

Tradition & Discovery

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Larry Arnhart, *Darwinian Natural Right: The Biological Ethics of Human Nature*

Reviewed by Ursula Goodenough

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“Two Cultures Revisited,” Yu Zhenhua's essay in this issue, marks the first time that *TAD* has had a contribution from a scholar teaching in a Chinese university. This is an interesting essay that carefully analyzes the issues treated in Polanyi's *The Study of Man*, which was published only a year after *Personal Knowledge*. Percy Hammond's “Parts and Wholes--Contrasting Epistemologies” compares the discussion of parts, wholes and knowledge in Peter Simons, Ernest Nagel and Polanyi. He develops interesting criticisms of Polanyi's ideas about emergence. My own review essay in this issue summarizes themes in Ursula Goodenough's book *The Sacred Depths of Nature* as well as her broader discussions of religious naturalism. This piece is simply an effort to encourage members to take a look at Goodenough's writing, since she will give a paper in one session (co-sponsored by the AAR “Religion and Science” group) of the November 2002 Polanyi Society annual meeting that is devoted to her work. The second session will feature papers by Esther Meek and Richard Moodey (see the full program on page 4). In News and Notes, I mention several interesting scholarly projects, including the publication of a new Polanyi bibliography. Please continue to e-mail to me notices about papers and publications. Finally, note also biologist Goodenough's review of a work on moral matters by a political scientist drawing on both biology and the philosophical tradition.

Let me remind you that in the next issue there will be a flyer asking that you to pay your membership dues which go up from \$20 to \$25 US for the year beginning in the fall. Flyers are the simplest and cheapest device I have to notify members while operating within the bulk postage regulations. If you have a question about your standing, please write or e-mail me. Postage rates, particularly outside the US, are increasing so I must soon provide more push for prompt dues payment in order to keep the society solvent. In the next year, the Society will make an effort to increase library subscriptions. There are some requests for *TAD* materials that are not being met by the interlibrary loan system because we do not have enough library subscriptions. If you are willing to work to get a local institution signed up, please write or e-mail me. We may be able to provide some back issues free to libraries.

Phil Mullins

Tradition and Discovery is indexed selectively in *The Philosopher's Index* and *Religion One: Periodicals*. Book reviews are indexed in *Index to Book Reviews in Religion*.

NEWS AND NOTES

Just off the press is *A Classified And Partially Annotated Bibliography Of Michael Polanyi, The Anglo-Hungarian Philosopher Of Science* put together by M. W. Poirier. This 430 page volume, representing many years of careful labor, is divided into three major sections dealing with primary, secondary, and tertiary works, plus a whole set of internal divisions (13 in the first, 13 in the second, 7 in the third of these major sections, with many annotations), a brief biography of approximately 24 pages, a timeline, and an index of secondary and tertiary authors. This volume was published by Canadian Scholars' Press Ind. but is distributed by University of Toronto Press, 5201 Dufferin Street, TORONTO, Ontario, M3H 5T8 or 2250 Military Road, TONAWANDA, New York, 14150. It is selling for \$39.95 US and \$49.95 Canadian. In the US and Canada, you can call the University of Toronto Press toll free at 1-800-565-9523; copies may be ordered by e-mail at utpbooks@utpress.utoronto.ca A future issue of TAD will have more about this new publication.

Starting this Spring, Chris Goodman received funding from the Earhart Foundation to become a Visting Scholar at the Philosophy Department at Sheffield University, England. This should enable him to complete a book on Polanyi that he has been working on.

S.R. Jha presented a paper, "Michael Polanyi's Phenomenology of Science and Knowledge," at the International Conference on Intentionality: Past and Future held June 19-23, 2002, at the University of Miskolc, Hungary,

An essay by Ivan H. Ellingham (a psychologist interested in Polanyi), "Madness and Mysticism in Perceiving the Other: Towards a Radical Organismic, Person-Centred Interpretation" was recently published in G. Wyatt and P. Sanders (eds.),

Rogers' Therapeutic Conditions: Evolution, Theory and Practice, Volume 4: Contact and Perception (Ross-on-Wye: PCCS Books, 2002: 234-258). In September, another essay, "Foundation for a Person-Centred, Humanistic Psychology, and Beyond: The Nature and Logic of Carl Rogers' 'Formative Tendency'" will be included in J. C. Watson, R. N. Goldman and M. S. Warner (eds.), *Client-Centered and Experiential Psychotherapy in the 21st Century* (Ross-on-Wye: PCCS Books).

Two essays by Dale Cannon on teaching philosophy have been published in the last year: "A Post-Critical Approach to Conceiving and Teaching Introduction to Philosophy," *APA Newsletter on Teaching Philosophy*, 00:2 (Spring 2001), 186-191; "Levels of Socratic Irony and Escape from the Cave in Introduction to Philosophy," *APA Newsletter on Teaching Philosophy*, 01:1 (Fall 2001), 201-203.

The recent issue of *Polanyiana* (Vol. 10, No.1-2, 2001) has now been put on the web. It is available, as are many past issues, from the home page of *Polanyiana* (<http://www.kfki.hu/chemonet/polanyi/index.html>).

Electronic Discussion List

The Polanyi Society supports an electronic discussion group exploring implications of the thought of Michael Polanyi. Anyone interested can subscribe; send e-mail to Struan Jacobs (swjacobs@deakin.edu.au) who is the moderator. The address for the list is polanyi-list@deakin.edu.au

2002 Polanyi Society Annual Meeting in Toronto

The Polanyi Society annual meeting is to be held in Toronto, Ontario, Canada on November 22 and 23, 2002. As in past years, meetings are held in conjunction with the annual meeting of the American Academy of Religion and Society for Biblical Literature. Because of pressure for space, these large umbrella professional organizations are now carefully monitoring hotel reservations. It is necessary to register for the AAR/SBL annual meeting to be eligible for hotel accommodations in one of the primary hotels near where meetings are held. However, anyone who is interested is welcome to attend the Polanyi Society meetings, whether or not they are attending the AAR/SBL meetings. There are, of course, other hotels in the area. If you want information about registration for the AAR/SBL meetings go to <http://www.aar-site.org/meetings/default.asp>. You can phone for additional information (1-800-575-7185 [U.S. & Canada], 1-330-425-9330 [outside U.S. & Canada]) or e-mail (aarsblreg@conferon.com).

The room locations for the annual meeting sessions are not yet available. They will either be in the Metro Toronto Convention Centre or one of the three nearby AAR/SBL annual meeting headquarters hotels. The locations will be posted on the Polanyi Society web site (<http://www.mwsc.edu/~polanyi>) as soon as they are known. The two Polanyi Society sessions will also be listed in the AAR/SBL Annual Meeting Program as Additional Meetings of the Polanyi Society. Any late room changes will be noted in the program. Information will be included in the issue of *Tradition and Discovery: The Polanyi Society Periodical* to be published in the fall of 2002..

The November 22 session, co-sponsored by the Religion and Science Group of the AAR, will be focused around a paper by Ursula Goodenough, a prominent cell biologist who has for several years been an articulate voice in religion and science discussions. The November 23 session will include papers by Esther L. Meek and Richard W. Moodey. Abstracts of some papers are presently available on the Polanyi Society web site (<http://www.mwsc.edu/~polanyi>). When the complete papers are available in the fall of 2002, they can be downloaded from this web site by clicking on the title.

Program

Friday, November 22, 9:00 p.m. - 11:00 p.m

Theme: From Biology to Morality with Polanyian Footnotes

Presentation by Ursula Goodenough, Washington University, St. Louis

Respondents:

Nancy Howell, Saint Paul School of Theology

Phil Mullins, Missouri Western State College

Diane Yeager, Georgetown University

Open Discussion

Saturday, November 23, 9:00 a.m. - 11:30 a.m.

“Learning to See: The Role of Authoritative Guides in Knowing”

Esther L. Meek, Covenant Theological Seminary

Respondent: Paul Lewis, Mercer University

”Moral Passion and Moral Judgment: Polanyi and Lonergan on Ethics”

Richard W. Moodey, Gannon University

Respondent: Vincent Colapietro, Pennsylvania State University

Open Discussion

Business Meeting 11:30 a.m.

Chair: Marty Moleski

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WWW Polanyi Resources

The Polanyi Society has a World Wide Web site at <http://www.mwsc.edu/~polanyi/>. In addition to information about Polanyi Society membership and meetings, the site contains the following: (1) the history of Polanyi Society publications, including a listing of issues by date and volume with a table of contents for recent issues of *Tradition and Discovery*; (2) a comprehensive listing of *Tradition and Discovery* authors, reviews and reviewers; (3) information on locating early publications; (4) information on *Appraisal* and *Polanyiana*, two sister journals with special interest in Polanyi's thought; (5) the “Guide to the Papers of Michael Polanyi” which provides an orientation to archival material housed in the Department of Special Collections of the University of Chicago Library; (6) photographs of Michael Polanyi; (7) five essays by Michael Polanyi.

Two Cultures Revisited: Michael Polanyi on the Continuity Between the Natural Sciences and the Study of Man

Yu Zhenhua

ABSTRACT Keywords: Snow's problem, Michael Polanyi, the natural sciences, the study of man, continuity and distinction.

Polanyi's response to Snow's problem is a two-step strategy. First, he undermines the supposed gap between the natural sciences and the study of man and establishes the continuity between them. Second, based upon what is achieved in the first step, he explores the distinctions between scientific and humanistic meanings. All this is achieved on the basis of his theory of tacit knowing. Three features of this theory merit attention: (1) the predominance of the participatory perspective; (2) the recovery of the hermeneutic dimension of science; and (3) the constructive use of Heidegger's "being-in-the-world."

The split of science from the humanities and fact from value is a prominent phenomenon in modern times. C. P. Snow addresses this issue in his famous article titled "The Two Cultures" based on his 1959 Rede Lecture. One philosophical version of "Snow's problem" is the discussion of the relation between the natural sciences and the social, human sciences. Polanyi's view on this problem is quite clear. He insists on the continuity between the natural sciences and the study of man. In holding this view, Polanyi finds himself at odds with both positivists and secessionists, i.e., philosophers like Dilthey, Wildelband, Rickert, and Collingwood, who advocated the secession of the humanities, and history in particular, from the domain of the natural sciences. In this essay, I will argue that, by working out a new epistemology, that is, his theory of tacit, personal knowing and an ontology of stratified reality, Polanyi overcomes the deficiencies of both the positivistic approach and the secessionist movement and undermines the supposed gap between the natural sciences and the study of man.

1. The Supposed Gap

Polanyi is in line with Snow in complaining about the gap between science and the rest of our culture, but he disagrees when Snow attributes the gap to specialization, which results in, for instance, literary people's ignorance of thermodynamics. Polanyi thinks that specialization is indispensable to the advancement of modern science and the rest of our culture. Rather, he sees the trouble in the modern understanding of science. In Polanyi's diagnosis, it is the modern understanding of science, which, having originated in the scientific revolution in the 17th century, gained momentum in the Enlightenment, and ultimately found its paradigmatic expression in positivism, is responsible for the gap between science and the study of man. Positivism contributes to and sustains the gap. The break between science and the study of man is a logical consequence of the positivistic conception of science. Obviously, this observation is not compatible with the prevalent positivistic self-understanding concerning the relation between the natural sciences and the social, human sciences, which claims that the latter should model on the former and advocates the program of a unified science. Let's see how Polanyi justifies his thesis.

A survey of his various works in different periods shows that Polanyi's characterization of the positivistic conception of science and knowledge in general can be captured under the following three headings: objectivism, the obsession with the explicit, and reductionism.

By objectivism, Polanyi means the ideal of scientific detachment that sets the goal of absolute objectivity for science and characterizes science as impersonal knowledge. Since the 17th century, this objective, impersonal ideal of scientific detachment has become ingrained in our culture and has become the dominant view of science and knowledge in general.

Closely related to objectivism, is the ideal of wholly explicit knowledge. The paradigm case for this ideal can be found in logical positivism, which equates science with a body of highly formalizable and wholly explicit propositions and takes logical analysis of the structure of scientific theories as the main task of philosophy of science.

The third element in the positivistic understanding of science is reductionism. It manifests itself in the search for a mechanistic theory of the universe which demands insistently that everything should be explained by the laws of physics and chemistry. The Laplacian ideal of a universal knowledge of the world is an excellent example of it. It is also embodied in various naturalistic explanations of man and human affairs, for instance, Freud's reduction of man's morality to a mere rationalization of desires, or the behaviouristic elimination of intentions.

Polanyi points out that simply by adhering to this objectivistic and reductionistic conception of science, and applying scientific methods to the study of man and society, the study of man, as carried out in various disciplines, ends up inevitably with many anomalies, even absurdities, that are easily found in areas from neurophysiology, psychology, anthropology and jurisprudence, to sociology and moral theory.¹ To put it in another way, what Polanyi attempts to say, in my view, is this: if we stick to the positivistic understanding of science and study man and human affairs in a detached manner and in a reductionistic way, we can hardly avoid the "corruption of the conception of man,"² reducing him to an insentient automaton, or to a bundle of appetites, or to a passive being conditioned by the existing structure of power and profit. That is to say, man as a sentient, intelligent, and morally responsible being lies outside of the reach of science positivistically conceived. Any attempt to take man's moral and other cultural responsibilities seriously, as being apposite to his being, is doomed to be unscientific. Hence the gap between the natural sciences and the study of men as sentient and responsible beings. We can infer from Polanyi's analysis that, for positivists, there is a discrepancy between what they want to accomplish and what they can accomplish. Due to its objectivistic and reductionistic understanding of science, the program of a unified science is an unachievable goal. The gap between the natural sciences and the study of man is implicit from the very beginning in the positivistic conception of science.

While for positivists this gap is only implicit in their approach, it is blatantly announced by the anti-positivist secessionists.

Since the end of the nineteenth century there has been a continuous philosophic movement on foot claiming that the humanities, history in particular, must be studied by other methods than those of the natural sciences. In Germany, where this movement goes back to Hegel and Herder, and in Italy, where its roots can be traced back even further to Vico, this philosophic

movement soon became predominant. In England, the writings of Collingwood, who vigorously advocated what he called the ‘secession’ of history from the domain of the natural sciences, gained a limited influence for this doctrine.³

The rise of this philosophic movement was a reaction to the positivistic program of a unified science. But the irony is that, as will be shown clearly later in section 3, when the secessionists drew a demarcation line between history and the natural sciences, they shared the positivistic conception of sciences. Simply put, the dichotomy of history and natural sciences as advocated by secessionists was based upon a positivistic understanding of natural sciences.

In summary, no matter whether it is implied or explicitly stated, the secret of the gap between the natural sciences and the study of man lies in the positivistic conception of science. So, if we intend to bridge the gap, we have to call into question the positivistic conception of science. This is exactly how Polanyi approaches the issue. Polanyi does not take the above mentioned gap as a legitimate one, and he attributes the untenability of the supposed gap to the inadequacy of the positivistic conception of science. He suggests that, “we can start mending this supposed break between science and our understanding of ourselves as sentient and responsible beings by straightening out our conception of scientific knowledge.”⁴

2. Revision of the Positivistic Conception of Science

To Polanyi, the positivistic conception of science is far from satisfying. It does not provide us with a true picture of what science really is. It is the target of his lifelong attack.

According to Polanyi, the complete and absolute objectivity usually attributed to science is a delusion, and he rejects it absolutely as a false ideal. The substitute that he offers for the ideal of scientific detachment is personal knowledge.⁵ In his view, the personal participation of the knower in the shaping of knowledge is no mere imperfection that should be eliminated, nor a mere psychological by-product, but a logically indispensable element of science.⁶ Taking advantage of his expertise as a scientist and his familiarity with a stunningly wide scope of scientific knowledge in different branches, he demonstrates that personal participation exists in mathematics, physics, chemistry, biology, medicine, not to mention the social sciences and the humanities. In surveying the personal participation in scientific inquiry, Polanyi discusses different personal coefficients; among them are personal judgment, appraisal, imagination, intuition, intellectual passions, beliefs or convictions, commitments, and conscience. For the sake of an accurate understanding of Polanyi’s position, it is worth noting that, while endorsing the indispensability of personal involvement in scientific inquiries, Polanyi draws a clear line between the personal and the subjective. While what is subjective is defined as being private,⁷ personal participation “is a responsible act claiming universal validity. Such knowing is indeed objective in the sense of establishing contact with a hidden reality.”⁸ In a word, personal knowledge is a fusion of the personal and the universal, the objective.

In order to cast Polanyi’s position in sharp relief, it is worth noting that three conceptions of objectivity are involved here. Objectivity 1 denotes the independent existence of external reality; objectivity 2 refers to universal validity and objectivity 3 means scientific detachment. Obviously, Polanyi’s theory of personal knowledge is against objectivity 3, something which he calls objectivism, but fully acknowledges objectivity 1 and 2. It retains the universal, objective dimension of science and shows an attempt to situate it

in its real context, namely, the context of personal involvement. In this respect, it is analogous in structure to the concept of “situated reason” which tries to keep balance between the contextuality and universality, the immanence and transcendence of reason at the same time.⁹

The personal coefficients of knowing are often tacit powers of the mind and can hardly be put in explicit terms. The uncovering of the tacit dimension of knowing forcefully undermines the positivistic ideal of wholly explicit knowledge. The fact that we know more than we can tell in various situations in everyday life and scientific research bears witness to the existence of tacit knowledge. But Polanyi is not just content with demonstrating the existence of tacit knowledge; he has a more important point to make. In his view, tacit powers of the mind are decisive and predominant at all levels of human cognition, not only on the pre-linguistic level, but also in the domain of articulate culture. They represent man’s ultimate faculty of acquiring and holding knowledge. He says: “While tacit knowledge can be possessed by itself, explicit knowledge must rely on being tacitly understood and applied. Hence all knowledge is *either tacit or rooted in tacit knowledge*. A *wholly explicit knowledge is unthinkable*” (italics original).¹⁰ Obviously, this emphasis on the primacy of the tacit dimension of human knowledge is diametrically opposed to the positivistic obsession with the ideal of wholly explicit knowledge.

The analysis of the structure of tacit knowing is recognized as one of Polanyi’s most important contributions to philosophy. It can be described as a triad. It has three centers: “first the subsidiary particulars; second, the focal target; and third, the knower who links the first to the second.”¹¹ The knower gets to know the second term by attending to it, while he knows the first term by relying on it for attending to the second term. He has focal awareness of the second term and at the same time subsidiary awareness of the first term. By an act of integration, the knower establishes a from-to relation between the first term and the second term. Polanyi reminds us of the fact that there is one thing in the world which we almost know exclusively by relying on our awareness of it for attending to something else. This unique thing is our body. Normally, we do not attend to our body as an external object, but we always rely on our body as a means for our intellectual and practical control of the outside world. Polanyi generalizes this point and says: “*We may identify, therefore, our knowing of something by attending to something else with the kind of knowledge we have of our own body by dwelling in it*” (italics original).¹² Thus we arrive at his famous thesis of knowing by indwelling. To have subsidiary awareness of the particulars in attending to the coherent entity which they jointly constitutes is to dwell in it. The claim that knowing involves indwelling is reminiscent of Dilthey’s hermeneutics and related ideas. Polanyi acknowledges this connection, but he also points out that the strength of his own thesis lies in his analysis of the natural sciences, something that Dilthey’s hermeneutics and related ideas completely fall short of: “While knowledge by indwelling is clearly related to Dilthey and existentialism, its extension to the natural sciences is contrary to these philosophies.”¹³

In this connection, it is interesting to note how Polanyi interprets the notion of understanding on the basis of his theory of tacit knowing. First, Polanyi thinks that the word “understanding” covers different operations of man’s tacit powers. Understanding, or comprehension, is defined as the faculty of making sense of and reorganizing our experience so as to gain intellectual control over it. As noted above, tacit knowing is regarded as the ultimate faculty for acquiring and holding knowledge so it is the key to understanding. Polanyi claims that, understanding, or comprehension, “is the faculty which I recognize as the central act of knowing. For comprehension can never be absent from any process of knowing and is indeed the ultimate sanction of any such act. What is not understood cannot be said to be known.”¹⁴ Second, in Polanyi’s view, “The structure of tacit knowing is manifested most clearly in the act of understanding. It is a process of comprehending: a

grasping of disjointed parts into a comprehensive whole.”¹⁵ In comprehension, the central epistemological relation is that of the parts to the whole. In order to understand the whole, we should know the parts, but the way we know the parts is different than the way we know the whole to which we attend focally. We know the parts in terms of the whole which they constitute, that is, we know them subsidiarily. Surely, this analysis of the mutual relationship between the parts and the whole in understanding or comprehension can shed some light on our understanding of the hermeneutical circle. Third, in defiance of the positivistic doctrine, Polanyi’s notion of understanding carries with it a strong metaphysical overtone. Adhering to his realistic position, he characterizes understanding as an attempt to search for the hidden reality which will manifest itself in unthought of, or even unforeseeable, ways in the future.

This brings us to the ontological aspect of tacit knowing, and further, to Polanyi’s ontology of stratified reality which is his substitute for the mechanistic world view. According to Polanyi, there exists a correspondence between the structure of comprehension and the structure of the comprehensive entity which is the object of comprehension. The two terms of tacit knowing are identified as two levels of reality. Polanyi maintains that the logic between them is applicable to the whole sequence of levels of reality which constitute the universe. The universe is filled with different strata. Roughly speaking, the most important ones are the following. The lowest is the level of the inanimate nature. Above it is the level of vegetative functions of life; the next is sentience, the perceptive-appetitive agency in animals. Beyond that is the level of conscious behavior and intellectual action. The highest level in the hierarchy is the cultural stratum of human beings, the noosphere. Polanyi claims that “each level is subject to dual control; first by the laws that apply to its elements in themselves and second, by the laws that control the comprehensive entity formed by them.”¹⁶ On the one hand, the operations of the higher level—the comprehensive entity—cannot be accounted for by the laws governing the particulars forming the lower level. There are always some boundary conditions on the lower level, namely a set of conditions left undetermined by laws of the lower level. It is the laws of the higher level that exercise control over these boundary conditions. This is called the principle of marginal control. On the other hand, the operations of the higher level must rely on the laws of the lower level that govern the particulars themselves. Therefore, the lower level imposes restrictions on the higher level and determines the conditions of the successful operation of the laws in the higher level and explains the causes of the failure of it. From this ontology of stratified reality, it can be easily inferred that the positivistic strategy of reductionism is untenable. All living things cannot be accounted for by the laws of physics and chemistry. Man’s higher faculties, like morality, can not be accounted for by his lower functions.

As mentioned above, the supposed gap between the natural sciences and the study of man is based upon the positivistic conception of science which is now shown to be a misrepresentation of what science really is and should be rejected. Polanyi’s theory of tacit, personal knowing and his ontology of the stratified universe brings about a new understanding of science. It suggests that the understanding of men and society can only be achieved by a deep indwelling, that is, by putting ourselves at the same place as the persons that we are studying, and sharing their feelings and thoughts. Therefore, man as a sentient, intelligent and morally responsible being, which is out of the reach of the positivistic conception of science, is redeemed in light of this new understanding of science. Polanyi confidently claims that this new conception of science “opens the door for our entry into human personality in its whole moral, religious, and artistic outlook, as the bearer of a historical consciousness, a political and legal responsibility. Thus it introduces us through an extension of scientific inquiry straight into the whole sentient, creative, and responsible life of human concerns”¹⁷ This is borne out by his critique of secessionists in addressing the topic of history, a sphere where the most striking examples of human responsible decisions are recorded.

3. Critique of Secessionists

In the third lecture of his *The Study of Man*, which is entitled “Understanding History,” Polanyi faces up to the challenges raised by the secessionists who insisted on the logical gap between the natural sciences and the humanities, and history in particular. His encounter with the secessionists can be recapitulated here in the following three rounds of arguments and counter arguments.

The first group of arguments of secessionists for the split of history from the natural sciences runs like this: historians study actions, while scientists study events. Human actions involve responsibility, and therefore are subject to the moral judgment of historians, while scientists do not make value judgments. Historians have to re-live, or dwell in the actions of their subjects, while scientists do not.

These grounds for the secession of history from the natural sciences do not hold for Polanyi. First, Polanyi discredits the contrast between action and event by citing animal psychology as an example that lies in the domain of the natural sciences, but that, nevertheless, deals with the actions of animals. Second, as mentioned above, according to Polanyi’s epistemology of personal knowledge, among the personal coefficients that he discusses, is appraisal. Every act of personal knowing sets up a standard of excellence by which it appraises what it knows. Therefore, Polanyi claims that, “contrary to usually accepted opinion, every branch of natural science makes value judgments of some kind. Each appreciates the particular comprehensive entities which form its own subject matter, and the corresponding standards of excellence form an ascending series, continuously progressing towards a moral valuation of human actions.”¹⁸ Crystallography is an excellent illustration of the practice of appraisal in the exact sciences.¹⁹ It largely consists in a process of appraising any specimen of crystals in light of its standards of excellence. Likewise, in botany, zoology, physiology and animal psychology, scientists all set standards to their corresponding subjects on different levels as living beings. Finally, moral judgments of human actions provide us with one more higher form of appraisal in this ascending series. Third, according to Polanyi’s theory of tacit knowing, knowing by indwelling is ubiquitous. “No knowledge of nature lacks some measure of indwelling of the observer in his subject matter, and that the intimacy of this indwelling shows a continuous progression towards that fullest indwelling which has been rightly claimed to be a characteristic method of the historian.”²⁰ Therefore, Dilthey and Lipps were right in claiming that only by indwelling can we know human beings and works of art, but they were mistaken in contrasting indwelling with observation, and thus asserting that this very fact sharply distinguishes the humanities from the natural sciences. In Polanyi’s view, “the difference is only a matter of degree: indwelling is less deep when observing a star than when understanding men or works of art. The theory of tacit knowing establishes a continuous transition from the natural sciences to the study of the humanities.”²¹

It is worth noting here that, when secessionists attempted to distinguish history and the humanities in general from the natural sciences, they adopted the “usually accepted opinion” about the natural sciences, which is blind to valuations and indwelling in natural sciences. It is not difficult to detect that this “usually accepted opinion” of science is just the positivistic understanding of natural science. Then we have something which is really paradoxical. The secessionists’ effort to draw a line of demarcation between history and the natural sciences represented a heroic attempt to challenge the positivistic program of a unified science which tries to model the social and human sciences on the scientific methods that have been proven successful in the natural sciences. So, this philosophical movement is anti-positivistic in attempt. But this very claim of the

secession of history from the domain of the natural sciences is based upon the acceptance of the positivistic understanding of science. This shows, from one perspective, how deeply seated the positivistic conception is in the modern mind.

The second argument of the secessionists places the emphasis on the contrast between the uniqueness of historic events and the repetitiveness of natural occurrences. It was first clearly formulated by Wilhelm Windelband in his *Geschichte und Naturwissenschaft (History and Natural Science)*, where he claimed that, while the natural sciences seek nomothetic knowledge (that is, to grasp general laws), historical sciences pursue idiographic knowledge (that is, to describe the individual and unique events). Again, Polanyi thinks that the difference does not amount to the secession of history from the natural sciences. These two approaches, which Polanyi calls the theoretical and the factual, are actually present in all kinds of knowledge. Nevertheless, the relationship between uniqueness and repetitiveness varies in different sciences, from which we can detect a continuous transition:

The distinctive position of history was thought to be due to the predominance of the factual interest over the theoretical, as compared with the natural sciences, for which the reverse was true. Hence a continuously graded sequence of sciences, with variable proportions of unique to generalized features, was seen to lead from mathematical physics to the study of history.²²

The third argument of secessionists claims that while historians deal with man's responsible actions in terms of reasons, natural scientists can only explain what happens in terms of causes. Polanyi admits that the distinction between reason and cause is an important one, but he tends to interpret it in more general terms, the result of which renders the program of the secession of history from the natural sciences implausible. To Polanyi, the distinction between reason and cause, "is the distinction between a comprehensive principle operating at a higher level and the effects of the particulars belonging to a lower level on which these operations must rely."²³ The distinction, understood in terms of his ontology of stratified reality, has a metaphysical significance. In the hierarchy of the universe, the comprehensive entity constitutes the higher level of existence, while the particulars that constitute the comprehensive entity form the lower level. We talk about the reason for the success of the operation of the higher level, and the causes for its failure, which can be explained only in terms of the particulars form the lower level. Therefore, Polanyi claims that each level of living beings, and even machines, have reasons for their successful functioning,²⁴ while the failure of man's rational actions can be accounted for in terms of various causes. Reasons and causes operate at different levels in the stratified universe but form a continuity.

In concluding this section, I want to quote a passage that makes Polanyi's position crystal clear on the problem of the relation between sciences and the study of man. Polanyi says, his position

denies any discontinuity between the study of nature and the study of man. It claims that all knowledge rests on understanding, and that in this sense knowledge is of the same kind at all levels of existence. But this position admits, at the same time, that as the subject of our understanding ascends to higher levels of existence, it reveals ever new comprehensive features, the study of which requires ever new powers of understanding. I shall readily acknowledge, accordingly, that historians must exercise a special kind of understanding. But I shall argue also that all the characteristics of the historian's method emerge by

continuous stages from the progressive modification of the methods used within science. As the scientist gradually advances from the study of inanimate nature to that of life, approaching first lower, then higher forms of life and eventually ascending to the study of intelligence in the higher animals, ever higher modes of comprehension come into play, and the study of man merely adds to these yet one more, still higher mode of comprehension. The characteristic features of historiography will thus be shown to emerge by the continuation of a development broadly prefigured already within the natural sciences.²⁵

This is a succinct statement of his thesis on the continuity between sciences and the study of man, based upon his theory of tacit, personal knowledge and the ontology of stratified universe.

4. Distinctions within the Framework of Continuity

So far, we have established that, since indwelling and personal participation are ubiquitous in all human inquiry, contrary to the positivistic understanding of science, sciences and the study of man are of the same kind. The difference between them is only a matter of degree. However, this is not the whole story of Polanyi's reflection on the relation between sciences and humanities. In his later years, he devoted himself to clarifying the humanistic meanings as manifested in symbols, metaphors, works of art, myths and religions, based upon his theory of tacit knowing, with a twofold goal in mind: first, to demonstrate the reality of the humanistic meanings; second, to bring out the difference between humanistic meanings and scientific meanings (i.e., the meanings achieved in science). In the present context, it is the latter that is of interest to us.

Polanyi says, "continuity does not preclude fundamental distinctions."²⁶ Based on the premise of the continuity between sciences and humanities, Polanyi also explores the distinctions between them. Schematically, the distinctions that he touches upon can be restated as follows.

The first point has to do with imagination, which is one of the important personal coefficients in the shaping of knowledge, as mentioned above. It is at work in a large area of human activities. Scientific discoveries, technical innovations, works of art, myths and religions are all achievements involving feats of imagination. However,

knowledge bequeathed to us by scientific discoveries, we saw, eventually becomes commonplace knowledge to us and seemingly requires no imaginative effort on our part to make use of it, although its original discovery may have required a great deal of imagination. A work of art, on the other hand, is meaningless to us unless we exercise our imagination upon it each time we experience it.²⁷

For instance, we do not need to recreate Newton's imaginative vision in order to understand and apply his laws of motion and gravitation, nor need we do this when we use a telephone invented by Bell, but we have to exercise our imagination so as to appreciate a work of art, like Michelangelo's *Moses*, or Beethoven's *Ninth Symphony*.

Second, it is important for arts, myths and religions to have something which Polanyi calls a "frame"

(formal pattern) in contrast to “story” (prose content), like rhyme and meter in a poem, stagecraft in a play, canvas in a painting, and ritual context in religious events. It is this artificial frame that makes works of art, myths and religions detached from our ordinary life and daily concerns. Take a representative work of art as an example: its frame, “separates its affirmation from the context of our life space—the context of the whole course of our existence—and causes it to be detached in this sense from both its author and its public and indeed, from any natural experiences, including those of science.”²⁸ According to Polanyi, this detachment from daily life, is what Kant called “disinterested pleasure” when he talked about the aesthetic appreciation of art. Due to their detachment from natural experiences, arts, myths and religions have meanings that are transnatural, in contrast to the natural meanings that we have in ordinary perception and in science.

Third, the humanistic meanings are self-giving, while meanings found in ordinary perception and in science are often self-centered. According to Polanyi, tacit knowing has a semantic aspect, that is, meaning consists in a from-to relationship. The focal object is the meaning of the subsidiary particulars. The difference between humanistic meanings and the meanings found in ordinary perception and in science lies in the different use of this from-to relation. Basically, the difference can be demonstrated by the contrast between indication and symbolization. In indication, for instance, we use a word to indicate an object. We have no intrinsic interest in the subsidiaries, like the word, but the focal object which these subsidiaries bear on is of intrinsic interest, like the object indicated by the word. By integrating the subsidiaries, we achieve the meaning of them. Polanyi points out, “These integrations might be called self-centered integrations, because they are made from the self as a center (which includes all the subsidiary clues in which we dwell) to the object of our focal attention.”²⁹ In Polanyi’s view, meanings achieved in ordinary perception and in science are of the indication type. By contrast, in symbolization, such as a national flag representing a country to its citizens, the focal object, the flag as a piece of cloth, is of no intrinsic interest, while the subsidiaries, like the existence of the nation and our diffuse and unbounded memories of it, are of great intrinsic interest. It is important to note that, “ the symbol, as an object of our focal awareness, is not merely established by an integration of subsidiary clues directed from the self to a focal object; it is also established by surrendering the diffuse memories and experiences of the self into this object, thus giving them a visible embodiment.”³⁰ In this sense, Polanyi calls this kind of integration self-giving, that is, in our surrender to the symbol, we are at the same time being carried away by it. A more sophisticated instance of self-giving meaning is metaphor. When the symbol itself is of great intrinsic interest and is akin to what it symbolizes, it becomes a metaphor. The humanistic meanings manifested in arts, myths, and religions are all self-giving, that is to say, when we are confronted with a work of art, situated in a ritual or a ceremony, we emotionally surrender ourselves and are carried away by them at the same time.

To summarize what has been said, we can see clearly that Polanyi’s reflection on the relation between science and the study of man is a two-step strategy. First, is undermining the supposed gap between the natural sciences and the study of man and establishing the continuity between them. Second, based upon what is achieved in the first step, is exploring the distinctions between scientific and humanistic meanings. With this, we can say that now we get a glimpse of the whole picture of Polanyi’s response to Snow’s problem.

The status of Polanyi’s distinctions between scientific meanings and humanistic meanings in *Meaning* has been heatedly debated.³¹ Some regard Polanyi’s late discussions as a misguided attempt, a deviation or even a betrayal of his early insight which challenges the supposed gap between two cultures and successfully establishes the continuity of science and the study of man. I do not intend to go into the details of this debate here, but what has been said above implies a stance towards the debate which I would like to make

clear. As is clearly shown above, the insight which enables Polanyi to challenge the supposed gap and to establish continuity between two cultures is his theory of tacit, personal knowing and his ontology of a stratified universe. This insight was not denied or forgotten when he explored the humanistic meanings in art, myth, religion in his later years. It still was the basis of his analysis. As is nicely put in *Meaning*, continuity does not preclude distinctions. The distinctions that Polanyi drew presuppose the continuity between the two cultures. They are distinctions within the framework of continuity. Therefore, one has no reason to fear that these distinctions will reintroduce the invidious gap between two cultures. The supposed gap between two cultures is in opposition to Polanyi's account of tacit, personal knowing, while the distinctions between scientific meanings and humanistic meanings are based upon it. Certainly, one can question the adequacy of these distinctions, as one might find here and elsewhere, and, as Polanyi himself admits, there are many loose ends in his philosophy. However, it should be recognized that this kind of investigation was not a deviation, but a deepening of his early insight.

5. Concluding Remarks

It is not difficult to detect that what is crucial to Polanyi's efforts to undermine the supposed gap between the natural sciences and the study of man and to demonstrate the continuity between them, is his revision of the entrenched modern understanding of science and knowledge in general. In my opinion, some features of his theory of tacit, personal knowing merit attention. I mention three interconnected points in concluding my paper.

1. The predominance of the participatory perspective

To some extent, the supposed gap between the natural sciences and the study of man can be viewed as a dualism of perspectives. As Habermas puts it,

With the methodological separation of the natural sciences and the humanities, the perspectival difference between outside and inside develops. . . . Only an objectifying approach to nature based on observation is now seen as promising for the nomological empirical sciences, whereas the hermeneutical sciences only gain accesses to the historical-cultural world through the performative attitude of a participant in communication. A splitting-up of object realms corresponds to this privileging of the observer's perspective in the natural sciences and of the participant's perspective in the humanities.³²

Polanyi's theory of tacit, personal knowing shatters this perspectival dualism, and establishes the dominance of the participatory perspective in all human inquiries, especially in the domain of the natural sciences. Scientists are as participatory as historians. The difference between the natural sciences and the humanities is not that the former is observational, while the latter is participatory. Rather, it is a difference within the participatory perspective. To find the difference between the natural sciences and the humanities in this perspective is the task that Polanyi set to himself in his later years when he tried to bring to light the distinctions between scientific meanings and humanistic meanings as achieved in arts, myths and religions. This, in my view, is the significance of Polanyi's philosophical investigation in his final years.

2. “The recovery of the hermeneutic dimension of science”

Closely related to Polanyi’s introduction of the participant’s perspective in the natural sciences is his “recovery of the hermeneutic dimension of science,” to use Richard Bernstein’s terminology, which he employs to characterize the postempiricist philosophy and history of science with Kuhn as a paradigm case.³³ In my view, Polanyi also fits in nicely with this category. This is clearly borne out when he relates his knowing by indwelling thesis to Dilthey’s philosophy and underscores that the difference between them lies in his extending the idea of indwelling to an analysis of the natural sciences. Also, I mentioned previously his emphasis on the importance of understanding as the ultimate faculty of knowing, and pointed out that his analysis of the part-whole relation in tacit knowing can shed some light on our understanding of the hermeneutic circle. To this, I would also add the following. His undermining of the principle of universal doubt in modern critical philosophy,³⁴ is reminiscent of Gadamer’s critique of Enlightenment’s prejudice against all prejudice. His fiduciary program that reveals the fiduciary rootedness of all rationality is akin to the Gadamerian notion that all understanding involves prejudice. His overcoming of the hostility of the critical philosophy towards authority and tradition and his affirmation that tradition and authority are constitutive of scientific inquiry are analogous to Gadamer’s rehabilitation of tradition and authority. Again, one should remember that all this is achieved in his analysis of natural sciences. I am quite sure that an adequate exposition of the hermeneutical content in Polanyi’s philosophy of science will lend a strong support to Bernstein’s thesis.

3. A constructive use of Heidegger’s “being-in-the-world.”

The refutation of epistemology is in vogue in the present intellectual climate. The whole epistemological enterprise, from Descartes, through Locke and Kant, and continued in various 19th and 20th century philosophies, is under attack. Talk about the “end,” the “bankruptcy,” the “crisis,” and the “overcoming” of epistemology can be heard everywhere. Then, the question arises, what about Polanyi’s theory of tacit, personal knowing?

The central thesis of the modern epistemological enterprise that philosophers like Richard Rorty and Charles Taylor would call into question is the representational construal of knowledge, that is, in Rorty’s words, “To know is to represent accurately what is outside the mind.”³⁵ As Taylor points out, one of the weak points of this representational model of knowledge is disengagement, or, to put it in Heideggerian terms, knowledge is interpreted as a relation between a disengaged subject and the present-at-hand object. Taylor points out that it is Heidegger’s “celebrated analysis” of being-in-the-world, which reveals that we are “first and mostly” agents engaging things ready-to-hand in the world, that renders this representational construal of knowledge completely implausible. Here we see Taylor’s use of Heidegger’s analysis of being-in-the-world leads to the demise of epistemology. So far as epistemology is concerned, I call this use negative.

In Polanyi, we will find a more positive, more constructive use of Heidegger’s being-in-the-world. To Polanyi, indwelling is not just a way of knowing, it is also a way of being. “Such indwelling is a participation of ours in the existence of that which we comprehend; it is Heidegger’s being-in-the-world.”³⁶ Each time we dwell in the particulars of that which we want to comprehend, or in the physical tools, or in the intellectual tools, like the interpretative frameworks in our articulate culture, our being undergoes some change. “Indwelling is being-in-the-world. Every act of tacit knowing shifts our existence, re-directing, contracting

our participation in the world. Existentialism and phenomenology have studied such processes under other names. We must re-interpret such observations now in terms of the more concrete structure of tacit knowing.”³⁷This is Polanyi’s way of appropriating of Heidegger’s being-in-the-world which shows the epistemological potential of Heidegger’s fundamental ontology. The traditional epistemological enterprise that is made possible by disengagement and detachment should certainly be overcome. But this is not the end of epistemology. The problem of knowledge is still there and tempting. What is needed is a transformation of perspective and approach. At least, Polanyi’s theory of tacit, personal knowing is a possibility.

Endnotes

¹ For instance, neurophysiologists deny the existence of consciousness (cf., Michael Polanyi, *Knowing and Being* [Routledge & Kegan Paul, 1969], p.42.). Sociologists declare that sociology is a-ethical (cf., Michael Polanyi: *Scientific Thought and Social Reality-Essays by Michael Polanyi*, ed. Fred Schwartz. [International Universities Press, Inc.], p.143). Logical positivists claim that ethical statements are meaningless, etc.

² Michael Polanyi and Harry Prosch, *Meaning* (University of Chicago Press, 1975), p.25.

³ Michael Polanyi, *The Study of Man* [University of Chicago Press, 1958], p.72.

⁴ Michael Polanyi, *Meaning*, p.28.

⁵ The attack on objectivism is regarded as the most radical aspect of Polanyi’s philosophy of science. As Harry Prosch points out, though people like Norwood Hanson, Thomas Kuhn, Paul Feyerabend, and Stephen Toulmin challenged the “received view” of science and made various radical suggestions to change it, they left intact the ideal of objectivity of science (Harry Prosch, *Michael Polanyi: A Critical Exposition* [SUNY Press, 1986], pp. 30-32.

⁶ Polanyi thinks that his theory of personal knowledge deals with the logic of science and knowledge in general, rather than, as might be held, explaining the psychological causes of such knowing. Personal participation has to do with being right or wrong. In “Science, Tacit and Explicit”, Polanyi points out, “Any relation which can be said to be right or wrong and any process that can lead to valid results, or fail to do so, forms in this sense a subject for logical analysis.” Different from the prevailing conception of strict, formal logic, the logic of personal knowledge is informal. In the same paper, Polanyi says, “I call ‘logic’ the rules for reaching valid conclusions from premises assumed to be true. Currently, logic seems to be defined instead as the rules for reaching strict conclusions from strict premises. I think we should reject this definition. No strict rules can exist for establishing empirical knowledge.” I quote this unpublished essay from Harry Prosch, *Michael Polanyi: A Critical Exposition*, pp.112-113. This paper was presented at the International Congress for the Philosophy of Science, Jerusalem, August, 1964.

⁷ Polanyi distinguishes intellectual passions from bodily passions and considers the former as being public and the latter private: “But while appetites are guided by standards of private satisfaction, a passion for mental excellence believes itself to be fulfilling universal obligations” (*Personal Knowledge*, p.174). Also, he points out that scientific beliefs are different from “individual preference—like the love of one’s wife and children. The beliefs of scientists concerning the nature of things are held with a claim to universal validity and thus possess normative character”(Michael Polanyi, *The Logic of Liberty* [Liberty Fund, 1998], p.27).

⁸ Michael Polanyi: *Personal Knowledge*, p.vii.

⁹ As Putnam puts it in “Why Reason Can’t Be Naturalized?” (*After Philosophy—End or Transformation?* ed. Kenneth Baynes, James Bohman, and Thomas McCarthy, [The MIT Press, 1991], p.228), reason, is “both immanent (not to be found outside of concrete language games and institutions) and transcendent (a regulative idea that we use to criticize the conduct

of all activities and institutions.)” In his *Postmetaphysical Thinking*, Habermas refers to the above quotation by Putman when he discusses the concept of situated reason which, in his words, amounts to this: “the validity claimed for propositions and norms transcends spaces and times, but in each actual case the claim is raised here and now, in a specific context, and accepted or rejected with real implications for social interaction.” (*Postmetaphysical Thinking* [Polity Press, 1995], p.139).

¹⁰ Michael Polanyi: *Knowing and Being*, p.144.

¹¹ Michael Polanyi, “Logic and Psychology”, *American Psychologist* 23, 1968, pp. 27-43.

¹² Michael Polanyi: *Scientific Thoughts and Social Reality*, p.142.

¹³ Michael Polanyi, *Knowing and Being*, p.156. In the “Bibliographical Note” of *The Study of Man*, Polanyi elaborates on this point more fully. In his account, Dilthey’s work “forms a part of a great intellectual network which includes phenomenology and existentialism and has transformed the whole climate of philosophy on the Continent of Europe. Out of it has issued modern Gestalt psychology, which I myself am trying to restore in its philosophical origins. Many of my statements are reminiscent of this movement; but let me recall that its thought was based throughout on the exclusion of the natural sciences from its scope” (*The Study of Man*, p.102).

¹⁴ Michael Polanyi, *Scientific Thought and Social Reality*, p.120.

¹⁵ Michael Polanyi, *The Study of Man*, p.28.

¹⁶ Michael Polanyi, *Tacit Dimension* (Doubleday & Co, 1966), p.36.

¹⁷ Michael Polanyi, *Scientific Thought and Social Reality*, p.96.

¹⁸ Michael Polanyi, *The Study of Man*, p.80.

¹⁹ Michael Polanyi, *Personal Knowledge*, pp.43-48.

²⁰ Michael Polanyi, *The Study of Man*, p.80.

²¹ Michael Polanyi, *Knowing and Being*, p.160.

²² Polanyi, *The Study of Man*, p.83.

²³ Ibid, p.91.

²⁴ Polanyi takes the case of the machine very seriously in arguing against reductionism. His analysis of a machine underscores that the reason for the success of the function of a machine cannot be accounted for by the laws of physics and chemistry, but only by its own operational principles. The function of the operational principles relies on the laws of physics and chemistry, which can explain the failure or breakdown of the machine.

²⁵ Michael Polanyi, *The Study of Man*, p.73.

²⁶ Michael Polanyi, *Meaning*, p.122.

²⁷ Ibid., p.150.

²⁸ Ibid..

²⁹ Ibid., p.71.

³⁰ Ibid., pp.74-5.

³¹ Cf., Marjorie Grene: "Tacit Knowing: Grounds for a Revolution in Philosophy", in *Journal of the British Society for Phenomenology*, Vol.8, No.3, October 1977, pp. 164-171. Articles in the special issue of *Zygon* on "Science and Religion in the Thought of Michael Polanyi", Vol.17, No.1, 1982. Harry Prosch: *Michael Polanyi: A Critical Exposition*, pp. 235-271.

³² Habermas: *Postmetaphysical Thinking*, pp.35-36.

³³ Richard J. Bernstein, *Beyond Objectivism and Relativism* (University of Pennsylvania Press, , 1983), p.30.

³⁴ The term as used by Polanyi is not limited to the philosophy of Kant as is usually assumed. Rather it is used in a broader sense, which denotes the trend in modern Western philosophy that discredited belief, tradition and authority, on the one hand, and upheld the principle of universal doubt and critical attitude, on the other.

³⁵ Richard Rorty, *Philosophy and the Mirror of Nature* (Basil Blackwell, 1980), p.3.

³⁶ In 1964 the Harper Torchbook edition of *Personal Knowledge*, Polanyi wrote a new preface; I quote from page x.

³⁷ Ibid., p.xi.

Polanyi Society Membership

Tradition and Discovery is distributed to members of the Polanyi Society. This periodical supercedes a newsletter and earlier mini-journal published (with some gaps) by the Polanyi Society since the mid seventies. The Polanyi Society has members in thirteen different countries though most live in North America and the United Kingdom. The Society includes those formerly affiliated with the Polanyi group centered in the United Kingdom which published *Convivium: The United Kingdom Review of Post-critical Thought*. There are normally three issues of *TAD* each year.

Annual membership in the Polanyi Society is \$25 (\$10 for students) beginning in the fall of 2002. The membership cycle follows the academic year; subscriptions are due September 1 to Phil Mullins, Missouri Western State College, St. Joseph, MO 64507 (fax: 816-271-5680, e-mail: mullins@mwsc.edu). Please make checks payable to the Polanyi Society. Dues can be paid by credit card by providing the card holder's name as it appears on the card, the card number and expiration date. Changes of address and inquiries should be sent to Mullins. New members should provide the following subscription information: complete mailing address, telephone (work and home), e-mail address and/or fax number. Institutional members should identify a department to contact for billing. The Polanyi Society attempts to maintain a data base identifying persons interested in or working with Polanyi's philosophical writing. New members can contribute to this effort by writing a short description of their particular interests in Polanyi's work and any publications and / or theses/dissertations related to Polanyi's thought. Please provide complete bibliographic information. Those renewing membership are invited to include information on recent work.

Parts and Wholes--Contrasting Epistemologies

Percy Hammond

ABSTRACT Key Words: : transitivity, hierarchical structure, analogy, determinism, emergence, reductionism, tacit knowledge.

This article discusses three different approaches to human knowledge. The first is that of Peter Simons, a linguistic philosopher, who suggests that language has an underlying algebraic structure. The second approach is that of Ernest Nagel, a philosopher of science, who maintains that the key to knowledge lies in logical analysis. The third approach, due to Michael Polanyi, stresses the idea of tacit integration of parts into composite wholes. All three employ hierarchical schemes, the first two work from the top down, whereas Polanyi works from the bottom up, using the idea of 'emergence' .

Human perception relates to objects. We see houses and trees rather than patterns of light and shade and hear words rather than mere sounds. Our brains organise the visual and auditory sense data into meaningful composite entities. These entities have both internal and external relationships so that they can be analysed into parts and can also be regarded as parts of other wholes. In this article, I examine the views of three philosophers concerning the relationship between parts and wholes. Peter Simons is concerned with the structure of language, Ernest Nagel with the structure of scientific theories and Michael Polanyi with the way in which we obtain knowledge of the external world.

Peter Simons' book *Parts- A Study in Ontology*¹ begins with an account of the concepts and principles of a formal representation of parts and wholes in terms of algebra. He defines the term 'proper part' mathematically by the symbol 'less than'. (The word 'proper' is used to exclude the possibility of the part being equal to the whole.) Simons writes that the term 'part' is so basic and intuitive that 'it seems almost superfluous to offer examples'. However, he provides a table of typical wholes and parts to illustrate the notion. Five of the examples relate to a spatial relation between the whole and the part and two give a temporal relation.

Having satisfied himself that the meaning of parts and wholes is established, Simons then constructs an algebraic structure in terms of symbols. This algebra has such properties as asymmetry and transitivity and includes operations such as summation. The details are discussed fully in the book. Here we merely note that the treatment moves at one step from composite real objects and their parts to the general abstract term 'part' and from that to symbols, such as x and y , subject to algebraic operations. Clearly, these steps are not free of difficulty.

Let us illustrate some of these difficulties by considering the special case of a can of soup, such as might be bought at a supermarket. The soup can be divided into parts by pouring it into various plates. It can be further divided into spoon-fulls. That satisfies the transitivity property: the part of a part is also a part of the whole. However, this division of the soup does not reveal much about its ontology. There are other more interesting ways of dividing the soup into parts. For example, the purchaser is likely to be interested in the ingredients; how much of the soup consists of potatoes and carrots, or of water and salt. It is likely that this information will be given on the can and the label will also give 'nutritional information' about the relative amounts of carbohydrate, fat and protein. The potatoes contain carbohydrate, but it is unclear whether carbohydrate is a

part of a potato, or whether potatoes are parts of the class of substances containing carbohydrate. Nor is it obvious in what sense potatoes are parts of the soup. The generic term 'part' hides the wide variety of its usage.

Simons attempts to deal with a number of difficulties by using qualifying expressions to restrict the generality of the term 'part'. He mentions 'temporary' parts, which an object can gain or lose without prejudice to its identity. These differ from 'essential' parts, some of which are 'permanent essential'. These and other restrictions are difficult to accommodate in the algebraic structure.

There are other difficulties. In the first chapter, Simons insists that transitivity is a fundamental property of the meaning of the term 'part'. He writes, 'if one thing is a proper part of another, and the second is a proper part of the third, then the first is a proper part of the third', and anyone who seriously disagrees with this has failed to understand the meaning of the term. Later, however, he admits that this is not obvious. As an example he discusses the question, 'if a handle is part of a door and the door is part of a house, is the handle part of the house?' He is inclined to think that this is true, but that perhaps the term 'part' needs to be restricted to parts 'making a direct functional contribution' to the wholes of which they are parts. That is an important restriction.

The motivation underlying this book is the desire for clarity. There is in linguistic philosophy an underlying dissatisfaction with the vagueness of ordinary language and the hope that it should be possible to discover a logical structure within or behind such language. These considerations often cause philosophers to turn to mathematical models, because such models can be expressed in symbols having clearly defined logical connections. Moreover, the symbols are separated from the messiness of common speech and have great generality. There is an even more ambitious hope that the use of logic should lead to ontology, the study of things as they are. Indeed, Simons writes in the preface that his book is about ontology and not about logic.

Such an aim involves not only the development of a formal mathematical structure, but also requires that this structure should refer to the ordinary world of human perception. Hence there is a tension between the two aspects of the model, its formal internal relationships and its external applicability. Throughout the book, Simons repeatedly tests his mathematical structure against practical examples. The reader will not soon forget the adventures of the unfortunate cat that lost its tail! However, in spite of this pragmatism, it is clear that the chief concern of the book is with logical structure and analysis. Simons begins with a mathematical model and then seeks to adapt ordinary language to that model.

Readers of a book on 'parts' would expect to find an explanation of the 'wholes' to which the parts belong. Surprisingly and significantly, there is little discussion of wholes in the book. The author looks at the possibility of *Gestalten* and *Ganzheiten* but is unhappy with these concepts. Instead, he considers wholes in terms of various aggregates of parts such as sums and complexes. However, since these aggregates consist of parts, there is in this a circularity of definition. Wholes are defined as sums of parts and this seems incomplete. Thus in the example of the chain 'house – door – handle', the significance of the term 'door' is not exhausted by listing its parts such as the door handle. Without a handle, the door might not be so useful, but the significance of the handle derives from the door and not vice versa. If there is no whole, the term 'part' loses its meaning.

What then is the meaning of the term 'door' considered as a whole? The author does not tell us except to say that the door is a part of a house. So, once again, the whole is considered as a part of another whole. That is a very important discovery, although it is not made explicit in the book. The inevitable conclusion is that there are no isolated wholes, because each whole is embedded in other wholes. The other end of the chain is equally problematic. The handle is also a whole with parts of its own. It is not merely a part of a door. Handles can be purchased at a builders' merchant without reference to doors. In fact, every item in the chain has a double meaning as a part and as a whole. Nor can the problem be resolved by extending the chain until its last part is an atom or subatomic particle. The fact that such a particle is a part of something else gives no information about its inner structure or possible indivisibility. That question has to be answered experimentally by seeking to isolate the particle and, if that is possible, by then attempting to determine its separability into parts.

Nor is it possible to envisage isolated chains. The author's concentration on the significance of wholes as aggregates of parts suggests that the production of motor cars should depend entirely on assembly lines. Apparently, there need be no marketing department to assess the needs of customers and no design department trying to meet those needs. The ontology of cars involves the use of them as well as their assembly. A single linear chain of parts having other parts cannot represent such an activity. This negative conclusion does not apply only to artefacts. For example, the hierarchical chain often used in biology, 'organism – organ – cell – molecule – atom', suffers from the same problems because each term has multiple meanings in terms of parts and wholes belonging to different systems that are related by a multiplicity of connections.

Although in a sense the author is right to concentrate his attention on parts, because strictly speaking there are no isolated wholes, human perception needs to focus on wholes as separate entities. Such focusing 'reduces' the field of vision and is a necessary means of acquiring understanding. Although it is true that reduction will not lead to ontology in a single leap, there is no means of avoiding it. It is impossible to deal with the totality of all there is with its intricate inner relationships. A 'theory of everything' is a contradiction in terms just like a map of scale 1:1. Hence it is unavoidable that knowledge must be acquired by specialising, although it is a mistake to regard a particular specialism as all encompassing. The need for isolating wholes therefore suggests that a formal mathematical structure will at best have value as a tool in epistemology, but cannot lay claims to any ontological insights. In particular, the replacement of objects by symbols hides the distinction between the role of an object as a part and as a whole. In ordinary language, this distinction is preserved by the context. The apparent lack of clarity is here an advantage of ordinary speech. More specifically, one could think of clarity as having other aspects besides logical connection. For example, in poetry, metaphor and analogy are used to achieve clarity.

The practical examples discussed by Simons are simple objects or sentences. This is appropriate in a book chiefly concerned with philosophical matters. It is, however, insufficient for readers whose special interest is in the application of logic to the study of science. An older book that deals with such matters is Ernest Nagel's *The Structure of Science – Problems in the Logic of Scientific Explanation*.² This is a most impressive work, showing the author's astonishing breadth of philosophical and scientific knowledge. It is rightly considered to be a classic treatment of the subject and it is impossible to give an adequate account of the entire book in this short article. I shall confine my attention to Nagel's treatment of parts and wholes and their logical connections.

In the preface to his book, Nagel distinguishes between the logical structures of scientific explanations and the logical structure of scientific concepts. This distinction gives him considerable

flexibility in dealing with different branches of science. Unlike Simons, he does not seek for a single logical structure embodied in a mathematical formalism. In his treatment, both the mathematical symbols and the operators can have a variety of meanings. As an example, Nagel considers the development of the term 'number'. Originally, this referred to positive integers, but the meaning was later extended to include negative integers, fractions, irrational numbers, complex numbers and other mathematical entities. Similarly, the operations of addition and multiplication were extended so that they could be applied more widely. Such extension and adaptation do not imply logical contradiction.

Another example he gives is the extension of the terms of classical mechanics into quantum mechanics. The words 'position', 'momentum', 'particle' and 'wave' are used as analogies of the classical terms when they are applied to quantum theory. This throws light on the problem of indeterminacy. Nagel thinks that the apparent lack of determinism in quantum theory is due to a misunderstanding of the extended meaning of the terms. It is unreasonable to expect that position and momentum can be observed simultaneously because these terms have no separate existence in quantum mechanics. Their use in that theory is different from the use in classical mechanics.

Determinism is for Nagel the supreme regulative principle of science and applies even to so-called chance events. He provides a detailed discussion of the possibility of chance events, distinguishing between relative and absolute chance. His view is that unexpected events may be described by the word 'chance', but only because their determining factors are not known. The question whether statistical events are indeterminate is an open philosophical one that does not affect scientific practice. In its application, even quantum theory is deterministic. Although absolute chance is free from logical contradictions as far as a single event is concerned, a distribution of events in time is always associated with some type of order. Scientific knowledge is, in Nagel's view, essentially the knowledge of causal chains between the phenomena.

Like Simons, Nagel concentrates his attention on the parts of objects or processes rather than on wholes. 'Locutions like wholeness, unifiedness and indivisible unity' are not 'expressions of genuine knowledge'. Only analysis and the study of parts lead to scientific knowledge. This is a much stronger assertion than those made by Simons and goes beyond our previous consideration that wholes are also parts. Nagel dismisses the objection that 'a melody is not the sum of its individual notes' as meaningless for the technical reason that the word 'sum' has not been defined. That is an astonishing statement contrasting sharply with Einstein's view that the chief quality required in scientific research is 'musicality'. Nagel's dismissive attitude is also illustrated when he writes, 'Natural scientists are sometimes motivated by moral and aesthetic aims, and the moral passion and literary artistry with which some of them write about achievements in their domains of enquiry do not automatically impair the objectively warranted content of their expositions'. In spite of this, he writes in the preface that the most precious harvest of the scientific enterprise is the achievement of generalized theoretical knowledge. That sounds as if he thinks that there is more to science than the study of parts. Nevertheless, the dismissal of wholes is dominant. Thus he mentions clocks on several occasions without any reference to their use in telling the time. The total explanation of clocks seems to be obtainable by examining the parts and applying the laws of mechanics to their interaction.

Like Simons, Nagel toys with the idea of *Gestalt*, but he is not impressed by it. He writes that 'such wholes can be analysed into elements standing to each other in specified relations'. This suggests that he has misunderstood the term or, what is more likely, that he is turning his back on it because it does not fit into an epistemology that is dominated by analysis into parts.

Nagel provides an extensive discussion of the doctrine of emergence. As might be expected, he is not sympathetic to this concept. He readily admits that wholes may have properties that differ from the properties of their parts considered in isolation. But he strongly denies that this distinction between the properties can be inferred or deduced by logical reasoning. The point is that it is statements or propositions that can be deduced but not properties. There is no logic of properties unless there is also a connecting theory. Talk of the 'inherent nature' of a whole is meaningless in the absence of an explanatory theory.

The converse of this view is seen in Nagel's rejection of a general reductionism applied to properties or theories. He believes that such reductionism implies the existence of logical connections between theories and in general such connections do not exist. There is also a difference between the usage of different terms in different fields of scientific study. Nagel stresses the criterion of usefulness of particular terminologies and theoretical structures in different branches of science at different stages of development. Any proposal for the reduction of one science to another, such as the reduction of chemistry to physics, must be justified by its fruitfulness in uncovering new phenomena. Nagel's world of science is therefore a very rich one.

Nevertheless, it is not a world of scientific discovery. It is significant that the name of Karl Popper appears only in two footnotes. The use of hypothesis in the formulation of theories receives little attention. Although Nagel is keenly aware of the use of analogies between different properties and theories, he does not mention the use of such analogies in scientific research. Although he mentions Maxwell's comments on mathematical analogies between different physical processes, he does not show the manner in which Maxwell used the analogies to guide his discovery of the electromagnetic theory of light.³ Nagel's work leaves the impression that the only weapon in his armoury is the, admittedly powerful, weapon of logical analysis.

An altogether different approach to the acquisition of knowledge is given in the work of Michael Polanyi.⁴ Not only does he regard the parts as subsidiary to the whole, but he warns that the process of analysing a whole into its constituent parts may make it impossible to understand the whole object. Thus the recognition of a face as a whole is due to an integration of the knowledge of the parts and may be impeded by analysing the features. Another example he cites is the skillful diagnosis of the condition of a patient by an experienced physician. This involves, in Polanyi's view, the physician's concentration on the whole person rather than on the various symptoms presented by the patient. Polanyi distinguishes between the physician's tacit knowledge of symptoms and his focal knowledge of the patient. The doctor attends *from* the symptoms *to* the patient. He uses the tacit knowledge as a tool in the diagnosis. Polanyi's experience as a medical practitioner lends weight to this approach.

It is interesting that Nagel also speaks of tacit knowledge in the context of medical diagnosis. His explanation is that the physician uses logical deduction tacitly in arriving at the diagnosis. That explanation sounds implausible because it suggests a well-ordered set of verbal connections in the doctor's mind. Polanyi stresses that tacit knowledge is essentially tacit. He writes, '*we can know more than we can tell*'⁵ (TD, 4) and considers this ability to be the basis of all skillful activity. Thus, a pianist uses his tacit knowledge of the muscular control of his fingers in giving his attention to the music that he is playing. If he were to focus attention on his fingers, he would not be able to play the musical piece. Of course, this does not deny the usefulness of finger exercises, but these represent different wholes rather than parts of a composition.

Polanyi distinguishes the *proximal* knowledge involved in the perception of an object from the *distal* knowledge of its meaning. Tacit knowledge establishes a relation between the two kinds and so provides ontological knowledge. The proximal component involves a personal *indwelling* in the particulars of the objects that we are seeking to understand. These ideas enable Polanyi to apply his theory not only to physical objects but also to the understanding of comprehensive entities such as scientific theories.

It is clear that Polanyi's view of wholes involves tacit integration rather than the logical analysis used by Simons and Nagel. In fact, Polanyi believes that knowledge is essentially concerned with wholes and not with parts. As soon as a part is brought into focus, it becomes a whole. In his view, the lucidity aimed at by Simons and Nagel is liable to destroy rather than explain a comprehensive object.

A difficulty common to the three accounts of parts and wholes that I am considering is how to explain the process of the scientific discovery of wholes. An analysis of existing wholes into their parts does not help. Unlike Simons and Nagel, Polanyi is keenly aware of the problem. He mentions Plato's paradox in the *Meno*. How can it be possible to search for something that is unknown? Polanyi's answer is that our tacit knowledge reaches beyond explicit logical deduction and supplies us with hunches for possible answers to problems. Correct answers show their correctness by leading to the solution of further problems and so enlarge our general understanding.

Polanyi pursues this question of the existence of wholes in a process of discovery by using the idea of *emergence*. He approaches this concept by considering the arrangement of parts and wholes in hierarchical chains similar to Simons' example of the chain house – door – handle. However, he reverses the direction of the chain by proceeding from the parts to the wholes. One of the examples concerns the making of a speech. Polanyi constructs the chain: voice – words – sentences – style – literary composition and ascribes to it a structure of five levels associated with five laws. Each level has its own laws, which are respectively the laws of phonetics – lexicography – grammar – stylistics – literary criticism. The notion of 'level' is linked to the notion of 'complexity'. Polanyi regards complexity as an emergent property. This property is controlled by the laws operating at the level under consideration and these laws are also subject to those of the level below. For example, the use of words is subject to the rules of grammar and to the vocabulary. This 'dual control' provides the connections between the hierarchical levels.

Polanyi proceeds to apply his model to biological organisms. But before he does so, he has a reference to engineering. He draws attention to the 'operational principles' of machines, which cannot be inferred from a knowledge of physics and chemistry, although machines are subject to the laws of physics and chemistry. In Polanyi's view, these laws are located therefore at a lower level than the operational principles. They determine the possibilities of failure of the machine, but are incapable of accounting for the function of the machine as a comprehensive entity. The function of clocks is to tell the time. That is their operational principle and it controls the laws of mechanics obeyed by the motion of the clock. Polanyi describes the operational principles as the boundary conditions for the laws at the lower level and speaks of a *principle of marginal control*. This, he believes to be a general principle that can be recognised in all human performances and also in all biological organisms. He believes that it is the principle behind the evolution of human beings and that it is far more general than the principle of selective improvement of species.

In spite of its attraction, Polanyi's theory of emergence faces grave difficulties. One of these is his use of boundary conditions to provide a connection between a lower and a higher level. In physics, boundary

conditions are needed to supplement the equations before these can be applied to a particular situation. The function of boundary conditions is to isolate a region in which the equations operate from the rest of the external world. This requires that the boundary conditions act at the same level as the equations. Thus the equations of the electromagnetic field require boundary conditions in terms of electric charge and current. Although at a 'higher level', the field may transmit information; there is no logical connection between the content of the information and the field. Nagel repeatedly, and correctly, asserts that reduction or emergence depend on the existence of connecting theories by which the terms at one level can be related to the terms at another level.

The chief difficulty with the idea of emergence lies in the asymmetry between parts and wholes. Whereas it is easy to divide complex wholes into parts by analysis, there is no method of synthesis by which wholes can be assembled from parts. In his description of levels, Polanyi is aware that the properties at the higher level cannot be inferred from those of the lower levels. A related difficulty arises from the absence of links between the levels. In Polanyi's example of words and sentences, there is such a link, because words are an essential part of sentences. However, in his example of machines, there are no essential links between the operational principles and the embodiment of those principles. There are many different ways of constructing devices to tell the time.

I have previously mentioned the use of analogy by James Clerk Maxwell in his discovery of electromagnetic radiation. Maxwell writes,

In using such words as electric momentum and electric elasticity in reference to the known phenomena of the induction of currents and the polarisation of dielectrics, I wish merely to direct the mind of the reader to mechanical phenomena which will assist him in understanding the electrical ones. All such phrases in the present paper are to be considered as illustrative, not as explanatory. In speaking of the Energy of the field, however, I wish to be understood literally.⁶

Thus the term 'energy' anchors Maxwell's analogical description of electromagnetics to its underlying mechanical description. Polanyi's analogies in his doctrine of *emergence* lack such an anchor.

This is not surprising when we refer back to his idea of tacit knowledge. If indeed we 'know more than we can tell', it must be impossible to devise an explicit, objective hierarchy of levels for our knowledge. That there exist such levels of parts and wholes is indisputable. It is also obvious that there exist levels of organismic development. But the process Polanyi proposes for this emergence cannot explain the existence of levels. Polanyi's greatest insight is that all knowledge is personal. This is the missing ingredient in Nagel's analysis of science. As a result, Nagel cannot and does not put forward a theory of scientific discovery. Polanyi does have such a theory in his idea of tacit knowledge. It is surprising that in his attempt at an explanation of emergence, he seems to omit the personal element.

The final word in this discussion of parts and wholes can perhaps be given by Maxwell in an excerpt of some humorous verses he wrote as comments on the presidential address at the meeting of the British Association for the Advancement of Science in 1874. He wrote:

First then let us honour the atom, so lively, so wise, and so small;

The atomists next let us praise, Epicurus, Lucretius, and all;
Let us damn with faint praise Bishop Butler, in whom many atoms combined
To form that remarkable structure, it pleased him to call – his mind.
Last praise we the noble body to which, for the time, we belong,
Ere yet the swift whirl of the atom has hurried us, ruthless, along,
The British Association – like Leviathan worshipped by Hobbes,
The incarnation of wisdom, built up of our witless nobs,
Which will carry on endless discussions, when I, and probably you,
Have melted in infinite azure – in English, till all is blue.⁷

Endnotes

¹ Peter Simons, *Parts – A Study in Ontology* (Oxford University Press, 1987).

² Ernest Nagel, *The Structure of Science – Problems in the Logic of Scientific Explanation* (Hackett Publishing Company, 1979).

³The process by which James Clerk Maxwell arrived at his theory of the electromagnetic field is described by him in the three papers: ‘On Faraday’s Lines of Force’ (*Trans. Camb. Phil. Soc.*, Vol 10, Part 1 1855/56) ‘On Physical Lines of Force’ (*Phil. Mag.*, Vol 21, 1861/62) and ‘A Dynamical Theory of the Electromagnetic Field’ (*Trans. Royal Soc.*, Vol 155, 1864). An insightful discussion of the third paper is given by T F Torrance in the edition edited by him, which also has an appreciation of Maxwell from Einstein. (Scottish Academic Press 1982). All three papers are discussed by T K Simpson in his book, *Maxwell on the Electromagnetic Field- A Guided Study* (Rutgers University Press 1997).

⁴ Most of the discussion in this article is based on Polanyi’s opening two chapters in *The Tacit Dimension* (Doubleday & Co, 1966). These chapters complement discussion in Polanyi’s great work, *Personal Knowledge – Towards a Post-Critical Philosophy* (Routledge & Kegan Paul 1958).

⁵ *The Tacit Dimension*, 4.

⁶ ‘A Dynamical Theory of the Electromagnetic Field’ (*Trans. Royal Soc.*, Vol 155, 1864).

⁷ These verses and several others are quoted in H. H. Skilling, *Exploring Electricity – Man’s Unfinished Quest* (New York: Ronald Press, 1948).

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Submissions for Publication

Articles, meeting notices and notes likely to be of interest to persons interested in the thought of Michael Polanyi are welcomed. Review suggestions and book reviews should be sent to Walter Gulick (see addresses listed below). Manuscripts, notices and notes should be sent to Phil Mullins. Manuscripts should be double-spaced type with notes at the end; writers are encouraged to employ simple citations within the text when possible. MLA or APA style are preferred; because the journal serves English writers across the world, we do not require anybody's “standard English.” Abbreviate frequently cited book titles, particularly books by Polanyi (e.g., *Personal Knowledge* becomes *PK*). Shorter articles (10-15 pages) are preferred, although longer manuscripts (20-24 pages) will be considered. Consistency and clear writing are expected.

Manuscripts normally will be sent out for blind review. Authors are expected to provide a hard copy and a disk or an electronic copy as an e-mail attachment. Be sure that electronic materials include all relevant information which may help converting files. Persons with questions or problems associated with producing an electronic copy of manuscripts should phone or write Phil Mullins. Insofar as possible, *TAD* is willing to work with authors who have special problems producing electronic materials.

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The Sacred Depths of Nature and Ursula Goodenough's Religious Naturalism

Phil Mullins

Ursula Goodenough, *The Sacred Depths of Nature*. Oxford and New York: Oxford University Press, 1998. pp.182. ISBN 0-19-513629-2 (paper), \$13.95.

ABSTRACT Key words: Ursula Goodenough, science and religion, religious naturalism, philosophy and biology, Michael Polanyi.

This review essay summarizes major themes in Ursula Goodenough's The Sacred Depths of Nature and in several of her recent shorter publications. I describe her religious naturalism and her effort to craft a global ethic grounded in her penetrating account of nature. I suggest several parallels between Goodenough's "deep" account of nature and Michael Polanyi's ideas.

Unlike the physical universe, which for most people becomes increasingly bleak and terrifying the better it is known, the biological world yields an increasing sense of sacredness the better it is known. The more we know about life, the more we can care about it.¹

What follows is a rough effort to chart the territory covered by Ursula Goodenough in her concise but rich 1998 book, *The Sacred Depths of Nature*. Many of the themes in her book are also treated in several articles in *Zygon* and other journals, published both before and after her book.² Where appropriate, I shall draw elements from these articles into the discussion as part of a somewhat broader effort to suggest the scope and coherence of Goodenough's ideas. My concern here is faithfully to outline Goodenough's project, not to criticize it. As material elsewhere in this issue of *TAD* indicates, Goodenough will be a featured speaker at the 2002 annual meeting of the Polanyi Society. My comments will, I hope, encourage those who are unfamiliar with Goodenough's work to take a look for themselves, for she is truly an interesting contemporary voice in science and religion discussions, one who appreciates some of the themes in Polanyi's writings.

Goodenough is a prominent cell biologist at Washington University in St. Louis. At the beginning of her book, she is straightforward about her interests and motivation for putting together this book. Her father was an intellectual deeply interested in religion and he sowed a seed that germinated about twenty-five years after she became a cell biologist: Goodenough's curiosity about why people are religious and why she was not religious in the same way led her to join some communities engaged in religious practices and in reflection about religion. In addition to a local Presbyterian church, Goodenough became a member of the Institute on Religion in an Age of Science. These new engagements seem to have stimulated her thinking and led ultimately to writing about science and religion, including *The Sacred Depths of Nature*.

Scientific Understanding As a Moral and Religious Resource

Religion and culture are seamlessly woven together in Goodenough's account of things. Religious diversity and ongoing change in the many religious traditions she takes for granted. Goodenough thinks religion is the human effort to respond to basic questions about how things are (cosmology) and what things are valuable (ethics). A religion struggles to integrate responses to these big questions so as "to render the cosmological narrative so rich and compelling that it elicits our allegiance and our commitment to its emergent moral understandings" (xiv). At this stage in the earth's history, Goodenough contends that it is important that a planetary ethic begin to emerge, but she thinks global conversations bog down as people stake out positions of national, cultural and religious self-interest. She thinks science can provide a culture-independent account of how things are and that this can provide a common worldview that can be a foundation for a global ethic.³ However she holds a scientific cosmology can unite people only if it works as a "religious cosmology" which "makes the listener feel religious" (xvi). Goodenough thus says the goal of her book is "to present an accessible account of our scientific understanding of Nature and then suggest ways that this account can call forth appealing and abiding religious responses—an approach that can be called religious naturalism"(xvii).

Although it is not altogether clear what Goodenough means when she points to "feeling religious" as the key to cashing out scientific understanding as a common global ethic, this is an interesting approach. One of her fellow scientist reviewers notes that an important novelty in Goodenough's perspective is that for her "'nature' encompasses not just our direct experience of the natural world but also our scientific understanding of it."⁴ At the end of her Introduction, Goodenough alludes to this view when she says the "story of Nature has the potential to serve as the cosmos for the global ethos" but this is the case "only if we all experience a solemn gratitude that we exist at all, share a reverence for how life works, and acknowledge a deep and complex imperative that life continue" (xvii). This sort of emotionally rich and empowering experience can come, she contends, from "an understanding of human nature and an understanding of the rest of Nature," or, to put it in a slightly different way, from a "perspective on how Nature is put together, and how human nature flows forth from whence we came" (xviii). Although she does not use Polanyi as a direct resource, Goodenough's brief discussions of understanding as impassioned and empowering offer an interesting parallel to Polanyi's views. As I studied some of her later treatment of human nature as the outgrowth and gift of a larger nature, I could not help but think of the fourth part of *Personal Knowledge* or the discussion at the end of the "Emergence" chapter in *The Tacit Dimension* where Polanyi points to circularity in noting accounts of evolution must make sense of what he terms an "afterthought to five hundred million years of pure self-seeking" (52). This "afterthought" is the human "moral sense and our respect for it" (52) which Polanyi holds "presuppose an obedience to commands accepted in defiance of the immemorial scheme of self preservation. . . ." (52). Goodenough attends to the same circularity of human belief—respectfully accounting for and appreciating human knowing in the context of the larger evolving cosmos—and, finally, also to questions about responsibility that Polanyi thought central.

Religiopoiesis

In a recent *Zygon* article, “Exploring Resources of Naturalism,” Goodenough describes *The Sacred Depths of Nature* as a “contribution to present-day religiopoiesis” (562). She distinguishes religiopoiesis from more traditional theological reconstruction that works to incorporate new insights into traditional myths, rituals and theology. Religiopoiesis is a crafting of religion, a finding of ways to tell a story—the scientific story in her case—to convey meaning and motivation. It operates between two poles, the more reflective or theological pole and the more spiritual or feeling-directed pole. In the end, Goodenough seems to think a scientific understanding of life, what she calls the “Epic of Evolution” (xix) in her book, is capable of producing belief with a capital “B” which she takes to be a constellation of compelling theology and satisfying spiritual experience. When this happens, she believes that scientific accounts will help us find “our capacity to walk humbly and with gratitude in their presence” (565). As the quotation I have used above as an epigram suggests, understanding life scientifically also then will invoke “awe and wonder” which serves as “its own inherent reward” (565).

Goodenough thinks that this kind of empowering understanding of the scientific account of things can become commonplace only if, in the “process of religiopoiesis,” we

open ourselves to metaphors: those in our traditional religions, those in the poetry and art of past and present times, and those that emerge from our articulation of scientific understandings. . . .The goal is to come up with such a rich tapestry of meaning that we have no choice but to believe in it (“Exploring. . .” 566).

Metaphor, for Goodenough like Polanyi, has “cognitive and emotional valence” (“Reflections. . .,” 233) and is a key to religiopoiesis: “If the universe story is to compete with other stories for human attention, we need to offer human-friendly analogies for those who best understand scientific concepts through experiential referents” (“Reflections. . .,” 235). But Goodenough is also quite wary about metaphors and analogies in science and religion. Clearly, she does not think a watchmaker or intelligent designer God is an appropriate inference from nature; here analogy leads to a misunderstanding of nature. Contemporary claims about matters such as “irreducible complexity” garner no support from her. Goodenough insists in her book and in several other publications that she should not be understood as a theist, although she is equally insistent that she is religious. What she seems to be resisting with the term “theist” is all claims for a supernatural agent. She does not seem to imagine that there might be other interesting and illuminating ways to think about gods and their relations to human beings—ways that are not chained to the anchor of supernaturalism.

Goodenough is also critical of metaphORIZING scientists like Brian Swimme who are not religious conservatives but opt for metaphors primarily clever and charming to recast earlier religious narratives. Goodenough holds that good metaphors must “ring true with science” (“Reflections. . .,” 235) in the sense that they deeply reflect an understanding of the scientific concept they represent. They must carry over core truths. But they must also be words that (borrowing from another scholar’s account of native Americans) she says foster “cosmological personalism, words steeped in moral character and a sense of the sacred, words that

invite—indeed insist upon—our anthropocosmic participation” (“Reflections...,” 237).

To see Goodenough’s skill in drawing metaphors, the reader only has to plunge into the main body of *The Sacred Depths of Nature* which has twelve chapters that treat the stages of the “Epic of Evolution.” Each chapter discusses a development in the life of the universe with most chapters concerned with biology “at the level of molecules and genes and cells, since this is what cries out to be understood” (xix). Goodenough’s discussions are condensed but clear and here she carefully chooses metaphors and analogs for a lay scientific audience. Following the presentation of a particular scientific topic is what Goodenough terms a “religious response” (xx) to that topic, completing the chapter. She says this response is “personal, describing the particular religious emotion or mental state that is elicited in me when I think about a particular facet of the evolutionary story” (xx). Obviously, the pattern through which matters unfold in her book is both an overt expression of Goodenough’s personal commitments about the way things are and an illustration of how she believes that understanding the story of science can produce (paraphrasing her comment quoted above) gratitude that we exist at all, reverence for how life works, and a deep and complex imperative that life continue. In short, *The Sacred Depths of Nature* models the claims that it and other Goodenough writing sets forth about the potential of scientific understanding to shape the ethos.

Some Central Scientific Ideas and Their Implications

I cannot here systematically discuss the scientific account or the religious implications of the account that Goodenough builds chapter by chapter. It must suffice to sketch only very roughly the contours of the story that she lays out, moving from the origins of the earth through the origins of life and the development of life’s complexity. She treats not only how organisms and evolution work, but she discusses the biology of topics such as awareness, emotions and meaning, sex, sexuality, multicellularity and death and speciation. These are all matters central to the “Epic of Evolution” and all, in her view, stimulate “religious emotions” that help reshape the ethos.

Goodenough succinctly outlines the evolution of the cosmos from Big Bang. Life evolves after the laws of physics are in place. She notes that her first confrontation with physics left her staggered at the immensity and incomprehensibility of the universe but she “found a way to defeat the nihilism that lurks in the infinity and the infinitesimal”(11) by coming to see the universe as a locus of mystery. Although she does not link this mystery with God, she says the mystery generates wonder and produces awe and this allows her to “join the saints and the visionaries in their experiences of what they called the Divine”(13). As the plot of the scientific story moves on to the matter of the origins of life, Goodenough summarizes her account around two points:

First, a system got thrown together, apparently quite by chance, that allows biomolecules to be synthesized by a sunlight-driven chemistry that is not at all left to chance. And, second, the instructions for constructing this system acquired the ability to be copied and inherited. That is, life emerged from nonlife. The stages that were traversed, the trials and errors, the near-extinctions, the struggles to recover, all these have been erased, sup-

planted by our intimate understanding of the ultimate winner, the first progenitor cell from whom all creatures flow (27).

Goodenough emphasizes that life can be explained by its underlying chemistry (and chemistry by its underlying physics) but “the life that emerges from the underlying chemistry of biomolecules is something more than the collection of molecules” (28). She identifies the interaction of molecules residing inside cells as capable of generating new processes and such new processes “have no counterpart at simpler levels. These new, life-specific functions are referred to as emergent functions”(28). The origin of life is an emergent function and the development of more complex functions in life are emergent processes. Goodenough summarizes her view of emergence thus as “something more from nothing but” (28). She suggests that emergence is “the near-inevitable consequence of our thermal and chemical circumstances”(28).

Goodenough notes that the Anthropic Principle has gotten much attention lately, but such thinking leaves her unsatisfied. Her own approach is to “respond to the emergence of Life not with a search for its Design or Purpose but instead with outrageous celebration that it occurred at all”(29-30). She regards as “miraculous” the property of emergence: “Life does generate something-more-from-nothing-but, over and over again. . .”(30). She says for the religious naturalist that the “tales of natural emergence” are “far more magical than traditional miracles. Emergence is inherent in everything that is alive, allowing our yearning for supernatural miracles to be subsumed by our joy in the countless miracles that surround us” (30).

Life works, in Goodenough’s account, in terms of biochemistry and biophysics. Biophysics is concerned with “electrochemical gradients” and the physics through which “channels and pumps” work to “span the cell membrane” (40) and thus allow the chemical processes of the cell to work. Basic biochemistry is all about the shapes of proteins, particularly enzymes, and the sequences of shape changes or cascades which are the processes through which a cell perceives or interacts with that which is external. The “cell is set up to optimize the flowing of cascades”(42): that is, proteins that will interact with one another have “domains, called addresses, that target the proteins to the same cellular location” and each “destination proves optimal for particular biochemical reactions” (44). This means that “a cell is like a community, its inner workings segregated into interacting compartments, its outer membrane defining its interactions with the rest of the world.” (44).

In a way somewhat reminiscent of Polanyi’s account of hierarchy, Goodenough thinks of the operation of the cell by moving up and down through a hierarchy of levels. Her analog of this movement is the case of a Mozart sonata. We can think about the sonata as a lovely piece of music (as a whole) but we can move down through the levels to think about the production of sound that is sequenced by successively hammering piano keys. It is a matter of where the person wishes to focus attention. The down and up motion of analysis is a movement of reducing and then synthesizing. We can understand things we appreciate at a higher level in terms of activities at a lower level: for example, Mozart’s sonata modulates at some point into a B-flat and that is done with the intricacy of a particular chord that makes the change.

The real unit of life in Goodenough’s account is the organism, which is treated in the central fourth chapter, “How an Organism Works.” This is the intermediate level of emergence, the locus of “biological

patterns”(50) concerned with ““how the biochemistry and biophysics are organized, arranged, played out in space and time to produce a creature that grows and divides and is” (49). Goodenough explains such patterns in terms of the expression (rarely or frequently) of genes, a process by which instructions for making a protein are read. Thus the lactase gene that creates the lactase enzyme that metabolizes lactose for an amoeba is either switched on or off according to whether or not an amoeba crawls into a lactose-rich puddle. This switching is a function of lactose receptor proteins in an amoeba’s cell membrane, which bind or fail to bind to molecules of lactose in the environment. Binding causes receptors to shift shapes and this sets off “a signal-transduction cascade that eventually brings about a shape change in an activator protein” (53). An amoeba has hundreds of gene activators and repressors and each is a protein encoded by its own gene and elements often work together in complicated ways. Mutations affect things like whether activators can recognize shapes and thus can affect the entire complicated system. Genes are switched on and off as a response to environment and in terms of internal clocks, but regulation of gene expression also occurs in space. About a billion years ago, genetic instructions emerged that allowed two-celled organisms — and later, instructions for multicellular organisms —eventually to evolve. Multicellularity brings specialization:

Our two-celled organism, for example, might be programmed to switch on a set of light-detection genes in cell #1 and a set of motility genes in cell #2. We could now have an organism in which the motile cell is found pushing its light-sensitive cell ahead of it like a tiny eye. The four-celled organism might expand this idea. . .(57).

Multicellularity in humans means a trillion cells each with a full set of genetic instructions for making a human being, although each cell reads only some of the code and thus reproduces specialized cells.

What does Goodenough conclude about the human organism, given this scientific account of the incredible intricacy and complexity of functioning levels constituting the comprehensive entity? For her, chance and complexity have conspired to produce an entity to whom she must bear witness with affection, tenderness and respect: “I have come to understand that the self, my self, is inherently sacred. By virtue of its own improbability, its own miracle, its own emergence.” (59). She says “to the extent that I know myself, I am known” and this leads her to “sing my own song, with deep gratitude for my existence” (60). In a sense, Walt Whitman comes fully home in the enriched modern biological perspective of Goodenough’s affirmation that “I sanctify myself with my own grace” (60).

Goodenough’s chapter on evolution is lucid: “Evolution can be minimally defined as changes in the frequencies of different sets of instructions for making organisms” (64). In order to understand evolution, one must understand mutation (“how the instructions become different”) and natural selection (“how the frequencies of those instructions are changed”[64]). Goodenough’s discussion of both mutation and selection is well fitted to the discussions in earlier chapters of how cells and organisms function. Selection, she suggests, poses two questions: “Does the new protein or promoter work better, worse, or the same as the old one? And, how important is this difference to the organism?” (66). For amoebae dependent on lactose for food, a deleterious lactase mutation will likely be fatal. Such a “new gene will fail to spread, whereas a beneficial mutation may allow it to grow and divide more rapidly and hence the new gene may come to be more

prevalent than the old one” (66-67). Goodenough provides an illuminating example (the rise of the flagellum of modern bacteria) that shows how complex traits get started and evolve. She summarizes her evolutionist account of cumulative change and emerging complexity thus: “increasing complexity entails selections of selections” (71). But she also points out that evolution is conservative: “once a complex trait is established, like a signal transduction cascade or a metabolic pathway or an embryonic induction, it also tends to be used again and again, with appropriate embellishments to suit the circumstances” (72). In the final analysis, it is the “deep interrelatedness, our deep genetic homology, with the rest of the living world” (72) that is the lesson that most impresses Goodenough about evolution:

And now we realize that we are connected to all creatures. Not just in food chains or ecological equilibria. We share a common ancestor. We share genes for receptors and cell cycles and signal-transduction cascades. We share evolutionary constraints and possibilities. We are connected all the way down (73).

The web of life in the understanding of a sensitive scientist like Goodenough really is transformed into a new creation: about the many living forms, she says,

I no longer need to anthropomorphize them, or value them because they are beautiful or amusing or important for my survival. I see them as they are; I understand how they work. I think about their genes switching on and off, their cells dividing and differentiating in pace with my own, homologous to my own (74).

By the “outpouring of biological diversity” (86), humans (one of 30 million species existing today with many more millions having passed away) should be made humble, Goodenough thinks. We are called to acknowledge our solidarity with and our dependency on the web of life. As a religious naturalist, Goodenough holds it only fitting to locate deference to the divine “somewhere within the Earthly whole” (87).

Goodenough’s chapter on awareness is one that both distinguishes and links human self-awareness and awareness of other sorts in humans and other organisms. Awareness is biologically rooted in the fact that the first cells needed energy to carry out their biochemistry. Evolution favors receptors of use and early awareness systems focused on physical and chemical properties of the environment and eventually on other organisms. Early animals “devised the neuron, a cell type specialized for awareness, and this made possible the avenue of awareness called consciousness” (91). In the long course of evolution, complex nervous systems and brains, localized neuron centers, emerge; mammalian brains are particularly interesting since they are much different than that of organisms with more hard wiring. Self-awareness or consciousness, in Goodenough’s account, is “awareness of awareness” (99) which seems to be a witnessing of mental activity represented in symbolic forms in the working memory. She contends that an “I-ness” is primary for humans and, although not a theist, she links traditional western and eastern mysticism with this sense, Goodenough affirms what she calls “immanence” (102) which is immediate, experienced and known. She identifies immanence with that “part of my self that I most cherish and value” (102-103). Her response to immanence is to open herself “to its blessing”: “I give myself over to my mystic potential, to the possibility of becoming

lost in something much larger than my daily self, the possibility of transcending my daily self” (102). Goodenough’s broader reflections here on awareness are but one of many places in her book where echoes of William James can be heard; she acknowledges her debts to James in her book’s prefatory materials (xiii).

The Sacred Depths of Nature outlines a brief but provocative biology-based account of emotions and meaning. The evolution of awareness has brought organisms that value things perceived and attach meaning to what they are aware of. Humans, with our capacity to think and act symbolically, can integrate ideas and emotions and place them in working memory. Thus symbols have for us “cognitive and emotional resonance” (105) and we can “extrapolate our understanding of ourselves to the experience of other creatures” (106). Goodenough describes emotional responses as a function of a complex nervous system which is really a part of the evaluation processes all living things have and which operate in terms of shape changes induced in receptors and signal transduction cascades and biochemistry. Many emotional responses in humans seem to be “ancient and hardwired survival systems that mediate our behavioral interactions with the external world” (107). Animals without self-awareness likely experience emotions such as fear, but not feelings (“a conscious response to the unconscious fact of having had an emotional system activated” [107]) such as that of being frightened. Goodenough acknowledges that there is much that science has not understood about complex feelings which she suspects “represent elaborate combinations and syntheses of ancient emotional circuits, experienced by us in new ways. Anguish and elation may be reconfigured versions of anger and lust, without in any way being the less compelling or important” (110).

In a way somewhat reminiscent of Polanyi’s discussions, Goodenough discusses meaning as an element common to life. “Meaning” for an amoeba operates in terms of using receptors to note chemoattractant molecules that help the amoeba move toward food. Unicellular sexual organisms have similar “meaning systems” (111) using pheromones to note mates in the vicinity. Indexical meaning systems (that point like a finger) are frequently found in nature. But the most flexible and rich meaning systems use symbols and Goodenough thinks it likely that only humans have real capacity to construct and manipulate symbols. Working memory can produce an intricate integration of thought and feeling. Thus one can remember grandmother’s smile while recalling her admirable energy and annoying fussiness and at the same time be sorrowful that grandmother is dead.

Goodenough holds that emotion, feeling, meaning and symbolism come together in human religious frameworks. She contends that we only have to look at religious art from any culture to see this. Humans have a capacity “to apprehend the meaning and the emotion embedded in symbols that endows us with our capacity for empathy”(114). Empathy paves the way for the feeling we know as compassion and from compassion, which is always “in mortal conflict with out insistent sense that we should win,” emerges “our haunting sense that things should be fair”(115).

Goodenough’s chapter on sexual reproduction points out how this process generates enormous variety in genetic information: “although parents each contribute half of their genetic endowment to a child, they basically end up with a stranger” (121). As an evolutionary strategy, each sexual generation produces a whole new card game in which the genetic deck has been shuffled. While asexual reproduction “makes as many

specialized organisms as you can before the niche changes—the strategy of bacteria” (126), sexual reproduction “makes enough different kinds of organisms in one generation that at least some survive the vagaries of the niche and make enough different kinds of new organisms that the whole enterprise keeps going” (126). Goodenough’s broader reflections on the biology of sex point to another element of what she calls “caring”(127). Above I have sketched two elements of care: she acknowledges “our deep genetic homology with all of life and the affinity, the fellowship that emerges from that acknowledgment” (127); she also celebrates “our capacity to experience empathy with other creatures and respond to their concerns as our own” (127). Understanding sex makes us “encounter our biological imperative to nurture our offspring, sacrificing, if need be, our lives on their behalf” (127). Goodenough contends that she finds in herself “inherent maternal altruism” and “joy attends this kind of knowledge” (128). She links parental instincts with the emotions associated with evolutionary affinity and compassion; all three elements of caring also are tied to developing fitting responses to the earth:

It seems likely that the emotional circuits invoked when we contemplate our deep evolutionary affinity with other creatures, and when we are infused with compassion, will turn out to map closely onto the circuits that drive our parental instincts, emotions that generate such feelings as tenderness and warmth and protectiveness. These same emotions extend to our understanding that the Earth must be nurtured, an understanding embedding in many religious traditions (128).

The chapter on sex in *The Sacred Depths of Nature* is complemented by a chapter on sexuality, a topic about which Goodenough provides much complex biological detail as well as some conclusions about religious matters. What is especially interesting here (as in her treatment of several other complex biological topics) is the way in that Goodenough convincingly draws together different levels of description. Sexual creatures have complicated lives since they produce gametes that must “find, recognize, and then fuse with gametes of the same species and opposite gender. . . (131). The strategies of sexuality require relationships, some simple, but some—those built upon simpler ones—are complex and involve “elaborate emotional networks” (132). Goodenough sketches the range of attraction mechanisms and practices. For animals with nervous systems, “behavioral possibilities for sexual attraction” are taken “to every possible limit. Fireflies pulse, houseflies beat their wings, moths send out musk, fish dance. . .” (132-133). This leads Goodenough to conclude “if this is a planet shimmering with awareness, then a great deal of that awareness is focused on the sexual signals that creatures send to one another”(133). Humans rely on other human beings for care and nurture of offspring and much of this occurs in social groups; we exhibit a wide range of sexual behaviors. Like other animals, we need to attract mates. Goodenough suggests that whether or not humans alone consciously experience this need, “what we experience is an awareness of emotional pathways that have deep evolutionary roots” (134). She links affections for parents to “emotional networks that establish parent-offspring bonds in other mammals” (134) but such emotional responses, at least in early years, are “thoroughly wondrous, thoroughly compelling, and deeply joyous“(135). With parents, we eventually must separate and yet try to remain intimate, but all intimate relationships, perhaps especially those with mates, are “inherently fraught with conflict” (135).

Goodenough's broader reflections on human intimacy suggest a link between our needs and desires and the attractions of religion. Western monotheistic traditions "offer the opportunity for intimate relationship with deity. Indeed, they suggest that the most stable and fruitful outlet for passion and dependency is in relationship with the Divine" (136). A personalized deity who is both an object and a source of love, Goodenough acknowledges, is a deeply appealing--although not a viable--option for her:

I lack the resources to render my capacity for love and my need to be loved to supernatural Beings. And so I have no choice but to pour these capacities and needs into earthly relationships, fragile and mortal and difficult as they often are (140).

Goodenough is quite self-consciously not a supernaturalist, but she seems content to allow those who can entertain and love a supernatural God to do so. She does note that in fact she finds, from talking to thoughtful theists, that between theism and non-theism there is a spectrum rather than a polarity. Opportunities are everywhere for non-supernaturalists "to open ourselves to human relationship and hence to fill our lives with the religious experience of love" (140). She finds in monotheistic traditions "challenging and enchanting images and evocations for how to best love" (140).

The final chapters on multicellularity, death and speciation round out issues in basic biology that Goodenough treats in her book. Multicellular organisms evolved from single-celled organisms and are sexual but in a fundamentally different way than single-celled sexual organisms. Embryogenesis involves differentiation and part of this is the specialization of germ-line cells: "The dichotomy between germ-line cells and the remaining somatic cells effectively parcels out the job of being alive" (145). During embryogenesis, cell death is programmed in and, in fact, the whole soma dies. Thus with complex multicellular organisms,

once you have a life cycle with a germ line and a soma, then immortality is handed over to the germ line. This liberates the soma from any obligation to generate gametes, and allows it to focus instead on strategies for getting gametes transmitted (148).

The brain, the locus of human self-awareness, is part of the soma. Its specialized functions as a center of perception and feelings are actualized only as specialized cells die and ultimately the brain itself dies. This is a matter that Goodenough finds deeply significant:

So our brains, and hence our minds, are destined to die with the rest of the soma. And it is here that we arrive at one of the central ironies of human existence. Which is that our sentient brains are uniquely capable of experiencing deep regret and sorrow and fear at the prospect of our own death, yet it was the invention of death, the invention of the germ/soma dichotomy, that made possible the existence of our brains (149).

Religious naturalism, Goodenough says, recognizes empathy and compassion which allows humans in all cultural contexts to "experience unmitigated loss and grief" (150). Religious naturalism also accepts the inevitability of death and finds meaning in it: "my somatic life is the wondrous gift wrought by my forthcoming

death” (151). The American poet Wallace Stevens (in his famous poem “Sunday Morning”) succinctly summarized matters in a way that Goodenough would likely approve: “death is the mother of beauty.”

Biologically, speciation concerns the segregation of organisms according to those that will and will not mate with one another and this, in turn, allows species to develop distinctive traits and greater biodiversity. Goodenough sketches the dynamics of speciation in terms a card-playing metaphor:

Speciation creates a new deck of shuffling genomes. If the new deck has only recently become isolated from the old (parental-species) deck, the two will share a great many alleles. But because they are not being shuffled together and are subject to different kinds of natural selection, the two decks will come to have quite different frequencies of alleles. Importantly, new decks will also come to contain new cards—new genetic ideas that endow the new species with distinctive sexual and adaptive traits not present in the parental species (155).

She discusses primate speciation: recent evidence makes it clear that humans branched off much more recently (five million years ago) than was earlier thought (fifteen million years ago) and that human evolution was not a separate affair from the rest of primate speciation. The chimps and bonobos diverge after humans, and we have a common ancestor. She sketches a genetic perspective on the likenesses and differences between humans and our fellow primates. Goodenough explains how both the evolution of novel genes and mutations that affect the timing of switching genes on and off can have large consequences:

Chimps, humans and bonobos emerged as very similar species with some very important differences. In particular, our lineage has come up with the symbol systems that allow our language and self-awareness, apparently the only time in evolutionary history that such capacities have developed. Accompanying this has been a huge amplification in the number of neurons and neuronal connections in the human cerebral cortex and prefrontal cortex, a change evident in the fossil record of skull size about 2 million years ago—about the time we encounter the first tools. The genetic changes that generated our big brains were perhaps not very complicated, but the results are complicated (163-164).

Goodenough offers a meditation on what human distinctiveness entails and calls for. She draws certain moral implications from her evolutionary account. Humans share the planet with our “next of kin, oranges and gorillas and chimps and bonobos” (164). We can learn from one another, and the preservation of habitat and dignity emerges as a commandment” (164). Within our own gene pool with a large number of alleles (“a few concentrated in particular geographic groups we call races”[164]), each is distinctive but all are “members of the human species and hence share the distinctiveness of our species” (165). Goodenough says that as environmentalists we learn to defend the diversity of the species and as a religious naturalist one is called “to celebrate human distinctiveness with the same full-throated thanksgiving that we celebrate the whale and the spotted owl” (165). In her catalog of elements of human distinctiveness there are echoes of points Polanyi touched in his discussions of this topic: (1) humans as a symbol-using species communicate

in language and this allows us capacities of abstract thought that seem unparalleled (e.g., planning the future, articulating and transmitting our cultural lore); (2) humans have the capacity to go beyond minimal interpretation of perceived reality, since they have the capacity to analyze reality—we can ask and answer questions and, among other things, this leads to science and humanistic knowledge; (3) humans have the capacity to create art and it "as we respond to understandings and feelings inherent in our art that we acquire much of our truth, much of our nobility and grace, and much of our pleasure" (166); (4) humans are *Homo religiosus* and, for Goodenough, this implies that

We need answers to existential questions. We need to believe in things, to structure and orient our lives in ways that make sense and offer hope, to identify values and ideals, to transcend and interconnect. And happily, we have the capacity to transmit our accumulated religious understandings to one another and to our children through our languages and our arts, allowing them to endure and evolve (166).

At the very end of her book, Goodenough summarizes her themes around what she dubs four "emergent religious principles" (167): (1) Human beings raise big questions about the universe and her response is "to articulate a covenant with Mystery" (167). Responses to questions of ultimacy are deeply personal and beyond proof or refutation, but she suggests that asking questions of ultimacy "is to generate the foundation for everything else" (169). (2) Goodenough suggests that the religious naturalist holds thankfulness to be a basic human response. The attitude of a sensitive evolutionist should be "we arrived but a moment ago, and found it to be perfect for us in every way. And then we came to understand that it is perfect because we arose from it and are a part of it" (169). What Goodenough says is important is that "gratitude flows from our beings" (169) and not whether it is directed to God, Mystery, Cosmic Evolution or some other being, direction or object. (3) Evolution, as Goodenough has portrayed it, is a deep and sacred story that calls forth reverence. As a religious naturalist, she says "we are called to revere the whole enterprise of planetary existence, the whole and all of its myriad parts as they catalyze and secrete and replicate and mutate and evolve" (170). (4) Goodenough proposes that evolution can be thought of not only as "about prevalence, about how many copies there are of which kinds of genomes" but in a "more germinative" way as "being about the continuation of genomes" (170). Evolution has already produced creatures with awareness that acknowledge value and purpose. This implies that in future evolution "genomes must dictate organisms that are aware of their environmental circumstances, evaluate these inputs correctly and respond with intentionality" (171). She claims as an article of "Faith" that "existence of all this complexity and awareness and intent and beauty, and my ability to apprehend it, serves as the ultimate meaning and the ultimate value" (171). In the final analysis, Goodenough says,

The continuation of life reaches around, grabs its own tail, and forms a sacred circle that requires no further justification, no Creator, no superordinate meaning of meaning, no purpose other than that the continuation continue until the sun collapses or the final meteor collides. I confess a credo of continuation." (171).

Michael Polanyi expanded philosophy of science in a way that showed it must be woven with *Lebensphilosophie*. Ursula Goodenough makes much the same move in the account of biology provided in *The Sacred Depths of Nature*. I suspect that anyone who has read Polanyi's work deeply will find an intriguing resonance in Ursula Goodenough's thought.

Endnotes

¹ Ursula Goodenough, "What Science Can and Cannot Offer to a Religious Narrative," *Zygon* 29:3 (September 1994): 327.

² In addition to the essay cited above for the epigram, the following are of interest: "Creativity in Science," *Zygon* 28: 3 (September 1993): 399-414. "The Religious Dimensions of Biological Narrative," *Zygon* 29:4 (December 1994): 603-618. "Biology: What One Needs to Know," *Zygon* 31: 4 (December 1996): 671-680. "Reflections on Science and Technology," *Zygon* 35:1 (March 2000): 5-12. "Reflections on Scientific and Religious Metaphor," *Zygon* 35:2 (June 2000): 233-240. "Exploring Religious Naturalism," *Zygon* 35:3 (September 2000): 561-566. "Causality and Subjectivity in the Religious Quest," *Zygon* 35:4 (December 2000): 725-734. "'Religious Naturalism' and a New Planetary Ethic: Barbara Forrest Interview with Ursula Goodenough," *Free Inquiry* 20:3 (Summer 2000):45-47. References hereafter to any of these articles are by title abbreviation and page number.

³ There is something a bit naive or at least incomplete about Goodenough's claim that science is culture-independent, a point that she does not try to develop and clarify in her book. Polanyi, of course, suggested that culture is complex and its bearing on scientific work is very complicated. He argued that science is deeply dependent on culture, particularly political culture. Civil liberties, fairness and tolerance are noted as critically important to science. He also argued that science has many overlapping neighborhoods and is governed by scientific opinion; science is a community endeavor reliant on creative individuals and it in many ways generates its own particular culture nested with a larger cultural framework. Polanyi however was eager not to slip into a "two cultures" view like that of Snow. Indeed, he rejected Snow's view. Polanyi argued for a spectrum of sciences and humanistic study running from physics to study of historical figures. He tried both to link and to distinguish different areas of study. Goodenough touches on a few of these matters in "Creativity. . ." but her thesis about the cultural independence of science seems to need a good deal more substantive development and refinement.

⁴ Barbara Smuts "Reviews and Commentaries: Sanctifying the Cosmos," *Scientific American*, May 1999: 100.

REVIEWS

Larry Arnhart, *Darwinian Natural Right: The Biological Ethics of Human Nature*. Albany NY: State University of New York Press, 1998. Pp. xvi + 332. ISBN 0-7914-3694-2 (paper), \$25.95.

Arnhart has brought together, in a clear, accessible, well-researched paperback, the core arguments for concluding that humans are by nature moral animals, that there is every reason to speak of an ethical naturalism. He skillfully integrates the writings of Aristotle and Hume, who arrived at this conclusion via philosophical insight, with the writings of Darwin and contemporary biologists such as de Waal and E. O. Wilson, who arrive at this conclusion using evolutionary principles. Being a political scientist, albeit one well versed in both biology and the philosophical tradition, he uses his later chapters to analyze such institutions as slavery and genital mutilation, and such social issues as male/female differences, from the perspective of ethical naturalism, chapters that will serve as excellent material for discussion in undergraduate and graduate courses.

Arnhart summarizes his perspective succinctly (p. 69): “My position is Aristotelian in that I agree with Aristotle that human beings are by nature social and political animals. It is Humean in that I agree with David Hume that human beings are by nature endowed with a moral sense. And it is Darwinian in that I agree with Charles Darwin that human sociality and morality are rooted in human biology.” And (p. 83), “The ethical naturalist would argue that our moral experience requires a notion of moral freedom as freedom within nature. For Aristotle, Hume, and Darwin, the uniqueness of human beings as moral agents requires not a free will that transcends nature but a natural capacity to deliberate about one’s own desires.” Such straightforward declarative statements are a most welcomed antidote to the usual treatment

given to this material, where competing perspectives are given equal time and qualifiers are added to every paragraph. Moreover, although we are given an adequate account of kin selection and reciprocity, he does not dwell on these strategies the way many writers do: he understands, correctly to my mind, that there is much more to morality than defending your relatives and games of tit for tat.

So, I greatly admire this book and think it should be required reading for any and all students of moral and political philosophy. I will go on to offer a few comments that do not in any way detract from that evaluation but rather indicate where I hope persons in this field, Arnhart among them, will be heading next.

A great deal still remains to be done to sort out what we mean, exactly, by the moral sense that is rooted in human nature. Arnhart has a go at it, stating that he advocates “an ethics of desire: the good is the desirable, and reason judges how best to satisfy the desires.” He then lists 20 natural human desires and tells us that “if the good is the desirable, then human ethics is natural insofar as it satisfies natural human desires.” We know that this can’t be the whole story, in fact, because just as we inherit our moral sensibilities, our moral susceptibilities are likely to be “natural” as well, and words like sin and evil, which do not appear in Arnhart’s index, are very real to us. Arnhart has a strong chapter on psychopathy, where egregiously amoral individuals are described, correctly, as neurologically compromised; for the rest of us, he makes the Aristotelian move of saying that somehow we will be able to figure out what to do if we act with prudence (his translation of *phronesis*), prudence being the “intellectual virtue” that allows us to make appropriate judgments. At the same time, he cites approvingly Aristotle’s maxim that “thought by itself moves noth-

ing,” and when he tries to indicate how our emotion-laden moral sensibilities might come to be integrated with our prudence, things get a bit muddy.

It should quickly be added that these things get muddy in most other people’s hands as well; to my mind, the best contemporary navigator of this interface is philosopher Rosalind Hursthouse, who uses a book (*On Virtue Ethics* [Oxford, 1999]) to consider ground covered by Arnhart in a few pages. Moreover, Hursthouse is not deeply informed by modern biology/neuroscience, and in general, there is much left to say, from many perspectives, about how best to understand, and nurture, the sensibilities we bring to the project of being good social animals.

Arnhart also evinces a curious negativity towards idealism. To be sure, one of his central targets is the Kantian-type notion that morality is somehow “out there to be found” rather than “in here to be cultivated,” and perhaps this has biased his outlook. But his account of human nature does not include the impulse to revere persons of exceptional moral worth and to set lofty moral goals for ourselves, our kin, and our communities. In his one negative set of comments on Darwin (p. 142 ff), he faults him for his “utopian yearning for an ideal moral realm.” While Arnhart is, of course, free to hold this view, it is not, to my mind, inherent in ethical naturalism. If one believes, as I do, that the capacity for idealism is as robustly in our nature as our capacity for empathy and justice, then the ethical naturalist can view morality both as a fully natural capacity and as an ideal to strive for, an ideal not “out there” but recorded in the best writings and art of our cultural heritage. Nor need moral ideals be framed in supernatural contexts. Here, for example, is Howard Bloom’s “Promethean Benediction”:

God is not a being, he is an aspiration,
a gift, a vision, a goal to seek.

Since there is no God, it is our job to
do his work.

Ours is the responsibility of making

a cruel universe turn just, of creating
ways to the skies for generations
yet to come, of fashioning wings
with which our children’s children
shall overcome, of making worlds of
fantasy materialize as reality, of mining
and transforming our greatest
gifts—our passions, our
imaginings, and our lusts.

This is the work of deity, and deity
is a power that resides in us.

If thought by itself moves nothing, such
exhortations can go far to move us along in the cultivation
of our moral sensibilities.

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