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# REVIEWS

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Niels Henrik Gregersen, editor, *From Complexity to Life: On the Emergence of Life and Meaning*. Oxford/New York: Oxford University Press, 2003. Pp. 243. Hb £25.50, \$35.00. ISBN 0-19-515070-8.

Collections of articles are popular with publishers on the grounds that if they pick an interesting enough topic, and persuade enough academic celebrities to make a contribution, they hook readers hoping not only to read at least one good article, but also to become familiar with some of the questions preoccupying specialists in that field. On these criteria, the above book edited by Niels Henrik Gregersen is a success. The topic is the big one: existence, life, and meaning.

In the first, and best, article, Paul Davies notes that physicists have sought to reduce everything into irreducible entities (such as particles or strings or membranes) and then describe the behaviour of these entities in terms of universal laws. The problem with such an approach is that it fails to acknowledge the reality of complex entities. But how does complexity emerge from the ‘uniform soup’ from which everything originates? The assumption that simple laws will generate simplicity is undermined by chaos theory. Complexity can also arise spontaneously. For example, when a pan of water heated from below reaches a particular temperature, it forms hexagonal convection cell patterns. In both examples, complexity is a product of non-linear systems driven far from equilibrium by feedback. Helmholtz noted that a study of thermodynamics tells us that entropy increases. In other words, all complexity will eventually degenerate. But the complexity of our universe seems to be increasing, not decreasing. Davies points out that the manifest increase in the complexity of our universe is being funded by its expansion. The conversion of hydrogen into the more stable helium was halted when

the universe cooled as it expanded. Gravity clumped matter together into stars. Our planet became covered with living organisms. But life on Earth is largely reliant upon the continuation in our sun of the process by which hydrogen is converted into helium. Although the expansion of the universe increases the gap between actual and potential entropy, the thermodynamic destination remains the same. It has become increasingly clear that if the physical laws of our universe were only slightly different, any form of life would be highly unlikely. Davies concludes that the universe has been structured to generate meaning.

Gregory Chaitin suggests that the failure of our attempt to measure randomness is linked to the Godel incompleteness theorem. To demonstrate the randomness of a series of digits, it is sufficient to find a program, smaller than the series, which is able to generate the series. Because formal systems are finite, and a series of digits may be arbitrarily large, it will always be the case that a number series cannot be proved to be random. This does not undermine formal systems; what it demonstrates is that there will always be new axioms for us to discover.

Stuart Kaufmann speculates about the existence of a law that can explain why the open system ‘life’ generates increased complexity. Since computers are non-equilibrium systems, and there are computer programs of which no shorter description exists than that which is obtained by running a program, this demonstrates that it is misguided to seek a law that can describe every possible non-equilibrium system. But Kaufmann does not seek to rule out the possibility of discovering a principle that can account for living systems. It was a lecture by Schrodinger called ‘What is Life?’ which inspired a generation of physicists to attempt to identify the essential characteristics of a living organism. Although his suggestion, that encod-

ing in aperiodic solids is the key to understanding life, was a brilliant anticipation of the discovery of DNA, Kaufmann asserts that it falls short of being an adequate account of autonomous agency. What is the origin of this agency? Darwinian evolution identifies selection of heritable variation as the source of all biological order. But according to Kaufmann, while descent with modification helps to explain changes in form, it does not explain the emergence of radically new forms. Kaufmann argues that Darwinian evolution needs to be supplemented by a 'fitness landscape' that is possibly structured by a principle that generates the purposeful behaviour we associate with living systems.

Harold Morowitz defines reductionism as the quest to comprehend structure or process at one level of reality in terms of the next lower level in an emergent hierarchy. Emergence takes place when the parts that make up a level of reality do not in themselves wholly account for it; i.e., the whole is more than the sum of its parts. Morowitz identifies 28 such levels in our universe, culminating in what he describes as spirit.

Arthur Peacocke tries to make sense of what it is to be a level of reality by citing the way in which Polanyi refers to boundary conditions. This is neither a geometrical term, nor a set of initial conditions; it specifies the structural parameters of a process. A strand of DNA, for example, is the product of chemical bonding and genetic encoding. That which determines its sequence is under dual control. We apply to a hierarchy of organisation the concepts that are distinctive to each level. Each level has its own causality. The 'bottom-up' biochemical view of a strand of DNA has to be supplemented with a 'top-down' analysis of the circumstances of its formation. The reason why an individual has a specific DNA sequence is not simply explicable in terms of the laws of chemistry. Peacocke notes that this way of understanding reality has implications for our understanding of what it is to be a mind. Within an emergent monism, what it is to be a mental event is the joint product of more than one level of existence. The recognition of the existence of emer-

gent levels of reality not only undermines reductive physicalism, it also undermines Cartesian dualism.

Niels Gregersen draws the collection he has edited to a close by noting that 'Complexity Studies' seeks to understand the principles by which structures organise themselves in the absence of any directing consciousness. Whereas 'Intelligent Design' (which is advocated in this collection by William Dembski) relies upon supernatural interventions by a transcendent God, theistic naturalism derives the emergent complexity of the universe from an immanent God. Perhaps these different conceptions can be reconciled by viewing God as a reality that exercises an emergent causal power in the minds of all reflective beings. This however leaves us with the puzzle of why the physical laws of our universe are such that it generates reflective beings. The claim that there are an infinite number of universes, each with its own physical laws, seems a rather desperate attempt to avoid having to conclude that the order of our universe is not accidental. However we conceive God, it does seem clear that the more we contemplate the universe, the more absurd seems the observation by the Nobel Prize winning physicist Stephen Weinberg that 'the more we comprehend the universe the more it seems pointless.'

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Harold J. Morowitz, *The Emergence of Everything: How the World Became Complex*. Oxford, New York: Oxford University Press, 2002. Pp. viii+209. Hardback ISBN 019513513X. \$28 £18.99.

This book looks promising. The appealing title is hubristic, but what is the point of trees being cut down for books that lack ambition? Morowitz, former editor of the journal *Complexity* and co-chair of the science board of the Santa Fe Institute, is a leading figure in emergence studies. His views, at least on some interpretations, fit hand in glove with Polanyi. According to Morowitz, when faced with the chal-

lenge of discussing emergence, it would be better if we discussed the world around us instead of using computer models. A monist, he identifies three key emergent layers of existence: the physical, the biological, and the spiritual. To bridge the ontological gaps between these emergents, he breaks them down into 28 different levels.

At this point, you might expect to be given some theoretical account of what is meant by emergence, but you will be disappointed. What you are given, and this claim is repeated throughout the book, is that selection or pruning laws impose limitations upon what is possible. The universe grows in complexity in accordance with selection principles. There then follows a series of short chapters, the first few of which describe the first phases of the universe. From a hot, dense beginning, our universe expanded and cooled, and got progressively lumpier. In accordance with the Schrodinger equation and the Pauli exclusion principle, the number of possible atomic configurations is limited, and within successive generations of stars various heavier elements are generated. The material from one of these stars, as it drifts around what becomes our Sun, coalesces into our planet, on the surface of which water vapour is transformed into seas. This is interesting enough, but it can be found in any standard textbook of cosmology.

Morowitz then turns to his own field: the chemical processes associated with life. He claims that just as physicists have identified laws that serve to determine the order of the periodic table, so selection rules will be identified that will enable us to comprehend why the core metabolic processes that underlie life on our planet occurred. No such principles have yet been identified. Morowitz then sets out an evolutionary history in which self-replicating cells combine into a variety of different forms, which due to selective pressure become ever more complex. This is fascinating stuff, but it is also described in numerous other works. The nature of evolution is far from a settled issue, but its difficulties are not discussed, nor is any attempt to supply solutions offered.

Morowitz, having outlined the first billion years of life, then draws our attention to the significance of the emergence of the neuron. A neural net generates a variety of different animal behaviours that are subject to an evolutionary selection process. Along the evolutionary pathway from fish, to amphibians, to reptiles, to mammals, there is a continuous growth in the complexity of the central nervous system. Then, about 70 million years ago, primates evolved, and as a shift in the climate transformed some forests into savannahs, human-looking primates began to evolve. Again, there are numerous other books that on the basis of surviving fossil remains and contemporary genetic evidence, seek to trace out the lineage of modern humans.

Our extended childhood means that genetic transfers of information are augmented by a transmission of learned information. The development of tool making, language, and agriculture renders cultural evolution possible, and this leads to innovations such as cities, temples, and the invention of writing. According to Morowitz, the pruning rules that underlie these processes are unknown. The book ends with the claim that emergence has a divine aspect – it is the process by which ‘the word becomes flesh’. Twelve billion years of emergence leads to the emergence of a creature with the ability to ask – what does it all mean? Morowitz claims that emergence supplies us with a new foundation for religion – one that enables the natural sciences to supply a foundation for spiritual realities. The volitional mind of man is the transcendent emergence of an immanent God, who is knowable to us via our actions. Maybe this view is correct. I certainly believe that emergence enables us to comprehend how acting in accordance with the pursuit of transcendent ideals is possible. But if you are hoping that this book will illuminate such a claim, rather than simply asserting it, then you will find this book disappointing. The view that the universe is no more than an arrangement of atoms, or that what it is to be alive is simply a set of biochemical pathways, has had a devastating effect upon the spiritual life of our times. Morowitz is right about the potential significance of emergence in validating the life of the spirit, but

although he points you in the right direction, he is not much help for the journey.

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Jim Kanaris, *Bernard Lonergan's Philosophy of Religion: From Philosophy of God to Philosophy of Religious Studies*. Albany, NY: State University of New York Press, 2002. Pp. Xii+200. ISBN 0-7914-5466-5. \$18.95.

This book addresses a technical question in Lonergan studies, but it should be of interest to Polanyi's who are interested in comparing the thought of Lonergan and Polanyi as well as to specialists in religious studies.

In the first of four chapters, Kanaris describes a *Kehre* or "turning" in Lonergan's treatment of religious experience. He argues that Lonergan's basic notion of religious experience did not change, but that late in the third decade of his career, he began to make religious experience much more central to his writing. He suggests that Lonergan might have delayed this fuller treatment of religious experience for political reasons, in order to avoid being censured as a "modernist." The second chapter is a detailed exposition of the concept of experience in Lonergan, with illuminating comparisons to Kant, Hegel, Ricoeur, and the contemporary David J. Chalmers. The third chapter focuses upon specifically religious experience, and the final chapter explains the significance of experience for Lonergan's theology and philosophy of religion.

Kanaris distinguishes between Lonergan's specific and general meaning of experience. For both kinds of experience, there are correlative contents. We are quite familiar with the idea that acts of what Lonergan calls "specific experience" have their proper correlative contents. Acts of seeing are *of light*, and acts of hearing are *of sound*. Less familiar, and much more controversial, is Lonergan's assertion that different "levels" of "general experience" also have

correlative contents. In this context, the *level* of experience includes all the sensory acts Lonergan includes within the category of "specific experience." The general content of all conscious acts at this level is "potency." The next level of general experience is insight or understanding, and the correlative content is "form." And at the third level is "judgment," of which the correlative content is "act."

This correlation between cognitive acts and contents forms part of the argument for a controversial feature of Lonergan's ontology — that there is an "isomorphism" between the structure of knowing and the structure of the known. This is quite similar to Polanyi's controversial assertion that there is an ontological counterpart to the "from-to" structure of knowing. Kanaris does not refer to Polanyi, but Polanyi's who seek to explore the implications of Polanyi's "ontological equation" should find much that is interesting in Kanaris's discussion of the correlative contents of acts of knowing in Lonergan's thought.

Another important similarity between Lonergan and Polanyi is that they both stress what Lonergan calls "self-appropriation." In Lonergan, this involves both reflecting upon the dynamic structure of knowing and self-consciously affirming that one is indeed a knower. In Polanyi, this involves moving from a tacit acceptance of the tacit dimension of knowing to a self-conscious recognition that even criticism of something held in focal awareness implies the tacit affirmation of a vast background of knowledge and belief. What might appeal to some Polanyi's is the idea that this self-appropriation of the dynamic structure of our knowing is at the heart of what Lonergan means by *method*. Self-appropriation is a grasp of the method we *are*, not a technical tool we can pick up or discard at will.

In addition to *levels*, Lonergan also distinguishes *patterns* of experience — biological, practical, aesthetic, dramatic, intellectual, moral, and religious. The intellectual pattern of experience is dominated by the pure desire to know, and one of its fruits is the self-appropriation described above. At the

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heart of religious experience is the sense of being loved, and of responding in love. In spite of his turn towards religious experience in the middle of his career, Lonergan remained profoundly intellectual in orientation. Being loving and being loved does not replace the pure desire to know but complements and enhances it. Theology and the philosophy of religious studies must be conducted from within the intellectual pattern of experience. Following Thomas Aquinas, Lonergan insists upon the importance of bringing the intellectual pattern to bear upon the religious pattern of experience, and upon the faith by which one can recognize that, even here, there is a correlative content to religious experience.

Polanyians should not be driven away by the characterization of Lonergan’s philosophy as “critical realism,” for what Lonergan advocates is a very “personal knowledge.” As Kanaris puts it: “As has become only too clear, Lonergan’s ‘philosophy of’ is all about the personal equation, the view that our particular outlook and experience influences our reflective or so-called objective undertakings” (p. 124).

The answer to the technical question mentioned in the beginning is that Lonergan does not really have a “philosophy of religion,” in the usual sense. He has, rather, a two-part foundation consisting of religious experience — the “infrastructure,” and a model of religion — “the suprastructure.” This model of religion incorporates both religious experience and the “method” that is the self-appropriation of the dynamic structure of conscious experience. Upon this foundation, rest two “philosophies of” — the philosophy of God, and the philosophy of religious studies. Neither taken separately nor together do these correspond precisely to what is usually meant by the “philosophy of religion.”

Although not meant to be an introduction, this book would be accessible to interested Polanyians who are unfamiliar with Lonergan.

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Beginning Bal. Checking	1634.89
Income	
From Interest	6.73
From membership dues & gifts	3000.
Total Balance + Income	4641.62

Expenses	
Moleski – AAR, 2002	200.
TAD 28:3	741.37
Gulick – Goodenough	75.
Lewis – Goodenough	14.04
Mullins – Goodenough	13.68
Transport – Goodenough	136.45
TAD 29:1	1136.16
TAD 29:2	1011.
TAD 29:3	635.75
(print only+misc)	
Moleski – AAR, 2003	250.
Checking Reorder	6.03
Total Expenses	4219.48
Year End Checking	422.14

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Beginning Bal. Savings	2049.91
Interest Income	20.91
Other Income	-0-
Year End Savings	2070.82

Richard Gelwick,  
Treasurer