

Review Article

RELIGION IN AN AGE OF SCIENCE; METAPHYSICS IN AN ERA OF HISTORY

by Holmes Rolston, III

Religion in an Age of Science: The Gifford Lectures, 1989-91. Vol. 1.
By IAN G. BARBOUR. San Francisco: Harper and Row, 1990.
297 pages + xv. \$29.95; \$16.95 (paper).

Abstract. Ian Barbour's *Religion in an Age of Science* is a welcome systematic, theoretical overview of the relations between science and religion, culminating his long career with a balanced and insightful appraisal. The hallmarks of his synthesis are critical realism, holism, and process thought. Barbour makes even more investment in process philosophy and theology than in his previous works. This invites further inquiry about the adequacy of a highly general process metaphysics in dealing with our particular, deeply historical world; also further inquiry about the adequacy of its panexperientialism and incrementalism.

Keywords: Ian Barbour; historicity; law and narrative; metaphysics; the nomothetic and the idiographic; panexperientialism; process philosophy; process theology.

Few readers of *Zygon*, perhaps none, need an introduction to Ian Barbour, for he is "the dean" of science and religion and has been for nearly half a century. Everyone in the field is indebted to him; he is an intellectual notable of the twentieth century; and therefore we greatly welcome these Gifford Lectures, coming at his retirement and offering him a double opportunity to survey his position. Volume 1, the 1989-90 lecture series (reviewed here) is his systematic, theoretical overview. Volume 2, the 1990-91 lecture series (forthcoming in print), *Ethics in an Age of Technology*, assesses ethics in the modern world, advocating a Christian ethics as the most

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adequate response to the world described and encountered in science and in religion. The two volumes promise to be well integrated, and it is safe to say that reading these two volumes would do about as much to forward a liberal education in both the arts and sciences as would reading any other two volumes currently in print.

Science in this book means "natural science," but one main question Barbour explores is what physics and biology say about human nature, so we regularly pass from natural science to human life. A second main question is what theology says about human nature and whether this is compatible with these sciences; and, again, we regularly pass from the sciences to the humanities. At the same time, Barbour makes only a peripheral exploration of psychology, sociology, and anthropology, much less economics and political science, as sciences. If the social sciences have some methods or insights that neither the natural sciences nor the religions have for illuminating human nature, we may be missing that perspective. Meanwhile, let us be grateful for what we have.

Barbour is outstanding in his surefooted capacity to pick his way over slippery terrain. Covering such large amounts of territory, he could easily wander or get lost, but Barbour is remarkably able to keep on course, to maintain balance and perspective. His sense of the whole guards him against going astray where there are local extremes. He knows too much to accept any fragment of truth as the whole. He is not going to fall into any traps. Consider several examples.

When dealing with complementarity in physics, some have been tempted to see complementarity everywhere. They extrapolate the method discovered in physics into a grand methodology. There is complementarity in mechanism and organism in biology, in behaviorism and introspection in psychology, in free will and determinism in philosophy, in love and justice in theology, and even complementarity of science and religion. But Barbour is cautious. The method of complementarity is useful only (1) where the complementary models refer to the same entity and are of the same logical type, (2) where we realize that the complementarity, extrapolated from physics to another field, is analogical and not inferential, and so we must insist on independent evidence of the usefulness of complementarity, and (3) if we do not permit the recourse to complementarity to allow any justification for an uncritical acceptance of dichotomies (pp. 100-101).

Or, again, some are tempted from the discovery of relativity in physics to extrapolate to relativism everywhere. They claim,

“Relativity supports relativism.” But Barbour is cautious because he knows both the sciences and the humanities, both physics and ethics.

Science is said to have shown that everything is relative and there are no absolutes, and this has been cited in support of moral and religious relativism. But the claim is dubious even in physics. Many absolutes have been given up (space, time, mass, and so forth), but there are new ones. The velocity of light is absolute, and the spacetime interval between two events is the same for all observers. Everyone carries their own clock and their own time zone, but the order of causally related events does not change. Moreover, Einstein took pains to show that while phenomena do vary among frames of reference, the laws of physics are invariant among them. There is a core of relationships which is not observer-dependent, though it is described from multiple points of view (p. 111).

Or, some physicists hope to unify their multiple theories and find a “Theory of Everything,” which, rather comically, they abbreviate as a TOE. Barbour knows better:

It is misleading to refer to a unified theory in physics as a “Theory of Everything,” for its unity would be achieved only by a very high degree of abstraction that leaves out all of the diversity and particularity of events in the world and the emergence of more complex levels of organization from simpler ones. We could hardly expect a TOE to tell us very much about an amoeba, much less about Shakespeare, Beethoven, or Newton (p. 143).

This breadth of perspective returns when, moving to biology, we hear that the Theory of Everything is chance and law, random mutations selected by the law of the survival of the fittest. Barbour knows that there is more. Chance and law are not all that we are dealing with in evolution.

In evolution we have to look at *chance*, *law*, and *history*. In a roulette wheel or a kaleidoscope, law and chance are both present in ever-changing patterns, but there is no historical memory, and the past is irrelevant to the future. But in natural history, earlier achievements get folded into the developmental levels of later organisms because they have left a record in the genes. The memory of the past contributes to the present and the future. Evolutionary history involves unpredictability, irreversibility, and memory. Even the general trends cannot be predicted from scientific laws but can only be described in historical narratives (p. 173).

Turning from physics and biology to theology, Barbour notices how existentialist theology rejoices in the personal self in response to God; for existentialists that is really the core of theology, and to worry about God’s action in nature is misplaced. Barbour, too, delights in personal decision, commitment, involvement, but he will not get carried away. There is more good sense, which comes naturally to Barbour because he keeps as his location the big scene:

The existentialist dichotomy between the sphere of personal selfhood and the sphere of impersonal objects can also be criticized on theological and ethical grounds. The retreat to the realm of human inwardness leaves nature unrelated to God and devoid of enduring significance. What was God doing in the long history of the cosmos before the appearance of humanity? Is the world only the impersonal stage for the drama of human life? Should we then treat it as an object to be exploited for human benefit? In the biblical view, by contrast, the natural world is no mere setting, but part of the drama that is a single, unified, creative-redemptive work. Today we need a theology of nature as well as of human existence (p. 256).

This stability of big-scale perspective means that Barbour has a wide-ranging way of fitting data, authors, and events from all over the world into his umbrella schemes. Almost anything can turn up in this book. One might not expect, for instance, to learn that liberation theology has been criticized for its Marxist roots in a book devoted primarily to the relations between natural science and theology (p. 77). Some have said that science is influenced by social factors; some have said that theology is influenced by social factors, and the Marxist roots of certain kinds of theology might be a case in point. One might not expect to learn that the Eastern Orthodox Church rejected the *filioque* clause, but that too is here (p. 211). The context is understanding Christ as the presence of the Spirit of God, brooding over all natural and cultural history.

One might not expect stretches where one is doing comparative religion, asking what attitudes religions take toward each other. The problem arises when religions seem pluralistic in ways in which the sciences do not, and so religious pluralism demands a closer look (pp. 84-87). One might not expect inquiry as to whether Christ is unique, but Barbour advocates a pluralist dialogue. There are pages on ritual (pp. 200-201); the context is a summary of the basic features of religion, in the midst of a query as to whether biological survival value can adequately explain religious phenomena. So almost anything going on in science or in religion can be brought within his comprehensive gaze.

That the work is so sweeping means that individual authors are often dealt with briefly. Treating the conflict between science and religion, Barbour gives three authors, Jacques Monod, Carl Sagan, and E. O. Wilson, three pages (pp. 5-7). He does not intend a full encounter with any of them but only sets reference points for the broad claims he is recommending or rejecting. He returns to each of the three later, mostly by way of mention. Seen at one of these momentary encounters (a one-sentence reference to Fritjof Capra, p. 22), he can seem superficial. Readers who wish a substantive critique of these authors will be frustrated. But this is to expect too

much and misread Barbour's intent. He is taking stock. Seen together these short encounters are puzzle pieces that form a scenic picture, giving us an orientation on the current intellectual landscape. One has to resist a little impatience at the summary nature of the discussions—just a page on the differences between cultural evolution and biological evolution, for example (pp. 193–94)—and to realize that one is getting in comprehensive treatment what is lacking in depth; or, better still, that the comprehensive treatment is one of value not because of an intensive visit in any one place but because of the extensive tour of the continental landscape. This is overall synthesis, not local analysis; it is regional, global analysis, a big-scale map, not a small-scale one.

With this mapping scale there is a certain feeling of flying low over a lot of country. In the concluding chapter on God and nature, there is, one right after the other, a paragraph or two on Robert Boyle, on Etienne Gilson, on Austin Farrer, on Karl Barth, on W. H. Vanstone, on Brian Hebblethwaite, on Keith Ward, on Paul Fiddes (pp. 247–54). These passages sometimes seem like beads on a string, not much more than a summary of the literature. Barbour has some tendency to include a reference to everything going on in any field, whether or not this contributes much to his systematic task. For example, there is a paragraph that notes how Gerd Theissen's evolutionary model of religion reduces the harshness of natural selection (p. 203). One has to realize that Barbour is surveying the land and locating himself with reference to all the landmarks on the horizon. Some of these references are quite relevant to where he wants to travel. C. H. Waddington showed that there is behavior by which the organism selects the environment in which its natural selection afterward takes place, and that this does have results that feed back into the DNA; this helps Barbour's case for hierarchy (p. 157). Other claims are noticed only in passing—such as Stephen Jay Gould's punctuated equilibria (p. 158)—and some claims are located only to observe that they are unimportant. In the end, however, Barbour's overview comes through on the pluralistic intellectual landscape over which he travels.

In this comprehensive survey, Barbour uses a regular format somewhat like the preacher who said, "First I tell 'em what I'm goin' to tell 'em, then I tell 'em, then I tell 'em what I told 'em." There is always summary anticipation, then exposition, then summary recollection. We have come to expect this of Barbour; this is why his books have sold well since the middle of the century. Barbour's virtue is his vice all at once; his method is good for the student, good for clarity, although it can make for repetitive reading and little sense of

surprise or inspired moments of revelation. With Barbour there are no gestalt switches; there are no reversals or conversions. He never says, "Eureka!" But there is great stability, and there are many moments of truth.

The hallmarks of the book are critical realism, holism, and process thought. "I advocate a critical realism" (p. 16; cf. p. 43, p. 92, p. 221). "The *meaning* of truth is correspondence with reality" (p. 35). He pursues this from physics all the way through theology and refuses to get thrown off course. In physics, "models are symbolic representations of aspects of interactive reality that cannot be uniquely visualized in terms of analogies with everyday experience; they are only very indirectly related to either the atomic world or the observable phenomena" (p. 100). "In religion, too, knowledge is possible only by participation, though of course the forms of participation differ from those in science. We can ask how God is related to us, but we can say little about the intrinsic nature of God" (pp. 121-22).

Barbour finds hints of holism way down in physics and builds up this discovery steadily through the other sciences. "Even in physics we can see the beginning of a *historical, ecological, and many-leveled* view of reality" (p. 124). "Interpenetrating fields and integrated totalities replace self-contained, externally related particles as fundamental images of nature" (p. 105). In biology, he wants to move selection up from the individual level to a multilevel selection process. The molecular genes do venture the trial mutations, expressed at the level of the organism, but selection is from the environment, from the holistic ecosystem. DNA is not atomistic at all; it is information about how to integrate a whole organism from the skin in and about how to integrate that organism into its whole environment from the skin out.

[Biological] nature consists of relatively stable strata within a continuous spectrum of complexity. *Levels of organization* specify structure relationships. *Levels of activity* specify events and processes. A hierarchy of *functional processes* is always closely correlated and integrated with a hierarchy of *structural parts*. In a systems framework, the parts are identified, conceptualized, and related to one another through their roles in functionally construed processes (pp. 168-69).

The human person is, not surprisingly, another holism—not a dualism, not a materialism, not a disembodied soul. "We can escape both dualism and materialism if we assume a holistic view of persons with a hierarchy of levels" (p. 209).

Barbour advocates process thought as the most adequate conceptual scheme, and, if I judge correctly, he advocates it here more resoundingly than in any of his previous works. Barbour's final

interest is process theology, but he reaches that through process philosophy—the archetypal scheme into which both God and nature must be fitted. Chapter 8, “Process Thought,” is devoted to process philosophy and theology; and chapter 9, “God and Nature” (the concluding chapter), advocates replacing classical theism with process models of nature and God. Better than any other worldview, a process metaphysics agrees with the data, has coherence, scope, and fertility (pp. 265–66)—the principal criteria for evaluating a theory. So he closes his magisterial volume, summing up a lifetime of pondering the interrelationships between science and religion.

Then, having done his best to complete this comprehensive view, Barbour reflects another moment on how diverse the world is and becomes cautious once more: “The pursuit of coherence must not lead us to neglect such differences” (p. 270). He seems to realize that, most adequate though the process thought he recommends is, it is not the whole story, and that even the models he rejects may have insights that process thought fails to provide.

Actually and fortunately, most of what Barbour maintains through the preceding seven chapters is sound whether or not one endorses process thought with Barbour’s enthusiasm. The two introductory methodological chapters, for instance, are not especially process oriented. Nevertheless, since Barbour says from start (Preface, p. xiv) to finish (chapters 8 and 9) that process thought is the best available model, we must assume that this is integral to his position.

In that spirit, I wish to probe what might yet be missing in Barbour’s process model. My queries will focus on its generality, panexperientialism, and incrementalism. These three turn out to spiral around the same central problem.

I. GENERALITY AND HISTORICITY

Process metaphysics tries to identify the “general characteristics of nature, which are evident in all its forms” (p. 218). It discovers the basic categories “sufficiently general to be applicable to all entities in the world . . . from particles to persons” (p. 221). Process is “a common evolutionary and ecological view that cuts across disciplinary lines” (p. 218). This requires a very elastic scheme in which there is dynamism and persistence, order and disorder, continuing creation and incremental development.

There is a certain depth but also a certain “ho hum” to these general characteristics always evident in everything. Their universal,

nomothetic character misses the excitement of idiographic particularity. The main problem with physics is not that it covers everything, which it does, but that it covers nothing of particular interest in world history. There is nothing in a physics book to interpret the world lines of speciation by which trilobites became dinosaurs and primates became persons, or the invention of writing, or the signing of the Magna Carta. Barbour knows this and moves through physics into biology and from biology into human nature and culture. His conclusion is process thought, which is best because it covers all these disciplines and more.

But here an opposite thought strikes us. Process thought is not better than physics; it is worse because it operates at an even higher level of generality. The metaphysics is no more capable of interpreting these particularities than is the physics, because the capacity to abstract misses just what we want explained—the particularity. It is general form without historical content. A critical realism that cannot deal with crises in real history is not a very exciting or realistic critical realism.

Barbour says repeatedly that openness and historicity are part of the process, but if that is really so then maybe these “general characteristics of nature, which are evident in all its forms” are themselves open and historically surprising. Futures arrive that really were unprecedented in the past—as when information appeared, or photosynthesis, or conditioned learning, or sentience, or self-consciousness, or prayer. Process thought misses the story because it transcends the story. It moves at a high level of abstraction and generality. But that isn’t the epic narrative, with all its surprises, adventures, and critical turnings. Metaphysics tells a dull story.

Now we begin to worry that Barbour’s process thought is too much like evolutionary theory, difficult to falsify because it covers not only what does happen but every life event that did not happen but might have, and if something else had happened instead, process thought (like natural selection) would cover that too. So the generalities do not get at what makes the critical difference on the creative occasions of life. A metaphysics that posits potentialities and interprets any actualizations in terms of the general characteristics that cover everything, both actual and potential, cannot track particular world lines with much insight.

Barbour’s process thought is a little too much like the Theory of Everything (TOE) about which he fretted earlier. It is so abstract and general that it leaves out all the particulars; it is really a theory that tells us nothing at all about the singular epic story that, in fact, gets

told. It isn't really a theory of anything. Perhaps Barbour needs to take his own advice. To borrow his own warning about a TOE, of process thought, too, we can complain: "Its unity would be achieved only by a very high degree of abstraction that leaves out all of the diversity and particularity of events in the world. . . . We could hardly expect a POE (Process of Everything) to tell us very much about an amoeba, much less about Shakespeare, Beethoven, or Newton" (cf. p. 143 and above).

"The future cannot be predicted in detail from the past, either in principle or in practice" (p. 220). In detail, of course not. But if we know these "general characteristics of nature, which are evident in all its forms" we might hope to know what to expect generally in the future as a result of these universals exemplified in the past, to have the outlines of the future either in principle or in practice. But process thought covers all that can happen, whether it does or does not happen. Process thought does not predict the particular story that actually manages to occur. Such prediction would be too much to expect. Does it forecast any of the outlines of either natural or cultural history? Does it have any empirical content prospectively? Or retrospectively either, for notice, too, that the theory is unable to interpret the story even after it happens in its particularity. Just because of its high-level generality, it misses the actual local story that it so majestically embraces. General process is not narrative, though it preaches openness and historicity.

Basic categories "sufficiently general to be applicable to all entities in the world . . . from particles to persons" are unlikely to give much insight when sentience appears in some (but not in thousands of other) organisms, or when one species of primates rather surprisingly develops a reflective self-consciousness (and hundreds of other primate species do not), or when Jesus dies on the cross, one death making a critical difference (though millions of other people die forgotten). These singular events are as demanding of explanation as are the world generalities, and on an Earth where turns of events are punctuated with such singularities, we need metahistory as much as, maybe more than, we need metaphysics. In a chancy, pluralistic, adventurous, surprising, epic world, even the competence and confidence of universal metaphysics gets topsy-turvy now and then.

We earlier heard Barbour insist in biology that "even the general trends cannot be predicted from scientific laws but can only be described in historical narratives" (p. 173). That is even more true of metaphysics; it is no substitute for narrative, and good metaphysics knows this. The metaprocess is not "up to" the metahistory.

But if even the general trends in our world cannot be anticipated from the metaphysics with its "general characteristics of nature which are evident in all its forms," what good is it? What can we rightly expect from a metaphysics anyway? A metaphysics comes "after" (from the Greek, *meta*, or "beyond") physics and goes beyond it in its pervasive generality, detecting the fundamentals and possibilities, but metaphysics hardly orients for directions of travel. A metahistory comes "after" history and surveys natural and cultural history to detect actual headings in the past; it gives us stories, pathways, within which we may orient ourselves for a future that lies beyond.

Barbour's process schema really does not have anything to say about the actual general trends on Earth or in this universe, much less the specific or particular ones, either prospectively or retrospectively. There is nothing to be said interpretively and historically about the fine-tuned universe, its age or size, time dilation or reference frames, or singularities; nothing about the appearance of life from nonlife, about natural selection and survival of the better adapted, ecosystems and trophic pyramids; nothing about information coding, genetics, phenotypes and genotypes, the evolution of heterozygotes, or males and females; nothing about instinct, conditioned learning, aerobic photosynthesis and energy transfer, followed by aerobic respiration; nothing about diatomaceous shells (with silicon) followed by calcareous shells (with calcium), from which calcium-containing endoskeletons arose; nothing about mitochondria endosymbiotically incorporated into chloroplasts, about autotrophs and heterotrophs, about predation, about the rapid increase of cerebral power in one line of primates, about opposable thumbs; nothing about the differences between cultural and genetic transmission, about the discovery of fire or the invention of writing, about altruism or selfishness, about sin and forgiveness, atonement and salvation, about alienation and angst, about causes and meanings. If not, where is all this deep insight into what is going on in natural and cultural history, in science and religion? Before all this drama, the theory can only stutter and says nothing historically general or specific at all. Everything that happens is only fortuitous meanderings within bounds vaguely set by an all-inclusive metaphysics.

This hardly helps us to tell the story. We can say, I suppose, that complexity and diversity will increase, that subjectivity will deepen. But is process thought really helping analysis? Is it helping synthesis?

Is it helping prediction? Is it helping retrodiction? Is it helping us understand causes? Contingencies? Meanings? Stories?

Abstractions can sometimes clarify, but abstractions can just as often confuse. An overgeneral model forms habits of thought that are not applicable to particular complex systems, and, focusing on the abstract model, we really miss most of what is going on because our general model is incompetent to detect the particulars of significance. The abstract model covers so little in the actual process, or, phrased another way, it covers so much so loosely, that we cannot distinguish the alleged exemplifications of the model, the lawlike trends, from what appears as stochastic noise in the system, anomalies to the model or insignificant events—all these other phenomena appearing as noise because the theory is ill-suited to unravel the rich patterns in history. That is why the law of gravity, simple, true, and pervasive, is useless to explain the politics of the Persian Gulf War. That is why process metaphysics, vague and abstract, is useless to interpret the evolutionary passage from nature to culture.

Barbour praises the way in which process thought agrees with observations, as well as its coherence, its scope, its fertility. But perhaps process thought overagrees with the observed generalities, since much more that did not happen would also agree with the theory; perhaps it underagrees with the observed historicity, because what did happen is not particularly inferred from the theory at all. This is a problem of scope, of overscope and underscope, too much and too little scope at the same time. It is also a fertility problem, a problem of overfertility and underfertility, since a theory that is fertile enough to interpret everything actual and potential is not fertile enough to interpret Earth's biography. It is also a coherence problem, a case of overcoherence and undercoherence, since these categories that make everything and anything cohere really do not help us tell a coherent narrative.

But perhaps if one has a lofty enough generality, one can interpret everything. Barbour's process thought (following Alfred North Whitehead) recognizes that the simplest fundamentals of the universe have to be interpreted in terms of the most complex constructions, and not the other way around. That is precisely why "subjective aim," known immediately in human experience, in mind and at hand (the most complex event known), has to be extrapolated backward and downward into the simplest entities (atoms and subatomic particles). Only if we have this aim there at the start can we explain the subsequent outcome. This brings us to the next problem.

II. PANEXPERIENTIALISM, SUBJECTIVITY, AND OBJECTIVITY

Throughout nature, says Barbour, "I will argue for the attribution of elementary forms of experience. . . . Unified entities at all levels should be considered as *experiencing subjects*, with at least rudimentary sentience, memory, and purposiveness" (p. 172). "Reality thus consists of an interacting network of individual *moments of experience*" (p. 223). Such experience is not experience in the objective but in the subjective sense, felt experience. This view is commonly termed *panpsychism*, but Barbour dislikes that term, since he does not hold that there is any mind or consciousness in the lower levels of life, much less in molecules or atoms. He prefers to call it (following David Griffin) "panexperientialism" (p. 225).

Barbour finds it impossible to think that any form of animate life is a sheerly objective affair, indeed that any unified existent form is sheerly objective. So far as subjectivity is concerned, he does not think that there can arise an emergent "more" out of a nothing "less," something new in kind where there was nothing of that kind present before, but rather there can only be graded organization and deepening of what is already present. Subjectivity can appear in concentrated forms if and only if it is already present diffused and inchoate in what appear to be only objects. You cannot get in kind in the conclusion what you do not already have of that kind in the premise, although you can certainly integrate and enrich in the conclusion what you have already in the premises.

Barbour frequently and correctly emphasizes that there are new levels of organization (consistent with process thought, though neither predictable from it nor specifically interpretable by it). Do we get what was not there at all before? The answer is *no* for the elemental subjectivity pervasive from the ground up, but *yes* for levels of organization. We must have like causes for like effects. This might not be so where things are destroyed (a bullet, which is unlike a person, can destroy a person), but certainly this is so where things are created. Only a person can create a person in native-range reproductive life; at the cosmological range, only a world with "subjective aim" (p. 223) can create subjects.

We cannot get brilliance of mind by organizing armies of stupid atoms, but we can get brilliance of mind by organizing armies of atoms that in principle have subjective aim, even though each atom has negligible amounts of it. This brilliance of mind has to be somehow discharged step-by-step downward and backward, but it cannot ever be entirely discharged. We can get nearer and nearer to zero

subjectivity but never all the way there, because if we ever did posit zero, there would be no way to integrate the zeros into any subjectivity at all. It is not possible for subjectivity to be more organized above unless it is present below in “elementary forms” in “*experiencing subjects*” (p. 172, Barbour’s italics). In our “general characteristics of nature, which are evident in all its forms,” in our basic categories “sufficiently general to be applicable to all entities in the world . . . from particles to persons,” we must posit subjectivity panexperiential from the start, from the bottom up. This requisite subjectivity can be “thinned out” (“attenuated,” p. 225) at the fundamental level, but it cannot disappear.

Does this process philosophy agree with observations? Is it coherent? Has it the right scope? Is it fertile? Working from Barbour’s list of the most fundamental interpretive categories, I find it difficult to recommend that an astronaut should look at the lunar surface, see the rocks strewn there, the meteor craters pitted from meteorite impacts, and reflect on how the moon really is “an interacting network of *moments of experience*.” Even in the most reflective moments, should the astronaut get excited about “the self-creation of every entity” and “reality as organic process” on the lunar landscape? Does the astronaut need “an ecological metaphysics” (pp. 221–23)? There isn’t anything with a “self” on the moon; there are no organisms; there isn’t any ecology, and Barbour would agree. But what, then, is the cash value of the basic process model of “the *self-creation* of each new entity as an individual instant of experience under the guidance of its subjective aim” (p. 223)? Though myriads of “entities” are scattered about, though there are “events” (meteorite crashes), I do not think there are any lunar “*experiencing subjects*, with at least rudimentary sentience, memory, and purposiveness” (p. 172), whether these are the rocks or the atoms of which they are composed.

Of course if the astronaut returns to Earth, he will need a metaphysics with the categories of self, organism, and ecology. I do not wish to oppose an ecological metaphysics on Earth. But that is because there have been historical surprises on Earth that have not happened on the moon. If the astronaut inclines to cosmology, he will have to fit these historical surprises into his worldview, but that need not mean that he can best interpret the lunar surface by attenuating these surprising events on Earth. He needs superposition to interpret Earth, not attenuation to interpret the moon. Also, an atom on the moon, brought to Earth, might get taken up into a life, perhaps a human life, and so matter on the moon has the possibility of participating in what has happened on Earth. But if so, it gets adopted into

the peculiar, surprising Earth history. Such an atom takes on life not so much because of what it is in itself, not for its negligible subjective aim “from below,” but it lives because of its transformation “from above” when pulled into the narrative of Earth events.

Barbour would reply that he does not think lunar astronauts need subjective aim to interpret the lunar landscape either, not at least at its rocky, superficial level. He notes that the prototype moment of human experience, with its memory, feeling, bodily data, and sensory data, “can be postulated for the experience of any unified entity, though not for inanimate objects such as stones or aggregates such as plants, which lack a center of unified experience” (p. 223). So what are plants and stones? They are an odd combination to set aside as anomalies in the scheme of otherwise unified entities pervaded with elemental subjectivity. Atoms, cells, zoological organisms, and persons fit the scheme of developing subjectivity, but minerals and plants do not. Perhaps this can help us to interpret what we do and do not need by way of interpretive categories on the moon, where there are plenty of stones and no plants at all.

“A stone has no unified activity beyond the physical cohesion of the parts” (p. 224). Stones are not unified entities, Barbour says, and if this means that there is no program autonomously being defended that holds the stone together, I agree. But then what of the claim that “reality thus consists of an interacting network of individual *moments of experience*”? None of it does on the moon, nor most of it on Earth, apparently, since all of the moon and most of Earth is a big chunk of rock. Most of astronomical reality consists of asteroids, planets, stars, black holes, photons, and dust. Only on the thin skin of Earth (so far as we know) is any of reality organized enough to rise to the level of interacting moments of experience. Barbour knows this. So where is all the “elemental subjective aim” so essential to understanding what is going on? It seems to be down there (negligibly?) in the atoms of the moons’s rocks, in those of the Earth’s bedrock and molten magma beneath.

Besides stones on the moon, plants on Earth are an anomaly. Just what kinds of things (entities or events) have “subjective aim”? Process thought “attributes *subjective experience* in progressively more attenuated forms to persons, animals, lower organisms, and cells (and even, in principle, to atoms, though at that level it is effectively negligible), but not to stones or plants” (p. 225). That is rather odd; atoms can in principle have (effectively negligible) subjective experience, cells can have “considerable integration” (p. 224), but plants, which consist of billions of atoms organized in cells in startling ways, coded with DNA and defending a life program, cannot in principle

have even the considerable integration allowed to their cells, much less the negligible subjective experience allowed to their atoms (and all other atoms).

Is this helping us to understand plants? Hardly. Plants are unified entities of the botanical though not of the zoological kind; that is, they are not unitary organisms highly integrated with centered neural control, but they are modular organisms, with a meristem that can repeatedly and indefinitely produce new vegetative modules, additional stem nodes and leaves when there is available space and resources, as well as new reproductive modules (fruits and seeds) that contain the DNA coding to organize more of that species kind. Plants do some interesting things: They repair injuries and move water, nutrients, and photosynthate from cell to cell; they store sugars; they make tannin and other toxins and regulate their levels in defense against grazers; they make nectars and emit pheromones to influence the behavior of pollinating insects and the responses of other plants; they emit allelopathic agents to suppress invaders; they make thorns, trap insects, and so on.

All this makes them unified entities of a kind, although they not only lack a center of unified experience, but also felt experience, centered or not. "Plants have no higher center of experience," says Barbour (p. 224); more accurately, I think, plants are not "higher," they are not "centered" in the animal sense, and they have no "experience" at all in any subjective sense. They are modular unified organisms devoid of moments of experience in either their whole or their cells. Plants are, of course, quite real; they are quite alive, they are processes, they are wholes, they inhabit communities (on most of this Barbour and I agree); but on the "panexperientialism" posited in atoms and cells and denied to stones and plants, we do not agree. I further add that plants are integrated enough to defend intrinsic value, a good of their own kind.

We might notice, in passing, that the subjective aim problem returns when we analyze many of the wholes that Barbour wants to defend. Species understood as historical lines have a defended biological identity, but they do not have any subjective experience. Ecosystems as communities are systemic processes, but they do not have any subjective experience, either. Likewise, species and ecosystems are quite real, they are lively and full of life, they are processes, they are wholes, they have a kind of unity and integrity (Barbour and I agree again); but neither is "panexperiential." If Barbour agrees to this, too, then, contrary to his claim (with which we began), here are "unified entities," but we cannot interpret them as "*experiencing subjects*, with at least rudimentary sentience, memory,

and purposiveness” (p. 172). Community, which is Barbour’s paradigm, is a kind of unity, but not organismic unity; it is community, not centered but loose unity, interacting lives, some of which may have moments of subjective experience, while other lives do not, and the community has no subjective experience at all. Meanwhile, the community has great systemic value.

Why all this hanging on in principle to subjective experience, this defense of that attenuating paradigm right down to atoms, though skipping stones and plants en route, and not really needing it when rising to the levels of species or ecosystems either? Where is the promised agreement with data, interpretive scope, coherence, and fertility, if the scheme that interprets the general characteristics of everything has to exempt stones and plants, species and ecosystems? Perhaps this theory cannot narrate the story by which stones became plants. Stones and plants are startlingly different; stones (and atoms) have no historical memory at all; plants have historical memories coded in DNA that go back a billion years; stones obey the laws of physics all over the universe; plants are earthbound and do not (in the strict sense) obey any “universal” biological “laws” at all, past a puzzlingly semitautological “survival of the fittest to survive” as they maintain species identity in ecosystems. Like stones, of course, plants obey the laws of physics and chemistry. But what is really interesting about them is the adapted fit of species into ecosystems, coded in their genetics, historical achievements about which the general process scheme is mute.

The evolution of stones (dirt) into plants is one of the great surprises of natural history, one of the rarest events in the universe, but the process explanatory scheme just sets these stones and plants aside as unimportant aggregates in the general “panexperiential” scheme of attenuating subjective experience. Maybe Barbour’s process thought does not have as much feeling for the organism as it advertises; maybe it needs some idiographic geomorphology, botany, evolutionary history, and information theory. Maybe a theory about “the general characteristics of nature which are evident in all its forms,” all the way through “subatomic particles, atoms, molecules, lower forms of life, animals, and human beings” (p. 219), is not going to be able to narrate that story, because all stories are washed out in generalities, and even the allegedly high-level generality (“subjective aim,” “self-creation of every event”) doesn’t seem to fit either the stones or the plants, or the evolution from the one to the other as species develop to fill niches in ecosystem communities.

There is impressive evidence of a certain prolife, prolific potential in matter right from the formation of the universe. Barbour surveys

this evidence in his discussion of the anthropic principle (pp. 135-36). But a prolife heading of the system as a whole is not already a negligible (though nascent) subjective aim in the atoms. The point is to the contrary; that the whole has, surprisingly and transcendently, what the parts do not; not that the whole has more richly what is attenuated in the parts.

III. INCREMENTALISM AND EMERGENCE

No one informed by modern science wants to deny incrementalism, but is it the whole truth? Process thought is not committed to mere incrementalism, it regularly speaks of "emergence" and "novelty"; still, it does not really like jarring arrivals. Does this process allow for surprises of the first magnitude? Or is there almost too much capacity to digest anything in the solvent of process? Process is not that dramatic a term; process does not yet reach the adventure of narrative. A process is not an epic, and one reason is this lack of startling critical turns. It is so evolutionary that it cannot be revolutionary.

Emergence does not only mean that you get a little more of what you had some of before; in emergence you can get what, once upon a time, you did not have any of at all. You get something of a kind of which you had nothing of that kind earlier. The assembly can be incremental, but there are quantum leaps. Does the mysterious element become any less mysterious if the big lumps of it are powdered and finely distributed through the process? There is still leaven in the dough, working secretly. Was the continuing creation throughout the past always powdered and finely distributed? Earlier, we had to take the simple (atoms) to the complex (minds) to understand it, but now we insist on taking the complex (minds) apart into simple increments (bit by bit) to understand it.

"There are no sharp lines between an amoeba and a human being. . . . The universe is continuous," insists Barbour (p. 226). "How can we draw a sharp line at any point?" (p. 229). Well, there are some sharp lines in nature, as every good physicist knows, Barbour included. The line spectra are sharp lines, and radiation is not continuous. One gets either a whole photon or none at all. There is either a radioactive decay event or there is not. Phenomena are regularly quite discrete in nature; the skin of an organism is a rather sharp line, inhabit an ecosystem though it may, and semipermeable though that skin is. Either there was a thunderbolt or there was not; a woman either is or is not pregnant. Maybe there are some quantum leaps in biology, as when information signals first appeared. Maybe Barbour

should have listened a little more carefully to Gould and the others impressed with “punctuations” in evolutionary history. Maybe there are some rather sharp changes of state in between an amoeba and a human, as when conditioned learning or felt experience first emerged. Maybe there are some critical divides in history, as when Christ died for our sins.

Barbour might get nearer the truth if he could find moments of crisis in the evolutionary and cultural history that really startle him—as when signals first appear among the amino acids in the thin hot soup, or when historical memory first began to be stored in a genetic code, or when inwardness first appeared, or in the first act of forgiveness, or when the first primate prayed, or when Abraham set out from Ur, or when Jesus was resurrected from the dead. *Novelty*, though loved by process thinkers, is a comparatively weak word, especially when incrementalized in slow emergence. Contrast with it the term *miracle*, probably deliberately avoided in process thought, because it is too powerful, or has connotations process thought dislikes. But in all this process, we do need some occasions of wonder at superb moments of critical turning. At the really innovative points, we need an amazing word like the Hebrew *bara'*, unparalleled in the other ancient cosmogonies and reserved even in the Genesis narrative for those astonishing points that science yet finds most elusive, the first creation of matter-energy (Gen. 1:1), the first creation of life (Gen. 1:21), and the first creation of man and woman (Gen. 1:27).

Barbour would probably say, correctly, that quantitative changes can sometimes pass over into qualitative changes. “Differences in degree . . . can add up to differences in kind, but with no absolute lines” (p. 213). There were (it seems likely) incremental increases of cerebral power by which primates passed over from nonhuman species to human species, and the resulting human species has qualities different from any in its primate precursors—for example, the capacity to pray. So prayer appears in a world where there was none before. But then to posit a diffused or inchoate religiosity that is incrementally deepened through time is exactly what we do not want to do. Rocks do not have a diffused religiosity; they have none at all. With this Barbour would agree. But the same applies to the subjectivity that Barbour insists on positing in the atoms to prevent having it take us by surprise when it appears in primates with over-enlarged brains.

There are some qualities that do not arise by organizing or deepening or developing increments of them, even though the assembling of some kind of increments to get such qualities may be requisite.

I am not sure that when life appears we have differences of degree (the incremental accumulating of more and more molecular parts) passing over into differences in kinds (inert matter becoming living organisms, objective life becoming felt experience), though I readily grant that there was assembly going on when these things evolved. There were: surprising arrival, quantum leaps, breakthrough, miracle, inspiration, revelation, awakening; we grope for terms with discontinuity as much as for those with continuity.

It is not that rocks have a little life; they have none at all. Nor do they have adaptive fitness, nor do they have any information in memory storage. (Rocks bear, of course, the traces of what has happened to them in the historical past. The craters of the moon reveal events in the moon's past, and in that sense there is information on the moon that can be decoded by scientists who wish to reconstruct natural history.) Rocks on the moon have no program to defend because they have zero stored information on how to make a way through the world. With this Barbour would presumably agree. But why then insist that these lifeless, programless, informationless rocks nevertheless in their atomic constituents are panexperiential subjects with rudimentary sentience, memory, and purposiveness? Why not posit these, too, as among the emergents? When such experiential capacities arise, as they did once (at least) on Earth, they arise as things are assembled incrementally, but the properties also arise *de novo, ex nihilo*, miraculously (a spectacular event without explanation in previously operative natural law). We are in the presence of process unfolding; but, in these quantum leaps punctuating the process, we are in the presence of the numinous.

A question Barbour could examine profitably is whether it is a sufficient explanation of an event to discover that it is natural. Even the natural can still be numinous, especially the negentropic natural, when the natural continuously, incrementally builds life up over the millennia. But the numinous can also be discontinuous, quantized, with startling breakthroughs, and if this is natural it is both natural and super. Some events, at least, are super-to-the-previously-natural; that is, they exceed in achievement and power anything previously attained; they exceed this not only quantitatively but qualitatively; not in a deepening of what was already immanent, but in a transcendence of what was earlier there.

"Historicity is a basic characteristic of nature" (p. 220). Barbour recognizes "radically new emergents in cosmic history," of which consciousness and mind are outstanding examples (p. 226). Can anyone say it more forcefully than that? But the forcefulness is attenuated when process thought hates discontinuity so much that it

projects “subjective aim” “in principle” all the way down to atoms, taking as “the prototype” “a moment of human experience” and simplifying it downward (p. 223). So subjectivity of mind is not so radically new a force after all. The demand for coherence has overcome the capacity to accept radical new emergents and so prejudices agreement with these spectacular observations.

In historical terms, the beginning of the story has to be interpreted in terms of its ending, not the other way around, which means that history, not physics, is the ultimate science. But that means that metahistory, not metaphysics, is the ultimate philosophical category. That is really where the problem arises; the effort to do metaphysics as the ultimate explanatory activity results in trying to project the end of the narrative (where subjectivity is manifest in persons) back to the beginning; it results in supposing it to be primitively there in the elemental atoms, rather than accepting dramatic history and realizing how the end of the narrative quite transcends the beginning because of transcendent as well as immanent divine creativity. We are not dealing simply with the unfolding of innate potential “from below”; we are dealing with the Creator Spirit inspiring nature “from above.” Process thought sometimes tries to say this; there is the “lure” of God coaxing formless nature upward. Is that enough to account for such a marvelous genesis?

R. W. Sperry remarks, “The subjective qualities are . . . of very different quality from neural, molecular, and other material components of which they are built” (quoted p. 199). But Barbour is not prepared to accept this dramatic difference. “*Experience and subjectivity* are present in integrated entities at all levels. Interaction takes place between entities at diverse levels (for example, the mind and the cells of the brain), but this is interaction between entities that all have an inward side as moments of experience” (p. 199). That is why the moving of a molecule is not just an objective event; the moving of a molecule must have an inward side, a moment of experience. Else we cannot have the incrementalism of process; else the surprises of history are just too much to take.

Now we see how incrementalism is related to panexperientialism. You can get an (apparent) machine by attenuating organism, but not the other way around; you cannot reach an organism by enhancing a machine. “No extrapolation of mechanical concepts can yield the concepts needed to describe subjective experience,” protests Barbour (p. 226). Either we will be reduced to mechanism (where mechanism overtakes all) or forced into dualism (where mind enchants matter). So, if we ever want to be able to handle subjective experience, when it arises, we must have subjectivity all the way down, in

principle, though we can be satisfied with negligible amounts of it in practice.

Well, why not take genesis seriously, believe in something spectacular, and find later a new unprecedented kind (assemble the prior parts to get this new kind though we may)? Why not find miracle in a super-to-the-previously-natural sense; that is, in the sense that physics is transcended by biology, which is transcended in turn by psychology, matter marvelously rising to new heights of attainment and power, matter divinely inspired? At each such crisis in the plot there is (I hope I am not misunderstood) the creation of something special; that is, the arrival of a distinct, singular, particular kind which, though it was potential in the precedents, was not yet present there. Barbour's process thought says that, or tries to say it, but can only say it halfheartedly, with a certain failure of nerve, owing to its love of metaphysical continuity and its dislike of "sharp" surprises. So it extrapolates subjective aim down to the bottom of things and back to the start of things; else it will be unable to handle it when it does appear.

"Human experience, as an extreme case of an event in nature, is taken to exhibit the generic features of all events" (p. 226, cf. pp. 221-22). Even Barbour is not so happy with that claim; it seems "somewhat strained" (p. 227). It seems, indeed, quite implausible, because human experience exhibits marvelously what is not found elsewhere. Human religious experience, for example, is absent in rocks when asteroids crash into the moon. So is human ethical experience, human philosophical experience, human aesthetic experience, human political experience. Barbour knows all this, and so how does human experience exhibit the general features of all events? Nor do I wish to deny that humans share experiences (hunger) with nonhuman animals, or that humans obey laws of nature (gravity) which rocks also obey. We want to affirm what modern science has principally taught us; the world is not enchanted through and through and is not to be understood by taking our *anima* (spirit) as pervasive throughout animate and inanimate nature. Nor our *experientia*. In a way, the Genesis writers already knew this. The world stuff is sacred, creative, but it is not subjective, not enchanted. It is dust, and the spirit that animates it comes from above.

Eventually, fundamentally, everyone is going to have to posit the "special creation" of subjective aim (that is, its appearance where none was before, *ex nihilo*) if not later on in evolutionary history (somewhere in the vertebrates, perhaps), then early on, perhaps when the first hydrogen atom formed, perhaps way back at the start-up "singularity." This will be true even in the theory of oscillating

universes—big bang, big crunch, big bang, big crunch—because not even subjective aim can get “squeezed through the knothole” (John A. Wheeler) of the initial singularity of a reprocessed universe. In fact, we may be dealing, say the astronomers, with a universe that has singularities scattered rather frequently through it, of which black holes may be an example. Maybe some of these “singularities” are showing up also in biological history, as when subjective inwardness first appears in a complex stew of objective parts.

Barbour’s process theology is inspired by his process metaphysics but is often less abstract. Now we do get some reflection on historical biblical material. “If God has acted historically, we can learn about this only from the particularities of history and not from the general structures of reality, which metaphysics studies. Because historical events are unique and unpredictable, they cannot be deduced from universal principles” (p. 236). Amen, and good-bye to the much-lauded metaphysics! We now begin to face the problem of evils in the natural and social world (pp. 238–42), we puzzle over how divine intervention can be made consistent with causal natural processes and indeterminacies as described by science (pp. 243–59). The cross, a historical event, becomes the clue to God’s nature (p. 266).

In this discussion, incrementalism, holism, subjectivism, and process metaphysics affect theology, often for the better, but not always. According to Barbour, God works gradually, hardly by dramatic manipulation of objects, more by persuading subjectivity. “Process theology offers a distinctive answer” (p. xiv), Barbour promises at the beginning. After his comprehensive survey, in the process paradigm, Barbour concludes that God is “*the leader of a cosmic community*” (p. 260, p. 244). That is modern enough theologically speaking, but, let’s face it, that is a rather tame concept of God beside the *mysterium tremendum* of Yahweh, the ineffable Presence in the holy of holies. And maybe it really isn’t modern enough, scientifically speaking, for the God in, with, and under the big bang, fine-tuning the universe; for the God omnipresent in all inertial reference frames; for the God animating dust on Earth three billion years ago, awakening conscious experience in nonconscious nature; for the God who can transform physics into biology into psychology into anthropology into history; or for the ground of all being incarnate, atoning, redeeming the world. Some leader! Now we see why Barbour finishes the book with a backward look and laments a bit that process thought may have forgotten some insights of the rejected models of God.

A welcome and insightful feature of the book is that Barbour in his concepts both of nature and of God always has an eye on

environmental responsibility. Another gracious feature is how Barbour is scrupulously fair in recounting what others claim, and never meanspirited in rejecting them. One thing might have been added. There is no index of subjects, only an index of names, though the table of contents is ample enough to serve as a modest subject index. Need I add that the misgivings expressed here are lover's quarrels. Barbour needs to be tangled with because he is the best in this exciting, hazardous, and rewarding business of integrating science and religion.