, within each position, a further distinction can be made. Natural integrationists may be either *deductive* or *inductive* in orientation, whereas those who see integration as artificial may regard it as a *perversion* or an *improvement* of the natural course of inquiry. More space is devoted to the artificialist perspective, since that provides the more instructive example for contemporary attempts at knowledge integration.

3.1. Knowledge Integration as Natural: Deductive and Inductive Versions

When integration is seen as a natural development of knowledge, it is usually

conceptualized in one of two ways, both of which were developed in Western Europe in the second quarter of the 19th century. The deductive version is associated with Auguste Comte's understanding of positivism, whereas the inductive version is associated with William Whewell's vision of science as what he called "consilience." According to the deductive orientation, integration occurs by the most progressive discipline serving as the methodological and theoretical template for expediting the development of more backward disciplines. This strategy, recognizable as a version of the instantiationist approach to reality, has historically relied on Newtonian mechanics as the template. In contrast, the inductivist imagines that integration is an emergent feature of several strands of inquiry flowing into a common trajectory, much as tributaries flow into a major river. Here too Newtonian mechanics serves as the paradigm case, but less as an exportable model than as the synthesis of several prior and often countervailing tendencies, as in Newton's unification of Baconian empiricism and Cartesian rationalism. The Neo-Darwinian synthesis of the 1940s may be similarly portrayed as having brought together the natural history and experimental genetics traditions in biology, which represent, respectively, conservationist and interventionist attitudes toward the physical environment.

The different roles that Newton's work plays in the deductive and inductive orientations reflects an underlying difference in the institutional location of the people who laid claim to integrating knowledge. From today's standpoint, deductivists are best seen as self-styled "knowledge managers" who took it upon themselves to instruct and encourage inquirers in the backward disciplines to approximate Newtonian standards. The leading 19th century positivists – Comte, John Stuart Mill, and Herbert Spencer – were free-lance writers more warmly received by chemists, biologists, and social scientists than by the professional physicists whose practices they wanted their readers to imitate. In contrast, inductivists have tended to be ensconced academics who used the classroom as the medium for bringing together disparate strands of thought, much as Newton himself did at Cambridge. Whereas the deductivists pitched their arguments for integration to mature knowledge producers, the inductivists held that integration was always a project best left for the *next* generation of disciplinary practitioners, since the value of integration would lie in the fertile ground it lay for future research, as opposed to the legitimation of current research.

Finally, it should be noted that the natural approach recognizes that knowledge integration may be artificially *blocked* by various means, including disciplinary parochialism and ideological opposition, as well as the fact that genuinely new discoveries and inventions are difficult to assimilate into the collective body of human knowledge. Despite being subjected to severe criticism for his own sociobiological commitments, E.O. Wilson has been exceptionally sensitive to all these blockages. In particular, he suggests that the very development of the social sciences as autonomous fields of inquiry has constituted one such long-term blockage. Before Emile Durkheim's 1895 declaration that social facts are "*sui generis,*" the social sciences had routinely sought a systematic understanding of human nature, in which biological considerations informed at least the foundational principles. This train of thought connected Aristotle, Montesquieu, and Adam Smith with Marx and Wilhelm Dilthey, both of whom embraced Darwin's theory of evolution as underwriting the unity of *homo sapiens* as, respectively, producers and interpreters of their life conditions.

To be sure, the autonomy of the social from the biological sciences has been also spurred by the rediscovery and continuation of Gregor Mendel's original work in genetic inheritance, against which social scientists often defined their research in the 20th century, via the "nature versus nurture" controversy. Before the rediscovery of Mendel's work in 1900, the germ plasm was seen as susceptible to environmental (and hence, social) influence. But with the rise of an autonomous science of genetics, biological and social factors have been increasingly seen as trading off against each other, perhaps via some “epigenetic” process whereby the environment triggers preordained patterns of behavior. Consequently, sociobiologists hold that social scientists provide much data, but little theory, that is of use to the overall synthesis of human knowledge because social scientists willfully ignore the biological bases of human life. For their part, social scientists respond that the institutional and political cost of the sociobiological synthesis is much too high, namely, an elimination of the modes of intersubjectivity that precisely distinguish humans from other animals.

3.2. Knowledge Integration as Artificial

To say that knowledge integration is “artificial” is to admit that inquiry naturally tends toward dispersion and fragmentation, unless specific measures are taken to alter that tendency. The historical intuition behind this vision is that the special sciences have successively spun off from their original basis in philosophy by "disciplining" inquiries that had been previously subject to unresolvable metaphysical or ideological disputes. On this view, the most advanced sciences are the ones that left philosophy first, whereas the least advanced sciences retain a strong philosophical residue. This distinction is epitomized in Kuhn's idea of "paradigm," a model for inquiry in the physical sciences that is generally lacking in the social sciences, in which the most popular theoretical frameworks (Marxism, Freudianism, behaviorism, cognitivism, sociologism -- not to mention capitalism) also happen to be the ones over which there is the most disagreement.

Like the natural approach to knowledge integration, the artificial one is also largely a product of a 19th century vision of European intellectual history, but one bred in the fourth quarter of the century, once academic philosophy began to formally acknowledge the devolution of its inquiries to specialized departments. Artificialists who treat integration as an improvement on the natural course of inquiry have generally envisaged the university as an agency for consolidating the power of the nation-state; whereas those who treat integration as a perversion of inquiry have envisaged the university's agency in more politically modest terms that have often afforded the easy appropriation of academic knowledge for non-academic ends. In the case of "pro-integrationists," the open question is whether an intellectually consolidated nation-state encourages more inclusive or more discriminatory policies toward its own residents. In the case of "anti-integrationists," the open question is whether the appropriators represent the entire public or merely private interests.

3.2.1. Pro-Integrationism: From Sublation to Reduction

The idea that knowledge integration requires deliberate effort in the face of

natural dispersion is traceable to the role that the great synthetic idealist philosophies of the early 19th century played in reinventing the university as the founding institution of German national unity. The figures behind these philosophies -- Fichte, Schelling, and Hegel -- were all prominent civil servants. Common to their quest for synthesis was a belief that humanity had suffered a "fall" comparable to the expulsion of Adam and Eve from the Garden of Eden. The Tower of Babel -- though referring to a later episode in Biblical history -- became the symbol of this decline. The idea of "pristine wisdom" (*prisca sapientia*) available to the ancients but lost to the moderns had motivated the Italian Renaissance's recovery of the founding languages of Indo-European culture, which culminated with the rise of philology as the intellectual-cum-ideological basis for Europe's primordial Aryan identity in the late 18th century.

However, even the most zealous knowledge integrators have rarely believed in a return to an original holistic state of inquiry. Indeed, knowledge integration always comes at a cost. For example, the principal Hegelian mechanism of integration, *Aufhebung* -- translated in English as "sublation" or "sublimation" -- implies that disparate bodies of knowledge must lose some of their distinctiveness to become absorbed into a greater synthesis. By the end of the 19th century, *Aufhebung* itself had come to be sublated into a more generalized concept of *reduction.* What was usually claimed to be lost in "reduced" sciences were the marks of their spatio-temporal origins, which had restricted the range of eligible contributors and validators of knowledge claims. For this reason, reductionism has tended to be championed by anti-establishment, often younger, inquirers with relatively little investment in the current epistemic orthodoxy. This pattern fits not only the major idealist and materialist movements of the 19th century, but also the most famous pro-integration movement of the 20th century, logical positivism.

Perhaps the most interesting recent attempt to justify the reductionist approach to knowledge integration is due to the philosopher of science Alexander Rosenberg, who argues that a combination of human cognitive limitations and instrumental interests renders reductionism an inevitable feature of any form of knowledge that aspires to understanding stable patterns of phenomena. However, from the standpoint of the history of science, what ultimately tends to be "reduced" is the need for an exact physical specification of the phenomena in question. Thus, the fundamental categories of the non-physical sciences in the strict sense -- that is, the biological and social sciences -- are typically defined by the *functions* they serve in a larger system, not by properties intrinsically possessed by the individuals falling under these categories. For example, a species in biology is defined in terms of organisms that can conjoin to produce fertile offspring, regardless of the organisms' exact physical constitution. This means that in principle *homo sapiens* could be perpetuated by individuals with very different physical make-ups. Of course, naturally occurring tendencies in genetic variation and considerable inter- and intra-species genetic overlap make this unlikely -- that is, just as long as biotechnology can do no more than enhance or diminish tendencies already present in the gene pool. But once that technical barrier is

surmounted, the biological definition of species would seem to allow certain high-grade androids to pass as humans.

It would seem to follow that the reductionist imperative ultimately renders the distinction between idealism and materialism itself immaterial. Inquirers' interests in adopting a particular theoretical system ultimately override the difficulties in specifying all the physical parameters needed to identify entities in that system. In short, physicalism turns into functionalism. More precisely, micro-reduction eventually yields to macro-reduction as the preferred strategy of knowledge integration. This, in turn carries profound normative implications. Consider, by way of illustration, the history of systemic attempts to understand the nature of (1) *mind* and (2) *society*.

(1) (1) Systemic attempts to understand the mind began as a battle between those who wanted to reduce mind to matter and those who held that mind transcends matter. In a nutshell, achievements in the former research program eventually rendered the latter program less plausible. But ultimately, difficulties in specifying all of the mind's physical parameters have led inquirers to think in more functionalist terms, so that increasingly mental life is defined in terms that are indifferent to whether it transpires in carbon-based brains, silicon-based computers, or some combination of the two (i.e. "cyborgs").

(2) (2) Similarly, systemic studies of society began as a dispute between those who would reduce society to the physical circumstances of its members and those who held that society's existence transcends those circumstances. The "naturalistic" tradition leading from Aristotle and Ibn-Khaldun through the Enlightenment to Marx and Darwin has cast significant doubts on the idea of societal transcendence. Yet, this tradition's own shortcomings have encouraged the notorious philosopher of "animal liberation," Peter Singer, to redraw the boundaries of the social order so that some (sentient) non-humans are included, while some (disabled, deranged) humans are excluded.

Consequently, just as a brain is now neither necessary nor sufficient to constitute a mind, so too humans are neither necessary nor sufficient to constitute a society.

3.2.2. Anti-Integrationism: From Neo-Kantianism to Neo-Kuhnianism

Those who regard integration as a perversion of the natural course of inquiry generally object to integrationism's historical tendency to reduce differences in bodies of knowledge to differences in how one accesses and/or expresses a common, unified sense of reality. Today this opposing perspective is typically called *disunificationism*. Three contrasts capture what has been at stake in the opposition to integrationism. First, whereas integrationists have aspired to one ultimate court of epistemic appeal -- say, by reducing all knowledge claims to statements about sensory experience or physical evidence -- disunificationists have celebrated the proliferation of local knowledges. Second, whereas

integrationists have been keen to remove barriers to epistemic access associated with jargon and related mystifications, disunificationists have aimed to protect spaces for different epistemic communities to flourish autonomously. And third, whereas integrationists have sought to provide a common direction to disparate bodies of knowledge, disunificatonists have demythologized historical narratives that promote just this sense of teleology, so as to enable different fields to follow the path of inquiry wherever it leads.

When disunificationism was first articulated as Neo-Kantianism in Germany in the third quarter of the 19th century, the idea of a unified sense of reality was criticized on the grounds that it was, in Kant's original term, "noumenal," which is to say, knowable only through its appearances and not in itself. For the Neo-Kantians, these various appearances were systematically comprehended by the academic disciplines that had begun to spin off from philosophy and establish themselves as university departments. The spirit of this argument is captured by the slogan: "Scientific epistemology recapitulates academic bureaucracy." However, nowadays disunificationists take a somewhat different tack. They normally suppose that reality is indeed knowable, but it happens to be diverse in nature. Following Kuhn, they regard the history of science as the natural history of human knowledge. Thus, the fact that scientific paradigms operate on self-contained domains of objects that are accessed by unique sets of concepts and techniques implies the existence of multiple incommensurable realities. A slogan that captures the spirit of this perspective is: "Scientific ontology recapitulates laboratory technology." Another important difference between the Neo-Kantian and Neo-Kuhnian versions of disunificationism is that whereas the Neo-Kantians tended to envisage disciplinary specialization as akin to the "functional differentiation" of organs in the maturing embryo, the Neo-Kuhnians appeal to a biological metaphor that renders knowledge production irreversible but completely purposeless, namely, Neo-Darwinian speciation, which is, in Kuhn's terms, a "progress *from"* that is not a "progress *to*."

Neo-Kantianism arose in response to philosophy's loss of authority as the interface between the university and its state sponsors. This is usually traced to the politically divisive consequences of the ideological uses made of Hegel's unified vision of reality by his followers in the 1840s, not least Karl Marx. Thus, instead of discussing the larger societal ends of knowledge, as Hegel had seemed to encourage, the Neo-Kantians confined the normative purview of academics to the "peer review" of their disciplines, the results of which then could be appropriated as the state saw fit. Even philosophers were reduced to "underlaborers" for the special sciences who spent their time disentangling disciplinary foundations, streamlining disciplinary histories, and adjudicating disciplinary boundary disputes -- again, all in the aid of making academic knowledge more accessible to non-academic users. Not surprisingly, Neo-Kantianism is the source of the ongoing debates over the sorts of knowledge that the natural sciences, social sciences, and humanities make possible. Wilhelm

Dilthey, Max Weber, and Ernst Cassirer are figures from this movement whose work in this vein continues to have currency.

However, the fact that Germany lost World War I, despite its high scientific standing, generated an irrationalist backlash, which was crystallized in Oswald Spengler's popular *The Decline of the West* (1918-22). The Neo-Kantians had no effective response to this backlash, since they had divided the forces of "Reason" and "Truth" into specialized "reasons" and "truths" that together evaded Spengler's looming question, namely, what precisely gives world-historic meaning and direction to the pursuit of knowledge. Despite their profound differences, the followers of logical positivism, critical theory, and existential phenomenology tried to tackle this problem, leading thinkers as different as Karl Popper, Theodor Adorno, and Martin Heidegger to trawl through the history of philosophy to find lost insights into the unity of inquiry, fully realizing that they might appear "reductive" to those who treated the current array of academic disciplines as normatively acceptable. In effect, they stripped modern science of its diversity and technical virtuosity and brought it back to basics. Thus, Popper and Adorno returned the sciences to their original unity with Socratic dialectic in the spirit of critical inquiry, while Heidegger sought an ultimate sense of "Being" that is presupposed by the various "beings" studied by the sciences.

It may not be long before Neo-Kuhnian disunification is subject to a backlash of this kind. Creationism, Ecologism, Sociobiology, Feminism, and Computationalism are all very different contemporary socio-intellectual movements that have, with varying degrees of success, criticized the disciplinary structure of universities for evading matters of "ultimate concern" that come from inhabiting a common reality.

4. The Future of Knowledge Integration: Identifying and Overcoming the Obstacles

Intellectually, the time may be ripe for a new round of knowledge integration. But there are several very important institutional counter-tendencies. These are related to what was called in section 1.3 the *secularization of science.* In short, over the past half-century, the core Western knowledge producers have operated in a knowledge policy environment dominated by the Cold War. On the one hand, in the name of consolidating both national and international knowledge bases, the Cold War seeded processes for the exchange, evaluation, and integration of knowledge that carry on as the infrastructure for post-Cold War knowledge policy. One need only recall the conditions under which the internet, the Science Citation Index, and artificial intelligence research were first developed. On the other hand, the withdrawal of what Alvin Gouldner dubbed the "welfare-warfare state" from regulating these developments has left them captive to the competing demands of the global marketplace and sectarian communities, as exemplified by the uncertainties surrounding the institutional future of the university in most

countries. It might be said that the day-to-day autonomy that the state routinely granted to researchers during the Cold War exacted a high cost, as it provided a structural disincentive -- if not outright prohibition, when national security was at stake -- against researchers addressing the ends of their knowledge production. The result is now felt in the lack of rhetorical space available for expressing a research standpoint that is autonomous from the interests of potential clients that does not also appear like a self-serving plea for the researcher's narrow guild interests.

The university traditionally provided that increasingly scarce rhetorical space, as the demands of a common curriculum compelled the practitioners of different disciplines to integrate their disparate inquiries together. These demands simultaneously enabled academics to escape their narrow guild interests and prepare the groundwork for a public that would be receptive to academic work, namely, the future leaders that make up the student body. However, this strategy is now being eroded by the piecemeal and vocational character of academic instruction, which is partly due to the increasing use of credentials as a principle of social stratification: More students need to attend university for more specific reasons. Moreover, the problem is compounded by the changing character of academic staff. Most of the current generation of academics will have to spend at least some time as teachers and researchers on fixed-term contracts, and some will spend their entire careers that way. Such an arrangement offers little incentive for younger academics to invest in the institutional future of the university, and indeed relatively few of them are inclined or encouraged to participate in peer review processes, publish substantial synthetic works, or occupy academic leadership positions -- activities that cannot be justified mainly in terms of short-term career advantage.

But perhaps the biggest obstacle facing knowledge integration in our time is a science policy ideology sees the secularization of science, as described in the last two paragraphs, *as an almost entirely good thing*. Thus, European science policy gurus proclaim the advent of a "new mode of knowledge production". The main arguments in favor of a transition in the mode of knowledge production from a narrowly discipline-based ("mode 1") model to one more sensitive to the needs of users ("mode 2") turn on the emergence of such hybrid fields as artificial intelligence and molecular biology. However, it is often overlooked that these fields are counted as *fields of knowledge* -- as opposed to merely sets of useful concepts and techniques -- only because they were eventually absorbed into more academic modes of knowledge production. These include journals, textbooks and degree programs, all of which are explicitly designed to reproduce and extend the inquiries on which these fields are based, typically in ways that go beyond the stereotype of academic knowledge production as too specialized for its own good.

Another way of putting the point is as a critique of the idea that knowledge is created and transmitted in "networks." The contemporary appeal to networks is,

of course, connected to the pervasiveness of information technologies, but it has further implications. Networks arise to accomplish rather specific goals. Therefore, given the ease with which networks can emerge and disappear, to what extent is the knowledge they generate available to future inquirers who are not part of the original network? Might there not be *network failures*, analogous to market failures, in which network-based knowledge production leads to a restriction on the general distribution of the knowledge produced? Even if the intended beneficiaries of a network are satisfied, a problem remains if others who could have benefited from the new knowledge are prevented from doing so, simply because they were not part of the original network. In traditional forms of academic knowledge production, this problem was solved by ensuring that new knowledge was freely disseminated through teaching and publication. In that sense, the university was the institutional safeguard of knowledge as a "public good." However, nowadays the networks in which new knowledge is produced, while in themselves quite flexible, may be bounded by corporate proprietary rights coupled with a lack of institutional memory (say, once the network disperses), which in the end serve to restrict the overall flow of information.

In addition, the burgeoning *knowledge management* literature has begun to effect a subtle transformation in the value accorded to knowledge. Most academic discussions of knowledge -- ranging from the philosophy to the economics of science -- presume the unmitigated good of producing more knowledge. However, knowledge management tends to regard knowledge more as a necessary evil, the production of which is good only insofar as it promotes corporate goals, given the costs that its production entails. Indicative of this change in perspective is the distinction between "smart" and "dumb" organizations, the former exemplified by a fast food provider and the latter by a university. The structure of, say, a McDonald's enables the whole be much more than its relatively ill-skilled parts, whereas the structure of, say, Oxford enables the expertise of its parts to escape from informing the whole because it is not channeled in appropriately productive ways. This comparison presupposes that a university has corporate goals in the same sense as a business firm but its personnel are not as efficiently organized. If the academics themselves fail to offer their own collective goals, the goals turn out to be output measures, such as the number of students graduated or the number of articles published. And sometimes (e.g. in the UK) the two are measured by such different means that the university is rendered incapable of engaging in the task of knowledge integration.

Even granting that universities must be ultimately accountable to their "users and beneficiaries", it
does not follow that clients' immediate goals must dictate the goals of knowledge production. In particular, academic values may be important to ensure that the knowledge produced is relevant beyond the original context of its production. While it is usually assumed that academics need to be more open to problem-oriented "real world" issues, much less is said about what non-academics should

get from their encounters with academics, aside from help in solving their immediate problems. In particular, not enough is made of the opportunity for non-academics to acquire certain virtues -- say, a respect for critical reasoning, thorough research, and thinking beyond the short-term -- that in turn might serve to spread the responsibility for knowledge integration to other institutional settings. To be sure, an experimental "Executive Ph.D. program" has been designed just for this purpose. It is administered between the Stockholm Business School and the Chalmers University of Technology (Sweden's answer to MIT). The students are mid-level managers, and the instructors are post-doctoral researchers who would otherwise be on fixed-term academic contracts. One might say that the idea is to get the academics to persuade the managers of the value of long-term integrationist thinking before the managers persuade the academics that they should pursue more dispersed short-term goals.

However, even if academics are unable to convince corporate executives that integration is in their interest, they may function as "intermediaries" in integrating academic and non-academic forms of knowledge production. The concept of intermediary is meant to overturn any sharp distinction between the "production" and "distribution" of knowledge because it implies that work always needs to be done to make knowledge usable in particular contexts. Unfortunately, this has tended to reduce the role of the intermediary to that of "facilitator", which presumes that the main barrier to the flow of knowledge is the inability of either producers to access their intended consumers or consumers (understood as recognized interest groups) to obtain the knowledge they need. In both cases, the intermediary is supposed to remove an already existing barrier. Yet, the full range of those affected by the introduction of new knowledge normally exceeds the intended range of consumers, so as include people who are not even organized as "consumers". For example, the debate surrounding genetic-based forms of testing (e.g. for insurance or police purposes) currently transpires mainly between those who support research into the improvement of such testing and those who oppose it because they believe it would adversely affect their interests. But what about others who are not currently affected but could be, depending on the actual outcomes of the research?

The impetus behind those successful experiments in deliberative democracy known as the *consensus conference* is the desire to address precisely this question by enabling a cross-section of the entire citizenry -- not only interested parties -- to reach a consensus on guidelines that would be binding on national legislation. Participants are first presented with a range of alternative, and often conflicting, viewpoints on a policy issue that usually has a strong scientific or technical component and potentially controversial political consequences. They are then sequestered, much like a jury, to deliberate over these matters. In the course of the deliberations, the participants learn to differentiate their own preferences from the public interest, while they are in the process of integrating the expertises and interests to which they were exposed. In effect, the participants are integrated into the knowledge production process at the same

time they are integrating disparate forms of knowledge that neither the academics nor the policymakers had yet integrated successfully.

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