Well-Ordered Science and Indian Epistemic Cultures

Toward a Polycentered History of Science

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ABSTRACT

This essay defends the view that "modern science," as with modernity in general, is a polycentered phenomenon, something that appears in different forms at different times and places. It begins with two ideas about the nature of rational scientific inquiry: Karin Knorr Cetina's idea of "epistemic cultures," and Philip Kitcher's idea of science as "a system of public knowledge," such knowledge as would be deemed worthwhile by an ideal conversation among the whole public under conditions of mutual engagement. This account of the nature of scientific practice provides us with a new perspective from which to understand key elements in the philosophical project of Jaina logicians in the seventh, eighth, and ninth centuries C.E. Jaina theory seems exceptionally well targeted onto two of the key constituents in the ideal conversation—the classification of all human points of view and the representation of end states of the deliberative process. The Buddhist theory of the *Kathāvatthu* contributes to Indian epistemic culture in a different way: by supplying a detailed theory of how human dialogical standpoints can be revised in the ideal conversation, an account of the phenomenon Kitcher labels "tutoring." Thus science in India has its own history, one that should be studied in comparison and contrast with the history of science in Europe. In answer to Joseph Needham, it was not 'modern science' which failed to develop in India or China but rather non-well-ordered science, science as unconstrained by social value and democratic consent. What I argue is that this is not a deficit in the civilisational histories of these countries, but a virtue.

IT USED TO BE A COMMONPLACE IN MODERNIST STUDIES, and regrettably remains one still in philosophical historiography, that modernity is something that happened first, even uniquely, in Europe; and attempts were made to convert that supposition into a tautology through definitions of modernity that excluded non-European periodizations and geographies (e.g., seeing modernity in terms of capitalist modes of production, the

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emergence of nation-states and nationalist collective identities, the Industrial Revolution, secularization, and so on).[1] Progress of sorts occurred with the acknowledgment of the existence of alternative regional modernities, but that acknowledgment was tied to a center/periphery model and to an associated ideology of European diffusionism. Shmuel Eisenstadt, for instance, is willing to acknowledge "multiple modernities," but only insofar as these new modernities imitate and copy a first modernity centered in Europe. Postcolonial writers such as R. Radhakrishnan have struggled with what they term "the curse of derivativeness" and have sought to find in the interplay between colonized and colonizer, between tradition and modernity, a more dialectical pattern of engagement, identifying, for example, a modernizing effect on Europe in the new modernities of Asia. I will argue that it is better and more correct to think instead of modernity as a happening potentially indigenous to any culture, irrespective of period or place; like the famous Indian banyan tree it is "polycentric," to borrow Susan Friedman's very useful term. "The new geography of modernism," Friedman says, "needs to locate many centres of modernity across the globe, to focus on the cultural traffic linking them, and to interpret the circuits of reciprocal influence and transformation that take place within highly unequal state relations"; it involves a recognition that these modernities are not derivative but different. Modernity—and this is a point that has been made forcefully by Sanjay Subrahmanyam in his use of the term "conjuncturality"—is also characterized by the "intensification of intercultural contact zones. . . . Heightened hybridizations, jarring juxtapositions, and increasingly porous borders both characterize modernity and help bring it into being." Subrahmanyam says, perfectly accurately, that "modernity is a global conjunctural phenomenon, not a virus that spreads from one place to another."[2]

"Modern science" is one of the more manifest embodiments of modernity, and the above observations have equal application to the history of science. Here, likewise, a center/periphery model should make way for a polycentric understanding, one that acknowledges that scientific practice and scientific modes of inquiry are differently if conjuncturally instantiated across the globe. As with modernity in general, the point of departure is to avoid definitions that turn the privileging of Europe into a tautology. In the natural sciences, the standard view is still that a scientific conception of inquiry is a specially European achievement, and the acceptance of that view is what lends continuing significance to a question first posed by Joseph Needham some forty years ago: "Why did modern science, the mathematization of hypotheses about Nature, with all its implications for advanced technology, take its meteoric rise only in the West at the time of Galileo? . . . [The question is] why modern science had not developed in Chinese civilization (or Indian) but only in Europe?"[3]

[1] The following quotation is representative: "Historically, modernization is the process of change towards those types of social, economic and political systems that have developed in Western Europe and North America from the seventeenth century to the nineteenth." Shmuel N. Eisenstadt, *Modernization, Protest, and Change* (Englewood Cliffs, N.J.: Prentice-Hall, 1966), p. 1. For similarly Eurocentric definitions of modernity see also Anthony Giddens, *The Consequences of Modernity* (Stanford, Calif.: Stanford Univ. Press, 1990); and Stuart Hall and Bram Gieben, *Formations of Modernity* (Cambridge: Polity, 1992), pp. 1–16.

[2] Shmuel N. Eisenstadt, "Multiple Modernities," *Daedalus*, 2000, *129*(1):1–29; R. Radhakrishnan, "Derivative Discourses and the Problem of Signification," *European Legacy*, 2002, *7*:783–795, on p. 790; Susan Friedman, "Periodizing Modernism: Postcolonial Modernities and the Space/Time Borders of Modernist Studies," *Modernism/Modernity*, 2006, *13*:425–443, on p. 429 (cf. Friedman, "Definitional Excursions: The Meanings of Modern/Modernity/Modernism," *ibid.*, 2001, *8*:493–513); and Sanjay Subrahmanyam, "Hearing Voices: Vignettes of Early Modernity in South Asia, 1400–1750," *Daedalus*, 1998, *127*(3):75–104, on pp. 99–100.

[3] Joseph Needham, *The Grand Titration: Science and Society in East and West* (Toronto: Univ. Toronto Press,

Needham, an eminently sympathetic chronicler of the achievements of Chinese intellectual culture, was fully cognizant of the fact that "between the first century B.C. and the fifteenth century A.D., Chinese civilization was much more efficient than occidental in applying human natural knowledge to practical human needs," but he regarded it as uncontroversial that modern science is a uniquely European accomplishment. Needham's question calls us to ask what Europe had that Asia did not, and there have been a plethora of proposals—including the Protestant ethic, the application of mathematics in the description of nature, and capitalism's facilitation of ties between academia and craftsmen. The most astonishing suggestion of all, it seems to me, is one that has appeared in some recent issues of the respected journal *Scientific American*. Gennady Gorelik proposes that what distinguished Europe was the Bible, which he claims contains within its story about the tree of knowledge a model of free rational inquiry unavailable to any other religious culture. Science meant the free and unconstrained quest for the truth about nature, a quest legitimized in the idea that the truth about nature is also the truth about the mind of God. The trope's endurance is evident in the controversial final sentence of Stephen Hawking's *A Brief History of Time*: "However, if we discover a complete theory . . . it would be the ultimate triumph of human reason—for then we should know the mind of God." Such a view about science is easily traceable to the first exponents of scientific inquiry in seventeenth-century Europe, who presented themselves as "gentlemen, free and unconfin'd," asking questions for their own sake, without concern for, and unhindered by, the implications for society at large.[4]

If we are to make room for a polycentric history of science, we must begin with a definition that does not presume at the outset that science is in essence an originally European practice. Instead I will work with a definition that borrows two ideas from recent work in the philosophy of science. The first is Karin Knorr Cetina's idea of "epistemic cultures," defined as "those amalgams of arrangements and mechanisms—which, in a given field, make up how we know what we know. . . . Epistemic cultures are cultures that create and warrant knowledge, and the premier knowledge institution throughout the world is, still, science." The second is Philip Kitcher's idea of science as "a system of public knowledge."[5] Kitcher's thesis is that what scientific practice should aim for is such public knowledge as would be deemed worthwhile by an ideal conversation among the whole public under conditions of mutual engagement; the practice is then, in his phrase, "well ordered." It is to Kitcher that we owe the idea that the social values to which scientific endeavor must submit itself are those of a democratic consensus, understood not in the vulgar sense of the majority vote but, rather, in the idea of tutored preferences based on mutual engagement of all human points of view in an ideal conversation. Science, then, in my expanded working definition, is a well-ordered epistemic culture facilitating the production of public knowledge.

1969), p. 16; and Irfan Habib and Dhruv Raina eds., *Situating the History of Science: Dialogues with Joseph Needham* (Delhi: Oxford Univ. Press, 1999).

[4] *Needham, Grand Titration*; Gennady Gorelik, "How the Modern Physics Was Invented in the Seventeenth Century," *Scientific American*, Guest Blog, 6, 7, 8 Apr. 2012; Stephen Hawking, *A Brief History of Time* (New York: Bantam Dell, 1988), p. 193; and Thomas Sprat, *History of the Royal Society of London, for the Improving of Natural Knowledge* (London: Royal Society, 1667), p. 67. More generally, see H. Floris Cohen, *How Modern Science Came into the World: Four Civilizations, One Seventeenth-Century Breakthrough* (Amsterdam: Amsterdam Univ. Press, 2011).

[5] Karin Knorr Cetina, *Epistemic Cultures: How the Sciences Make Knowledge* (Cambridge, Mass.: Harvard Univ. Press, 1999), p. 1; Philip Kitcher, *Science, Truth, and Democracy* (Oxford: Oxford Univ. Press, 2001); and Kitcher, *Science in a Democratic Society* (Amherst, N.Y.: Prometheus, 2011).

Understanding science in this way enables us to ask, as Needham could not, whether the epistemic cultures of India or China qualify as genuine modes of scientific inquiry. One promising approach, with which I have much sympathy, is that of Kapil Raj. Raj recommends a move beyond the use of concepts like dissemination, transmission, and communication; instead, he uses the idea of circulation to refocus attention on "the processes of encounter, power and resistance, negotiation, and reconfiguration that occur in cross-cultural inter-action." In keeping with an emphasis on the microhistorical analysis of skills, practices, and material, Raj says that "by science we understand not free-floating ideas, but the production of knowledge, practices, instruments, techniques, and services."[6] Of equal importance, however, and running in tandem with an examination of the microprocesses of scientific practice, is an analysis of the practitioners' theoretical self-understanding of the nature, scope, and ambitions of the scientific methods they employ. After describing in a little more detail the role of the idea of well ordering in the philosophy of science, I will therefore use the remainder of this essay to explore two historical Indian accounts of the ideal conversation whose deliverances seem to govern the aspirations of scientific inquiry: the synthetic pluralism (*syādvāda*) advanced by Jaina thinkers in the second half of the first millennium, and a Buddhist account of balanced deliberation (*vādayutti*) from the time of Aśoka. With a shift in perspective from a center/periphery model of the history of science to a polycentred approach, we can appreciate these contributions as genuine encounters with the emergence of scientific methodologies in India. It is of particular relevance to this Focus section to take note of the fact that these historical methodologies have figured in postcolonial history of science by way of stratagems to ground scientific practice in India on a retrieval of noncolonial resources. Practicing scientists from the Jaina community have been notably active in this regard, reaching into their intellectual history for a cosmopolitan and egalitarian vision of modern science.[7] I should also stress here that I have selected examples from Jaina and Buddhist materials precisely so as to distinguish the phenomenon I want to bring into consideration from science-related activities motivated by nationalist politics[8] or by intercommunual tensions in the fallout of Partition.

WELL-ORDERED SCIENCE

Well-ordered science, another name for which is "properly functioning inquiry," is science as constrained by goals and values inherent in the pursuit of human goods. The term "science" here has a broad designation, inclusive of many forms of inquiry that contribute to what Kitcher calls the "system of public knowledge": "The forms of inquiry designated as 'sciences,' where the term is used inclusively to cover studies of art,

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[6] Kapil Raj, "Beyond Postcolonialism . . . and Postpositivism: Circulation and the Global History of Science," in this Focus section.

[7] Typical are Duli Chand Jain, "Jainism and Modern Science: A Comparative Study," *Jain Study Circle*, Oct. 1981, *11* (http://www.jainstudy.org/JSC1.08DCJ.pdf); Jain, "How Karma Theory Relates to Modern Science," *Jain Journal*, 1982, *16*:104–118; Muni Nandighosh Vijayaji Gani, *Scientific Secrets of Jainism* (Ahmedabad: Research Institute of Scientific Secrets from Indian Oriental Scriptures, 2000); and K. V. Mardia, *The Scientific Foundations of Jainism* (New Delhi: Motilal Banarsidass, 1990). Modern scientists from the Jain community include Vikram Ambalal Sarabhai and Jainendra K. Jain. A fuller study of their activities will need to appeal both to the microhistorical details about circulation emphasized by Raj and to the oral histories of all the participants involved, in the manner recommended by Indira Chowdhury, "A Historian among Scientists: Reflections on Archiving the History of Science in Postcolonial India," in this Focus section.

[8] See David Arnold, "Nehruvian Science and Postcolonial India," in this Focus section.

literature and music, investigations of human behavior, culture and societies, as well as facets of the physical and organic world, play a central role in our contemporary system of public knowledge, that body of shared information on which people draw in pursuing their own projects." A system of public knowledge is defined by norms pertaining to the processes of investigation, whose goal is to acknowledge that there is a division of epistemic labor among the contributors to public knowledge, distinguished by their distinctive "trajectories through the habitat" as well as by their various talents and acquired capabilities. Contributors are subject to norms of sincerity and competence with respect to the submissions they make, and there are norms pertaining to submission and transmission (Which people are entitled to submit information to the depository and about what? Who is entitled to receive which parts of public knowledge?). Fundamentally, there are also norms pertaining to investigation, norms that allow us to ask "What types of investigation are viewed as worth pursuing? How are they supposed to proceed? What constraints govern them?"[9] A properly functioning inquiry—a well-ordered science—is one that proceeds in conformity with these norms, especially the norms pertaining to the selection and progress of a research agenda.

Kitcher's radical and distinctive proposal is that the norms bearing on inquiry can be derived from the values and goals of democracy. What the appeal to democracy supplies is a conception of an ideal form of deliberation, inclusive of all perspectives and achieving consensual agreement in matters of significance to all parties concerned. Thus,

> science is well ordered when its specification of the problems to be pursued would be endorsed by an ideal conversation, embodying all human points of view, under conditions of mutual engagement. . . . A society practicing scientific inquiry is well ordered just in case it assigns priorities to lines of investigation through discussions whose conclusions are those that would be reached through deliberation under mutual engagement and which expose the grounds such deliberation would present.[10]

Three ideas are involved in this definition: that of a human point of view, that of mutual engagement in a panhuman conversation, and that of endorsement. Kitcher lacks any general theory of human points of view, their range and variety, of the sort that would ensure that no type of human point of view is left out of the ideal conversation. Mutual engagement, however, is central to his understanding of the account as involving an appeal to democracy more plausible and sophisticated than the "vulgar democracy" of the majority vote, which leads only to a "tyranny of the ignorant." Instead, mutual engagement requires participants to move beyond their prudential initial preferences in a process of learning about the merits of other points of view and the weaknesses of their own and adjusting their preferences accordingly:

> Built into the ideal of discussion under mutual engagement are cognitive and affective constraints: instead of myopic voters choosing in ignorance of the possibilities, and of the consequences for others, completely absorbed in their own self-directed wishes, the ideal conversationalists are to have a wide understanding of the various lines of research, what they might accomplish, how various findings would affect others, how those others adjust their

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[9] Kitcher, *Science, Truth, and Democracy* (cit. n. 5), p. 118; and Kitcher, *Science in a Democratic* Society (cit. n. 5), pp. 85, 90, 91.
[10] Kitcher, *Science in a Democratic Society*, p. 114.

starting preferences, and the conversationalists are dedicated to promoting the wishes other participants eventually form.[11]

What mutual engagement issues in is what Kitcher calls the "tutoring" of the participants, their coming to acquire an understanding of various fields of inquiry, their own preferences revised by a new appreciation of the perspectives of others and by a wish to accommodate others' preferences as far as possible.

HUMAN POINTS OF VIEW AND THE LOGIC OF CONSENSUS

This image of the nature of science provides us with a new perspective from which to understand key elements in the philosophical project of Jaina thinkers in the seventh, eighth, and ninth centuries C.E. Situating the Jaina theory in this context will enable us to ask if the extra-European perspective these thinkers afford on the concept will itself—in the spirit of mutual engagement—lead to a reformation of contemporary understandings of the requirements of deliberative democracy. For Jaina theory seems exceptionally well targeted to two of the key constituents in Kitcher's depiction of the ideal conversation— the classification of all human points of view and the representation of end states of the deliberative process—insofar as it provides extensive and detailed descriptions of any possible human point of view (*naya*) as well as a seven-dimensional structuring of consensual outcomes (*saptabhaṅgī*), these two analyses being jointly constitutive of the celebrated perspectival Jaina theory of conditionality (*syādvāda*). So situating the theory has the advantage of affording a justification of the proposal that the Jaina theory is best interpreted as a dynamic dialogical logic,[12] although my view is that the dynamic element, which has its source in the processes of mutual engagement, is underrepresented in Jaina theory.

The Jaina classificatory scheme of human standpoints has it that there is an exact number of distinguishable types. Several interpretations are available in the recent literature.[13] In the last section I pointed to a lacuna in Kitcher's account: that he provides no theoretical model that can ensure that all human points of view have been taken into consideration in the ideal conversation. The question for any interpretation of the Jaina classification, therefore, if it is to be brought to bear in the project of understanding how scientific inquiry is constrained by democratic values, is comprehensiveness: Where is the guarantee that excludes the possibility of a human point of view that falls outside the classification? I find this question most fully appreciated in the thinker Malliṣeṇa, who quotes his predecessor Siddharṣigani:

> Each preceding viewpoint has larger domain, whereas each subsequent [viewpoint] has [its] province [more and more] determined. The comprehensive [viewpoint] is more extensive in [its] province from the collective [viewpoint], which has as [its] province merely the existent,

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[11] *Ibid.*, pp. 186, 113.

[12] Nicolas Clerbout, Marie-Hélène Gorisse, and Shahid Rahman, "Context-Sensitivity in Jain Philosophy: A Dialogical Study of Siddharṣigani's *Commentary on the Handbook of Logic*," *Journal of Philosophical Logic*, 2010, *40*:633–662; and Matthieu Fontaine, Gorisse, and Rahman, "Dynamique dialogique: Lecture d'une controverse entre logiciens jaïns et grammairiens en Inde classique," *Kairos Journal of Philosophy and Science*, 2011, *2*:45–65.

[13] Jonardon Ganeri, *Philosophy in Classical India: The Proper Work of Reason* (London: Routledge, 2001), pp. 134–137; Piotr Balcerowicz, "The Logical Structure of the *Naya* Method of the Jainas," *Journal of Indian Philosophy*, 2001, *29*:379–403; and Clerbout *et al.*, "Context-Sensitivity in Jain Philosophy," pp. 635–647.

insofar as it has as [its] scope existence and non-existence. The collective [viewpoint] is larger from the empirical [viewpoint], which reveals an existent [particular] individual, insofar as it shows the amassment (sc. set) of all existent [individuals]. The empirical [viewpoint] has broader reference than the direct [viewpoint], which has as [its] province [only] the present [time], insofar as it rests on the province [made up of] the three times. The direct [viewpoint] has wider reference than the verbal [viewpoint], which shows different things by [reference to] the difference in tense (lit. time), etc., insofar as it comprehends what is contrary to that [scope of the verbal viewpoint]. The verbal [viewpoint] has more comprehensive province than the etymological [viewpoint], which takes separate synonymous expressions as [characterised by] difference of reference (denotata/meaning), insofar as it pertains to what is contrary to that [scope of the etymological viewpoint]. The etymological [viewpoint] has wider domain than the factual [viewpoint], which asserts that an object is different as [something possessed of its] specific activity. Likewise the account [based on] viewpoints, [when] it functions with regard to its province, follows the method of the seven-fold predication of affirmation and negation.[14]

Considered as levels of description, the order is one of increasing specificity. The first viewpoint describes everything, whether existent or nonexistent. The second describes only existents, but all existents. The third describes only the existence of a single particular, but does so at all times. The fourth describes only the existence of a particular at the present time, but allows any name of that particular. The fifth describes only the existence of a particular at the present time under a name, but under any co-referring name. The sixth describes only the existence of a particular at the present time under a single specific name. The seventh describes only the existence of a particular at the present time under a single name of a specific sort, one that denotes the actions the thing is capable of performing. As far as I can see, this explanation exhausts the possibilities for perspectives on the knowledge derivable from "trajectories through the habitat," varying in the degree to which the contributor to the system of public knowledge is attuned to specificity in his or her perceptual given and the variation in its modes of linguistic or cognitive representation. Of recent treatments of the Jaina theory of standpoints, the CATLES account presented by Piotr Balcerowicz is designed specifically to encode the hierarchy of specification by parameterizing over objects, times, linguistic conventions, etymologies, and current status, but it is more a redescription than a formal model, while in the dialogical model of Nicolas Clerbout, Marie-Hélène Gorisse, and Shahid Rahman each standpoint is interpreted as a distinct dialogical system with its own set of structural rules.[15] I find this second proposal very promising but do not yet see what supplies the guarantee that the seven dialogical systems are exhaustive.

It is clear that each of these descriptions relates to a point of view in principle accessible to a human being. There is no mention of anything like a "god's eye" point of view—that is, of a perspective inaccessible to an actual person situated in space and time, following a spatiotemporal path and with restricted perceptual, inferential, and linguistic capacities. It is exactly because of this that the Jaina theory engages with the notion of an ideal conversation in which all human points of view are represented, forgoing any appeal to the transcendental in favor of ideal democratic consensus. The Jainas, however, wish for theological reasons to introduce a quite different epistemological standpoint, the omni-

[14] Malliṣeṇa, *Syādvādamañjarī of Malliṣeṇa with the Anyayoga-vyavaccheda-dvātrimśikā of Hemacandra*, ed. A. B. Dhruva (Bombay Sanskrit and Prakrit Series, 83) (Bombay, 1933), p. 167, ll. 9–18; the translation comes from Balcerowicz, "Logical Structure of the *Naya* Method of the Jainas," p. 395.

[15] Balcerowicz, "Logical Structure of the *Naya* Method of the Jainas" (CATLES is an acronym for "class of denotata, a particular individual from the class, time of reference, prevalent linguistic convention, etymology, status of individual denoted"); and Clerbout *et al.*, "Context-Sensitivity in Jain Philosophy" (cit. n. 12).

science of Mahāvīra. I believe that the perspectival theory of human standpoints and conditionalization does not stand in a relation of conceptual dependence on this further move, however.

OUTCOMES OF THE IDEAL CONVERSATION

Kitcher claims that we should recognize three sorts of outcome in ideal conversation: consensus; partially overlapping consensus but agreement on a view as the fair representation of different points of view; and nonoverlapping agreement among the preferences of the participants, with majority voting as the course of last resort in the final case:

> Conversation may end in one of three states. The best outcome is for the deliberators to reach a plan all perceive as best. . . . Second best is for each person to specify a set of plans he considers acceptable and for the intersection of these sets to be nonempty. . . . The third option occurs when there is no plan acceptable to all and when the choice is made by majority vote. This is a last resort for expressing the collective will.[16]

The Jainas whose work I am reviewing add detail and complexity to this analysis. A tripartite scheme emerges on the assumption that each participant in an ideal conversation, inhabiting a particular point of view, gives assent to one range of proposals and dissents from another range. Then we can distinguish the three possibilities identified by Kitcher: that every proposal assented to in any point of view is assented to in any other point of view, that some proposal is assented to from every point of view, and that no proposal is assented to from every point of view. I have elsewhere shown that the Jaina analysis adds sophistication to this story by introducing the concept of a proposal about which the participant is agnostic, neither giving agreement nor presenting an objection.[17] We might also call such a person tolerant or liberal in his attitude toward the proposal in question, allowing its validity in the conversation without subscribing to it himself. When attitudes of toleration, over and above those of assent and disagreement, are introduced into the frame, then possible outcomes multiply, and it is not hard to demonstrate that there is an isomorphism between such possibilities and the seven-dimensional structuring of consensual outcomes (*saptabhaṅgī*) presented in Jaina theoretical discussion.[18] We might understand the underlying point of this maneuver as follows. Classifying someone's attitude as being one of disagreement forecloses possibilities for compromise and so restricts the opportunities for agreement. What the Jaina theory permits is a more finely grained distinction in the ways that a person might withhold assent: the distinction between disagreement and toleration. That opens a new range for reaching compromise without unanimous endorsement and so reduces the eventual appeal to the last resort of the majority vote. If it is understood as a mapping of outcomes in ideal conversation, it is clear that there is no rejection of the law of contradiction in the Jaina theory.[19]

The strategy, it might be thought, is especially available under conditions of mutual engagement, when, as a result of sensitive reflection on the priorities and obligations of

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[16] Kitcher, *Science in a Democratic Society* (cit. n. 5), p. 115; see also Kitcher, *Science, Truth, and Democracy* (cit. n. 5), pp. 119, 121–122.

[17] Jonardon Ganeri, "Jaina Logic and the Philosophical Basis of Pluralism," *History and Philosophy of Logic*, 2002, *23*:267–281.

[18] See *ibid.* for details.

[19] Contra Graham Priest, "Jaina Logic: A Contemporary Perspective," *Hist. Phil. Logic*, 2008, *29*:263–278.

others, a participant allows space not to be obstructive while at the same time not being willing to give unqualified consent. Yet I do not find an analogue of the idea of mutual engagement in Jaina discussions of the topic, where the presumption seems to be that dialogical positions are fixed and inflexible. For a full appreciation of the virtues of mutual engagement in formulating the deliberative democratic constraints on well-ordered science, I suggest that we need to look to Buddhist rather than Jaina resources.

TUTORING AND MUTUAL ENGAGEMENT

Kitcher has this to say about the important notion of tutoring:

> In a well-ordered science, a proper verdict would be one achieved by ideal deliberators, well tutored and mutually engaged, who considered the effects both of the proposed experiments and of not undertaking them. . . . Ideal conversationalists form their sympathetic desires by extended mirroring of the desires of others, achieving the desires they judge to be the best balance among the varying assessments (indefinitely iterated) made by fellow participants. If there is complete agreement about how the balancing is to be done, there is no need for further conversation. If there is not, the ideal conversation consists in attempts to support or reject various ways of balancing.[20]

The concept of tutoring is essential in Kitcher's account of deliberative democracy's ability to provide norms for scientific research. Without it there would be nothing to distinguish deliberative democracy from the tyranny of the ignorant produced by simple majority voting. Tutoring involves a revision in one's initial preferences in the light of one's deliberative engagement with others, an appreciation of the virtues in their points of view and of their perceptions of the failings in one's own. It is the idea of a community of suitably tutored participants, rather than raw expressions of self-interest, that distinguishes Kitcher's proposal from the zero-sum rationality of commonplace economic theory. Again, however, I find an absence of depth in Kitcher's description of the phenomenon, and I see in Buddhist Abhidharma a more sophisticated appreciation of the idea in question.

A Buddhist treatise from the time of Aśoka (304–232 B.C.E.), the *Kathāvatthu* or *Points of Controversy*, describes for the benefit of adherents to various Buddhist schisms the proper method to be followed in conducting a critical discussion of an issue of doctrinal conflict.[21] Recent scholarship on this treatise has largely focused on the question of the extent to which there is an "anticipation" of results in propositional logic. In fact, however, the text offers a particularly clear example of a work whose richness and interest lie elsewhere than in its anticipation of deductive principles and propositional laws. As a meticulous analysis of the argumentation properly to be used in the course of a dialogue of a specific type, its concern is with the pragmatic account of argument evaluation, the idea that arguments have to be evaluated as good or bad with regard to their contribution toward the goals of the dialogue within which they are embedded. The leading concern of the *Kathāvatthu* is with issues of balance and fairness in the conduct of a dialogue, and it recommends a strategy of argumentation that guarantees that

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[20] Kitcher, *Science in a Democratic Society* (cit. n. 5), p. 132.

[21] *Kathāvatthu* [*Elements of Dialogue*], ed. Arnold C. Taylor (Pali Text Society, Text Series, 48, 49) (London: Routledge & Kegan Paul, 1894 [Vol. 1], 1897 [Vol. 2]), trans. as S. Z. Aung and C. A. F. Rhys Davids, *Points of Controversy; or, Subjects of Discourse: Being a Translation of the Kathāvatthu from the Abhidhammapiṭaka* (Pali Text Society, Translation Series, 5), rpt. (London: Luzac, 1960).

all parties to a point of controversy have their arguments properly weighed and considered. It is important, in the normative framework of the *Kathāvatthu*, that there is a distinction between the global aim of the dialogue as a whole—to rehearse in an evenhanded manner all the considerations that bear on an issue of dispute, to clarify what is at stake even if no final resolution is achieved—and the local aim of each participant—to advocate the stance adopted with regard to that issue by supplying arguments for it and attacking the arguments of the other parties. A dialogue conducted in accordance with the prescribed method of the *Kathāvatthu* is called a *vādayutti*. The goal of a *vādayutti* is the "reasoned examination" (*yutti*; Skt. *yukti*) of a controversial point in and through a noneristic dialogue (*vāda*). The dialogue is highly structured and is to be conducted in accordance with a prescribed format for argumentation. There is a given point at issue—for example, whether "a person is known in the sense of a real and ultimate fact" (i.e., whether persons are ontologically primitive or reducible), whether there are such things as ethically good and bad actions, and so on. The dialogue is next divided into either subdialogues or "openings." Each such "opening" proceeds as an independent dialogue, and each is divided into five stages: the way forward (*anuloma*), the way back (*paṭikamma*), the refutation (*niggaha*), the application (*upanayana*), and the conclusion (*niggamana*). In the way forward, the proponent solicits from the respondent the endorsement of a thesis and then tries to argue against it. In the way back, the respondent turns the tables, soliciting from the proponent the endorsement of the counterthesis and then trying to argue against it. In the refutation, the respondent, continuing, seeks to refute the argument that the proponent had advanced against the thesis. The application and conclusion repeat and reaffirm that the proponent's argument against the respondent's thesis is unsound while the respondent's argument against the proponent's counterthesis is sound.[22]

As such, the *Kathāvatthu* is an excellent analysis of the phenomenon Kitcher describes as "tutoring." Each participant in the ideal conversation comes to understand clearly the embedded commitments, desirable or otherwise, of his own point of view, and each also comes to understand the virtues of the points of view of others. The notion of *vādayutti* constitutes an exact equivalent of the process of mutual engagement and tutoring that Kitcher identifies as essential to ideal deliberation, and the *Kathāvatthu* provides a theoretical framework for understanding the idea that is unparalleled in any contemporary discussion of deliberative democracy. It also provides what I suggested is lacking in the Jaina analysis of standpoints: namely, an account of the way by which one revises one's standpoint in the light of an appreciation of the virtues of the standpoints of others. While Jaina discussion presents standpoints as self-formed and static, the supplementation of Buddhist analysis enables us to appreciate their dynamic aspects. With this supplementation, it seems to me entirely right to use the formal tools of dynamic dialogical logic in the modeling of Indian theoretical analysis (dynamic modeling of the mutual revision of each participant's standpoint within and as a result of the dialogue, along with modeling of outcomes).

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[22] For further analysis see Jonardon Ganeri, "Argumentation, Dialogue, and the *Kathāvatthu*," *J. Indian Phil.*, 2001, *29*:485–493.

FINAL COMMENTS

Science is properly conducted—it is "well ordered," in Kitcher's terminology—if it selects its investigative research agenda and submits, certifies, and transmits its results as if they were the outcome of an ideal conversation, one in which all human points of view are represented and which takes place under conditions of mutual engagement. Participants in the ideal conversation begin with given preferences and objectives, the concept of mutual engagement implying that in the course of discussion each comes to a greater appreciation of the virtues of other perspectives and in doing so revises his own. The endorsement of a research project is the result of a survey of the "tutored" points of view of the participants, and the process of surveying includes cases where there is uncompromised agreement, cases where some participants agree and others do not dissent, and cases where there is both agreement and disagreement, resolved in this instance by voting. To specify the ideal at which investigation should aim is not to prescribe any procedure for bringing it about; the point is, rather, to set out an ideal of scientific inquiry by the lights of which one can judge any actual investigative process. So, "the central task is to understand what valuable ends a system of public knowledge, with Science at its center, might promote, how our existing system succeeds with respect to those ends, and how its functioning might be further improved."[23]

  I agree with Kitcher that we should derive the values that frame scientific practice from the democratic notion of an ideal conversation encompassing all human points of view. I have given examples of theory from the history of Indian epistemic cultures that, according to this definition, surely qualify as contributions to the history of scientific method; and my own essay is a contribution to a comparative integrated history and philosophy of science. These examples provide a refined analysis of the spectrum of human points of view, of the range of potential outcomes, and of the processes by which participants mutually engage with one another, thereby modifying their initial stances in the course of their deliberation. Amartya Sen observes that it is certainly a mistake to think of democracy as a Western idea that India has latterly embraced, for "public reasoning is central to democracy, [and] part of the global roots of democracy can indeed be traced to the tradition of public discussion that received much encouragement in both India and China from the dialogic commitment of Buddhist organisation."[24] Sen argues in a Nehruvian vein that Indians—possibly because India has always been deeply hospitable to contravening conceptions of the good for human beings—offer not merely supplementation but a reconfiguring of the discussion. My conclusion is that it is certainly possible to identify the emergence of scientific understanding in the history of Indian epistemic cultures as long as we reject the center/periphery model of modernity and of science in favor of the type of polycentered account I spoke about at the beginning of this essay. What I have sought also to demonstrate is how those postindependence practices that involve a retrieval of precolonial science in an effort to develop scientific methodologies that are neither colonial nor archaic have a basis in the theoretical resources available. Their ambition was not to rediscover "Western science" in Indian intellectual history but to promote an alternative postcolonial and egalitarian image of scientific endeavor. That vision has begun to gain a broader basis of support in the academic community in a

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[23] Kitcher, *Science in a Democratic Society* (cit. n. 5), p. 102.
[24] Amartya Sen, *The Argumentative Indian: Writings on Indian Culture, History, and Identity* (London: Lane, 2005), p. 182.

process driven primarily by the United Nations, in the form of a series of declarations ancillary to the 1948 Universal Declaration of Human Rights. The 1997 Convention addressing human rights and biomedicine concerns itself with research into the human genome and affirms that "no research or research applications concerning the human genome, in particular in the fields of biology, genetics and medicine, should prevail over respect for the human rights, fundamental freedoms and human dignity of individuals or, where applicable, of groups of people." The 2005 United Nations Universal Declaration on Bioethics and Human Rights acknowledges "the rapid developments in science and technology, which increasingly affect our understanding of life and life itself, resulting in a strong demand for a global response to the ethical implications of such developments," and recognizes that "ethical issues raised by the rapid advances in science and their technological applications should be examined with due respect to the dignity of the human person and universal respect for, and observance of, human rights and fundamental freedoms." Article 18 refers to processes of decision making, asserting that

1. Professionalism, honesty, integrity and transparency in decision-making should be promoted, in particular declarations of all conflicts of interest and appropriate sharing of knowledge. Every endeavour should be made to use the best available scientific knowledge and methodology in addressing and periodically reviewing bioethical issues.
2. Persons and professionals concerned and society as a whole should be engaged in dialogue on a regular basis.
3. Opportunities for informed pluralistic public debate, seeking the expression of all relevant opinions, should be promoted.[25]

Insofar as the global scientific community has taken heed of these declarations, there has been movement toward a less ethnocentric and more fully international conception of the scope of and constraints on science, a conception that permits the sort of rethinking of the global history of science I have been recommending. Finally, in answer to Needham, it was not 'modern science' which failed to develop in India or China but rather non-well-ordered science, science as unconstrained by social value and democratic consent. What I have argued is that this is not a deficit in the civilisational histories of these countries, but a virtue.

[25] Article 10 of 1997 European Union Convention for the Protection of Human Rights and Dignity of the Human Being with Regard to the Application of Biology and Medicine (http://portal.unesco.org/en/ev.php -URL_ID=13177&URL_DO=DO_TOPIC&URL_SECTION=201.html); and Preamble to 2005 Universal Declaration on Bioethics and Human Rights (http://portal.unesco.org/en/ev.php-URL_ID=31058&URL_DO =DO_TOPIC&URL_SECTION=201.html).