Reviews

Evolution as Entropy: Toward a Unified Theory of Biology. By DANIEL R. BROOKS and E. O. WILEY. Chicago: University of Chicago Press, 1986. 333 pages. $25.00.

Everything about this book seems to be controversial, even its title. In his review "Entropy as Nonsense," *Biology and Philosophy* 1:473-76, Harold Morowitz complains that the title is ungrammatical because evolution is a process, whereas entropy is a thermodynamic state variable. The authors meant to imply that the state of evolution as a system is measured by its entropy. Too clever perhaps, because Morowitz (and others) have rejected the authors' thesis *a priori* without, apparently, reading the biological evidence. This is a mistake, since the book presents a genuinely new theory which cannot be rejected on linguistic grounds or preconceptions about entropy from experience outside biology. Reductionist biases aside, unexpected things can happen when systems become more complex. The later chapters on biology are the strongest. This reflects the authors' backgrounds in zoology and systematics: Wiley is at the Museum of Natural History at the University of Kansas, while Brooks is currently in the Zoology Department at the University of British Columbia.

The book argues that both evolution and ontogeny (development) spontaneously generate organization and complexity due to increases in entropy. This occurs in addition to natural selection. This approach differs from similar attempts (e.g., by Jeffrey Wicken and David Layzer) in taking a perspective internal to the system through a novel combination of physical entropy and information (a measure of form, or order). The information within a system has a physical entropy if, first, the system has a hierarchical structure of cohesive levels and, second, the basic information units, here units of DNA, survive for a long time. (Understanding the details requires some mental gymnastics; see J. D. Collier, "Entropy in Evolution," *Biology and Philosophy* 1:5-24.) The approach also differs from other hierarchical accounts such as Stanley Salthe's *Evolving Hierarchical Systems* (New York: Columbia Univ. Press, 1985) in recognizing that the persistence of transmitted DNA places low level constraints on the system. Random variation at the lowest level (within the limits of the constraints) can be transmitted to higher levels by interlevel connections, increasing both the information and entropy together. This process is spontaneous, since the later state of the higher level has a larger phase space than its earlier state; thus random variations will likely produce the more informed state. This is not possible in nonhierarchical, uncohesive systems, which have no internal information. The real novelty of this theory has escaped many readers.

The new form of information theory is difficult to grasp because the authors were not aware of what they were presuming when they wrote the book. Another problem is that chapter 2 ("Why Entropy?") uses nonstandard language and symbols, partly because the authors were trying to squeeze new concepts into old terms. The naive reader should not try to use this chapter as a

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text. It is peculiarly oriented towards the authors' needs. (The second edition of the book, to be published in late 1988, contains a revised chapter 2 which corrects this problem.) I should also mention that many of the biological applications of the theory are very technical. I recommend reading chapter 1 ("Prelude"), the summary to chapter 2, chapter 3 ("Ontogeny, Morphology and Evolution"), chapter 4 ("Populations and Species"), and the final chapter ("Reprise and Prelude"), only delving into other parts as interests lead the reader. The final chapter provides a good statement of the authors' intentions and of the theory's fundamentals and implications.

The germ of the authors' thesis came from their work in cladistics (a method of classification which tries to minimize differences between traits in trees called "cladograms") which uses parsimony, or "minimal entropy" rules. This *entropy* comes from Bayesian (subjective) probability theory and is not the same as physical entropy. The authors initially assumed that parsimony rules and physical entropy are related; that is, that the methods of cladistics and what it represents correspond. This connection is still unproven and was perhaps fortuitous. In the book, however, the branching of lineages is treated as similar to the branching of dissipative structures in response to random fluctuations, as described in many places by Ilya Prigogine, except that information, rather than mass and energy, is the quantity of interest. Although the book bristles with cladograms, the theory, as far as I can see, has no essential dependence on cladistics. Nonetheless, the book reflects strongly the authors' initial concern with systematics. Later developments have taken them further afield.

The increases in organization and complexity result from lower level variation (in DNA, and both structural and regulatory genes) being transmitted to higher levels (cells, organisms, and species) by developmental pathways which are themselves determined by past development and evolution. This process is mediated by environmental constraints (at every level) but is also dependent on initial conditions and past development or evolution. History places major constraints on future possibilities for change.

An essential part of this process is the cohesion of the system at various levels. Without something holding a level together there would be no objective grounds for talking about its state. This is also true in classical thermodynamics, in which states must be physically distinct systems. It would not make sense, for example, to define the thermodynamic state of the collection of gas molecules made up of every tenth molecule, unless those molecules could be separated by some simple physical or chemical process. Cohesion in species comes from reproduction (definitely a physical process). Loss of cohesion is entropic since the division of a species (a speciation event) will result in a greater total entropy than before. Increases in the entropies of information and cohesion produce evolution. The former produces variety within a species and the latter produces new species. The authors describe analogous ontogenic processes which produce specialization and differentiation of tissues.

Although critics have complained that Brooks and Wiley overlook lateral organization in favor of "bottom-up" organization, the central notion of cohesion depends entirely on lateral organization. They virtually ignore the "top-down" organization of adaptation. They state that selection is merely rate-determining, not the main dynamic of evolution. This has been unacceptable to most biologists. Recent work of mine suggests that adaptation can be defined entropically in terms of the mutual information of an entity and its environment. If so, although adaptation still affects the rate of Brooks-Wiley processes, fitness can be included within the core of the paradigm.

Several philosophical criticisms can be raised against the theory. One is that it only extends selection to the interior of organisms and proposes new forms of sexual selection. This complaint is petty, since in any case the theory is novel. Another complaint is that the theory is too general and cannot explain the origins of particular traits and mechanisms. This objection applies to the core of neo-Darwinism as well, but the Brooks-Wiley theory subsumes many of the successes of neo-Darwinism. A last complaint is that the theory does not explain the dynamics of biological organization and function. This objection has some weight, although the incorporation of adaptation together with further resources developed in particular applications of the theory will alleviate this criticism.

The major advantage of the theory is that it provides a mathematically defined measure of the structure and dynamics of biological processes above the chemical level within a unified general model. Those who like to think of biology as essentially qualitative and disunified will resist the model. The theory does not itself, however, determine the details of biological form and organization, and predicts a greater variance and diversity than expected on purely selectionist models. Another consequence of the theory is that biological traits can be preserved even though they lack adaptive value. Social Darwinists will not like this, but I say, "Vive la difference!" Also interesting is that evolution not only does not contradict the Second Law of Thermodynamics, it also depends upon it.

I hesitate to draw ideological consequences from scientific theories, but I recognize that it is an age-old practice. The significant feature of the Brooks-Wiley theory that might indulge this practice is their rejection of the view that evolution is due to "competition" (a misleading term anyway) in which the fittest survive. They hold that evolution is due, at least in part, to the fostering of variety within higher level cohesive systems. Despite myself, I find the idea appealing.

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Star Wave: Mind, Consciousness, and Quantum Physics. By FRED ALAN WOLF. New York: Macmillan, 1985. 342 pages. $19.95.

The late Wolfgang Pauli was not only a great physicist but also a great scientific critic. He sometimes was called the "conscience" of physics. Pauli had three basic categories by which he classified physics papers: right, wrong, and the worst category, beyond wrong; that is, something so muddled that it transcends both right and wrong. Mr. Wolf's latest book *Star Wave* falls into this last category. Its contents are divided into four parts including "Quantum Physics and the Mind of the Observer," "Normality in Physics and Psychology," "Psychophysics: The Mind of Matter," and "New Frontier of the Mind." The bibliography includes over 120 entries.

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The putative subject matter is an attempt to use the ideas of quantum mechanics to develop a scientific theory of mind. Mr. Wolf's previous book *Taking the Quantum Leap* (winner of the American Book Award in 1982 for an original science paperback), while to my mind a little silly (he invented a new language of "quiffs" and "pops" to describe aspects of the quantum theory of measurement), at least had a clear subject—the quantum theory of matter. It may well be that at some future time there will be a real scientific theory of mind and consciousness. If there is one, the quantum theory will certainly play a role in it. However, at present it is next to impossible to use the quantum theory to describe a material like glass—one is overwhelmed by the complications. Imagining that one can say something sensible about consciousness in terms of the quantum theory is beyond belief. In fact, not much of what Mr. Wolf has to say makes any sense. What he says makes so little sense that one may well ask why a book like this should be reviewed at all. The reason is that most lay people are defenseless against such a book. One of the defenseless is a reviewer for the Sunday *New York Times* who, while admitting that he knew nothing about the quantum theory, said in effect that Mr. Wolf had written a book that should be taken seriously. I wonder how he would feel if a physicist suggested that he take seriously some book in his field which he knew to be nonsense. As the physicist John Wheeler once said about parapsychology, "where there is smoke there is smoke."

It would take several reviews to sort out all of Mr. Wolf's arguments in detail, and it really would not serve the reader or the reviewer. Let me instead focus on one typical argument. It has to do with the so-called Pauli exclusion principle invented by Pauli in 1925. The principle deals with the fact that all the electrons in the world are in some sense the same. (All the photons in the world are also the same, and this produces symmetries of a different kind than those appropriate to electrons.) In quantum mechanics this identity of particles is expressed in terms of a symmetry. The mathematical functions of the theory must be either symmetrical or antisymmetrical when one permutes the identical particles (I am speaking here a little loosely). The electron is the antisymmetric case and this means that no two electrons can occupy exactly the same state.

This principle is absolutely essential in explaining atomic and nuclear structure, but Mr. Wolf is after much bigger game. He wants to use the Pauli principle to explain ego and self-hatred. His explanation is as follows: "The electron's loneliness and her insistence [Wolf has given the electron a gender] on doing her own thing [Wolf writes from Southern California where he is a 'science consultant to high tech industry' and therefore occasionally lapses into 'valley' English] and maintaining her separate identity by having unique quantum numbers is, I believe, the origin of our own egos, self-hatred, and, when reflected onto the outside world, our tendency toward destruction. [In a deep sense the electron is also the origin of popcorn.] It is the origin of the fear mechanism, that uncomfortable feeling that always crops up when we are put into strange surroundings [like reading this book], especially with strange people around us" (p. 141).

That is the level of scientific argument in this book. It will appeal to people such as the magician Doug Henning, whom I heard recently on television explaining that quantum mechanics had now established extrasensory perception. It will appeal to the publisher who, on the face of it, is not aware of the

unwisdom of presenting this book as science; and no doubt it appeals to Mr. Wolf. It does not appeal to me.

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Reality and Scientific Theology. By T. F. TORRANCE. Edinburgh: Scottish Academic Press, 1985. xvi + 212 pages. $15.50.

The latest major work by T. F. Torrance, professor of Christian dogmatics at the University of Edinburgh from 1952-79, is the first volume in a new series under his editorship entitled "Theology and Science at the Frontiers of Knowledge." This series is designed to address the fundamental shift in epistemology which has taken place in the modern period under the influence of the natural sciences and to promote a creative exchange between natural and theological science. As stated in the "General Foreword" to the series:

> The different volumes in this series are intended to be geared into this fundamental change in the foundations of knowledge. They do not present "hack" accounts of scientific trends or theological fashions, but are intended to offer interdisciplinary and creative interpretations which will themselves share in and carry forward the new synthesis transcending the gulf in popular understanding between faith and reason, religion and life, theology and science. Of special concern is the mutual modification and cross-fertilization between natural and theological science, and the creative integration of all human thought and culture within the universe of space and time (p. x).

Given the correspondence between these aims and those of *Zygon* itself, readers of the journal should be alerted to the publication of these works in the coming years.

Torrance's work, *Reality and Scientific Theology*, is an appropriate and impressive first volume in the series. The six chapters, which had their origin as "The Harris Lectures" delivered at the University of Dundee in 1970, examine from numerous angles the task of foundational theology when informed by the insights of modern theories of science and knowledge. The theoretical proposals of Albert Einstein, Michael Polanyi, Julian Hartt, and Karl Popper, among many others, have challenged Torrance to conceptualize theology in such a way that both the knowledge obtainable through the natural sciences—and especially the method by which that knowledge is attained—find their validity. At the same time that he strives to learn from the latest proposals in scientific method, Torrance also insists upon the valid source of knowledge originating in God's self-revelation and in fact argues that it is within the horizon of the knowledge ascertained via God's self-revelation that the natural sciences discover their most adequate interpretive context. In this line of argumentation the profound influence of Karl Barth's theology upon Torrance is ever present.

A brief examination of the themes Torrance discusses can help to offer an overview of the book. In the first chapter ("Classical and Modern Attitudes of Mind") Torrance argues for the recovery of a "classical attitude of mind" with

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its affirmation of the inherent rationality of the universe as an important step in overcoming the excesses provoked by modern technological rationality. Torrance proceeds by contrasting the conceptual development and primary characteristics of these two divergent attitudes of mind separated by the watershed of the subject-object dichotomy in modern thought. In the second chapter, and for theologians the most interesting one ("The Status of Natural Theology"), Torrance proposes the proper location of natural theology within the contours of positive (revealed) theology. Prompted by new insights arising in the natural sciences, Torrance discusses anew the relevance of Anselm of Canterbury's explication of theological method as *fides quaerens intellectum*. Once again the influence of Barth is apparent.

The third chapter ("The Science of God") develops the theoretical background for what Torrance calls an "axiomatic dogmatics"; that is, a dogmatics which is both informed by divine revelation and by modern theories of the nature of science. Integral to such a dogmatics will be an empirico-intuitive moment which parallels a similar moment within several contemporary theories of science. In the fourth chapter ("The Social Coefficient of Knowledge") Torrance explores the legitimate contribution of the social dimension of existence to the epistemological process. It is the social coefficient of knowledge which allows us to "be *at home* in the universe," sharing meanings and intelligibility, particularly through language. At the same time our human constructs continually are in danger of becoming rigid and therefore incapable of remaining open to "the vast intelligibility of the universe" (p. 114). A theologian who seeks to incorporate adequately the social coefficient of knowledge must, according to Torrance, attend to four distinguishable dimensions: the ecclesial, the scientific, the mystical, and the aesthetic.

The fifth chapter ("The Stratification of Truth") deals with what Torrance calls "the stratification of truth" which is based ontologically upon the divine disclosure of all truth. In the process of inquiry into the nature of truth, one discovers "different levels of truth in the cross-level coordination with one another. Each level is found to be open to the level above it and to require that meta-level relation in order to be consistent in itself as a level on its own. Thus there becomes disclosed the organic structure of thought that characterizes our apprehending of reality in all its depth" (p. 146). Science penetrates and seeks to apprehend certain levels within the hierarchy of truth. Torrance will, however, point out the rooting of all the various levels of truth in ontology and ultimately in God in order to discover the ultimate basis for the intelligibility of all reality. According to this understanding of the stratification of truth in its implications for theology, Torrance argues in the final chapter ("The Trinitarian Structure of Theology") that it is the doctrine of the trinity which lies at the core of Christian theology and that it is an understanding of God as trinity which can unify and ground the human quest for a meaningful and intelligible life, even and especially in view of the rigors of scientific inquiry.

This brief sketch of the issues addressed by Torrance in *Reality and Scientific Theology* can only begin to indicate the depth of reflection and the solid scholarship which underlies this work. Although one can argue at times with the adequacy of Torrance's constructive proposals—for example, his apparent confounding of a dynamic, disclosive notion of truth by the use of a rather static descriptive terminology (dimensional language might be argued as preferable to stratification and hierarchy language)—one will nevertheless be challenged and stimulated by Torrance's attempt to incorporate the insights of recent scientific epistemology into theological method.

For those interested in dialogue between theology and natural science, especially those concerned with fundamental methodological issues, the work of Torrance as presented in his latest book deserves careful consideration. It is only regrettable that the book has not been provided with an index either for names or subjects. Hopefully, this oversight will be corrected in future volumes in the series.

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Charles Hartshorne and the Existence of God. By DONALD WAYNE VINEY. Albany: State University of New York Press, 1985. 192 pages. $32.50, $10.95 (paper).

Proponents of the dialogue between religion and science usually assume that scientific findings have a bearing on the question of God's existence. This book directly contravenes that assumption. An argument based on empirical findings assumes that God could possibly exist, and actually does if certain contingent conditions are met, but otherwise does not. Yet the ontological argument shows, as Charles Hartshorne demonstrates in detail, that a perfect being must necessarily exist, if at all possible. If necessary, then God exists under all conditions, and particular findings are irrelevant. If so, *all* arguments for God's existence must ultimately be *a priori* in character, making no reference to scientific investigation.

Donald Viney concurs, although he does point out in the final chapter how scientific findings (in this case relativity physics) can have a bearing on our understanding of the nature of God. The majority of his book, however, is an exceedingly careful presentation of Hartshorne's global argument, which is composed of six interlocking arguments, each making up for the deficiencies of the others.

The first is the ontological argument. In his most recent formulation Hartshorne follows the procedure of exhausting all possible alternatives to theism, and then gives reasons for rejecting these alternatives:

A1 Deity cannot be consistently conceived.

A2 Deity can be consistently conceived, equally whether as existent or as nonexistent.

A3 Deity can be consistently conceived, but only as nonexistent, or as an unactualizable or regulative ideal or limiting concept.

T Deity can be consistently conceived, but only as existent.

Viney does not examine Hartshorne's formulation of the ontological argument in detail as that task has been admirably accomplished by George L. Goodwin in *The Ontological Argument of Charles Hartshorne* (Scholars Press, 1978). His comments are directed primarily to the way this argument is related to the other arguments. The weakest feature lies in the rejection of A1, for it is difficult to see how we can demonstrate that a perfect being can be consistently

[*Zygon*, vol. 23, no. 1 (March 1988).]
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conceived. The other arguments are needed in order to show this possibility, while this argument shows that God's existence must be necessary. (A similar strategy was adopted in *De Primo Principio* by Duns Scotus; he used a version of the cosmological argument to show that God, in the form of an Uncausable Producer, was possible, from which, by a version of the ontological argument, he sought to show that God was indeed actual.)

The second is the cosmological argument. Here the alternatives are:

A1 Nothing exists.

A2 What exists either (a) has no modal character or (b) is wholly contingent.

A3 What exists is wholly necessary.

A4 What exists is partly contingent and partly necessary, and nothing is divine.

T What exists is partly contingent and partly necessary, and something is divine.

Empirical versions of the cosmological argument take the world to be radically contingent. If God had not created it, the world would not exist. Then the world could possibly *not* exist. In rejecting A2 Hartshorne argues that some world or other must necessarily exist. However, this necessity is only partial, since the particular way the world concretely exists is quite contingent. The world needs some divine support, but the nature of this God, particularly with respect to goodness and knowledge, remains indeterminate.

The third argument from design lists these alternatives:

A1 There is no cosmic order.

A2 There is cosmic order but no cosmic ordering power.

A3 There is cosmic order and ordering power, but the power is not divine.

T There is cosmic order and divine power.

Usually this argument, in denying A1, hinges on the amount of order in the world, but "Hartshorne's view is that an unordered universe is not genuinely conceivable" (p. 78). Any world is partly ordered and partly disordered. Disorder or evil does not tell against God unless God were conceived as an omnipotent creator unilaterally bringing about the world divinely intended. This is not Hartshorne's conception of God. As Alfred North Whitehead first discovered with his principle of limitation, God can be the cosmic orderer without being a unilateral creator.

The cosmological and design arguments demonstrate the possibility of God's existence, but not the divine attributes of subjectivity, omniscience, and goodness. The other three arguments aim to do this.

The fourth is the epistemic argument:

A1 Reality (or truth) is in no way dependent upon knowledge.

A2 Reality is actual or potential content of nondivine knowledge.

A3 Reality is potential content of divine knowledge (what God would know if he existed).

T Reality is actual content of divine knowledge.

This is Hartshorne's adaptation of Josiah Royce's idealistic argument. It perhaps can be best understood in terms of past reality. If there is truth about

past events, to what reality does this truth refer? Human minds can only experience a fragment of this past in memory. The next alternative (A3) presupposes that God's existence is possible, but by the ontological argument God necessarily exists if possible, thus collapsing the last two alternatives. Omniscience thus defines reality, which in turn provides the content of divine knowing.

The fifth is the moral argument:

A1 There is no supreme aim or *summum bonum* whose realization a creature's action can promote.

A2 There is a supreme aim, which is to promote the good life among some (or all) creatures during their natural life spans.

A3 There is a supreme aim, which is to promote the good life among creatures after death or in heaven.

T There is a supreme aim, which is to enrich the divine life (by promoting the good life among creatures).

This is not an argument designed to demonstrate that God is the ultimate source of good, but that God is the ultimate *recipient* of creaturely attempts at goodness. The transcending aim in leading the good life is to enrich the one necessarily permanent life, God. This argument depends upon the particular claims of process theology, that God is capable of being enriched by the world. A similar claim, that the content of divine knowledge is dependent upon reality, and not vice versa, is implicit in the epistemic argument.

The sixth is the aesthetic argument:

A1 There is no beauty of the world as a (de facto) whole.

A2 There is a beauty of the world as a whole, but no one enjoys it.

A3 There is a beauty of the world as a whole, but only nondivine beings enjoy it.

T There is a beauty of the world as a whole and God alone adequately enjoys it.

This argument is least convincing to me, for to be an *a priori* proof it must hold that the world as a whole is *necessarily* beautiful. Hartshorne holds that "Beauty in the emphatic sense is a *balance* of unity and variety" (p. 122). It would be extremely difficult to show that this were always the case, or we have stretched the meaning of beauty beyond recognition. Also, how could we know about experiencing the world as a whole, since only God can do this? I prefer to argue that God experiences fully the goods and evils of the world (classically expressed as taking upon himself the sins of the world), but is able to transform this into tragic beauty by his infinite imaginative resources. The world as a whole is not beautiful, but God can transform it into an experience of beauty.

By presenting and developing this set of six interlocking arguments, Viney provides an important corrective to the widespread view that Hartshorne is only concerned with the ontological argument. His writing is clear, precise, and well-ordered. Hartshorne has written: "Viney's account is remarkably accurate, faithful to my meanings" (p. viii). In highlighting this global argument, Viney has shown that side of Hartshorne which is least indebted to Whitehead. Whitehead and Hartshorne largely agree as to the nature of God, and this is at some considerable variance with the tradition. Whitehead, however, was content to derive the existence of God from the exigencies of his own system, using

a distant relative of the design argument. Yet he paid scant attention to the traditional arguments, particularly the ontological argument. Hartshorne has thoroughly appropriated those arguments, translated them into an *a priori* form, added some of his own, and shown how they interconnect. This is no mean achievement.

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Aldous Huxley and Eastern Wisdom. By BANSI L. CHAKOO. Atlantic Highlands, N.J.: Humanities Press, 1981. 308 pages. $16.25.

Bansi Chakoo was born in Kashmir, India. Holding a doctoral degree in English from Patna University, he teaches in Guru Nanak Dev University at Amiritsar in the Punjab. For some years he has engaged in critical study of the English novelists Aldous Huxley, Iris Murdoch, and William Golding. In this book he surveys the development of Aldous Huxley's thought from its earliest beginnings in the 1920s to *Island*, published in 1962. Chakoo's work is a remarkably full and detailed study of Huxley as a philosopher and as a "voyager in pursuit of sanity" (p. 9). It presents a clear and well-balanced picture of Huxley's stage by stage progress through a lifetime output of forty books, roughly one a year—novels, essays, and social criticism. Most of these works wrestled with the fundamental problems of our time.

Huxley's body of work covers a crucial period in modern history, from immediately after World War I when the nineteenth century was vanishing, to the emergence of the atom bomb, environmental pollution, and the seeds of the Vietnamese war. His last works were completed just before the assassination of President Kennedy and the start of the electronic age. The first highly successful and popular novels were cynical criticisms of the modern scene, a mode that culminated with the landmark *Brave New World* (New York: Harper, 1932).

Chakoo's book is organized in chronological order. After reviewing the early period, he discusses the phase when Huxley was greatly influenced by his growing friendship with the poetic prophet D. H. Lawrence. He devotes the next two chapters to the "Quest for Wholeness" and to "Unity in Diversity": a period when Huxley was grappling with the problem of integration of body and soul, of psyche and soma (a problem with which the Christianity he failed to espouse also has had great difficulty [see John P. Dourley, *The Illness That We Are: A Jungian Critique of Christianity*, Toronto: Inner City Books, 1984, paper]). Huxley was inclined toward the life worship of D. H. Lawrence for a time. However, with his friend's death in 1930, his "Search for Sanity" veered toward what Chakoo's next chapter calls the "Supreme Spiritual Ideal," which concerns the pursuit of the nonattached state of one-pointedness by meditative focusing upon the divine ground. This stage of intense concern with Eastern thought had ascetic overtones. It led to the publication after World War II of the remarkable synthesis *The Perennial Philosophy* (New York: Harper, 1945), in which the ideas of East and West are united. Yet the pull of

[*Zygon*, vol. 23, no. 1 (March 1988).]
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Western culture was too strong and his uncompromising scientific curiosity too deeply rooted. By the time he had been a resident of Southern California for sixteen years and had become acquainted with some of its more exotic ideologies he undertook the now famous experiments with psychedelic drugs and published *Doors of Perception* (New York: Harper, 1954).

After four more years, there came the cancer death of his wife and his remarriage to a woman with a career of her own. In 1960 his only son was divorced and in 1961 he lost all his possessions, including his books and papers, in a disastrous fire. In 1962 Huxley's own finally fatal cancer was first detected and, after three years of work, he published the novel *Island* (New York: Harper & Row, 1962). In the last chapter of his book on Huxley, Chakoo discusses this utopian story which was written in part as a corrective to the almost despairing *Brave New World* of thirty years before. By this time, Huxley's influence had waned and *Island* sold only one copy for every hundred of the earlier novel. In it he draws on his intimate knowledge and profound understanding of oriental religious philosophy including tantric practices. In addition he spoke positively of the contribution to Western thought of the "Perfectionists" of John Humphrey Noye's long-lasting Oneida commune: perfectionism implying not the unattainable search to be faultless but the attempt to integrate one's wayward psyche with the conservative instinct-driven soma.

Chakoo discusses the stages of Huxley's philosophically oriented attempt to explain the alienation of our society from the unitive knowledge of God's being and to detail what is needed for reintegration. In the discussion of the early novels, he points out that despite Huxley's early skepticism, these works already contain his perception that it is the Cartesian gulf in our Western society between the physical and the spiritual that makes it impossible to achieve an integrated intelligence. Already in *Those Barren Leaves* (New York: Harper, 1925), he makes the statement through one of his characters that what is required is not the restoration of past religions and ideas but an active effort to achieve another reality, another plane of consciousness.

The theme of Chakoo's book is that in his earliest years Huxley was not, as one critic has described him, an ordinary cynic who later found a sense of stability by collecting borrowed ideas and theistic platitudes. The later works, *Eyeless in Gaza* (Harper, 1936), *The Perennial Philosophy*, *The Doors of Perception*, and the last novel, *Island*, are measures of Huxley's progress to a genuine mystical enlightenment from the foreshadowing of this in his brilliant but depressing works of the 1920s. As those who knew him in his later years attest, despite the deep griefs of the last decade of his life he had developed a loving and affectionate stance, giving him the charisma of one who has had experience of the ultimate unity. One of his last remarks was, "I have known that sense of affectionate solidarity with people around me and the universe at large; also the sense of the world's all-rightness in spite of pain, death and bereavement" (Laura Archera Huxley, *This Timeless Moment: A Personal View of Aldous Huxley* [New York: Farrar, Strauss, & Gerous, 1968], p. 310).

Chakoo is of the Hindu faith, seeing it in the same philosophical and nondogmatic light as Richard Barnett views Taoism in his "Taoism and Biological Science" (*Zygon* 21 [1986]:297). In a personal communication, he has written "Hinduism in a deeper sense is not a religion. It is like modern science, liberating the human mind." Religion to Huxley was also of this nondogmatic and experiential nature. His search for East-West integration developed momentum as he came to believe that knowledge of other religions was both a

self-evident duty for all people concerned with building up of human community and a basic necessity for a proper understanding of our own cultural heritage. To Huxley, religion and philosophy were coordinate and converging disciplines; he recommended to modern humanity a new religion in which the world of the phenomenon and the unknowable noumenon or Kantian "thing in itself" could be harmonized.

Chakoo's cultural background and qualifications to judge whether Huxley had attained a measure of Eastern religious wisdom are excellent. It is therefore significant that he describes him as eventually becoming an enlightened mystic with all the mystic's "unshakable faith in the supremacy of knowledge, invincible optimism, ethical universalism and religious tolerance" (p. 291). He was, according to Chakoo, "a saint first, an artist next, and finally a mystic" (p. 291). This writer would add that, towards the end, he also, partly as a result of his work on psychedelic drugs, had become a pretty good biological psychiatrist.

In his last novel Huxley returns to the tantric philosophy and life worship of his and his wife Maria's close friend and mentor, D. H. Lawrence. Perhaps after the loss of Maria to cancer in 1955 and his remarriage to Laura Archera, a violinist and psychotherapist, he realized more and more that, as Peter Berger points out in *The Sacred Canopy: Elements of a Sociological Theory of Religion* (New York: Doubleday, 1967), the roots of religious experience rest in the numinous or holy: the stirring of emotionality which is overwhelming and inescapable to anyone who is seized by it.

Unlike Lawrence, who focused on emotionality, Huxley the mystic alternated with a highly intellectual alter ego steeped in modern science. For a journal of science and religion, it is important to discuss Huxley's competence from this point of view. The grandson of Thomas Huxley, Darwin's friend and advocate, Aldous Huxley was educated at Eton and Oxford. He had hoped to become a research physician. However, a bout in late adolescence with near loss of vision by infection of the cornea, the scars of which lingered to torment him all of his life, made him give up this career and turn to poetry and writing. He retained an absorbing interest in science, pursuing it with increasing devotion in his last decade. Already in his late twenties he wrote in *Along the Road: Notes and Essays of a Tourist* (New York: George H. Doran, 1925, p. 223) that if he could be born again he would desire to be a man of science; "the only thing that might make me hesitate would be an offer by fate of artistic genius. But even if I could be Shakespeare I think I should still choose to be Faraday." His continued thorough familiarity with medicine and biology was in part sustained by his close attachment to his brother Julian, the world famous evolutionary biologist. For many years the two families, Aldous and Maria, Julian and Juliette, made it a practice to spend a vacation period together. The two men were also in regular correspondence.

In his final essay, *On Literature and Science* (New York: Harper, 1963), Huxley tackles the dichotomy between the scientist's and the artist's worlds. Although this book was written twenty years ago, he already had recognized that "there is an endocrinology of elation and despair, a chemistry of mystical insight and, in relation to the autonomic nervous system, a meteorology—of changing moods" (p. 106). In light of contemporary data on the neurophysiology of emotions, this is a shrewd observation. Elsewhere he criticizes the theology that animals "are without souls and that therefore they may be used as things" (p. 109). For

him, "the ethical and philosophical implications of modern science are more Buddhist than Christian, more Totemistic than Pythagorean and Platonic" (p. 109). The findings of contemporary science show that "Nature is a series of dynamic balances and when a state of equilibrium has been disturbed, Nature always attempts to establish a new balance between the forces involved" (p. 110). Between the universe of observed facts and that of felt values, certain bridges are discernible. On the middle ground between them, he says, are the raw materials for a new kind of literature, one that responds to the question of what a literary artist should do about nightingales in a way that integrates science and poetry in an understanding of human truth that touches the essential nature of things, the "Suchness of the world." In one of the last paragraphs of the book Huxley writes:

> The words of the tribe and of the textbook must be purified into a many-meaninged language capable of expressing simultaneously the truth about nightingales, as they exist in their world of caterpillars, endocrine glands and territorial possessiveness, and the truth about the human beings who listen to the nightingale's song. It is a strangely complex truth about creatures who can think of the immortal bird in strictly ornithological terms and who at the same time are overcome (in spite of ornithology, in spite of the ineradicable dirtiness of their ears) by the magical beauty of that plaintive anthem as it fades "past the near meadows, over the still stream." It is a truth about creatures who know perfectly well that everything transient is *not* a symbol of something else, but a part of whose mind likes to hark back to Philomel and the horrible tale of crime and counter-crime, of incestuous rape and avenging murder. It is a truth, finally, about creatures, in whose minds, far more deeply interfused than any scientific hypothesis or even any archetypal myth, is the Something whose dwelling is everywhere, the essential Suchness of the world, which is at once immanent and transcendent—"in here" as the profoundest and most ineffable of private experiences and at the same time "out there," as the mental aspect of the material universe, as the emergence into cosmic mind of the organization of an infinity of organizations, perpetually perishing and perpetually renewed (117-18).

By the time Donald Watt's *Aldous Huxley: The Critical Heritage* (London: Routledge & Kegan Paul) was published in 1975, a positive reassessment was already beginning from the severe decline of Huxley's reputation in the post-war years. The last words of Watt's massive collection of critiques of Huxley's work were by literature professor Richard Kennedy. In an obituary carried by the *Southwest Review* (1 [1965]:37) titled "Aldous Huxley: The Final Wisdom" Kennedy makes this evaluation: "He has managed to synthesize religion and science; social order and individualism and the cultural values of East and West."

The definitive biography by Sybille Bedford, *Aldous Huxley* (London:Chatto & Windus, 1973), has in the epigraph a comment by Dennis Gabor: "I am not concerned here with Aldous Huxley's literary fame. My concern is his heritage to those who really care about the future of the human race and in this respect I hope that he will be remembered." On the same page, violin artist Yehudi Menuhin testifies to his charismatic personality: "He was scientist and artist in one, standing for all we most need in a fragmented world. He made it his mission to restore those fragments and at least in his presence men were whole again."

Chakoo has written a book concerning the progression of the life work of one of the most distinguished philosophically oriented scientific futurists and students of religion in our time. He draws attention to the body of Huxley's work,

identifying it as that of a remarkable thinker who lived squarely in *Zygon*'s interface between science and religion. Twenty years after his death, the book encourages us not to neglect Huxley as a source of insight into the problems with which humanity is struggling.

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Habits of the Heart: Individualism and Commitment in American Life. By ROBERT N. BELLAH, RICHARD MADSEN, WILLIAM M. SULLIVAN, ANN SWIDLER, and STEPHEN M. TIPTON. Berkeley: University of California Press, 1985. 355 pages. $16.95, $7.95 (paper).

Written by three sociologists, a philosopher, and a theologian, *Habits of the Heart* is becoming one of the influential books of today. It is an unconventional book in that it is difficult to classify; it is certainly not sociology in the rigorous sense, but surely it was not meant to be, having been authored by representatives from such a diverse group of disciplines. It is in the genre of books, however, that we are encountering more often: it examines contemporary American culture and says that we are in trouble. The aim of the book is to suggest how we can "preserve or create a morally coherent life," something which we now lack but which we can regain because there exist traditions in the American past in which such coherence is found.

The cause of the ills in contemporary American society is one that other books have also chronicled: atomistic individualism which "may have grown cancerous" in our society. The authors argue that although individualism has always been important in America, its overemphasis in the nineteenth and twentieth centuries has left us homeless in "glorious but terrifying isolation." We are no longer connected to each other in community but have become atomized; and yet, ironically, our communitarian background remains sufficiently strong with us that we yearn for this connectedness. Although in many ways we act as if we are connected, the authors find that we cannot justify these actions. We have lost our "second language," the language of connectedness, and are left simply with the first language of individualism. We are unable to justify or even to think clearly about ourselves in community and this has led to an emasculation not only of who we think we are but also of how we act.

According to the authors there was a time (described by Alexis de Tocqueville) when things were not so one-sided in American culture, a time in which three traditions were in creative balance: the biblical tradition, the republican tradition, and the tradition of individualism. Indeed, the book argues that the first two, which are more communitarian in orientation, were chief sources for eighteenth-century individualism.

We find the biblical tradition in Puritanism, which viewed itself as, among other things, attempting to set up a utopian community in America in which a genuinely ethical and spiritual life could be lived. Other concerns, particularly material concerns, were secondary although not unimportant.

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The second tradition, the republican one, also stressed community and is represented by Thomas Jefferson. Republicans viewed the American Revolution not simply as an attempt to overthrow monarchical authority but also including a moral and political dimension which stressed the independent and virtuous citizen. This republican tradition, which originated in the Latin literature and was revived during the Renaissance, stressed the equality of independent people; but the people were defined primarily as citizens, as being connected to and having obligations toward a government. It contained a morality which stressed common welfare and the public good, and it demanded an extraordinary moral quality from the citizen, who, as Samuel Adams said, "owes everything to the commonwealth." Similar to the biblical tradition, it stressed communitarianism and virtuousness.

It is within this context that we need to understand a legitimate individualism as opposed to an atomistic notion of individualism that views the person as logically independent and self-sufficient outside of the community. Beginning in the nineteenth century individualism was defined in a much more specific and atomistic way. The authors summarize their historical analysis by saying: "The Revolution which had brought notions of public virtue and proven wisdom to the fore, also unleashed an egalitarian spirit and a drive for individual success that soon swamped this first, fragile pattern in a torrent of territorial and economic expansion, ending dreams of secure leadership by national civic-minded elite in touch with the popular feeling" (p. 255).

The best way to see how the concept of individualism has changed is to look at what the authors call a "representative character," a symbol of the kinds of personalities and traits which a culture implicitly believes ought to be developed, giving "living expression to a vision of life." As far as I can tell, this is the same use of the term *character* as is found in Alistair MacIntyre's *After Virtue*, and the present authors must have depended heavily on MacIntyre for their analyses. In the nineteenth century the representative character was the entrepreneur, the person best able to exploit the economic potential of the industrial revolution. The twentieth century can be seen as having two representative characters, the therapist and the manager, both giving expression to a new kind of individualism, a utilitarian individualism. It is the job of the therapist, according to the authors, to get the patient working efficiently in the society. Its ideal is the autonomous individual, the one cut off and independent from a community but one who needs to function adequately within the society. There is no *a priori* vision of what a person should be; rather, it is the job of the therapist to help the patient to be able to function efficiently in all circumstances. The therapist has the ideal of the value-neutral scientist who takes each person's values as given. Therefore the therapist does not make value judgments but is only interested in helping the patient express him or herself.

The manager also represents a utilitarian individualism. Being committed to a job as opposed to a calling, the manager represents the American ideal to get the job done and to be self-sufficient.

The second form of individualism, expressive individualism, aims at making self-expression the end of life. Yet the question arises as to what this self is which needs to be expressed. I believe that the authors would agree with Richard Sennett in his *The Fall of Public Man* that the notion of the self in the eighteenth and nineteenth centuries became more and more without content. The more one views freedom as being free *for* atomistic self-expression, the more it becomes a notion of being free *from* encumbrances, since any kind of commitment to community or to others is an encumbrance on the self, a way of

restricting expression of the individual self. As such, the idea "express yourself" has become nothing more than the idea of fulfilling individual desires and even whims.

A common variety of expressive individualism is found in the jacuzzi set who are dedicated to living a particular "lifestyle." The logic of the notion lifestyle is such that it does not imply any commitments; rather, it involves a living out of the individual desires that a person happens to possess and that may change at any minute. Our desire for relationships with others expresses itself in "lifestyle enclaves." People who happen to have adopted the same lifestyle get together and express themselves in the same place, because they can do it more easily. Lifestyle enclaves, however, are not communities, since these imply commitment on the part of in the individual and are always institutions of "memory and hope."

Given expressive individualism, institutions such as marriage begin to be undercut. After all, if one is more oriented to expressing oneself than to commitments, marriage itself must become a kind of miniature lifestyle enclave in which I am willing to live with a partner so long as he or she continues to have the same desires as I, but with no further commitment than this. The logic of lifestyle, as the authors point out, dictates that utility replaces duty, self-expression unseats authority, and "being good" becomes "feeling good."

Perhaps wisely, the authors are less specific about the solution to the problem than they are in their analysis of the problem. However, they recommend that we need to recapture in some sense the second language which is the language of community, and in doing so we must at least capture the spirit of the biblical and/or republican traditions, if not return to them.

Yet, it is not clear that we can do this. On the one hand both the biblical and republican traditions grew out of and were sustained by a radically different kind of society from what we have today, particularly in terms of size and communication. Traditionally, the notion of community has found a more comfortable home in a smaller, more rural setting than in large, heterogeneous cities. The megalopolises of the east and west coasts do not appear to be the natural environments in which a traditional notion of community can be nurtured. Ironically, the greater communication of the twentieth century has made the notion of community even more untenable, for with mass communication comes the recognition of vast differences among people. Finally, size has led to alienation from life supporting and sustaining processes (we no longer kill our own chickens), and this alienation entails a distancing from relationships with others.

Further, attempts in the twentieth century to capture the spirit of a community pictured as an organic whole have been less than positive in their results. Fascism and Stalinism/Leninism have not led to societies which evoke feelings of respect for persons. Modern attempts at communitarianism, therefore, do not make us sanguine about creating community in a way that is not oppressive and/or engineered.

I do not believe that the authors of *Habits of the Heart* would deny these problems, and they may even find that attempts at communities based upon the notion of organicism may be misguided. After all, they have argued that the problem with individualism is not that is exists but that it has excluded other, mediating, forces: its cancer has ravaged the entire body.

One solution to the problem of retaining respect for individuals but mediating contemporary forms of individualism might be to make a distinction between individualism and individuality, stressing that community can be

found in individual differences implied by the notion of individuality, but individuality does not necessarily depend upon the atomism of the traditional idea of individualism.

I do not think that we can recapture the biblical and republican traditions in our society, for it would necessitate a turning back the hands of time in a way that would be impossible. What is necessary is that we take our culture as it is and look for ways to begin to express the idea of community in the language we now have. It may be, some analysts of culture and science are arguing, that the atomism of science assumed by seventeenth-century thinkers is now being mediated by twentieth-century physics and particularly quantum mechanics. In this way the natural sciences may suggest new metaphors and a new epistemology based upon interrelationships, systems, bootstrapping, or holism, which imply what might be called a communitarian epistemology. Certainly, ecological thinking, particularly in its "deep" forms, is groping toward models and metaphors which are less atomistic and upon which we may be able to envision a new community.

Habits of the Heart is rightly becoming a contemporary classic, urging us to understand better the assumptions of our tradition. It should be read, I think, in the broader context of urging us to begin to develop helpful metaphors and an appropriate epistemology from science and from other areas for understanding ourselves better as religious and moral beings.

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Culture and the Evolutionary Process. By ROBERT BOYD and PETER J. RICHERSON. Chicago: University of Chicago Press, 1985. 331 pages. $29.95.

Bridging disciplinary perspectives is always a tricky business in science and is even more tricky when the disciplines in question are, on the one hand, a natural science, biology, and on the other hand, social sciences dealing with aspects of human culture. The predominate model of how to bridge disciplines has been reduction—a strategy of trying to explain the phenomena in the domain of the higher level science in terms of the principles of the lower level science. In the interface between the biological and the social sciences, this reductionistic approach has in modern times involved trying to explain social phenomena within an evolutionary framework. In the nineteenth century the preeminent example was Herbert Spencer's Social Darwinism. In the 1970s and 1980s the major effort to reduce social phenomena to biology has come from sociobiology. Robert Boyd and Peter Richerson attempt to bridge the biological and social levels and do so by appealing to an evolutionary perspective, but they take pains to show how their perspective differs from that of sociobiology. What emerges is an interlevel perspective linking the biological and the social which is far less reductive than that usually put forth. The model they offer is powerful and suggestive and ought to be of interest to anyone interested in understanding and explaining cultural phenomena. Although religion is not a primary focus in their analysis, the model is clearly one that could be applied to religion as well as other aspects of culture.

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While Boyd and Richerson utilize the Darwinian evolutionary framework in their attempt to account for social phenomena, they depart from the reductive emphasis of sociobiology by focusing on "cultural" evolution. For them culture involves "the transmission from one generation to the next, via teaching and imitation, of knowledge, values, and other factors that influence behavior" (p. 2). The focus on transmission by teaching and imitation is key to their program. They view the modes of transmission as the distinguishing feature of culture, and attempt to show the general power of culture by showing how the different modes of transmission involved in cultural evolution give rise to different consequences than do the modes of genetic transmission characteristic of biological evolution. Cultural evolution thus emerges in their treatment as different from biological evolution, giving rise to partial autonomy of the cultural level. This autonomy is only partial, however, since the gap is mediated by an attempt to show how the modes of cultural evolution could themselves have arisen as products of biological evolution. They refer to their approach which distinguishes two levels of evolution as a "dual inheritance theory."

The methodology of Boyd and Richerson is that of evolutionary modelers in population biology. They formulate explicit, but general, mathematical models to characterize the phenomena of interest and investigate the consequences of these models. Their interest is directed at the question of whether these models can accommodate the features of culture that have been studied by social scientists. Thus, in each chapter they set out a formal mathematical model, characterize the results of the model in terms of the implications for cultural phenomena, and introduce examples of social or cultural phenomena that fit the pattern drawn from the model. The result is that the text is dense with highly mathematical formal models which give a misleading suggestion that it is the details of these models that matter. Boyd and Richerson clearly recognize that the social and cultural data that they are trying to explain is far too sparse to offer a basis for comparatively evaluating competing mathematical models. They explicitly characterize their models as "simple models" or "sample theories" which seek to capture the generic features of the situation being analyzed, not all the details of actual situations that arise in the world. Rather than trying to establish that their models are correct, they are interested in showing their plausibility. This plausibility buttresses their claim that their dual inheritance theory should be taken seriously as a basis for integrating biological and social/cultural levels of theorizing.

The perspective of Boyd and Richerson is grounded in biological theorizing in two respects. First they assume that neo-Darwinism offers a basically correct account of the evolution of biological organisms, including ourselves. They invoke neo-Darwinian evolutionary theory to show how a second mode of inheritance and hence a second level of evolution, cultural evolution, is possible. Because their invocation of contemporary biological theorizing is general and flexible, so that their claims do not depend on rigid acceptance of one particular approach to modeling biological evolution, this level of appeal seems quite unproblematic. The second level of appeal occurs when they use the basic apparatus of evolutionary modeling in an analogical fashion to describe events at the cultural level. While this use of the evolutionary model is clearly not reductive but analogical, it is at this level that the authors are likely to be criticized. Social scientists may well reject Boyd and Richerson's suggestion that they need to invoke a biological framework if they are to organize their own disciplines. While these critics may well turn out to be right, what is of interest is how far one might go in attempting to explain cultural phenomena by adopting

and modifying the evolutionary model. It should be considered that the evolutionary model, while it has been most widely used in the biological sciences, is not inherently a biological model and that in fact Darwin himself developed his theory by drawing on Malthusian economic theory. There are dangers in imposing a theory from one domain upon a foreign one, but these can be mitigated if one treats the whole endeavor as analogical and focuses equally on the differences and the similarities.

It is, in fact, the recognition of differences between cultural and biological transmission that makes Boyd and Richerson's model a "dual" model. Some of the prominent differences include the facts that an individual can have quite different cultural than biological offspring and that cultural parents can have different degrees of influence on offspring. Moreover, the mode of transmission involves direct copying of phenotypic traits, not of genetic material coding for such traits. These and other differences that the authors detail have powerful consequences in the models of cultural evolution they develop. The fact that it is phenotypes that are copied means that evolution can be affected by the rational calculation that goes into one individual's choice of behavioral patterns. Others can directly copy the result and thereby benefit. Further, with cultural transmission the cultural offspring can themselves select what traits to adopt from its cultural progenitors, giving rise to what Boyd and Richerson term "biased transmission."

While evolutionary biology provides the theoretical framework on which Boyd and Richerson develop their model of cultural evolution, they also draw heavily on a wide range of literature from the social sciences. In making the case for the importance of cultural transmission in chapter three ("The Cultural Inheritance System"), for example, they draw upon the observational learning research of the social psychologist Albert Bandura; a variety of studies on the effects of child rearing practices on behavior by sociologists and psychologists; psychometric studies showing familial correlations between behavioral traits such as political affiliations that are not likely to be genetically inherited; and anthropological evidence of cultural inertia. It is in light of this data that Boyd and Richerson turn to the task of developing the mathematical model of trait transmission based on similarities with the case of genetic transmission (e.g., the fact that in both cases stable structures are transmitted, and that the parents from whom traits are drawn are a small proportion of the actual population). They then turn to some of the complications that must be added into the model to handle cultural transmission, including the various ways a cultural offspring may fail to imitate its parents, the possibility of horizontal transmission, and blending inheritance of cultural traits.

After making the case for cultural transmission, the authors address some of the specific characteristics of cultural transmission that serve to distinguish it from genetic transmission. In chapter four ("Guided Variation and the Evolution of Cultural Inheritance") they introduce guided variation, which allows individuals to pass on cultural traits learned by the individual to offspring. In chapter five ("Biased Transmission and the Sociobiology Debate") they examine directly biased transmission in which individuals select from the cultural traits modeled in their society those that would most enhance their individual fitness. These first two features serve specifically to increase individual fitness, and so are quite compatible with sociobiological models. While they may explain some aspects of human cultural development, Boyd and Richerson argue that they are not universal. There are features of culture that violate genetic interest and thereby contravene the sociobiological framework

as well. These provide the main interest of Boyd and Richerson's discussion. Thus, in chapters six through eight they identify three other characteristics of cultural evolution and explore their significance: asymmetric transmission, frequency dependent transmission, and indirect bias.

Asymmetric transmission refers to the fact that cultural parents may be different from genetic parents. The ability to learn from other than one's genetic parents may be advantageous to an individual. Yet, this mode of inheritance may also lead to acquisition of genetically maladaptive traits when what is inherited is at odds from what is actually in an individual's genetic self-interest. Frequency dependent transmission involves the acquisition of those traits that are most widely shared in an environment. Since a widely practiced trait is likely to be advantageous, this often will provide an economical way of acquiring useful traits. However, it can also lead to conformist behavior such as that exhibited by Kamikaze pilots and to general forms of cooperative behavior that may favor the group over the individual.

Perhaps for scholars of religion the most interesting of the characteristics of cultural evolution Boyd and Richerson examine is indirect bias. This involves adopting traits that are exhibited by those individuals who possess yet other traits (indicator traits) that are found desirable. As long as the indicator traits are themselves culturally transmitted, this process, under the right circumstances, can give rise to a "runaway" process comparable to that Darwin identified in natural selection. Once the indicator trait has been found desirable, there will be selection to favor its development. Those who are cultural descendants of the possessors of the indicator trait will develop an ever-increasing demand for that trait as well. Boyd and Richerson offer this as a potential explanation for the cultural value placed on prestige items that are not themselves valuable—they may be indicator traits that have been favored by a runaway process. Moreover, the authors also suggest that their model of indirect bias may provide an explanation for the development of many social symbols. While they are not themselves functional, they could have resulted from a process of indirect bias, spreading widely as a result of being adopted by those who possess the valued indicator trait. As usual, the authors offer illustrative examples such as the spread of linguistic traits that show the plausibility of their model.

While I clearly find Boyd and Richerson's approach to be a viable and potentially informative one, I do maintain some reservations as to its overall prospects for accounting for social and cultural phenomena generally. Like them, I value the attempt to integrate and unify the approaches of the biological and social sciences, but I have qualms about their goal "to account for all the processes by which the distribution of beliefs, attitudes, and values in a population are transmitted and modified" (p. 12) within their basic approach. Theirs is heavily a bottom-driven approach. While they fault sociobiologists for not recognizing the power of various modes of cultural transmission which may produce results that diverge from those expected purely on the basis of biological evolution, I fear that they may not yet have done enough to identify all the potential factors at work in cultural development. For example, their basic mode of cultural transmission is imitation, but this may grossly oversimplify the actual processes of cultural transmission. In trying to show how cultural phenomena may differ from the predictions of sociobiology they try to accommodate the claims of anthropologists such as Marshall Sahlins that culture may have its own logic, but they do not investigate how such a logic may figure in the transmission and acquisition of culture.

In their defense, however, it should be noted that the goal for Boyd and Richerson is to develop a general framework in terms of which the contributions of various disciplines and their connections can be recognized. My concern is that, in striving for a general framework, the authors may have offered an approach that is so general that it can be made to fit many situations and still not have identified some of the important factors actually working in generating cultural phenomena. The danger of being too general, however, may simply be an inherent problem in an attempt to forge a new perspective, and Boyd and Richerson have certainly given us a perspective that is suggestive and may well guide future attempts to bridge disciplinary perspectives and build a new framework for looking at cultural phenomena.

The book is extremely challenging and difficult, partly as a result of the detailed treatment of the mathematic models. For those who do not want to follow through the mathematical analysis, Boyd and Richerson have provided qualitative characterizations of their models, and thus the main insights of their treatment can be gleaned without concern for the detailed mathematics.

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Notice

The Karl Heim Gesellschaft, a society chartered in West Germany "to further a biblical Christian orientation in a scientific technological world," will begin to publish a yearbook in 1988 with contributions that are geared to the general public. The society solicits submissions of not more than twenty manuscript (double-spaced) pages for the 1989 and following volumes. Contributions which are not in German will be translated by the editor. Please direct inquiries and submissions to Prof. Dr. Hans Schwartz, University of Regensburg, 8400 Regensburg, West Germany.